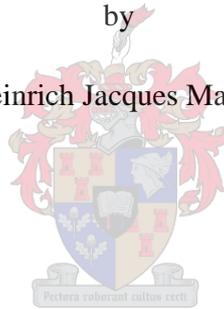


**ASSESSING THE DATA QUALITY OF
PERFORMANCE INFORMATION GENERATED BY
THE HEALTH SECTOR IN THE BREEDE VALLEY
SUBDISTRICT FOR EVIDENCE-BASED DECISION-
MAKING**

by

Heinrich Jacques Marais



*Thesis presented in partial fulfilment of the requirements for the degree of Master of Public
Administration at the University of Stellenbosch*

Supervisor: Ms Naomi Burger

March 2017

DECLARATION

By submitting this thesis electronically, I declare that the entirety of the work contained therein is my own original work, that I am the authorship owner thereof (unless to the extent explicitly otherwise stated) and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

Signature:

Date: March 2017

ABSTRACT

Internationally, health authorities have shown an increased dependence on information and communication technology (ICT) to provide timely and reliable information that can inform decisions about the effective, efficient and equitable distribution of health resources. The usefulness of the information, however, is determined by the quality of the data which underpins it. Inaccurate data can lead to inappropriate priorities and actions on the part of decision-makers.

The purpose of this study was to assess the data quality of performance information in the Breede Valley Subdistrict as a reliable source for evidence-based decision-making. To investigate this research question, a case study approach was followed. The management cadre in the subdistrict were consulted for data collection purposes. Data collection tools include face-to-face interviews and self-administered questionnaires.

The study concluded that the data quality of performance information in the Breede Valley Subdistrict meets the quality criteria for its intended purposes. The study revealed that the collection of performance information is perceived as laborious and irrelevant to improving patient care. The study recommends that the risk control measures should be enforced at facilities who regularly present data quality issues. Further studies should be conducted to gain a representative opinion about the relevance and the quality of performance information generated.

OPSOMMING

Gesondheidsowerhede wêreldwyd is afhanklik van inligting-en-telekommunikasie tegnologie (ITK) om tydige en betroubare inligting oor die effektiewe en gelykmatige verspreiding van gesondheidsbronne te verskaf.

Die doel van hierdie studie was om die data kwaliteit van prestasie-inligting in die Breede Vallei Subdistrik vir bewys-gebaseerde besluitneming te evauleer. 'n Gevallestudie benadering is gebruik om die navorsingsvraag te ondersoek. Inligting is onder meer deur vraelyste en onderhoude met bestuurders in die subdistrik verkry.

Die studie het bevind dat die data-kwaliteit van prestasie-inligting voldoen aan die kwaliteitskriteria vir die doel waarvoor dit gegenereer word. Die studie toon dat die versameling van prestasie-inligting uitputtend is en nie die kwaliteit van pasiëntesorg verbeter nie. Die studie beveel aan dat risiko-beheerkontroles in plek gestel word by fasiliteite wat voordurend data-kwaliteitskwessies het. Verdere studies moet onderneem word om 'n verteenwoordigende mening oor die relevansie en kwaliteit van prestasie-inligting te maak.

ACKNOWLEDGEMENTS

All the honour goes to God our Father for His grace in allowing me to complete this research.

I would also like to express my sincere gratitude to the following people:

- My parents, my children Blaine and Ruth, and my family for their love, support and understanding. Love always;
- My supervisor, Ms Naomi Burger, for her patience and valuable feedback;
- My colleagues and friends for their continued support throughout this project; and
- The subdistrict management and Operational Managers who participated in the endeavour.

LIST OF ACRONYMS AND ABBREVIATIONS

ABS	Australian Bureau of Statistics
AG	Auditor-General
AIDS	Acquired Immune Deficiency Syndrome
ANC	African National Congress
APP	Annual Performance Plan
BVS	Breede Valley Subdistrict
CARTA	Completeness, Accuracy, Relevance, Timeliness and Appropriateness of Presentation
CDC	Community Day Care Centre
CGITPF	Corporate Governance Information and Technology Policy Framework
CIHI	Canadian Institute of Health Information
CWD	Cape Winelands Health District
DHB	District Health Barometer
DHIS	District Health Information System
DHMIS	District Health Management and Information System
DHS	District Health Services
DoH	Department of Health
DPSA	Department of Public Service and Administration
DQAF	Data Quality Assurance Framework
EBM	Evidence-based Medicine
ECM	Enterprise Electronic Content Management System
EDM	Evidence-based Decision-making
EHR	Electronic Health Records
EMR	Electronic Medical Records
EPM	Evidence-based Policymaking
FFMPI	Framework for Managing Programme Performance Information
FOSS	Policy on Free and Open Source Software
G2B	Government to Business
G2C	Government to Citizen
G2E	Government to Employees
G2G	Government to Government
GCIS	Government Communication and Information Service
GITOC	Government Information Technology Officers' Council
GNQAF	Generic National Quality Assurance Framework
GSA	Geographic Service Area

GWM&E	Government-wide Monitoring and Evaluation System
HAST	HIV, AIDS, STI and TB
HIS	Health Information System
HIV	Human Immunodeficiency Virus
HMN	Health Metrics Network
HOD	Head of Department
ICT	Information and Communication Technology
ICU	Information Compliance Unit
IM	Information Management
IMF	International Monetary Fund
ISI	International Statistical Institute
ITU	International telecommunications Union
KM	Knowledge Management
LDM	Logical Data Model
M&E	Monitoring and Evaluation
MDGs	Millennium Development Goals
MEC	Member of the Executive Council
m-Health	Mobile health
MIOS	Minimum Information Inoperability Standards
MISS	Minimum Information Security Standards
MTSF	Medium Term Strategic Framework
NDoH	National Department of Health
NDP	National Development Plan
NGO	Non-governmental Organisation
NIDS	National Indicator Data Set
NPC	National Development Commission
NSDA	Negotiated Service Delivery Agreement
OECD	Organisation for Economic Co-operation and Development
PAC/RIS	Picture Archiving and Communication System and Radiology Information System
PGWC	Provincial Government of the Western Cape
PHC	Primary Health Care
PHCIS	Primary Health Care Information System
PHR	Personal Health Records
PI	Performance Information
PMTCT	Prevention of Mother-to-Child Transmission of HIV
PREHMIS	Patient Record and Health Management Information System

PTMS	Provincial transversal Management System
RSA	Republic of South Africa
SAO	Senior Administrative Officer
SARS	South African Revenue Services
SASQAF	South African Statistical Quality Assessment Framework
SITA	State Information and Technology Agency
SMS	Short Message Service
StatsCan	Statistics Canada
StatsSA	Statistics South Africa
STI	Sexually Transmitted Infection
TB	Tuberculosis
UN	United Nations
USSD	Unstructured Supplementary Service Data
WAN	Wide Area Network
WAP	Wireless Application Protocol
WCDoH	Western Cape Department of Health
WCED	Western Cape Education Department
WHO	World Health Organization
WOG	Whole-of-government

GLOSSARY

Alma-Ata Declaration

The first international declaration which highlighted the importance of primary healthcare as a means to achieve health for all (Wikipedia, 2015a).

Business Intelligence

This refers to the use of technology, applications and processes to collect and analyse data in making business decisions (Pearlson & Saunders, 2009:G1).

Data

Data are facts about people, places, events or things that are of importance to an organisation. Data can be captured, transmitted electronically and stored, but on its own it has no intrinsic meaning (Wager, Lee & Glaser, 2009:88).

Developing country

A developing country is one with a Gross National Income (GNI) of US\$11,905 or less (ISI, 2015).

E-Health

E-health involves the use of ICT to improve the flow of information via electronic media in support of the management and delivery of health services (WHO, 2012:1).

Evaluation

Evaluation is the systematic and objective assessment of an ongoing or completed project, programme or policy and its design, implementation and results. The aim is to determine the relevance and fulfilment of objectives, efficiency, effectiveness, impact and sustainability. It enables the incorporation of lessons learned in the decision-making processes of the organisation (OECD, 2010:21).

Feedback

The process within the monitoring and evaluation (M&E) framework through which information and knowledge are disseminated and used to assess the overall progress towards achieving results or to confirm the achievement of results (UN, 2002:7).

Indicator

It is the quantitative or qualitative factor or variable that provides a clear and reliable measure of achievement or change brought about by an intervention (OECD, 2010:25).

Information

Information is data that is processed or reorganised into a more meaningful form, such as reports or documents, which facilitates the acquisition of knowledge for decision-making (Wager, Lee & Glaser, 2009:88).

Information system

An information system is a set of interrelated components that collects, manipulates, stores and disseminates information and provides a feedback mechanism to meet an objective (Stair, Reynold & Chesney, 2008:521).

Knowledge

Knowledge is synthesised and contextualised information (Pearlson & Saunders, 2009:13).

Monitoring

Monitoring is a continuing function that provides management and stakeholders with an ongoing development intervention, with indications of the extent of progress in the achievement of objectives and use of allocated funds, through the systematic collection of data on specific indicators (Kusek & Rist, 2004:12).

Outcomes

These are the effect of an intervention's outputs (OECD, 2010:28).

Performance information

This is quality and credible information regarding programmes which enables the organisation to manage the achievement of strategies (National Treasury, 2010:v).

Results chain

This is the causal sequence of a development intervention to achieve the desired objectives, starting with the conversion of inputs into outputs, and culminating into outcomes and impacts. Throughout this whole sequence feedback about progress is provided (OECD, 2010:33).

Wellness

Wellness not only signifies the absence of disease but also the ability of individuals to maximise their personal potential in all spheres of life (WCDoh, 2014:xiv).

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CHAPTER 1: INTRODUCTION AND PROBLEM STATEMENT

1.1 Introduction

“Managing a health system without information is like trying to fly a plane blind.”

Dr Ben Gaunt (2013:6)

This statement epitomises the importance of information in the health system if it is to remain functional in terms of patient-centred care and treatment and in terms of the provision of health infrastructure and services.

Health systems, locally and internationally, are becoming more complex as globalisation has increased the risk of communicable diseases, such as Ebola, severe acute respiratory syndrome, avian flu and extremely drug-resistant tuberculosis, developing into pandemics. In response to these threats, health systems are moving away from a disease-specific health focus to a comprehensive strengthening of the health system in order to achieve improved and sustainable long-term health outcomes. Central to this quest is the supply of timely and reliable data that can assist health authorities in making decisions about the effective, efficient and equitable allocation and distribution of health resources (Nutley, 2012:2).

Data are “raw facts about people, places, events and things” that are of importance to an organisation. Data can be captured, transmitted electronically and stored, but on its own it has no intrinsic meaning. Information on the other hand is data that is processed or reorganised into a more meaningful form, i.e. reports or documents, which facilitates the acquisition of knowledge for decision-making (Wager, Wickham & Glaser, 2009:88).

The World Health Organization’s (WHO) *Framework to Strengthen the Health System* identified health information as the causal link and foundation that informs decisions relating to health personnel, services, finance, governance and leadership, medical products, vaccines and technologies. The framework follows a systems approach whereby inputs (resources) are converted into outputs (goods and services) that are focused on the attainment of specified outcomes (WHO, 2007:v-vi). A health information system (HIS) sets the value chain in motion as it collects, disseminates and stores information, and provides feedback to decision-makers about the overall performance of the system (Stair, Reynold & Chesney, 2008:521). According to Cloete (2003:29), the collected information can be used at operational and strategic levels. At operational level, the information can be used to monitor results, control activities, assess

and plan new services while at strategic level it assists senior management to manage the strategic direction of the organisation effectively.

The functionality of health information is further increased when combined with population and demographic statistics, especially when the health needs of a specified population are targeted. For example, to erect a new health facility, information is required about the age and size of the population, mortality rates, the burden of disease and the availability of infrastructure and resources within the vicinity. Based on this data, health authorities are able to make informed decisions about the size of the facility, the range of services to render and the number of personnel to deploy. This method of decision-making has become known as evidence-based decision-making¹ (EDM).

The Australian Bureau of Statistics (2010:2) defines EDM as the research and analysis of available evidence in a systematic and rational manner to inform the policymaking process. As a systematic approach, EDM is also able to track and measure the success or failure of policies because performance evidence is generated across the entire policy cycle.² In the light of this, EDM can provide health authorities with strategic direction to achieve sustainable health outcomes, foster greater accountability in terms of health policies, demonstrate the merit or value of a particular policy and facilitate the case for alternative forms of interventions.

Information and communication technology (ICT) has increased the accessibility and use of statistical data and research evidence as a means to build consensus around health policies and the distribution of resources. Heeks (2007:74), however, points out that inaccurate data not only leads to inappropriate actions on the part managers but also cause electronic services, like e-Health, to the collapse. Investment in ICT will yield very low or no returns unless it is underscored by reliable data. The reliability and usefulness of information delivered by an information system is dependent on the quality of data that is transformed into information. Technology and information systems are conduits that capture, process, store and disseminate information. ICTs cannot change the quality of data that is collected at the point of service delivery. One aspect that is often overlooked is how the perceptions of those who gather and use data on a daily basis affect the quality of the information and its further

¹ In this study, the terms evidence-based decision-making (EDM) and evidence-based policymaking (EPM) will be used interchangeably.

² Agenda setting, problem definition, policy design, implementation, impact and termination (Vestman & Conner, 2008:51).

use. According to Heeks (2007:83), there is no such thing as neutral data in the public sector for all data are shaped by those who use it.

The aim of this study was to assess the data quality of performance information captured in the Breede Valley Subdistrict from the perspective of the Operational Managers. Evidence-based decision-making, data quality, e-government and related concepts such as e-health will be explored further in Chapter 2. The remainder of this chapter includes an overview of the background and rationale of the study, the purpose of the study, the research design and methodology, and a chapter outline of the study.

1.2 Background and rationale of this study

Healthcare 2030: The Road to Wellness is the Western Cape Department of Health's (WCDoH) strategic framework for the medium-term future. It advocates an integrated and holistic approach to wellness by focussing on the social and contextual determinants of health (i.e. low levels of education, unemployment, alcohol and substance abuse, and exposure to environmental hazards) rather than just the physical manifestation of disease and illness. Accordingly, sustainable wellness is not a matter to be dealt with by the WCDoH alone but is linked to the performance of other social partners such as the departments of Education, Environmental Affairs, Community Safety and Social Development whose programmes directly impact on the social and environmental determinants of health (WCDoH, 2014:17).

A prerequisite to measure the success of this strategy is an information system that is able to integrate data from various sources, and provide timely and good quality information. Hence, *Healthcare 2030* relies on an expanded use of ICT. The term business intelligence³ is used to describe the automation of the data collection and analysis processes to inform business decisions. To this end, separate financial and clinical business intelligence systems will generate the data required for planning, implementation and monitoring and evaluation (M&E) purposes (WCDoH, 2014:119).

The WCDoH delivers health services to the Western Cape population through a decentralised district-based health service model, which consists of demarcated Geographic Service Areas (GSAs). GSAs follow the municipal district and subdistrict boundaries and are in the best position to deliver health services that are tailored to the needs of the population located in

³ Business intelligence refers to the use of technology, applications and processes to collect and analyse data in making business decisions (Pearlson & Saunders, 2009:G1).

that geographical area. On a monthly basis, data of various performance indicators are captured at subdistrict level to measure the performance of the various health programmes implemented across the province. The data collected from the districts are then aggregated into a provincial data set and deposited into *Sinjani*. *Sinjani* is the WCDoH's central data depository from where the data can be further analysed and exported to the National Department of Health (NDoH).

Healthcare data is particularly prone to systemic and random errors. Systemic errors are caused by discrepancies in following standard operating procedures or systems, unclear data definitions or non-compliance to data collection protocols. Random errors are caused by "carelessness", i.e. poor handwriting or transcription errors (Wager *et al.*, 2009:55). According to Heeks (2007:74-83), data errors can occur during capture, input, processing, storage and output phases of the information cycle and the causes can be either human or technical. He (Heeks, 2007:74-83) accordingly postulates, that poor data quality is caused by a combination of technical and human errors.

Technical causes include environmental hazards (high temperatures/humidity, static electricity, dust and smoke, fire, floods, and lightning), electrical problems, equipment breakage and software errors. Human errors are caused by perceptions that are based on certain beliefs. Data irrelevance (data is produced for someone else, hence it is irrelevant), non-use (data will be of no consequence in the decision-making process), fear of data-related punishment (providing data will have a negative consequence like paying taxes or political repercussions) and data-related rewards (inflating or creating data will result in a performance bonus or satisfy an ulterior political motive, i.e. gaining access to funding). Moreover, poor data is the result of people's assumptions about the value of the data, which, in turn, can either positively or negatively influence the quality of data they produce.

An assessment of data quality in the planning and management of ten rural clinics in Northern KwaZulu-Natal revealed that data quality was poor and that staff was unable to use information effectively. The latter was exacerbated by the lack of an information culture. The staff, for example, had no analytical or interpretative skills and displayed a lack of understanding about how to use data in general (Garrib, Stoops, McKenzie, Dlamini, Govender, Rohde & Herbst, 2008:511). The flow of information is often obstructed by data that remains confined in reports and databases, instead of being effectively transferred and used in decision-making processes (Nutley, McNabb & Salentine, 2013:1).

The problem of poor data quality is not only limited to the health sector but endemic to many of South Africa's public institutions. Indicative of this is the incessant⁴ spate of public service delivery protests that we experience. In this regard, the South African government acknowledged that the failure of departments to deliver services are related to the non-existence of information systems that can provide departments with reliable information about their levels of service delivery (GCIS, 2015a:1).

Although the information management processes are largely invisible to the public, quality data is indispensable in the quest to improve health and other governmental services. Information based on relevant, accurate and complete data can progressively improve public managers' decisions about what works, what does not work and why it does not work. Answers to these questions, however, will elude public managers as long as the evidence placed before them is based on questionable data or data which simply does not exist.

1.3 Purpose of the study

Healthcare 2030's ultimate aim is to attain a vision, a desired state, about how and where the WCDoH sees itself in the year 2030. Hence, policies and programmes will be put in place to realise that vision. By analysing the current reality, it is possible to make projections about the viability of the strategy and whether or not that desired state can be achieved.

The purpose of this study was to assess the quality of current performance data as a reliable source for EDM to improve the delivery of public health services. It is contended that the results of this study (positive or negative) will also indicate the feasibility to expand the ICT component of the mentioned strategy.

1.4 Potential value of the study

Healthcare 2030 can rightly be described as a first in South Africa, as it sets course on largely uncharted waters. It attempts to bridge the chasm between planning and the delivery of services by increasing the use and analysis of information captured at the coalface of service delivery. This requires both a new way of doing things and greater responsibility from managers to ensure that their decisions are informed and justified by evidence.

⁴ Some reports suggest that the incidence is as high as a protest every second day (Roets, 2015).

This study seeks to assess the reliability of performance data generated in the Breede Valley Subdistrict for evidence-based decision-making purposes. The results of this study will provide the WCDoH with a baseline indication of how far the districts have progressed towards the realisation of evidence-based decision-making (EDM), and what steps should be implemented to realise this goal. In addition, the study will assist subdistrict management to identify local risks to the realisation of EDM. It is also foreseen that other government departments might replicate this study to test the reliability of their data for EDM and/or monitoring and evaluation (M&E) purposes.

1.5 Research problem and objectives

In order to address the research problem, the research thesis had to be located within a relevant conceptual framework with clearly defined parameters. This subsection makes explicit the primary and secondary objectives the researcher plotted to address the research problem.

1.5.1 Research problem

The primary question that this study attempts to answer is whether the performance data generated in the health sector of the Breede Valley Subdistrict is a reliable source for evidence-based decision-making. In order to address this question, it is assumed that despite the WCDoH's strategic reliance on quality data to make evidence-based decision-making processes possible, data quality remains questionable.

1.5.2 Research objectives

The objectives of this study can be divided into the general aim and specific objectives.

1.5.2.1 General aim

The general aim of this research was to determine through a literature review, questionnaires and semi-structured interviews whether or not performance data generated in the health sector of the Breede Valley Subdistrict is reliable and can be used for EDM purposes. The outcome of this study will provide the WCDoH with an indication of whether or not the organisation is ready to implement evidence-based decision-making.

1.5.2.2 Specific objectives

The primary objectives of this study are to:

- Explore and inform the meaning of evidence-based decision making and its relevance to the delivery of public services within the context of the health sector;
- Provide an understanding of the e-health concept within the context of e-government;
- Explore and inform the use of data and data quality assurance models within the context of the health sector; and
- Describe the national Department of Health's strategic plan and how it interlinks with *Healthcare 2030*.

The secondary objectives of this study are:

- To describe the South African e-government legislative framework; and
- To explore the barriers to the successful implantation of South Africa's e-health strategy.

1.6 Scope and limitations of this study

The scope and limitations of the study delineate the focus area of the research and identify those factors that could impact on the result of the study.

1.6.1 Scope of the study

As mentioned above, this study attempts to assess the data quality of health information in the Breede Valley Subdistrict for evidence-based decision-making purposes. Although this study is performed in the health sector, it should be emphasised that the scope of this study is limited to performance data which is defined as "information regarding programmes which enable the organisation to manage the achievement of strategies" (National Treasury, 2010:v). No confidential patient information was required or assessed for this study.

1.6.2 Limitations of the study

The major limitation of this study was time. Hence, data was only collected from the Medical Superintendent, the Primary Health Care (PHC) Manager and Operational Managers of the

eight fixed primary healthcare facilities in the Breede Valley Subdistrict who collect and use performance data for the planning of health services.

1.7 Research design and methodology

This study used a qualitative, non-experimental research design as the objective was not to manipulate variables but to observe and study the variables as they exist within their natural environment. A case study was decided upon to answer the research question as it allows for an in-depth description of a small group of people or community (Mouton, 2004:148). At the time of this study, clinical personnel in the Breede Valley Subdistrict had to collect data about 96 data elements that were used to calculate 65 performance indicators. A non-probability, purposive sampling method was used to select key subjects who could make a meaningful contribution to the subject under investigation.

Primary data was collected through the use of questionnaires and semi-structured interviews. This component constituted the empirical component of the study while the literature review comprised of the non-empirical component of the study. In order to minimise a low response rate and expedite the data collection process, the researcher made appointments with all key informants to either administer the questionnaire or to conduct the interviews.

1.8 Outline of chapters

Chapter 1: Introduction and problem statement

This chapter provides an introduction to the critical role of timely and reliable information in the strengthening of health systems and evidence-based decision-making. It highlights the use of ICT and explains how *Healthcare 2030* envisages stronger reliance on ICT to improve the delivery of health services. The rationale, problem statement and objectives are also discussed as well as the research design and methodology. The research design and methodology section is further explained in Chapter 4.

Chapter 2: Theoretical framework

Chapter 2 provides a theoretical framework explaining how ICT is revolutionising the planning and delivery of health services. To this end, different data quality assurance models will be explored. Key concepts such as data quality, e-government and e-health will also be examined

in relation to the increased national and global uptake of information for the purpose of evidence-based decision-making (EDM).

Chapter 3: The South African legislative framework and National Programme of Action

The third chapter reviews the South African legislative framework and how it facilitates the development of e-government and e-health per se. This chapter will also explore the use of ICT to improve the provisioning and delivery of health services in terms of the government's national programme of action. The intention is to gauge how successful policies are being implemented and if there is alignment in the strategic objectives between the national and provincial spheres of government.

Chapter 4: The Breede Valley Subdistrict: a case study

This chapter will provide an overview of the Breede Valley Subdistrict as the case study in terms of its mandate, organisational structure and the services it renders.

Chapter 5: Data gathering and analysis

This chapter deals with the research problem and chosen research design as well as the data collection and analysis thereof.

Chapter 6: Explanation and interpretation of research findings

This chapter presents the findings of this study and compares it to the expected outcomes of the case study.

Chapter 7: Summary, conclusion and recommendations

This chapter summarises the research findings and presents recommendations based on the current evaluation of the findings.

1.9 Summary

Reliable and timely information has become the foundation for the planning and delivery of health services. Furthermore, public demands for greater accountability and evidence-based

decision-making have increased the need for good data quality. Although the use of ICT has improved the flow and use of information in the health sector, the information generated by information systems is only as strong as the quality of data these systems receive as an input. Poor data quality remains the biggest risk to evidence-based decision-making processes because it leads to errors in the measurement of health system performance and the setting of wrong priorities, which result in the wasting of resources.

Healthcare 2030 follows international trends by primarily focusing on the overall strengthening of the health system to ensure it remains responsive to the needs of the people in the Western Cape. To reach this goal, the Western Cape Department of Health envisages an ever-increasing reliance on ICT to deliver timely and reliable information to guide it towards that ideal.

This chapter outlined the background and reasons why this study was undertaken. The proposed choice of methodology used in this study has also been accounted for. The following chapters will assess the reliability of current data for the purposes of evidence-based decision-making.

In the following chapter, the theoretical framework and key concepts related to the use of information in evidence-based decision-making will be discussed.

CHAPTER 2: THEORETICAL FRAMEWORK

2.1 Introduction

The theoretical framework of this study was underpinned by a literature review of key issues related to the research objective of this study. Key concepts such as evidence-based decision-making, e-government and e-health, health information systems, and data quality assurance frameworks will be examined in this chapter. A deliberate attempt was made to use only the most recent writings but in some instances the researcher had to resort to sources older than five years as these sources were the most recent writings on the subject matter being investigated.

2.2 Evidence-based decision-making (EDM)

The roots of evidenced-based decision-making (EDM) can be traced back to evidence-based medicine (EBM), which advocates the appraisal and use of research evidence for clinical decision purposes (Hammer & Collison, 1999:5). Rather than solely relying on clinical experience or opinion, research evidence is incorporated into medical decisions about patients' health. Consequently, EBM was defined as the integration of the best research evidence with clinical experience and values (Craig & Smyth, 2002:9). Although the principles of EBM were later adopted by policymakers, educationists and managers alike, the actual use of research evidence remained largely confined to the health sector (Hains & Donald, 1998:4).

It was not until the 1990s, when the British government under the leadership of Tony Blair advocated the use of evidence for policy formulation, that EDM became part of the political discourse. Blair sought to modernise government by producing policies that would tackle the causes of problems and not only the symptoms. Blair's election slogan, "What matters is what works", meant applying research evidence to decision-making and policymaking formulation rather than solely relying on conjecture or ideology. The use of evidence became part and parcel of the greater modernisation process which questioned ideology-based decision-making to produce public value (Banks, 2009:3). Modernisation in effect stimulated EBM as it encouraged outcome management, emphasised management before process, being citizen-centred, and required transparency and credibility of government institutions (Ibarrola, 2012:15).

Scholars such as Kusek and Rist (2008:98), Mackay (2008:9) and Pew-MacArthur Results First Initiative (2014:1) agree that the need for a more pragmatic approach to decision-making

still prevails. Governments around the world are under exceeding pressure from internal and external stakeholders to demonstrate improved decision-making, governance, accountability, transparency and tangible results. Consequently, there is appreciation that rigorous evidence can substantially advance government decision-making to select, fund and more strategically operate public programmes, in order to improve and address societal problems. Likewise, advances in ICTs to store and process infinite amounts of data and generate the evidence or feedback loops make it possible to track and measure the success or failure of policies. In this regard, Strydom, Funke, Nienaber, Nortje and Steyn (2010:1) confirm that rigorous evidence provides a solid technical analysis of a problem and thereby exposes decision-makers to options that they otherwise would not have considered.

In order to understand the EDM process, Nutley, Walter and Davies (2008:12) conceptualised the evidence-based policy and practice paradigm. This paradigm highlights the ubiquitous use of research evidence at the various levels of an organisation. Figure 2.1 illustrates how research evidence informs policies, decisions and the practice of evidence-based medicine.

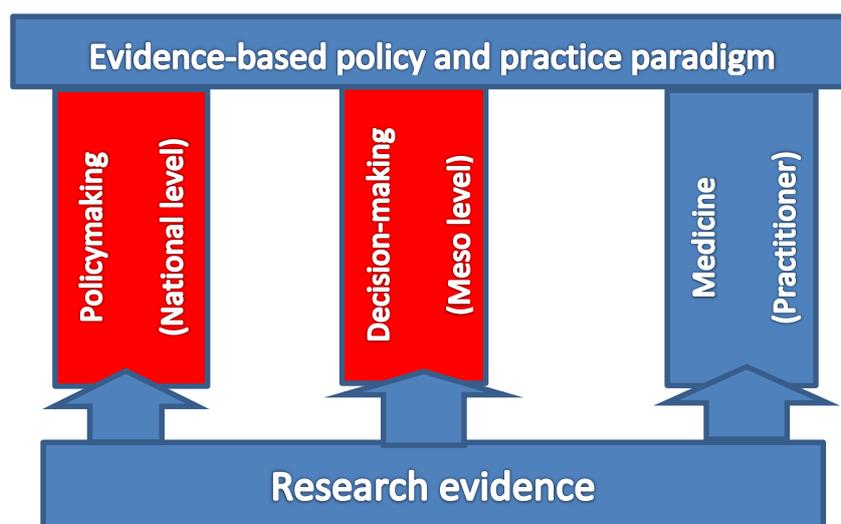


Figure 2.1: The evidence-based policy and practice paradigm

Source: Own elaboration based on previous research.

Conventionally, evidence-based decision-making is equated with evidence-based policymaking⁵ (EPM), in the broad sense, where evidence is used to inform national policies,

⁵Similar to EDM, EPM also rigorously use evidence to substantially advance and improve government decision-making to select, fund and more strategically operate public programmes in order to improve equity, effectiveness and efficiencies (Pew-MacArthur Results First Initiative, 2014:1). EPM facilitates policy argumentation for it sets the debate about the merit of a policy within the context of policy-relevant information (Dunn, 2008:19; Segone, 2008:35).

or with evidence-based medicine (EBM), in the narrow sense, referring to the day-to-day use of research evidence by practitioners such as doctors, social workers and educators. This paradigm, however, places EDM at meso level (organisational level) but also equates evidence-based decision-making with evidence-based policymaking. According to Nutley *et al.* (2008:7), policymaking is a two-way process that can take place at either national and/or organisational levels. The common thread that binds EPM, EDM and EBM is the use of research evidence to inform decision-making.

As mentioned, EDM is defined as the appraisal and uses research evidence in a systematic and rational manner to inform decision-making. The assumption about “what works” is based on statistical evidence generated through a rational inquiry to promote well-being and improve citizen’s quality of life (ABS, 2010:2; Hartley & Skelcher, 2008:9). Policies, programmes and projects are evidence-based if decisions regarding their development and implementation are based on the use of the best available evidence (Davies, 2004, cited in Nutley *et al.*, 2008:13). What therefore counts as good evidence or, put more succinctly, is fit for purpose is evidence that is able to address the initial problem statement that confronts decision-makers. Evidence can range from research and evaluation studies to routine monthly data, expert knowledge, and information derived from consultations with stakeholders.

As an added benefit, EDM directly underscores the knowledge management function at organisational level. Von Krogh (cited in Alvai & Leidner, 1999) defines knowledge management at this level as the identification, capturing and use of collective knowledge to compete with other organisations, and increase organisational innovation and responsiveness to emergent threats. In this regard, organisational generated evidence enables managers to define a problem and assess the impact of national policies on it. Oversight and organisational learning are also strengthened as research evidence allows the organisation, and in particular managers, to be responsive and adaptable to changing circumstances and contexts. Furthermore, EDM is also a monitoring tool to measure the efficiency and effectiveness with which public goods and services are delivered.

Strydom *et al.* (2010:8) in their review of EDM, however, noted that research evidence is predominantly applied to predefined problems or used to resolve perceived gaps in performance. Performance gaps arise when there is a difference between what an organisation actually delivers and its real potential (Walker & Damanpour, 2008:220). Such a mechanistic approach to EDM fails to appreciate the interrelatedness of societal problems and how the values of decision-makers determine the final outcome of a decision.

As the focus of this study is on the use of evidence at meso or organisational level and literature on EDM at this level is limited, the work of Nutley *et al.* (2008) will form the basis for the exploration of this concept in the sections that follow.

2.2.1 Evidence usage

The use and relevance of evidence depends on how a particular problem is framed and the extent to which the evidence contributes to the resolution thereof. In this regard, it is noted that evidence can take various pervasive forms, namely instrumental, conceptual or as a process to enable organisational improvement and learning.

The instrumental use of research embodies the widely held conception that research can directly impact on policy and practice decisions. A specific piece of research is offered as the defining solution to a problem. In reality, however, research evidence seldom supplies hard-and-fast solutions, and are more often used in subtle and indirect ways to influence people's perceptions, attitudes or understanding of an issue (Nutley *et al.*, 2008:36).

The conceptual use of evidence seeks to raise the consciousness of policymakers and practitioners in order for them to reflect on their decision-making processes, i.e. what they do, why they do it and how they do it. In so doing, the conceptual use of evidence informs and potentially alters the initial framing of a problem, and may even call into question what is considered to be a problem in the first place. The effect of such an enlightened approach is very powerful as it can cause shifts in opinion that directly impact on the social, political and policy discourses of the day. Segone (2008:32) also found that a new conceptual understanding of a societal problem can be directly applied in instrumental ways to address that specific problem. In the policymaking process, evidence is mainly used in subtle and conceptual ways.

Evidence can also be used as a strategic or tactical tool to influence public opinion about how a problem is defined and what solution might be appropriate. This is particularly true in politics where evidence is used to legitimise a particular stance or to discredit political opponents (Nutley *et al.*, 2008:37). In this regard, evidence is used selectively and can be employed instrumentally and/or conceptually.

Lastly, evidence can be used as part of a process that facilitates learning by engaging with different stakeholders who collectively assess how a problem is defined and what the possible

solutions to a specific problem might be. The process of conducting research serves as a means to engage with stakeholders, which can be as important as the research findings. Process learning can even continue beyond a single set of findings with the added advantage that this engagement might have a sustained impact on research (Nutley *et al.*, 2008:38).

Decision-makers at organisational level should be cognisant of the fact that research evidence can serve different purposes. As a result, determining what evidence is relevant can in itself be an iterative and interactive process. This is especially true if managers are grappling to define and/or devise a solution to a specific problem. In the next section, the various EDM models as practised at organisational level will be explored.

2.2.2 Models of EDM

The following three models exemplify how EDM is practised at organisational level and provide valuable insight into how evidence is used and incorporated into an organisation's decision-making processes. Moreover, these models are archetypes which can be used exclusively or in combinations. The archetype to which an organisation subscribes depends on the professional training of staff, the development or implementation stage at which the organisation finds itself, the complexity of the research question or findings, the service area in which the research will be used, the local or organisational context, and the purpose for which the evidence will be used (Nutley *et al.*, 2008:218).

2.2.2.1 The research-based practitioner model

In this model, skilled practitioners are able to express their knowledge needs as a research question which is resolved through the use of research evidence. This model mimics the evidence-based medicine approach where individual practitioners (doctor, nurse, educator or social worker) keep abreast of the latest research in their field of expertise which, in turn, informs their daily practice. It is assumed that the practitioner is highly skilled and accountable, and that service delivery takes place on a one-to-one basis. Research evidence is incorporated with clients' views and preferences in their day-to-day practice and decision-making.

This model predominantly assumes an instrumental use of research while the act of keeping abreast of current research informs the practitioner's conceptual understanding. Knowledge is continuously gained about a particular phenomenon and how best to address it. Despite the

general appeal of the research-based practitioner model, the use of research is limited to practitioners who fulfil a developmental role and organisations which promote a culture of evidence use and learning (Nutley *et al.*, 2008:205-210).

2.2.2.2 The embedded research model

In this model, research is the responsibility of management (national or local policymakers and service delivery managers) who translate key research findings into governance frameworks and supporting procedures, protocols and guidelines to which every employee should adhere. Research is thus refined and codified before being “embedded” into the organisation.

As research evidence is directly transferred, the impact can be very significant on the organisation. To this end, the uptake of research-based tools and programmes is higher if (a) the service delivery in the organisation is already standardised and routinised; (b) tools and programmes are refined to “fit” the local context; and (c) procedures and protocols are developed in conjunction with local service delivery managers.

Furthermore, this model does not allow a high degree of professional autonomy as compliance to procedures and protocols are entrenched by performance measurements, audits and appraisal regimes. The effectiveness of this model is compromised if employees are not provided with the necessary training (Nutley *et al.*, 2008:210-213).

2.2.2.3 The organisational excellence model

The organisational excellence model aims to improve the uptake of research evidence by contextualising research evidence to local circumstances and priorities. A high premium is placed on the experimentation and evaluation of research evidence. Organisational learning is stimulated as research knowledge is integrated with routine monitoring data and experiential knowledge to clarify a given problem. Unlike the previous models which primarily focus on evidence use, the organisational excellence model seeks to understand the nature of a problem and why it has arisen in local circumstances. Research use is both conceptual and instrumental. On the one hand, research informs the decision-maker’s understanding or perception of a problem, while, on the other hand, it affects decisions and influences behaviour.

A key tenet of this approach is that research use does not reside with practitioners or national policymakers but with the service delivery organisation itself – in other words, with its leadership, management and the organisation as a whole. The organisation continuously improves itself by emphasising both research uptake and local experimentation. This model is synonymous with the interpretivist approach that offers practical solutions to the real-life problems of decision-makers (Skelcher, 2008:43). The reflexivity or feedback loop of this model provides managers with constant feedback about how well a project or programme is meeting its objectives and identifies performance gaps that should be rectified. Nutley *et al.* (2008:217) contend that interactive models, such as the organisational excellence model, show the most promise in improving the uptake of research at organisational level.

Due to an increase in research activities, joint research ventures with universities or research organisations are commonplace. Although this seems like an advantage, it is at the same time a major drawback as it involves time and money which might not always be available (Nutley *et al.*, 2008:214-220).

The organisational excellence model is similar to the Logical Framework Approach also known as a theory of change which delineates how the conditionality (prevailing conditions and identifiable risks) between inputs, activities, outputs and outcomes can contribute to the achievement of an initial objective (Hall & Clauss, 2012). Feedback is provided to managers across the entire result chain. Consequently, managers have greater conceptual and direct control over how a policy, programme or project is implemented.

2.2.3 Translating evidence into decisions

Segone (2008:34) argues that evidence-based decisions cannot be reduced to mere technical analysis but have to be weighed against the interests and institutions represented in the decision-making process. This sentiment is shared by Strydom *et al.* (2010:3) who points out that the decision-making process is value driven and that scientific evidence is, consequently, not the only consideration. The political and institutional arrangements should be aligned with the evidence that is being used. Research evidence is of little value unless it is reconcilable with contextual factors and takes the bigger picture into account. Translating evidence into decisions is almost always dynamic and in constant flux, as political, cultural, social and economic factors change. In this regard, Head (2010) identified the political, scientific, organisational (implementation) and client/stakeholder evidentiary bases that a decision-maker should consider when justifying the use of research evidence.

The first, political knowledge is certainly the single most influential evidence base and refers to the contextual judgement of politicians who are invariably biased to their own points of view. Evidence is relevant to the extent that it perpetuates and entrenches the status quo. This is the most general and pervasive form of evidence used in the decision-making process. The second, scientific knowledge, unlike the political frame of reference, analyses current and past conditions and trends to determine the causes of a problem. Randomised controlled tests that examine the relation between causal factors are considered the golden standard to prove the effectiveness of an intervention.

The third knowledge base is implementation knowledge which focuses on practically derived knowledge about policy implementation and the delivery of services. This is the interface between policy and beneficiaries. Knowledge is systematised into operating standards and guidelines. Implementation knowledge provides for limited organisational learning as societal realities are ever-changing, which may require new modes to manage and implement decisions or policies. Ultimately, the appropriateness and responsiveness of a decision is determined by the effect (positive or negative) on the beneficiaries or service users. According to Head (2010), client and stakeholder knowledge is becoming increasingly important as ineffective decisions can bring the legitimacy of political leaders into question.

Despite the advantages that EDM holds for the public sector, the uptake of research evidence remains limited. In this regard, Strydom *et al.* (2010:3) identified an institution's organisational structure, function and composition; the prevailing socio-economic conditions; the credibility of the information and scientists; positive past experiences in applying evidence; and the extent to which decision-makers and scientists understand each other's values, priorities and ethics as the determining factors in the use of evidence at organisational level. In the next section, EDM in the South African context is discussed.

2.2.4 Framework for Managing Programme Performance Information (FMPPI)

In South African, the use of evidence in governmental decision-making processes is institutionalised by the Framework for Managing Programme Performance Information (FMPPI). The FMPPI together with evaluations and social, economic and demographic statistics forms the Policy Framework for the Government-wide Monitoring and Evaluation System (GWM&E), which is the overarching framework to monitor and evaluate government policies, programmes and projects (National Treasury, 2011:4).

The FMPPI regulates the collection and use of programme performance information which are contained in departments' administrative and financial records; social, economic and demographic statistics; and other sources, such as departmental surveys (National Treasury, 2011:4). Performance information (PI) is used to measure the performance of government services and activities and to set baseline targets which inform future planning and budgetary processes. Furthermore, the aim of the FMPPI is to clarify standards for PI in support of the regularity audits of the Auditor-General for non-financial information; improve the structures, systems and processes to effectively manage PI; define roles and responsibilities; and provide oversight bodies with timely, accessible and reliable PI (National Treasury, 2010:1).

To meet this legislative requirement, departments have to produce a five-year Strategic Plan which details projects and programmes, resource needs and other prescribed requirements; as well as an Annual Performance Plan with annual and quarterly targets for the current financial year with the aim to realise the five-year Strategic plan. In addition, departments have to identify core performance indicators to monitor progress towards the achievement of set targets. The results of this monitoring exercise are recorded in the quarterly reports which are submitted to the departments' administrative and political principals (National Treasury, 2010:1-2). Ultimately, PI should enable provincial and national legislatures to measure if government institutions have fulfilled their mandates and/or implemented required policies.

As a further measure to ensure the relevance and credibility of departmental PI systems, departments are obliged to submit their PI plans to parliament and provincial legislatures. These plans should detail the indicators used to measure PI; the source data selected to develop indicators; the storage and accessibility of PI data; and the use of PI for EDM purposes (National Treasury, 2011:1).

The statistical evidence generated by PI systems allows for the tracking of government policies, programmes and projects across the entire theory of change from inputs, outputs, outcomes to impacts. National and provincial treasuries use this data to assess the value-for-money of departmental activities against the objectives set out in the strategic and annual performance plans (National Treasury, 2007:4, 7).

Likewise, at the meso level, the PI system functions as an early warning system to alert managers to the performance of activities under their control. The collected data can be used instrumentally and conceptually to identify and understand an evolving need and/or to correct any dysfunction in an existing value chain. The use of evidence in this instance is congruent with the organisational excellence model (discussed above). The PI system holds great

promise as it is able to inform planning across all tiers of government and supply government with objective evidence about what works and/or the emergent needs of citizens. In the next section, e-government and related concepts will be discussed.

2.3 E-government

The advent of e-government basically rewired the flow of information by electronic means inside government, between governments, and between government, citizens and businesses. To illustrate the point, a message can be either delivered in person, by post or instantaneously by email. The electronic message has the added advantage that it gives the recipient more time to decide on an appropriate course of action in response to that message. Mayer-Schönberger and Lazer (2007:12) contended that information is the foundation on which the modern government bases its decisions and processes. Information guides government decisions ranging from peace and war to garbage collection.

As mentioned in Chapter 1, the health sector in particular is dependent on consistent information flows. WHO (2006:4) defined ICT very broadly as electronic tools that facilitate communication and transmit and process information. E-government allows governments to leverage the electronic transmission of information to improve efficiency and effectiveness in delivering services, improve transparency and accountability, and save on administrative costs (Gil-Garcia & Pardo, 2005).

Boviard (2005:48) argued that in a knowledge-based society and economy, ICT has become the main driver of organisational change. ICT provides endless possibilities to generate, disseminate, archive and reproduce knowledge which can be used to inform government decisions and innovations in the delivery of public services. The deployment of e-services are thus not about ICT per se but rather about using it as a strategic tool to improve and transform modern-day government.

As mentioned above, e-government refers to “electronic” government. Definitions abound as to what exactly constitutes e-government. Farelo and Morris (2006:1) define e-government as the use of ICT to promote efficient and effective government, to facilitate access to government services and information, and to make government accountable to citizens. The World Bank (cited in Boviard, 2005:19) define e-government as the use of ICT (Wide Area Networks, the internet and mobile computers) to transform relations between citizens, business and government. Gauld (2009:105) refers to e-government as the use of ICT with reference to the internet and the use of websites for public service activities. The Provincial Government of the

Western Cape (PGWC) (2015), in turn, define e-government as the sustainable use of ICT to improve information and service delivery and to encourage citizens to participate in decision-making.

Common to all these definitions is the primary use of ICT to optimise information flow regarding one or more of the following aspects: communication between government, businesses and citizens about government services, efficiency and effectiveness in delivering public services, and the promotion of public participation in decision-making or democratic processes.

For the purpose of this study, e-government will be defined as the use of ICT in the public sector. This is an all-encompassing definition that covers the use of ICT in all spheres or at all levels of government, i.e. national, provincial and local, and that distinguishes between the *internal* management of information systems and how these systems interface with *external* clients (Heeks, 2006:4).

The *external* interface or front office is where citizens access government services via ICT-enabled interfaces, such as a web portal, telephone, fax, television, radio, email, SMS, mobile portal and apparatus, social media and government kiosks at libraries, and community centres that provide free online access. The *internal* management processes, or back office, which is not visible to the public, support the front end and provide core services, such as finance, human resources, information technology, administrative support, legal services, facility management, travel services, marketing and communications (UN, 2008:4,128).

E-government is thus about the use of ICT in the public sector and how it transforms and improves the business processes of modern-day government. Operationalising the various e-government interfaces takes place on different domains, which is generally referred to as the e-government delivery model.

2.3.1 E-government delivery model

According to Pascuala (2003), e-government or e-services are directed at citizens (G2C), businesses (G2B), government employees (G2E), and government agencies (G2G). In terms of the e-government delivery model (see Figure 2.2), G2C and G2B can be classified as clients who receive government services via the front office while G2E and G2G can be equated to back-office services, which signify electronic information flow between governments, government departments and employees. Figure 2.2 depicts the different delivery domains and applicable service points.

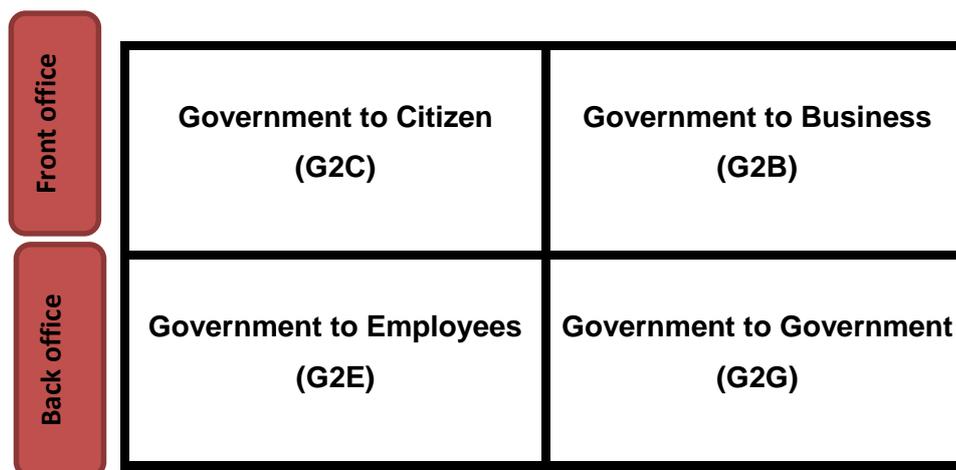


Figure 2.2: The e-government delivery model

Source: OECD/IUT, 2011.

Under each delivery mode, e-government offers certain electronic applications and services. The OECD/IUT (2011) describes these applications and services as follows:

G2C services are driven by the needs of citizens and allow government to react in a responsive manner. Services can be informational and educational, interactive or transactional, or can be general in nature and relate to matters of governance and citizen engagement.

Informational and educational services are characterised by a distribution of general government information and are delivered via push services like SMS or can be accessed via the internet or a wireless application protocol (WAP) site. Information can be general in nature (tourism, health, contact information, public safety, weather forecasts, services and regulations), specific (exchange and market rates, examination results, upcoming events, road closures, public hearings, services and fee changes), emergency alerts (severe weather, terrorist threats, fires, accidents, health risks), educational or notifications (library book deadlines, security notifications and news updates).

Interactive services take place on a one-to-one basis as citizens can send inquiries, problems, comments or service requests to designated government agencies. Unlike push services citizens can enter into dialogue with government. Services can be about health matters (screening and requests for illnesses, health monitoring and health forms), education services (admission requirements and exam results), security services (reporting of crime, law enforcement and requests for emergency assistance), filing of complaints and problems

(service interruptions, voting issues and lodging a complaint against a government official) and schedules (airline flights and field crew locations).

Transactional services allow citizens to transact with government electronically on a 24/7 basis. Services include employment (advertisements, applications and recruitment services); grants and social benefits; booking of appointments; transport services (purchasing bus, train or flight tickets); and completing a transaction with an electronic signature.

G2B applications support business development with emphasis on the development of small and medium enterprises. Services include information about policies, regulations and forms while applications deal with procurement, licenses, permits and the payment of taxes. In rural areas, government may also provide more elaborate services in support of businesses. These may include access to internet kiosks, mobile phones and apparatus, digital signature services, weather and market updates, and maps for transport and tourist sites.

G2E revolves around government empowering employees with tools, training and access to data to improve overall effectiveness and accountability of government services. The rapid evolution of mobile technology enables employees who are not office based or work in remote areas to have immediate access to record, retrieve and share data via mobile devices.

The **G2G** delivery mode facilitates effective and efficient response to the needs of citizens as government connects with itself to integrate back-office structures. The operative word is interoperability which allows for horizontal (among government agencies) and vertical (between different tiers of government) connections. Applications are used to coordinate activities, such as inspections, controls and supervisions; security services; and emergency and disaster management, and to access knowledge bases and records (health, education and public safety).

The delivery model highlights how information flow increases with comparative increases in the sophistication of the operating systems. This can clearly be seen when there is a government-to-government interface. In such instances, information has to be shared vertically (on national, provincial and local levels) and horizontally (across departments). E-government is not a once-off process but evolves as citizens and governments embrace the concept and use of ICT. As an evolving process, different stages of e-government development can be delineated as operating systems advance in sophistication and maturity.

2.3.2 Stages of e-government development

The United Nations E-government Development Index, which depicts five stages (emerging, enhanced, interactive, transactional information services and connected), is the benchmark against which UN member states measure their respective countries' e-government development (UN, 2008:16; UN, 2012a:95).

Stage I (emerging) sees the introduction of a government website with links to other departments such as education, social welfare, health, labour and finance. The mentioned departments deliver “bread-and-butter” public services which citizens require the most. The website typically contains basic information about services, downloadable forms and documents, and contact details. Information is static and communication is one-way, i.e. from government to citizens.

Stage II (enhanced) builds on Stage 1. Websites become multilingual and have audio and video capabilities. Websites also develop archive capability which can be easily accessed. Limited two-way communication is facilitated by the introduction of limited e-services which allow citizens to request non-electronic forms or personal information to be delivered via the post.

Stage III (interactive) sees the introduction of interactive web portals and various online services. Social media and mobile devices are used for information and alerts. The focus of this stage is solely on citizen convenience.

Stage IV (transactional information services) sees the government website linked to internal government systems which allow for electronic interaction between government and citizens. Two-way communication is introduced as both parties can request and receive inputs on government policies, regulation and decisions. Transactions are conducted online 24/7 and include the payment of fees, applying for licences and permits, and filing tax forms. Online security becomes an issue, and citizens are required to supply electronic verification of identity to complete transactions.

Stage V (connected) sees government transform itself into a connecting entity which develops an integrated back office in response to the needs of its citizens. E-services cut seamlessly across all government departments and entities. Information, data and knowledge are transferred vertically (between different tiers of government) and horizontally (within and outside government, i.e. private sector, civil society, NGOs and academic institutions) through

interoperable solutions. Citizens are engaged in government decision-making processes through various channels of e-participation.

The ultimate aim of all governments is to reach the connected stage. Stage V signifies unrestricted information flow inside government, between governments, and between government and other stakeholders. The focus is to consolidate and integrate the back office (operating systems) to enable multiple e-services as part of an expanded e-government framework. Underlying this vertical and horizontal connectedness is the systematic collection, reuse and sharing of data and information (UN, 2008:8).

In the next section, recent trends in optimising e-government information flow will be highlighted.

2.3.3 E-government trends

Snellen (2007:398) asserts that ICT has created new boundaries and jurisdictions that span networks which allow for both intra-organisational and interorganisational collaboration. Seamless government is the result of unrestricted information flow between operating systems.

The whole-of-government (WOG) trend underscores this by connecting government agencies, which share objectives and operate across boundaries, to develop an integrated government response to a particular issue. In practice, this means that ICT-based interoperable solutions⁶ applied to back-end integration will create a “seamless” front-end where citizens can find aggregated services and information through a central entry point. One-stop government portals are arranged according to life themes or audiences like the young, elderly, women, job seekers or students. From here, other government websites can be accessed (UN, 2014:58).

In terms of interorganisational collaboration, the WOG approach allows for both technical and organisational interoperability. In this instance, various stakeholders – including government departments, citizens, businesses and other concerned groups – whose business and information processes are synergised, work collectively to address to a societal problem,

⁶ The term has three possible connotations: **technical interoperability** which refers to interfaces, data integration, accessibility and security services; **semantic interoperability** which denotes the standardisation of data so that it can be shared and used in different applications and organisations; and **organisational interoperability** which refers to the alignment of the business processes of different organisations to collectively deliver a service or product (Skiftenes, Dertz, Jansen, Krogstie, Spjelkavik & Olson, 2009).

which can be economic, social or environmental in nature. In addition, the WOG approach entrenches the knowledge management function at organisational level.

In addition, the application and emphasis on interoperable connectivity has shifted attention from e-government portals to other electronic channels⁷ to target specific audiences. Mobile services, for instance, allow government to employ mobile applications that are context and location aware. ConnectMom is an example of a government short message service that informs pregnant women about their unborn child's development, nutritional needs and clinic visits. Government services are thus tailor-made to suit the information needs of specific groups of the population (GCIS, 2015b).

Lungisa (meaning "fix it"), in turn, is an example of how government can optimise the usage of multiple channels. Lungisa is a mobile platform created by the City of Cape Town to report service delivery problems via SMS, USSD, Mxit, a website and Facebook. This made it easier for citizens to lodge complaints and for the City of Cape Town to be responsive to the needs of its citizens (UN, 2014:105). The integration and optimisation of different channels leads to greater connectivity between government and citizens and affords government the opportunity to address the needs of specific population groups. The intention is not to replace current e-government services but to integrate them as part of an overall e-government strategy.

2.3.4 Western Cape Provincial Government: E-government Strategy 2012–2019

This strategy was developed in support of the Western Cape Government's vision of "delivering an open opportunity society for all" and the Provincial Strategic Objectives which identified ICT as an enabler to improve the provincial government's internal abilities, to improve the manner in which services are rendered, and to put citizens and other stakeholders first. The objectives of this strategy are to use ICT to foster efficiencies in the provincial government, to free up resources, and to transform provincial government services to the benefit of citizens, businesses and those charged with delivering government services.

The implementation of this strategy is closely linked to the achievement of three main strategic outcomes, namely e-services transformation, enhanced e-government and digitally enabled

⁷ Including but not limited to counter services, telephone and call centres, email, SMS and other messaging services, mobile websites, mobile apparatus, social media, public kiosks and intermediaries such as public-private partnerships (UN, 2014:97).

communities (PGWC, 2015:1-2). *Healthcare 2030* is currently the most prominent example of how this strategy can be translated into concrete actions.

E-services transformation entails improving governance and back-office efficiencies by eliminating stand-alone legacy systems, equipping staff with new technologies and productivity tools, providing staff development and training, enhancing information and security, improving workflow and service level management, developing appropriate policies, roles and processes, and developing web-based and mobile device accessible applications.

Enhanced e-government aims to produce a single point of access to government information and services. This would entail the broadening of the portfolio of e-services and transactions, providing self-service functionality, using social media tools, and improving the customer and content management of e-services (PGWC, 2015:29). E-service transformation and enhanced e-government outcomes are dependent on the Western Cape Province being able to provide fully connected e-government services which translate into providing citizens with a one-stop experience and information systems that are horizontally and vertically integrated.

Digitally enabled communities entails creating greater social cohesion by addressing the digital divide caused by a lack of telecommunication infrastructure, low levels of digital literacy and limited access to internet facilities. Initiatives include providing internet access in municipal wards, using multiple channels (such as call centres, walk-in centres, cell phone services and self-help terminals) to achieve this, and improving the digital literacy of the Western Cape population (PGWC, 2015:17). An example of the latter is the provincial government's commitment to provide high-speed internet to all schools by 2016. This is part of a R3.8 billion project to digitally connect all the residents of the Western Cape (WCED, 2015).

This strategy's ultimate aim is to implement fully connected e-government services by 2019. To achieve this goal, departments are required to align their e-government plans with that of the provincial master plan, develop implementation plans and ensure that progress is monitored and evaluated (PGWC, 2015:20). Fully connected e-government services in the Western Cape also depend on the province progressing, according the UN's e-government maturity model, to connected services (Stage V). However, an internal benchmarking process revealed that e-government services in the Western Cape government are operating at the level of emerging e-services (Stage I) (PGWC, 2015:4). In the next section, the barriers to e-government implementation will be highlighted.

2.3.5 Barriers to e-government in South Africa

The literature review revealed that South Africa's failure to progress beyond the initial e-government adoption phase is due to a lack of strategic leadership, weak ICT governance, project fragmentation, poor stakeholder engagement, high levels of digital illiteracy, financial inequality, weak ICT infrastructure and a general lack of ICT preparedness (Cloete, 2012:138; Matavire, Chigona, Roode, Sewchurran, Davids, Mukudu & Boamah-Adu, 2010:153; Singh & Averweg, 2012; Thakur & Singh, 2013:49). Moreover, this is an indictment against the South African government for failing to implement its own policies.

Indicative of the disjunction between policy and implementation in South Africa is the Auditor-General's (AG) finding in 2010 that public institutions failed to implement the prescribed legislative ICT requirements and/or governance structures. In total, 79% of institutions had no ICT policy in place as prescribed by law while the remaining 21%, who did have policies in place, failed to implement them (DPSA, 2012:4). Most departments were thus completely non-compliant with legislative imperatives which resulted in them being unable to leverage ICT to improve their internal functions and the delivery of public service in general.

To exacerbate matters, South Africa also lacks a common e-government policy. The 2001 interim e-government policy was only updated in 2011 with the Corporate Governance Information and Technology Policy Framework (CGITPF), which was promulgated in reaction to the AG's findings (above) regarding the negligent state of ICT governance across government departments. According to Cloete (2012:132), the CGITPF essentially affirms government's commitment towards e-government but does not address specific steps to propel e-government to greater levels of maturity. Conversely, the disjointed ICT policy and governance structures which paralysed South Africa's first decade of e-government still remain. This does not bode well for the National Development Plan (NDP) which also emphasises the institutionalisation of ICT as a means to drastically reduce poverty and inequality by 2030 (NPC, 2011:33).

Thakur and Singh (2013:49) attributed this dismal state of affairs to the dire lack of political leadership and appreciation among the ruling elite about how e-government can transform and improve the machinery of government. Consequently, the political objective is simply to label any online governmental information service as an e-government initiative instead of using it as an opportunity to automate, evaluate and improve the overall functionality of the e-government system. Departments, according to Thakur and Singh (2013:49), are basically adding a computer to automate an existing problem instead of fixing the problem. This

scenario has become commonplace in South Africa and explains why most e-government initiatives are characterised by static websites that are unable to progress beyond the initial stage of online information services to more mature levels of e-government which deliver interactive and transactional services.

As long as there is no national e-government policy, committed leadership and governance structures in place to provide strategic direction and to monitor and evaluate systems that track e-government progress, e-government will remain confined to static websites. This obviously has serious implications for the implementation of a national e-health strategy and the realisation of the Health Department's strategic objectives. Although the South African government has recently shown intent to resuscitate the e-government initiative, it remains to be seen whether the intent will be translated into concrete actions that can take e-government in South Africa to the next level.

The aforementioned informs the contextual reality within which the South African e-health strategy 2012–2016 (DoH, 2012) should be understood and analysed. It indicates the degree to which e-services are underpinned by an enabling environment and the success rate of these strategies in practice. In the following section, the concept e-health as part of the e-government transformation agenda will be explored.

2.4 E-health

E-health or electronic health is part of the wider e-government strategy to improve a government's efficiency, effectiveness and accountability in delivering public health services. E-health can be defined as the use of ICT in the treatment of patients, research and education, to track diseases and to monitor public health (WHO, 2015a). E-health thus signifies the use of ICT to improve the collection, analysis and dissemination of information in support of the management and delivery of health services.

The promise of the potential use of ICT to improve the management and delivery of health services resulted in the UN adopting resolution WHA58.28. This resolution institutionalised the use of ICT in the health sector on a global scale. Among others, the resolution urged countries to draw up long-term strategic plans (legal and infrastructure frameworks) that promote equitable, affordable and universal access to e-health benefits. Countries are encouraged to collaborate with private and non-governmental (NGO) ICT partners to promote the use of ICT in the health sector, and to ensure that e-health benefits are also made available to vulnerable groups such as women and children, the elderly and the disabled. Countries also

have to ensure that e-health standards promoted cost-effectiveness and the confidentiality of information. Added to this, countries specifically had to ensure that public sector health information systems are computerised to improve the flow of information and have surveillance capacity in order to respond to disease and other public health emergencies. This resolution sought to create an enabling environment to establish electronic health services.

Resolution WHA58.28 was subsequently augmented with Resolution EB132.R8, which urged member states to standardise health data and promote interoperability between different e-health systems and other internet-based health domains in order to strengthen the flow of information between national authorities, the private sector and academic institutions (WHO, 2015b; WHO, 2015c). As a result, e-health has become an integral part of countries' national health strategies in delivering health services, deploying personnel, managing programmes and conducting research.

Despite the global drive to deploy e-health technologies, the success of these technologies is lagging behind expectations. Van Gemert-Pijnen, Wynchank, Covvey and Ossebaard (2012) argue that the perception that e-health is a one-stop process, and an end in itself, is totally wrong. Firstly, stand-alone systems were implemented without any consideration for the maintenance thereof. The net result was a waste of financial resources, underutilisation and customer dissatisfaction. Secondly, technologies used in the developed world were transplanted to developing countries without considering the infrastructure, habits and culture of those countries. Hence, the said authors concluded that any e-health strategy should first and foremost consider the countries' contextual environments and the needs of the relevant stakeholders. Similarly, the WHO (2012:1) contended that implementing an e-health strategy should be informed by and contextualised in terms of a country's national health priorities.

In the sections which follow, the current e-health instruments available will be outlined, the different stages of integrating ICT into a country's national programme of health action will be explained, and South Africa's current level of e-health maturity will be described. Furthermore, the researcher considered it prudent to include a section on health information systems as they are the primary source of aggregate data in the health sector. The information generated by health information systems informs the management and delivery of health services globally, and forms the basis in terms of which governments report on the state of their health sector.

2.4.1 Examples of e-health technologies

The following are examples of e-health technologies currently in operation globally (WHO, 2012:78):

2.4.1.1 Electronic medical records (EMRs)

An EMR is an electronic record system that captures, stores and disseminates information of patients' visits to healthcare facilities. EMRs are the legal record of services provided during such an encounter. EMR systems can be stand-alone systems or they can be integrated with other information systems.

2.4.1.2 Electronic health records (EHRs)

EHRs contain electronic summaries of individuals' health status including demographics and medical history, which can be used in the provisioning of health services across the health services sector or within geographical boundaries.

2.4.1.3 Personal health records (PHRs)

Personal health records are records created and maintained by individuals who proactively manage their own health. PHRs can be made available by the owner to service providers. The record is composed of the individual's health status, family history and other applicable health encounters.

2.4.1.4 Telemedicine (teleHealth)

Telemedicine allows for the provision of health services when the individual and healthcare provider are not in the same location. Examples include:

- Teleradiology and telepathology are examples of store-and-forward services whereby medical data (e.g. images) is transmitted to a healthcare provider who assesses and recommends treatment off-line;
- Implanted devices and sensors with wireless or wired connections allow the healthcare provider to monitor a patient's condition remotely; and
- The telephone, web conference and video conference facilities and other forms off-line and remote communication can provide real-time interactive services between individuals and healthcare practitioners. Telecare services (alerts and monitoring

devices) enable the care and support of older individuals or those with special needs to live independently while remaining connected.

2.4.1.5 Mobile health (m-health)

M-health is the provisioning of health services through the use of mobile technology. Mobile phones have a larger penetration depth and provide access to large portions of the population. Examples include:

- Collecting surveillance and public health data to inform the public of an imminent disease outbreak;
- Monitoring, in real time, a patient's health;
- Providing treatment support and advice and ensuring compliance with a prescribed treatment regime;
- Providing health information to practitioners, researchers and patients;
- Health education and awareness campaigns; and
- Providing a diagnosis, treatment support and communication tool for healthcare workers.

2.4.1.6 Decision support systems

These electronic systems assist healthcare workers to diagnose and prescribe treatment. A patient's current and historical health information is combined with the knowledge of the healthcare provider to provide advice in order to improve the patient's health outcomes (e.g. medication management).

2.4.1.7 Chronic disease management services

These services are designed to improve the coordination and management of patients with chronic conditions. By tracking the patient's health status, test results and other parameters, the condition can be better managed to prevent episodes of acute illness or worsening of the condition. Tracked over time, such information becomes a valuable source to support the patient, allocate resources, research and management of the condition.

2.4.1.8 Practice, patient and clinical management systems

Practice, patient and clinical management systems form the foundation for collecting, recording and disseminating information across the whole health sector. Besides recording information about patients' health encounters, these systems also assist with diagnostics management, scheduling and resource management.

2.4.1.9 Electronic medication services

These services make it possible for healthcare providers to submit prescriptions electronically to pharmacies. This can reduce medication errors and render paper-based systems obsolete. Furthermore, patients can purchase medication online, which reduces costs, and improves convenience and access to medication.

2.4.1.10 Health knowledge resources

Manage and provide healthcare workers and other interested parties with access to international and national electronic journals, resource collections and national archives.

2.4.1.11 E-learning for health professionals

An e-learning service provides training and education in electronic format. Tools can range from digital libraries, electronic networks to share learning experiences, online courses and/or the use of mobile devices to access information. E-learning can be used to upskill doctors and nurses and to provide training on preventative services for community-based workers.

2.4.1.12 Health information systems

Health information systems gather, aggregate, analyse and synthesise data from multiple sources to report on a given health situation and/or trends. Information delivered by a health information system can lead to improved decision-making, policy development, health service management, response to emerging threats, and better allocation of health resources. Health information systems will be further discussed in 2.5 below.

2.5 National e-health strategies

Implementing national e-health strategies differ from country to country and are dependent on two critical factors, namely the ICT environment (ICT market and infrastructure) and the e-

health enabling environment (the availability of resources, governance structures, enablement policies, and legislation and standards). The greater the convergence between these two environments, the greater the integration and optimisation of e-health channels in the health sector, and vice versa. WHO (2012:4-7) differentiates between the national contexts below.

2.5.1. National context I: Experimentation and adoption

Both the ICT and enabling environments are emerging. National e-health initiatives are disconnected and project-based. Projects are introduced in a limited context and are conducted as proof-of-concept pilots. Although these projects may be innovative, they are rarely sustainable due to lack of infrastructure, skills and ownership by the users.

The commercial ICT market is fragmented, lacks technical expertise and is limited to the use of mobile technology. E-health is limited to the use of telemedicine and e-mails for remote consultation and medical advice. As government provides no funding or expertise for e-health, the major contributors are aid agencies, donors, NGOs and consultants. Factors driving e-health implementation are the need to improve access to and the quality of healthcare and the need to meet international public health reporting obligations.

2.5.2 National context II: Developing and building up

This national context is characterised by a rapidly developing ICT environment while the enabling environment is progressing slowly. E-health systems remain project-based but are larger and there is growing awareness of their potential. Various health systems (health information, supply-chain management and medical records) are introduced. These systems are not interoperable, which limits their impact on the health sector. Hence, international reporting obligations can sometimes be met. This is mainly due to a lack of standardisation, commitment to long-term investment and e-health being viewed as part of a broader effort to expand ICT and economic development. Government interest is growing but is limited to the research and development of high-performance technologies.

The general population, in turn, is expanding its use of ICT. E-government, e-banking and other commercial ICT activities are emerging. Aid agencies, donors and especially public-private partnerships remain the main funders of e-health projects. Projects are more extensive and include telemedicine networks, limited electronic records, procurement and supply tracking systems, and the use of mobile technology to manage the dispensing of medicines

and reminders of appointments. The major drivers remain the need to improve access and the quality of healthcare.

2.5.3 National context III: Upscaling and mainstreaming

In this context, the enabling environment is supportive of the ICT environment. Investment and expanding e-health uptake are informed by a comprehensive policy basis. National government adopts standards and laws, incorporates ICT in the health sector, invests in health projects and has policies that develop a skilled workforce. The health sector leads in the planning and utilisation of e-health to deliver health objectives and e-health is fully integrated in the standard health service delivery models. The health ICT industry has a strong market which creates new business models and competition. The public is used to e-services and has increasing expectations for new innovations.

E-health becomes mainstream by means of new business and economic opportunities emerging, leading to innovation and the creation of new services which are exported to other markets. Health information systems are becoming increasingly linked but legacy systems make integration difficult. That said, the international reporting obligation can now be met as transversal systems and processes are in place. Costs and quality become the main drivers of e-health innovations. E-health instruments include hospital and care networks, home health monitoring, chronic disease management applications and online services for the management of health records.

2.5.4 E-health maturity in South Africa

The only independent research currently available on the level of e-health maturity in South Africa was conducted by Vital Wave Consulting (2009). This research analysed the e-health maturity of health information systems in 16 developing countries. The result of this research was a five-stage model which categorised each country's e-health maturity in terms of scale, scope, resources and capacity, data usage and integration, and data flow and collection. Figure 2.3 graphically illustrates each of the selected country's level of e-health maturity.

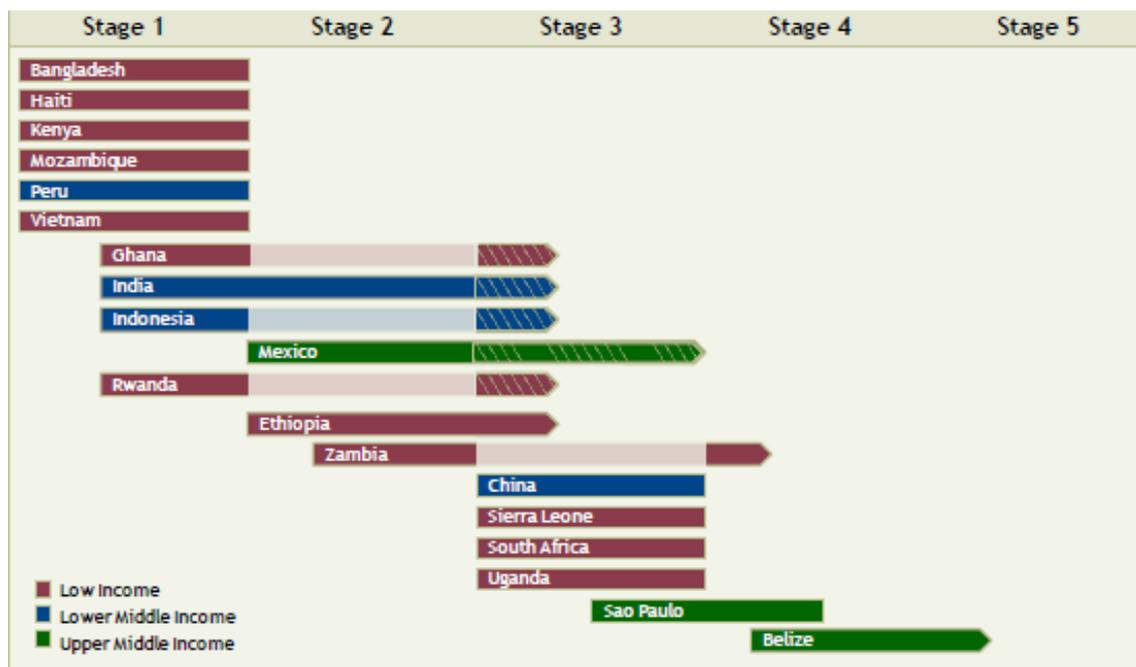


Figure 2.3: The 5-stage model of e-health maturity

Source: Vital Wave Consulting, 2008.

For the purposes of this research, the various stages will be summarised in terms of general characteristics, data use and integration.

Stage 1

This stage is characterised by a health information system (HIS) that is paper-based and fragmented, with health workers taking responsibility for data collection. District reporting is ineffective due to poor data quality, the unavailability of comparative data and non-integration of separate information systems.

Stage 2

This stage is similar to Stage 1 with the exception that the paper-based system is optimised to address the quality, timeliness and accuracy of data. This stage forms the basis of implementing an electronic system. Although the non-integration of different information systems persists, comparative data is more readily available on district level, making better managerial decision-making possible.

Stage 3

This stage represents the roll-out of an electronic system. Initially, it is only piloted in a few districts before gradually being installed nation-wide. A hybrid system is used whereby data is captured onto paper at facility level and captured electronically at district level. Mobile devices are also introduced to capture data. Despite the positive consequences – such as a reduction in aggregation errors and more flexibility and efficiency in reporting – health workers remain the primary data collectors. The inception of a central data repository enhanced data utilisation for purposes of reporting and analysis.

In order to facilitate the transition from a paper-based system to an electronic system, the following requirements should be in place: infrastructure and computers, training to improve health workers' level of computer literacy and ongoing software and hardware support.

Stage 4

In this stage, health and other business indicators – for example, human resources, supply chain, pharmacy and laboratory – are integrated into the overall business strategy and operations. This stage not only indicates a major shift in HIS strategy but also in capabilities and resource demands. Requirements such as system interoperability, end user computer literacy and technical support are critical to ensure the sustainability of the system. Data from various sources are used for systematic analysis to improve service delivery.

Stage 5

This stage represents the full optimisation of milestones achieved during previous stages. The policy and regulatory environment is conducive to evidence-based decision-making. A national policy exists on data standards and systems interoperability.

According to this model, South Africa is progressing to level 4 which is characterised by a demand for system interoperability and alignment between the business and operational processes. Despite the fact that the national government and the Department of Health have adopted policy frameworks for greater system interoperability, the biggest challenge hampering South Africa's progression to Stage 5 remains the differing levels of e-health maturity among provinces. This disparity can clearly be seen in the provinces' annual spending on ICT as a strategic enabler.

An audit of e-health spending by provinces in 2009 revealed significant disparities in provincial spending. On the one end of the spectrum, Gauteng spent R188.3 million while Limpopo spent R178.6 million and KwaZulu-Natal spent R105 million. On the other end of the spectrum, North West Province spent R15 million and Northern Cape spent R20.4 million while the Free State spent R32 million (DoH, 2012:13). As e-health maturity is linked to the availability of resources, the net result is that some provinces are still at Stage 2 while others are at Stage 4.

2.5.5 E-health Strategy South Africa 2012–2016

E-Health Strategy South Africa was adopted in 2012 as part of South Africa's compliance with UN Resolution WHA58.28, which was discussed earlier. This e-health strategy aims to provide a single, harmonised and comprehensive e-strategy in support of the medium-term priorities of the health sector, pave the way for future public sector e-health requirements, and lay the requisite foundations for the future integration and coordination of all e-health initiatives (public and private sectors) in South Africa (DOH, 2012:8).

According to Masilela, Foster and Chetty (2014:18), the South African public health sector is characterised by differing levels of e-health equity, expenditure and maturity across and within provinces, a lack of interoperability and communication between disparate systems, expensive broadband connectivity, the absence of a national master patient index and identification system, and limited capacity in the public sector for implementation. The latter can rightly be called a microcosm of what is happening with e-government at national level. South Africa's e-health strategy, however, bridges the chasm between intent and implementation by setting concrete action plans in place.

In order to introduce policy coherence and harmonisation, ten key strategic priorities with required activities for completion during the period 2012–2017 have been set. These are strategy and leadership; stakeholder engagement; standards and interoperability; governance and regulation, investment, affordability and sustainability; benefits realisation, capacity and workforce; e-health foundations; applications and tools to support healthcare delivery; and monitoring and evaluation of the e-health strategy (DOH, 2012:6). With the adoption of the *National Health Normative Standards Framework for Interoperability in E-health*, progress has been made on five strategic priorities, namely strategy and leadership; stakeholder engagement; standards and interoperability; governance and regulation; and the monitoring and evaluation of the e-health strategy.

The National Health Normative Standards Framework for Interoperability in E-health allows for the adoption and use of normative standards in patient information systems by, inter alia, prescribing a certification process of any patient information system that is in use or intended for use in the health sector to ensure compliance with the standards of interoperability; establishing a national E-health Standards Board to update, maintain and implement the framework; and establishing a national shared e-health infrastructure (e.g. health information exchange, demographic registries, shared clinical repositories, security and audit services) (Masilela, Foster & Chetty, 2014:20).

This legal framework is an important milestone in the evolution of South Africa's e-health system as it allows for access to and the harmonisation of different data sources. Through this framework a constant flow of information is ensured which can assist health authorities in making transparent and evidenced-based decisions for health system interventions where these are needed the most.

2.6 Health information systems (HIS)

The term health information system (HIS) is confusing as it is applied inconsistently in health informatics literature and can refer to any of the specialised information systems⁸ which operate in the health sector. In this research, a HIS will be defined as “an information system that collects data from health and other relevant sectors, and converts the data into information for health-related decision making” (WHO, 2010:44).

This definition recognises that timely and reliable information is key for decision-makers at all levels of the health sector to identify progress, problems and needs in achieving overall health outcomes and to make evidence-based decisions with regard to health policies and the allocation of scarce resources (Mutale, Chintu, Amoroso, Awoonor-Williams, Phillips, Baynes, Michel, Taylor & Sher, 2013). To perform these functions, a HIS needs to generate population-based and facility-based data, communicate eminent public health threats and have the ability to synthesise information and promote the availability and application of such information (WHO, 2007:17). A HIS is therefore not only about collecting data for the sake of collecting it, but also about using and analysing the data as an information resource that sets the entire health system into motion.

⁸ The term HIS can be applied to patient-centred information systems, administrative information systems, clinical information systems, radiology information systems, laboratory information systems, pharmacy information systems, hospital information systems, and telemedicine or clinical decision support systems (Yusof, Papazafeiropoulo, Paul & Stergioulas, 2008:378).

To achieve the optimal flow of information, the logical data model⁹ is used to map an organisation's data needs to ensure alignment with its business processes. Business processes can comprise a set of sequential sub-processes or tasks which are harmonised to achieve a given objective or to produce a given output. Consequently, each process or task feeds data into the information system which then synthesises and manipulates the various data sources to give an overall indication of the organisation's performance or of individual units in the organisation. The synthesised or aggregated data is captured in reports which can be distributed to internal or external stakeholders for further interpretation and/or corrective action (Wikipedia, 2014).

The integration of a health information system (HIS) with an organisation's business processes fosters a common understanding of the different data requirements (and elements) and facilitates the reuse of data throughout the organisation. From the discussion above, it is evident that the term HIS transcends the narrow, specialised sub-system definition to denote a wider, all-encompassing information system with the ability to integrate, process and exchange data from other information systems that can range from sub-national and national to global levels. This wider focus means that the demands placed on health information systems become even greater in order to deliver timely and reliable performance information. The tracking of organisational performance information provides the critical feedback that allows the organisation to change course if needed and, above all, to facilitate organisational learning. A HIS should therefore be able to measure and determine whether or not an organisation is reaching its strategic objectives.

2.6.1 Health information systems in developing countries

It might seem ironic that while the UN was advocating the deployment of ICT in the health sector, it was simultaneously involved in the strengthening of health information systems in developing countries. Health information systems in developing countries are in dire straits and are not functioning optimally. It is not surprising then that Asian and African countries have the unfortunate distinction that about one-third of all births and two-thirds of deaths go unrecorded in these countries. The non-achievement of Millennium Development Goals (MDGs) and the demand from donor countries for increased information and statistical data

⁹A logical data model (LDM) is a type of data model used in computing or systems engineering detailing an organisation's data needs, independent of any particular data management technology, and described in business language. It is typically represented as a diagram, organised in terms of entities and relationships, with underlying definitions (Wikipedia, 2014).

for monitoring and evaluation purposes are further examples of the inability of developing countries' health information systems to track and measure their respective countries' health performance (HMN, 2008:1).

In terms of the universality of healthcare data, it should be possible to implement a particular HIS solution across regions and countries. The developing world, which includes South Africa, is a case in point where the demand for information is high but the supply is totally inadequate.

2.6.2 HIS in developing countries: demand and supply

The literature study indicated that the following trends create an ever-increasing demand for reliable and timely healthcare information from the already faltering and overextended health information systems in developing countries (Vital Wave Consulting, 2009; Health Metrics Network, 2008):

- The increasing role of the private health sector created a need to augment public and private sector healthcare data. Likewise, a HIS focusing primarily on the public sector runs the risk of under-reporting on the number of households that use private health services and denying governments the opportunity to measure the performance of private healthcare and exercising their oversight function;
- Economic development is altering the profile of disease challenges from communicable diseases such as malaria, TB, HIV, cholera and diarrhoeal diseases to chronic diseases. This will result in the longitudinal management of patients which will require flexibility in HIS design to accommodate the latter while also monitoring the spread of communicable diseases;
- Globalisation has increased the risk that communicable diseases, such as SARS, avian flu, Ebola or Extremely Drug Resistant TB, can easily develop into pandemics. To detect and respond to these emerging diseases and health threats, a HIS must integrate disease surveillance data;
- The development of medical technology requires an improved distribution infrastructure to avoid the loss of drugs and vaccines as a result of spoilage or expiration. It is envisaged that a HIS will collect relevant indicators "to correct bottlenecks and misallocation", especially in cases where non-computerised systems are still operational;

- Globalisation and urbanisation are draining skilled health and ICT professionals away from the poor. It is foreseen that this will lead to greater investments in technologies such as mobile devices to allow non-physician healthcare workers to perform advanced functions. Similarly, health information systems will have to be simplified to decrease the time it will take for a person to become proficient in a HIS; and
- Improved accountability and evidence-based decision-making is another driver for better health information. Governments and development agencies have adopted results-based approaches which demand quality statistics to make evidence-based policies, to plan, manage and evaluate health services, and to access donor funding. Likewise, Stansfield (2005:562) found that better health information leads to improved health outcomes and overall system efficiency while it can also be used to hold politicians accountable and to advocate for an increase in health resources.

These trends indicate that positive or negative health outcomes are no longer confined to the borders of the country in which they were conceived. In this “new” context, a HIS has to provide information on both the internal health operations and health status of a country and on the capacity to detect and respond to emerging external threats. Meeting the demand for “new” information is a daunting task. Developing countries are already struggling to meet the most basic information demands and it is evident that the above-mentioned demands would only exacerbate an already critical situation.

Braa, Hanseth, Heywood, Mohammed and Shaw (2007) found that national health systems in developing countries comprise of relatively independent programmes and services, which in the absence of a central depository, maintain their own uncoordinated, vertical information systems. This is especially true of vertical donor-funded programmes that create their own information systems. These information systems usually run parallel to the country’s national HIS. Hence, there is no exchange of information between these systems. The lack of interoperability between the systems means that there are no standards for data sharing and collection. This situation results in duplication and the non-collection of data where gaps do actually exist. The use of different stand-alone systems leads to inconsistencies in data definitions and procedures which result in poor data quality that is unfit for evidence-based decision-making purposes. Consequently, health managers have no evidence base from which to make informed decisions about their countries’ health status.

Braa *et al.* believed that the problem of fragmentation and the lack of interoperability are directly related to a lack of health information infrastructure (technology, skilled labour and information

processes). Added to this, access to infrastructure components also varies between regions and geographical areas. However, this is a purely technical solution which negates national governments' responsibility as custodians of their citizens' health and which includes the capacity to monitor the health status of their citizens.

In this regard, Sahay, Monteiro and Aanestad (2009, cited in Saebo, Kossi, Titlestad, Tohourri & Braa, 2011:44) stressed that the question of data integration is partly a technical problem but mostly a political one that should be resolved between governments and the different role players. The mentioned authors also argued that the presence of multiple funders and organisations that operate in silos does elevate HIS integration from a purely technical perspective to the political realm. Political support and investment will go a long way to improve HIS interoperability and functionality.

HIS failure in developing countries can be ascribed to, among others, problems relating to parallel operating information systems that are inoperable, lack of political commitment to create a conducive environment for data and/or knowledge sharing, lack of strategic health planning, lack of data standardisation, and staff who are more clinically inclined and who perceive information management processes as an unnecessary add-on. This myriad of reasons obliterate the importance of information gathering and sharing in the operation of the health system and in the lives of people. Considering this, it is clear that there is incongruence between what a HIS is purported to do and actually does in practice.

2.6.3 Design-reality gaps

Heeks (2006:127; 2007:219) conceptualised the design-reality model to explain the success and failure of a HIS and to identify and mitigate risks when designing and implementing a HIS. The design-reality gap model is based on the premise that the success or failure of a HIS is determined by the degree of congruence between HIS design and the context in which it must operate. Figure 2.4 illustrates how this model seeks to close the gap between system design and reality. Finding the "right fit" implies either changing the design to make it reflect reality or the reality to fit the design or operating requirements (Heeks, 2003:9).

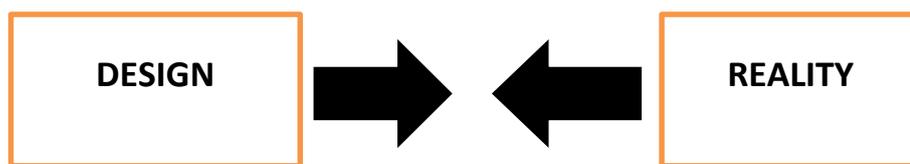


Figure 2.4: The design-reality gap

Source: Heeks, 2003.

In a HIS, the nexus of incongruence is exemplified by the divergent value perceptions of system designers on the one hand and that of the actual users on the other. Perceptions are predominantly informed by the different social, economic and cultural milieus of the designers and users. Consequently, they are psychologically and physically removed from each other. Donor organisations who design and implement their own health information systems because of differing information needs and the limited capacity of a national HIS are typical examples of health information systems being imposed on in a given context (reality).

Heeks (2007:130), in his study of health information systems, identified three archetypes of design-reality gaps that constrain the implementation and sustainability of a HIS.

2.6.3.1 Hard-soft gaps

Hard-soft gaps refer to a HIS design that was decided upon without considering the needs of the end users. Ibarrola (2012:60) argued that the active participation of all stakeholders from the onset is key to the success and sustainability of ICT projects. Failure to do so results in proof-of-the-pudding projects with limited capacity and alienated users. HIS design can be informed by either a technical, managerial or medical perspective or rationality.

The technical perspective focuses purely on the technological design of a HIS without any consideration of the organisation's cultural or political context. When this is the case, ICT professionals are in charge of the design process and their world view dominates the final design. Similarly, the health managerial rationality seeks to balance financial costs with the needs of the end users. According to Heeks (2006:130), in these instances, the financial point of view ultimately dominates the design outcome. The medical perspective, in turn, is solely concerned with satisfying the need for health information. They might argue that they are the actual users and therefore know what is best. Ultimately, the different perspectives impact on the use and functionality of the final product.

It is advisable that design of the process is managed by neutral project managers who engage all stakeholders to ensure that hard-soft gaps are addressed during the planning phase. Failure to do so will only escalate and widen the gap as some stakeholders might feel that the design process was not transparent. Consequently, they cannot be held accountable for the system's overall success. End users also need to be made aware that the introduction of new technology will require the unlearning of old skills and processes and will require increased flexibility on their part. Using a change management programme to bring about change in attitude and to upskill employees will help with the adoption of new systems.

2.6.3.2 Public-private gaps

In terms of this archetype, private sector HIS designs are transplanted to the public sector. Heeks (2003:5; 2007:131) explained that the private sector reality does not match that of the public sector. Imposing private sector HIS designs on the public is synonymous with using square pegs to fill round holes. In order to overcome this constraint, private sector initiatives had to be "customised" and "adapted" to public sector realities.

Heeks also found that private sector designs are based on unitary organisational objectives, with skilled ICT support staff and no political toe to line when making decisions. Furthermore, these designs are of a larger scale compared to the public sector reality which has to do with less healthcare and fewer ICT support staff. In practice, this means the public sector has to employ more staff simply to operate a private sector HIS. Large, grandiose HIS designs do not match the public sector reality and are destined to fail.

Motivating already overburdened healthcare staff to use a private sector HIS is courting disaster. Private sector staff members are usually better remunerated than their public sector counterparts. This demotivates public sector staff as they have to perform the same duties but at a lower income. Under these circumstances, data collection will become unnecessary to an already overburdened public sector healthcare staff member.

The public health sector also has limited resources available to spend on an elaborate HIS. Employing advanced ICT in the private sector is part of its marketing strategy to promote the use of private sector facilities in order to increase profits. The public sector, in turn, is fundamentally not concerned with profit but with the creation of goods and services that create public value.

In order to close the public-private design gap, Heeks (2007:131) advocates the principles of modularity and instrumentalism in HIS implementation. This basically implies that new modalities are added to public health information systems, based on the integration of previous modules. In this manner, the HIS functionality is increased and the design “adapts” to the public sector reality.

2.6.3.3 Country gaps

In the final archetype, designers try to impose developed countries’ HIS models on developing countries. Even among developing countries, contextual reality differs due to the impact that these countries’ political priorities have on the work processes of the public sector. Developing countries’ healthcare systems are hierarchical and centralised in comparison to developed countries (Heeks, 2006:131). The reality facing developing countries are vastly different from that of the developed world. Ultimately, the difference in structure, culture and financial resources makes HIS designs in the developing world more prone to failure in this contextual reality.

The design-reality model is a useful instrument that governments, system designers, ICT specialists and other role players can use to isolate and assess the constraints that can lead to HIS success or failure. Each archetype inherently also produces answers on how to close the design-reality gap. This, however, will require political and organisational leadership to take charge in order to find the “best design-reality fit” in the interest of sustainable and proactive health services. In the final analysis, the model advocates local designs for local realities. In the next section, data quality assurance frameworks and related concepts will be discussed.

2.7 Data quality assurance frameworks

According to Chen, Hailey, Wang and Yu (2014:5172) most countries monitor and evaluate multiple health performance indicators which increases the need for regular data quality assessments. Without regular data quality assessments, organisations run the risk that poor quality data can comprise the information needed for decision support (Redman, 1998:79-82, cited in Parker *et al.*, 2006). Data quality assessments form part of the quality assurance practices that institutions use to ensure that data is accurate, transparent and reliable. Aqil, Lippeveld & Hozumi (2009:218) agree that data quality is an institutional issue and commences the moment data is collected.

In this study, data quality assurance is defined as the process to improve data quality by profiling data for inconsistencies and other anomalies, as well as the cleansing thereof (Wikipedia, 2015b). Data quality assurance is a planned and systematic process that can occur prior, during and after data collection. The aim is to guarantee data quality and to prevent the recurrence of defects in the future (Shabestari & Roudsari, 2013:37; Arts, De Keizer & Scheffer, 2002:600). To this end, data quality assurance frameworks (DQAFs) provide a systematic and concise set of criteria against which to evaluate data quality (Parker *et al.*, 2006). The appreciation that an organisation's business processes are driven by high data quality, and the competitive advantage it gives an organisation, has led to the formulation of various DQAFs (Dedeka, 2000:126).

2.7.1 Data quality dimensions

Data is of high quality if it is "fit for purpose", which means it can be used in business operations, decision-making and planning processes (Wikipedia, 2015b). Blackstone (1999:3) describes data quality as a product that is quality assured through its production, delivery and utilisation to meet client-specific demands. Data quality is a subjective construction and cannot be confined to a precise statistical definition.

Loshin (2011:129), however, contends that this definition is too broad to measure and quantify a measurement of quality effectively. Shabestari and Roudsari (2013:37) concur with Loshin by defining data quality as "the totality of features and characteristics" that enables an entity to satisfy its stated and implied data needs. Conversely, data quality is defined in terms of the degree to which a data product conforms to dimensions that are relevant to an organisation's analytical processes and the degree to which a data product measures a specified organisational standard (Loshin, 2011:39). Dimensions constitute the measurable aspects (i.e. accuracy, completeness and timeliness) that are specified as a quality demand by the end user during the data production-delivery-utilisation cycle.

Dimension can be intrinsic, contextual or qualitative (a combination of both the intrinsic and contextual dimensions). The intrinsic dimensions of data quality, on the one hand, refer to the primary data values which measure accuracy, lineage, and structural as well as semantic consistency. Contextual dimensions (completeness, consistency, currency, timeliness, reasonableness and identifiability), on the other hand, measure the consistency or validity of one data element or record in relation to another. Contextual and qualitative dimensions are

informed by specific business policies and are usually implemented as business rules (Loshin, 2011:132).

A data quality assurance framework uses the predetermined dimensions as a metric to evaluate and quantify whether a given data product is fit for purpose. Although DQAFs differ from organisation to organisation, they all share a common logical structure, namely *defining* data quality dimensions, *assessing* data products against these dimensions and *improving* the quality of data products (Zhu, 2014:12).

In the following section, DQAFs measuring the data quality of health data sources, national statistics and e-government systems are discussed. DQAFs for national statistics include the International Monetary Fund's Data Quality Assessment Framework (IMF, 2006), the United Nation's Generic Data Quality Assessment Framework (UN, 2012), and the South African Statistical Quality Assessment Framework (SASQAF) (StatsSA, 2008). DQAFs, discussed under health data sources, are the model of the Canadian Institute for Health Information (2009) and the Weiskopf and Weng (2013) framework for electronic health records. This subsection (2.7) concludes with a discussion of the CARTA model (Heeks, 2008) for e-government systems.

2.7.2. The International Monetary Fund's DQAF

The IMF's DQAF is based on international accepted core standards, principles and practices for official statistics (Weisman, Zdravko & Venter, 2010:4). The framework covers various quality aspects ranging from data collection, processing to dissemination. It is extensively used in industrial and developing countries to measure compliance with standards and codes. It allows countries to perform their own data quality assessments and is applicable to eight different data sets, namely national accounts statistics, consumer price index, producer price index, government finance statistics, monetary statistics, balance of payment statistics, external debt statistics and household income statistics (IMF, 2006).

This framework quantifies data quality around 4 dimensions which are further disaggregated into key elements and indicators (IMF, 2006). The 4 dimensions are assurances of integrity, accuracy and reliability, serviceability, and accessibility. Integrity refers to objectivity with regard to the collection, compilation and dissemination of statistics; accuracy and reliability ensure that the statistical output covers the reality of the economy; serviceability ensures that statistics are disseminated in time, internally consistent and comparable to other data sets,

and comply with internal policies; and accessibility ensures that data and metadata are up to date, clear and understandable, easily locatable and support services are available (Weisman, Zdravko & Venter, 2010:7).

2.7.3 UN's Generic National Quality Assurance Framework (GNQAF)

While the IMF's DQAF sets strict quality parameters for countries over eight data sets, the GNQAF is a generic template that assists countries in developing their own framework or to further enhance existing ones. It considers a country's stage of development, the availability of resources, institutional arrangements and the most current, pressing data quality need. Despite the GNQAF adaptability, it conforms to the codes of good practice of the IMF, Statistics Canada and the European Union (UN, 2012b:2).

As the GNQAF's primary focus is the management of processes (i.e. the statistical system, institutional environment, processes, outputs, and assessment and reporting), the framework seeks to integrate all parties concerned with data collection and quality. This includes producers of national statistics and government agencies who develop multi-year and annual plans (UN, 2012b:7).

The intrinsic dimensions covered by this framework are accuracy and reliability while the remaining six dimensions (relevance, timeliness and punctuality, coherence and comparability, accessibility and clarity) all relate to legislation and policies that impact on data quality (UN, 2012b:48). This is similar to IMF's DQAF which also emphasises the need for proper institutional arrangements to ensure data quality. The GNQAF, due to its generic nature, is expandable and in theory can be applied to various national contexts and multiple data sets. This, however, requires a supportive legislative and regulatory environment to do so. Both the GNQAF and IMF's DQAF set benchmarks against which countries can measure the integrity of their national statistics.

2.7.4 The South African Statistical Quality Assessment Framework (SASQAF)

As mentioned in 2.2.4 social, economic and demographic statistics is one of the data sources that are integrated into GWM&E policy. Social, economic and demographic statistics is regulated by the South African Statistical Quality Assessment Framework (SASQAF). This framework is founded on the principles of the IMF's DAQF and functions under the auspices of StatsSA. SASQAF aims to promote the maintenance of quality statistics in a decentralised

system (The Presidency, 2007:14). In order to achieve this, SASQAF regulates the evaluation, ranking and certification of national statistics as official statistics. National statistics are statistics that is in the public domain and have a bearing on policy development and monitoring but is not yet certified as official statistics. Therefore, national statistics include surveys, registers and administrative data sets which are produced by either the three spheres of government or the private sector (National Treasury, 2007:13).

To qualify for certification, the producing body needs to be part of the National Statistical System, the statistics should be relevant beyond the needs of the collecting agency, should be accessible and sustainable, and should meet the quality criteria and standards set by the Statistician-General of South Africa (StatsSA: 2008:2, 25).

A Data Quality Assessment Team assesses the data of a producing entity and classifies it according to four levels, namely quality, acceptable, questionable or poor statistics. Quality statistics are certified as national statistics in that deductions can be made from them and they meet the initial design requirements. To maintain quality standards and relevance, official statistics are subject to periodic review (StatsSA, 2008:3, 25).

Acceptable statistics meet most but not all of the quality dimensions but are nonetheless fit for the purpose for which they were designed. Questionable statistics meet few of the SASQAF requirements, allow limited deductions and do not meet their initial design requirements. Lastly, poor statistics meet none of the quality requirements and are not fit for use (StatsSA, 2008:3-4). To improve data quality, the producers of acceptable, questionable and poor statistics are issued with a quality statement indicating the areas that need improvement in order for their statistics to be classified as official statistics (StatsSA, 2008:28).

SASQAF consists of 8 data quality dimensions which are further disaggregated into indicators which are used as a baseline during the assessment and/or certification processes. Similar to the UN's and IMF's DAQFs, SASQAF predominantly focuses on the contextual dimension of data quality with accuracy as the only intrinsic dimension. The 8 dimensions of data quality are relevance, accuracy, timeliness, accessibility, interpretability, coherence and integrity. Relevance refers to the degree to which the data meets the real needs of the client, i.e. the closeness between the estimated and true value. Accuracy measures the degree to which a statistical output correctly measures the phenomena it was designed to measure. Timeliness refers to the delay between reference points and the date on which the data was released. Accessibility focuses on the ease with which statistical information could be obtained. Interpretability refers to how easily users could understand the statistical information with the

aid of metadata. Adherence refers to the degree statistical information can be integrated with other data sources in an analytical framework and over a period of time. Lastly, integrity refers to confidence in the producing agency and the statistical product (StatsSA, 2008:3).

Unlike the IMF and UN's frameworks which are generic in nature and are transferrable to different national contexts, SASQAF was specifically designed to ensure that producers of official statistics deliver data products that are usable for monitoring and evaluation purposes. Through the GMW&E, SASQAF is institutionalised in the South African public service and is the primary reference against which to evaluate departmental data quality. Similar to the mentioned frameworks, SAQAF only have one intrinsic dimension, i.e. accuracy, while the other seven dimensions all relate to contextual dimensions. Contextual quality dimensions shared by these frameworks are relevance, accuracy, timeliness, accessibility, interpretability and coherence. In the next section, frameworks for measuring the data quality of institution-based health data sources will be discussed.

2.7.5. The Canadian Institute for Health Information (CIHI) model (2009)

The Canadian Institute for Health Information model is a conceptual framework that focuses on the prevention, detection and resolution of health data quality issues. The model is founded on the principles of Statistics Canada. To ensure data quality, a three-stage work cycle, which includes a planning, implementation and assessment component, is followed. Planning commences with the mapping of the workflow process in a given unit and then optimising it by setting data quality priorities. During the implementation phase, protocols and procedures are developed and implemented. The cycle concludes with an assessment phase where the process and resulting data quality are reviewed to determine if any changes are required. If changes to the production processes are required, the whole process is repeated. The model provides a practical methodology that can be implemented by any organisational unit which collects data and is concerned with data quality (CIHI, 2009: 3-4).

According to this framework, timeliness, usability, accuracy and comparability interdepend to create data that is relevant. The 5 dimensions are further divided into 19 characteristics and 61 criteria (CIHI, 2009:5-7). Figure 2.5 graphically illustrates the different dimensions. Relevance assumes the top position in the CIHI hierarchy as data products must meet the current and future data needs of the health managers or decision-makers.

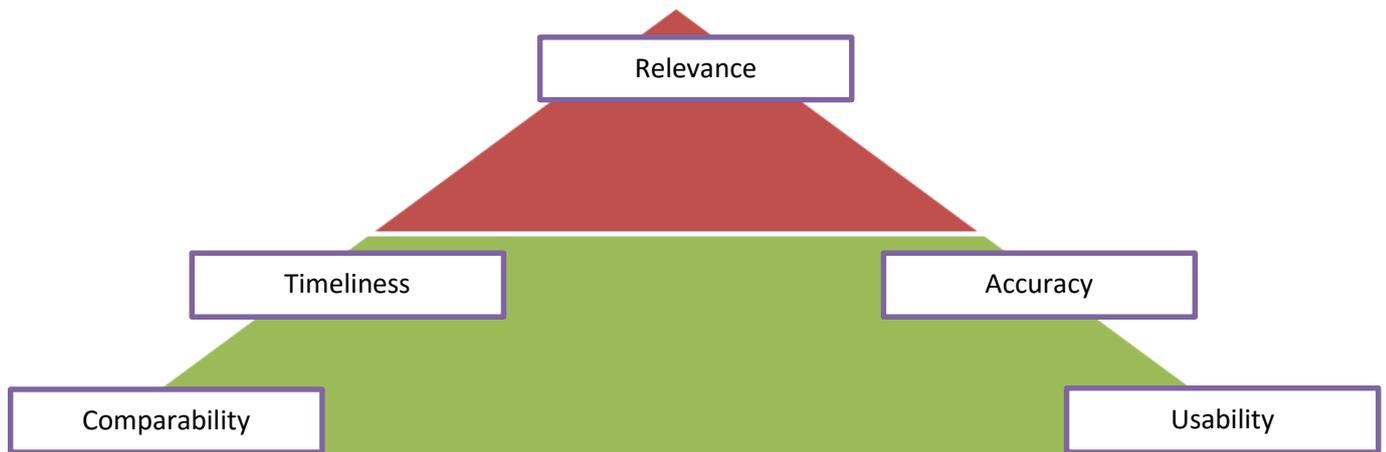


Figure 2.5 The CIHI model: Data Dimensions

Source: CIHI, 2009.

In this framework, comparability is enhanced by the accurate and consistent use of standard conventions (i.e. data elements and reporting periods) which facilitates comparisons between health facilities, districts and geographical regions. The timeliness dimension ensures that decisions are based on the most recent information while usability means the data generated is accessible and easy to understand. Once all the mentioned requirements have been met, the data is relevant or “fit for purpose” (CIHI, 2009:6).

2.7.6 The Weiskopf & Weng DQAF (2013)

The Weiskopf & Weng DQAF identifies data quality dimensions that enable the reuse of data contained in electronic health records (EHRs) for clinical research purposes.

Initially, 5 dimensions were identified to measure and quantify the data quality of EHRs. These were completeness (Is the truth about the patient present in the EHR?); correctness (Is the element used true?); concordance (Is there agreement between elements in the EHR and other sources?); plausibility (Does an element contained in the EHR measure what it is supposed to measure?); and currency (Is an element present in the EHR representative of the patient’s state at a particular point in time?). The authors found that dimensions overlap and were used inconsistently. “Accuracy” was either used synonymously with “correctness” or equated with “correctness” and “completeness” (Weiskopf & Weng, 2013:145).

Ultimately, only correctness, completeness and currency were considered to be fundamental, non-reducible core concepts that relate to the use of EHR in clinical research. Concordance

and plausibility can be used as proxies for “correctness” and “completeness” when these dimensions cannot be assessed (Weiskopf & Weng, 2013:148).

Compared to the DQAFs for national statistics, health-related DQAFs focus more on the intrinsic than the contextual dimensions of data quality. Common to the latter is accuracy, completeness and validity. Häyrinen, Saranto and Nykänen (2007), however, in their literature review of electronic health records, found that completeness and accuracy are the dimensions that were the most frequently assessed. Moreover, data quality dimensions are interrelated and overlap with one another to produce a data product that is fit for use. A deficit in any of the specified dimensions will invariably comprise the “quality” of a data product as a whole. This is to be expected as the concept “fit for purpose” directly relates to the extent to which the final data product meets the needs of the end user. The next section will describe the CARTA framework of Heeks.

2.7.7 The CARTA Framework (2006)

The CARTA framework is based on the assumption that the main causes of data quality issues in e-government information systems are incomplete data, data that requires updating, erroneous data and poor quality data. According to Heeks (2006:74) poor data quality is the result of either hard/technical problems (environmental hazards, electrical problems, equipment that breaks or errors in software) or soft/human factors (human perceptions about the value and use of data). Moreover, Heeks asserts that 80 per cent of data quality problems are caused by human errors which occur during data capturing, input, processing and output. To address this, the CARTA framework measures data quality in respect of the following dimensions:

- **Completeness** – the degree to which all the data required by the user is present in the information system;
- **Accuracy** – the level of errors or incorrect data present within the system;
- **Relevance** – the degree to which the data is necessary to complete a particular user function or action;
- **Timeliness** – the degree to which data can be delivered by the information system within a required time frame; and
- **Appropriateness of presentation** – the degree to which the data produced by the information system is accessible and intelligible to the end user (Heeks, 2007:72).

According to De la Harpe and Benjamin (2008:232), these elements are applicable to both the public and private sector. Whereas the previously mentioned DQAFs combine predetermined dimensions to deliver a data product that is fit for a specific purpose, the CARTA framework specifies universal core data quality dimensions. The model measures data quality on a continuum which increases in relation to the increased presence of each of the mentioned dimensions.

Moreover, the CARTA framework provides a conceptual understanding of the root causes of poor quality data and highlights those quality dimensions necessary to ensure reliable data in government information systems. In the empirical phase of this study, the dimensions of this model will be used to assess the “fitness” of data generated by the unit of analysis for the purpose of evidence-based decision-making.

2.8 Summary

In this chapter, key concepts related to this study were discussed. The discussion highlighted the role of information and communication technology (ICT) in the collection, storage, analysis and dissemination of information in the public sector. ICTs, however, are not an end in themselves but rather a powerful means to leverage and improve information flow between governments, citizens and businesses. As a case in point, health information systems in developing countries showed how ICT can fail when there is no congruence between the information system design and the cultural, economic and social context in which it must operate.

This chapter also examined the state of e-government in South Africa and its impact on electronic services such as e-health. Reference was also made to the Western Cape government’s e-government policy and efforts to create an electronically connected province. In the following chapter, South Africa’s legislative framework to enable e-services and the use of ICTs in health planning will be discussed.

It was further noted that the evidence used in decision-making processes is only as reliable and useful as the quality of the data sources which inform such decisions. In this regard, various data quality assurance frameworks were developed to ensure that data products meet the inherent quality standards for its intended purpose and use. Following this, the next chapter considers the South African legislative and planning frameworks.

CHAPTER 3: LEGISLATIVE AND PLANNING FRAMEWORKS

3.1 Introduction

In Chapter 2, it was emphasised that the successful implementation of an e-health strategy firstly depends on how advanced a country's ICT markets and infrastructure are and, secondly, on the extent to which a further expansion of these markets and infrastructure is enabled by a supportive legislative framework. In the following sections, the South African legislative framework, which forms the backbone of all electronic government services, as well as the challenges confronting the implementation of e-government will be explored. Reference will also be made to the national e-health strategy and the Western Cape's e-government strategy. Lastly, the role of ICT in the advancement of government's programme of action will be explored with specific reference to the National Health Department's (NDoH) strategic priorities.

3.2 Legislative framework

The following acts, policies, standards and documents directly and indirectly enabled the use of e-government services, as part of the overall government machinery, to improve the delivery of public services.

The Constitution of South Africa

Article 195 of the Constitution of South Africa (No. 108 of 1996) states that the public sector must be governed in such a way that it promotes the efficient, economic and effective use of resources and is able to provide the public with timely, accessible and accurate information. This section also enjoins government to enact national legislation that gives effect to the values and principles as stated in this article of the act (RSA, 1996a).

White Paper on Transformation of Public Service Delivery (Batho Pele)

The Batho Pele principles give effect to the constitutional imperative to render effective and efficient public services. These principles focus on eight essential areas, namely consultation, service standards, access to services, courtesy, access to information, openness and transparency, the right to redress, and value for money. Undoubtedly, the principles relating to "access to services" and "access to information" are relevant for the institutionalisation of e-

government services. Through the use of ICT, the Batho Pele policy aims to create a seamless and efficient public service by re-engineering and improving the back and front operations of government, as well as the internal and external communication processes (DPSA, 1997:11).

Public Service Act

Sections 3(1)(g) and 3(2) of the Public Service Act (No. 103 of 1999) make the Department of Public Service and Administration (DPSA) responsible for the establishment of e-government services, for giving effect to the regulations, determinations and directives in this Act and for performing any other acts provided for in this Act in order to give effect to this mandate (RSA, 1999).

State Information Technology Agency Act and State Information Technology Agency Amendment Act

The State Information Technology Agency Act (No. 58 of 1998) and State Information Technology Agency Amendment Act (No. 38 of 2002) are very important pieces of legislation as these acts established the State Information and Technology Agency (SITA) which operates under the auspices of the Department of Public Service and Administration (DPSA). According to this Act, SITA must supply mandatory services which include the provision and maintenance of the electronic wide area network (WAN) for government departments, citizens and businesses to interact with one another, as well as data processing and other transversal information services. SITA must also consolidate and coordinate government-wide ICT standards and infrastructure and conclude business agreements on behalf of government. SITA, by implication, should be an important partner in the delivery of e-health services (RSA, 1999; RSA, 2002a).

To strengthen SITA, the Cabinet in 2000 approved the appointment of the Government Information Technology Officers' Council (GITOC) and officials in national and provincial departments to consolidate and coordinate the implementation of e-government initiatives (DPSA, 2012:3). All SITA functions are embedded in its ICT House of Values policy which will be discussed below.

The Corporate Governance Information and Technology Policy Framework (CGITPF)

The CGITPF facilitates the governance of ICT by incorporating it as part of the corporate governance structure, i.e. by positioning GITOC functions in the executive branches of

government, fostering alignment between business and ICT strategies, and monitoring ICT service delivery functions and compliance with applicable policies, standards and documents. This policy was also adopted to support the achievement of national government's strategic outcomes by focusing on key ICT commonalities, as contained in SITA's ICT House of Values (see below) (DPSA, 2012:6,15).

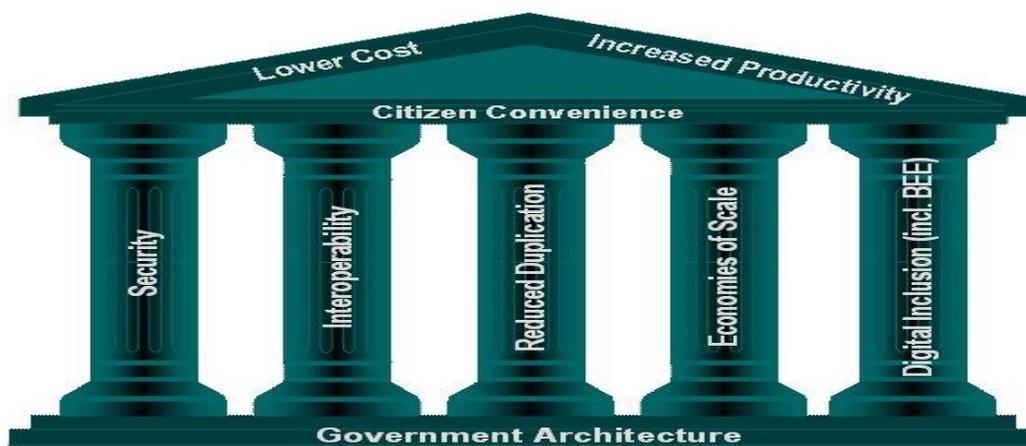


Figure 3.1: SITA's ICT House of Values

Source: SITA, 2015.

The ICT House of Values seeks to reduce costs, improve productivity and enhance citizen convenience by promoting a government-wide approach to the institutionalisation of ICT that would:

- Reduce duplication through the reuse and sharing of existing solutions;
- Leverage economies of scale by combining buying powers to procure ICT products and services for government centrally;
- Provide secure products and services;
- Ensure that all ICT solutions within government can integrate or interoperate; and
- Ensure that the previously disadvantaged are empowered by providing the following: access to economic opportunities; cost-effective access to government services via different channels – anywhere, anytime, anyhow; and training and overall skills development via the different channels available through which to access government services (SITA, 2015).

Electronic Communications and Transactions Act

The Electronic Communications and Transactions Act (No. 25 of 2002) regulates and facilitates electronic communications, electronic transactions and the development of a

national e-strategy, promotes universal access to electronic communications, and prevents abuse of information systems. This act also makes provision for the transmission of data messages and for making and receiving electronic payments (RSA, 2002b).

Electronic Communications Act

The Electronic Communications Act (No. 36 of 2005) provides for the regulation of telecommunication activities (excluding broadcasting) and the control of the radio frequency spectrum. It intends to establish an independent South African Telecommunications Regulatory Authority and a Universal Service Agency of South Africa (RSA, 2005).

Minimum Information Inoperability Standards (MIOS) version 4.1 and MIOS handbook

According to the Public Service regulations, it is mandatory to adhere to MIOS. MIOS defines government's technical standards to achieve interoperability and compatibility across the public sector. It is an essential component of an overall e-government strategy. It allows for the seamless flow of information across all tiers of government and for improving the accessibility of government services to citizens and businesses (DPSA, 2007).

Minimum Information Security Standards (MISS)

The MISS prescribes the security measures applicable to classified documents, personnel (guidelines for security vetting), communication and also computers. In terms of document security, the standards provide guidelines on access, transmission, storing as well as removal of these classified documents. The standards also provide for personnel security in that they explain the screening, validity of clearances and protection of executive officials. The security standards are clear in terms of how documents stored on a computer should be handled. The standards conclude with a chapter on breaches of security (DPSA, 2004:63).

Policy on Free and Open Source Software (FOSS) use for the South African government

Computer software is generally expensive. Therefore, the use of free software is a huge advantage in poor, developing countries. This policy summarises the use of free and open-source software (FOSS) to improve e-government. The policy also explains the implications, advantages and disadvantages of using FOSS and how FOSS contributes to development in South Africa (DPSA, 2006).

Promotion of Access to Information Act

According to the Promotion of Access to Information Act (No. 2 of 2000), any citizen of South Africa has the constitutional right to access information held by either a private or public entity in the exercise or protection of any right or matters related thereto. The Act fosters a culture of transparency and accountability by actively promoting the right of citizens to have effective access to information in order to fully exercise and protect their rights (RSA, 2000).

The National Archives and Record Service of South Africa Act

The National Archives and Record Service of South Africa Act (No. 43 of 1996) regulates the management and care of records in the possession of public bodies. Section 13 of the Act empowers the National Archivist to determine conditions for the reproduction and maintenance of electronic records (RSA, 1996b).

The District Health Management and Information Policy

This policy aims to harmonise health information across the country and to formalise the resources required for the effective implementation of a well-functioning District Health Management and Information System (DHMIS). This policy established the legal framework for health information systems in South Africa and details what the National Department of Health (NDoH) expects from users of the DHMIS at all levels of the health system (national, provincial, district and subdistrict) and of health establishments. The delineation of the different roles is to ensure “the production of comprehensive, timeous, reliable and good data” and to convert the data into information that can be used “for decision-making, planning and monitoring in the health sector” (DoH, 2011:13).

The Protection of Personal Information Act

The Protection of Personal Information Act (No. 4 of 2013) promotes the protection of personal information processed by public or private bodies. Section 32 of the Act specifically allows for the processing of a person’s health information by medical professionals and healthcare facilities for administrative or professional practice concerns (RSA, 2013).

The above-mentioned discussion highlighted that since the late 1990s, various acts, policies and standards were enacted to create an enabling e-government environment in South Africa.

Notwithstanding this, the South African e-government landscape is characterised by a general regression and disjunction between the policies and the implementation thereof.

Twenty years ago, South Africa and South Korea were comparatively ranked in terms of e-government but today South Korea is a global top performer while South Africa's ranking continues to plummet (Gilwald, Moyo & Stork, 2012:1). Although some pockets of excellence do exist, such as SARS's e-filing system, South Africa has experienced a regression¹⁰ in e-government development.

3.5 Information and communication technology and the planning cycle

During the first ten years of democracy in South Africa, the disjointed planning and lack of implementation capacity, alluded to in the previous section, has become the scourge of the this country's public service. In order to address this situation, the South African government adopted an outcomes approach which shifted the focus from the management of outputs to the management of outcomes that positively impact the lives of people (Mogaswa & Moodley, 2012:19). The management of outcomes entails the collection of programme performance information through the monitoring of indicators and evaluation studies across the entire results chain, i.e. from inputs to impacts. Consequently, government needs timely and reliable information to determine whether those outcomes were attained and had the planned or desired effect.

In this regard, ICT and specifically health information systems can undoubtedly add value to the governmental planning and implementation cycle by increasing the follow and uptake of statistical and research evidence relevant to the attainment of those goals. In theory, health information systems are able to supply authorities with information across the entire planning cycle, ranging from agenda setting, problem definition and policy, programme or project design to implementing and assessing outcomes and impacts. The following section will outline the outcomes approach and how it fundamentally changed government's planning and implementation cycle with an emphasis on the attainment of national health outcomes.

¹⁰ The United Nations' E-government Development Index, which is composed of the e-services offered by a government website, the telecommunication infrastructure and the literacy rate of the population of a specific country, indicates that South Africa has for the period 2003 to 2014 slipped from position 45 to 93 on this index (UN, 2014).

3.5.1 The outcomes approach

The outcomes approach promotes joint government action by emphasising the importance of integrated planning, budgeting and the monitoring and evaluation of government action across all spheres of government. The outcomes approach is similar to the WHO's systems approach mentioned in Chapter 1, which also focuses on converting inputs into outputs in order to achieve the desired outcomes and impacts. Figure 3.1 graphically illustrates how output and outcomes interrelate to form a results chain. The success of the outcomes approach depends on a monitoring and evaluation function that appraises managers and provides them with feedback about the progress in achieving the desired outcomes across the entire results chain. This information can be used in decision-making about improvements in programme effectiveness and efficiencies.



Figure 3.2: The results chain

Source: UN, 2002:7.

The planning and implementation of the outcome approach is facilitated by the conclusion of sector-specific Negotiated Service Delivery Agreements (NSDA) and the use of the Outcome Implementation Forums to “deliver” on these agreements. NSDA essentially transfer the political and administrative accountability and responsibility for the achievement of the outcomes across the whole of the results chain. The political and administrative accountability for the achievement of identified outcomes are accepted through the conclusion of performance agreements between the president and cabinet ministers and administrative staff.

The Outcome Implementation Forum under the leadership of the minister ensures that key outcomes are incorporated into the plans and programmes of national and provincial departments, municipalities and public entities. This approach thus addresses weaknesses such as the lack of strategic focus and leadership, poor interdepartmental and intergovernmental coordination, the tendency to work in silos, and inadequate planning and implementation capacity (Phillips, 2012:13).

Furthermore, accountability in the planning and implementation of programmes is enhanced by an M&E process which measures the progress and change that government priorities (outcomes) have brought about in lives of the targeted population. This reporting mechanism provides the necessary feedback for decision-makers to make determinations on budgets, to (re)set priorities and/or to continue or terminate a programme. Moreover, it emphasises the importance of information in ensuring transparency, accountability and oversight.

The outcomes approach heralded in a new way of conceptualising and addressing societal and/or developmental problems. Planning for outcomes entails working backwards from the outcome to determine what the best means is to achieve a specific outcome.

3.5.2 Medium Term Strategic Framework: planning for outcomes

The governmental planning cycle commences when the ruling party assumes office after a general election and its key strategic objectives are translated into the Medium Term Strategic Framework (MTSF). The MTSF is government's planning framework which sets out the strategic objectives, outcomes and targets government wants to achieve over its five-year electoral period. The MTSF informs all strategic and annual performance plans across the different spheres of government. In this way, plans and budgets are interrelated and an improved operational efficiency is achieved (The Presidency, 2013: 4-5). The MTSF thus ensures that there is alignment in planning and the allocation of resources across all spheres of government to realise the envisaged outcomes.

The 2009–2014 MSTF translated the five key priorities contained in the election manifesto of South Africa's ruling party, the African National Congress (ANC), into 12 priority outcomes which informed government's programme of action for the said period. The key priorities are the creation of decent work and sustainable livelihoods, education, health, rural development, food security and the fight against crime and corruption (Phillips, 2012:13). In 2012, Cabinet endorsed the National Development Plan (NDP) as its blue print for what government wants to achieve over the next 16 years. The ANC essentially augmented its election manifesto with the NDP.

The NDP endorses the outcomes approach and aims to eliminate poverty and reduce inequality by 2030 through a virtuous cycle of growth and development whereby progress in one area supports advances in others (NPC, 2011:25). By incorporating the NPD in the MSTF, government will be able to assess (new) programmes, legislation and regulation against long-

term goals and priorities, ensure policy coherence and improve its implementation capacity (The Presidency, 2013:14).

The 2014–2019 MTSF is structured around the 14 priority outcomes contained in the NDP and the ANC's electoral mandate. These include the 12 outcomes which were the focus of the previous MTSF cycle, as well as two new outcomes, namely social protection, and nation building and social cohesion. Each outcome is broken down into sub-outcomes which encapsulate action plans with commensurate indicators and time frames for measuring progress and targets. The 14 priority outcomes are:

- **Education:** quality basic education;
- **Health:** a long and healthy life for all South Africans;
- **Safety:** all people in South Africa are and feel safe;
- **Employment:** decent employment through inclusive growth;
- **Skills:** a skilled and capable workforce to support an inclusive growth path;
- **Infrastructure:** an efficient, competitive and responsive economic infrastructure network;
- **Rural:** vibrant, equitable, sustainable rural communities contributing towards food security for all;
- **Human settlements:** sustainable human settlements and improved quality of household life;
- **Local government:** responsive, accountable, effective and efficient local government;
- **Environment:** protect and enhance our environmental assets and natural resources;
- **Internal and external relations:** create a better South Africa and contribute to a better Africa and a better world;
- **Public service:** an efficient, effective and development-oriented public service;
- **Social protection:** a comprehensive, responsive and sustainable social protection system; and
- **Nation building and social cohesion:** a diverse, socially cohesive society with a common national identity.

The 14 outcomes are framed in such a way to emphasise the overarching goal for each sector. With the added advantage of the NDP's forward-looking vision, sectors are able to commence with backward planning and set targets to achieve the mentioned outcome. The MTSF can therefore be described best as the building blocks towards the NDP's vision of 2030. Achieving this vision, however, depends on the South African economy achieving a growth rate of at

least 5% per annum (NPC, 2011:31). The 2014–2019 MTSF heralds the first five-year implantation phase of the NDP whereby the plans of national and provincial departments, municipalities and public entities are aligned towards a common vision and goals (The Presidency, 2013:5).

In realising this vision for South Africa, the 2014–2019 MTSF for the health sector will specifically focus on constructing 213 clinics and community health centres and 43 hospitals and refurbishing more than 870 health facilities; increasing the training of doctors to 2 000 per annum; doubling the number of people on ARTs to 5.1 million; intensifying TB screening and treatment for vulnerable groups such as prison inmates, mineworkers and mining communities; and vaccinating 90% of girls between the age of 9 and 10 years against the risk of acquiring cervical cancer (The Presidency, 2013:15-36).

Although the focus is health specific, the virtuous cycle set in motion will not only lead to a healthier population but through the mentioned construction process also create employment opportunities and public-private partnerships, thereby stimulating local economic activity. The demand for more qualified health practitioners will, in turn, require an education system that is responsive in the sense that it delivers students who excel at mathematics and science. The advances made in one area and the resulting positive spin-offs they have in other area are the core purpose of integrated planning. Through the NDP, all 14 outcomes are interconnected and geared towards achieving a common vision for South Africa.

MTSF targets are again incorporated into the Department of Health's strategic plan. The introduction of the NDP means that the MTSF has become a five-year building block towards the achievement of a long-term vision and goal for South Africa.

3.5.3 The Department of Health's strategic goals 2014–2019

The central thrust of the Department of Health for the current MTSF is to strengthen the health system in order to improve the overall performance of the health system and to attain the envisaged health outcomes (DoH, 2014:13). A salient feature of this strategic plan is the acknowledgement that information is indeed the foundation of a functional health system. Likewise, Outcome 9 of the NDP, which emphasises health system reforms, prioritises improving health information systems in order to use the information to make informed decisions regarding the provisioning of services and to track the performance of the health

system as a whole. A proactive health system is also advocated which achieves sustainable health outcomes through a focus on the social causes of disease instead of the disease itself. The major challenges that prevent South Africans from living a long, healthy life are a quadruple burden of disease consisting of HIV and Aids, communicable diseases, non-communicable diseases, and violence and injuries; concerns about the quality of public healthcare; an ineffective and inefficient system; and the spiralling costs of private healthcare (DoH, 2014:13).

In order to address these challenges, the NDP set out 9 long-term health goals or outcomes with 9 key interventions to realise the vision of *a long and healthy life for all South Africans*. The achievement of the stated outcomes is applicable to both national and provincial departments of health. Table 3.1 (below) summarises the mentioned 9 outcomes and key interventions required to achieve the stated outcomes as well as the NDoH's strategic goals for the period 2014–2019 according to the MTSF.

The Western Cape Government's *Healthcare 2030* is fully aligned with the NDP outcomes (1-7) as it also proactively addresses the burden of disease, follows the PHC approach to deliver an accessible and equitable health service for all, employs ICT to improve data flow and collection, and uses the generated evidence to strengthen the health system.

Table 3.1: Department of Health's strategic goals 2014–2019

NDP outcomes 2030	NDP key interventions	Strategic goals 2014-2019
1. Average male and female life expectancy at birth increases to 70 years.	Address the social determinants that affect health and diseases. Prevent and reduce the disease burden and promote health.	Prevent disease and reduce its burden, and promote health.
2. Tuberculosis (TB) prevention and cure progressively improved.		
3. Maternal, infant and child mortality reduced.		
4. Prevalence of non-communicable diseases reduced.		
5. Injury, accidents and violence reduced by 50% from 2010 levels.		
6. Health system reforms completed.	Strengthen the health system.	Improve health facility planning by implementing norms and standards. Improve financial management by improving capacity, contract management, revenue collection and supply chain management reforms.
	Improve health information systems.	Develop an efficient health management information system for improved decision-making.
	Improve quality by using evidence.	Improve the quality of care by setting and monitoring national norms and standards, improving the system for user feedback, increasing safety in healthcare, and improving clinical governance.
7. Primary healthcare teams deployed to provide care to families and communities.	Meaningful public-private partnerships	Re-engineer primary healthcare by increasing the number of ward-based outreach teams, contracting general practitioners, and district specialist teams; and expanding school health services.
8. Universal health coverage achieved.	Improve the financing of universal healthcare coverage.	Make progress towards universal health coverage through the development of the National Health Insurance Scheme and improve the readiness of health facilities for its implementation.
9. Posts filled with skilled, committed and competent individuals.	Improve human resources in the health sector. Review management positions and appointments and strengthen accountability mechanisms.	Improve human resources for health by ensuring adequate training and accountability measures.

Source: DoH, 2014.

3.6 Summary

This chapter discussed the South African e-government legislative architecture, the state of e-government and how it impacts on the sustainability of e-health services. The regression in e-government services and South Africa's inability to development beyond the static website phase are mainly due to a lack of political leadership, poor ICT governance and a disjunction between policy and implementation. There are, however, also positive signs. The Department of Health's Normative Standards Framework for Interoperability in e-health allows for the standardisation of all e-health initiatives and, in doing so, attempts to bridge the chasm between design and reality, the gap espoused by Heeks as discussed in Chapter 2. In this regard, the Western Cape Government also embarked on a strategy to electronically integrate back-office operations and to use multiple digital platforms to connect and integrate communities.

The outcomes-based approach and MTSF were explained and contextualised in considering the national vision for 2030. Improvement in governmental planning and implementation capacity across all spheres of government depends on managers having access to reliable information and feedback about the attainment of strategic goals. In this regard, the NDP advocates a greater reliance on ICTs to collect and synthesise data for monitoring and evaluation purposes.

The last section of this chapter dealt with the national Health Department's strategic objectives for the 2016–2016 MTSF, the NDP's objectives for the health sector and the extent to which there is alignment between *Healthcare 2030* and the aforementioned documents. This section is important in relation to the study as it informs the discussion of the unit of analysis in Chapter 4.

CHAPTER 4: THE BREEDE VALLEY SUBDISTRICT: A CASE STUDY

4.1 Introduction

In this chapter, the Breede Valley Subdistrict is discussed as part of the greater Western Cape Department of Health (WCDoH) in terms of its mandate, vision and mission, organisational structure, and how it collects and monitors health data. Special attention is paid to core programmes such as district health services and the Information Management Directorate which has a direct bearing on the data collection process regarding the unit of analysis. This section also highlights the role of the National Department of Health in the collection and use of information and how it impacts on the data management processes at provincial, district and subdistrict levels.

4.2 The demographic profile of the Western Cape

The Western Cape has a population of 6 200 098 which is 11.3 per cent of the national population. The population is growing at an exponential rate of 2.6 per cent per annum which is mainly due to in-migration and decreasing mortality rates. The Western Cape also has the highest life expectancy rate in South Africa of 63.7 and 66.0 years for males and females respectively. Disaggregated by age, 6 per cent of the population is over 65 years, 60 per cent below 35 years, and 26 per cent under the age of 15. The economically active age group, 15–65 years, comprises 68 per cent of the total population. Afrikaans is the predominant language followed by English and isiXhosa.

The majority of the population (64.2 per cent) reside in the Cape Town Metro District followed by the Cape Winelands District (13.5 per cent), Eden District (9.9 per cent), West Coast (6.7 per cent), Overberg (4.4 per cent) and Central Karoo (1.2 per cent). In terms of its socio-economic profile (health, education, living standards and economic activity) 28 per cent of municipalities are classified as deprived while 78.8 per cent of the population is uninsured and relies on public health services (WCDoH, 2016:4, 7).

Health services in the Western Cape are under severe strain. This is evident from very high bed occupancy rates, high patient loads at emergency centres, and long waiting times at primary healthcare (PHC) facilities. Unlike the rest of the country, the Western Cape also has a higher incidence of alcohol and drug abuse which places an even bigger strain on already limited health resources. The Western Cape Government, however, acknowledges that

alcohol and drug abuse not only increases the burden of disease but also compromises education outcomes, destroys families and fuels insecurity and affects economic growth and job creation in the province negatively.

To address this situation, the WCDoH is involved in “joint planning initiatives” with the provincial departments of Community Safety and Social Development to address the social determinants of health, safety and social ills. In the 2014–2019 provincial MTSF, the primary focus of this collaboration is to reduce the impact of alcohol abuse on the health of communities, workforce, families, youth and children. Similarly, the “First 1000 days of a child’s life” campaign aims to raise awareness about the impact of societal influences on a child’s health, development and chances of success in later years. It is hoped that by addressing the social determinants of health, the Western Cape will achieve better and sustainable health outcomes (WCDoH, 2015c:21).

This section highlighted the situational challenges faced by the WCDoH. The next section will be limited to describing the National Department of Health’s efforts to monitor health outcomes through the district health information system.

4.3 The National Department of Health

As custodian of public health services in South Africa, the NDoH renders services to almost 80 per cent of the South African population. This translates to nearly 11 per cent of the annual national budget. Most of this budget is allocated to the eleven provincial departments of health to provide and manage a comprehensive health service via the decentralised, district-based PHC model (GCIS, 2016). These services, however, should be monitored to ensure that public funds are spent where they are needed the most.

The national district health information system (DHIS) was established in terms of section 74(2) of the National Health Act to monitor the delivery of healthcare services in South Africa. To ensure uniformity and the standardisation in the collection, collation and dissemination of health data, the District Health Management Information System Policy (DHMIS) was enacted (DoH, 2011:16). This policy authorised the Director-General of the NDoH to determine a national indicator data set (NIDS) which is used to monitor the achievement of national health goals and objectives and also to prescribe generic roles and responsibilities to DHIS users at national, provincial, district and subdistrict level. In this regard, the policy redefined seven SASQAF quality dimensions (relevance, accuracy, timeliness, accessibility, interpretability, adherence and integrity) into roles and responsibilities that the national department required from each level to strengthen the delivery of timeous and reliable data.

To ensure that relevant health data is collected, the national and provincial departments of health are responsible for the development of a uniform indicator and data definition data set to monitor the South African public health system. District Managers, in turn, must ensure that staff is trained and they must utilise the indicators applicable to their level. To ensure the integrity of data sources, provincial and national departments are, on a quarterly basis, required to validate the data captured at their respective levels.

In order to meet the timeliness requirement, all levels must compile quarterly timeliness reports in order to identify bottlenecks and instances where there was no compliance with the data collection processes. To improve accessibility and completeness of data, all programme managers at district, provincial and national levels are delegated the responsibility to ensure the completeness and data quality of programmes under their jurisdiction. The policy also prescribes that this responsibility should be contained in managers' performance agreements. To ensure the reliability of data, provincial departments are tasked to identify unstable health establishments by analysing DHIS data.

To strengthen the accuracy of data, facility managers are compelled to conduct regular accuracy assessments. As a further control mechanism, the NIDS and data collection tools are issued with validation rules to minimise errors in the collection of data. The policy further prescribes the use of data quality audits to identify weaknesses and to develop data quality improvement plans. To ensure coherence and comparability, the NDoH is obliged to compare DHIS data with survey data and to compare data sets of other departments at regular intervals (DoH, 2011:25-27). The DHIMS policy thus put checks and balances in place to ensure the delivery of timely and reliable data.

Despite this policy, the National Planning Commission contends that the poor performance of the district health services is the root cause of South Africa's poor health outcomes. The Commission found that the inability of district management teams to translate national policy into district-specific strategies, work plans and budgets can be attributed largely to an information system which does not provide regular feedback to managers at district level (NPC, 2011:331). As part of its turnaround strategy to strengthen the use of information at district level, the NDoH, in 2012, embarked on a five-year strategy to provide technical assistance to districts to improve their capabilities to deliver on their legislative mandate (Wolvaardt, Johnson, Cameron, Botha & Kornik, 2014:80, 83).

In the next section, the Provincial department of Health will be discussed in terms of its current priorities, legislative mandate, vision and mission, organisational structure and information management processes. This discussion will be focused on the unit of analysis.

4.4 The Western Cape Department of Health (WCDoh)

The Western Cape Government comprises 13 departments of which the department of Health is the second largest. The administrative headquarters of the WCDoh is seated in Cape Town. Similar to the rest of South Africa, health services are delivered via districts which comprise subdistricts located within the districts. The Western Cape has 9 districts (4 urban and 5 rural). The district offices for the metro district are located in the Cape Town City Centre while offices of the rural districts are located as follows: Cape Winelands District (Worcester); Overberg District (Caledon); West Coast District (Malmesbury); Eden District (George); and Central Karoo District (Beaufort West). The Cape Winelands incorporates the unit of analysis, the Breede Valley Subdistrict, which is discussed below.

In the 2014–2019 MTSF, the department plans to reorientate the organisational culture to be more person-centred, to integrate primary healthcare (PHC) services, and to prioritise Information and Communication Technology (ICT) (WCDoh, 2015c:48). The latter is relevant to this study as the department aims to roll out and operationalise core ICT infrastructure at hospitals and clinics; develop an interoperability mechanism to connect all systems; and encourage and manage innovation in ICT. Compared to the rest of the country, achieving these objectives is not far-fetched as it basically requires the consolidation of existing ICT infrastructure.

ICT successes of the department to date include the use of a unique patient identifier for each patient which allows for the patient care record to be viewed irrespective of the treatment centre; nearly all hospitals are connected to a single hospital information system; all primary health clinics are connected to either the Primary Health Care Information System (PHCIS) or Patient Record and Health Management Information system (PREMHIS); 43 per cent of medication dispensed is recorded electronically; all laboratory results are available electronically; the Picture Archiving and Communication System and Radiology Information System (PACS/RIS) is being implemented at hospitals; the Enterprise Electronic Content Management System (ECM) for patients' clinical history is being rolled out; and a complete database of HIV and TB patients exists and a similar system is being developed for other chronic diseases, pregnancies and births. Data exchange programmes applied to current ICT infrastructure has yielded positive results which pave the way for the implementation of an integrated business intelligence system which allows for a single view of a patient record (WCDoh, 2015c:41,48-49).

The consolidation of ICT infrastructure will improve the efficiency and effectiveness with which data about programme performance is captured, disseminated and used.

4.4.1 Legislative mandate

The Legislative mandate of the Department is derived from Schedule 4, Part A of the Constitution of the Republic of South Africa (RSA, 1996a). Sections 27(1)(a) and 27(3) of the Constitution obligate the Department to provide basic health services, including reproductive healthcare, as well as emergency medical treatment. In terms of the legislative mandate, the Department is directly responsible for implementing, managing and overseeing provincial health services and for related issues emanating from other legislative and policy mandates.

4.4.2 Vision, mission and values

The vision of the WCDoH is to provide a person-centred, quality healthcare service to the people of the Western Cape, in partnership with other relevant stakeholders within a balanced and well-managed health system. Underlying this vision are the values of innovation, caring, competence, accountability, integrity, responsiveness and respect (WCDoH, 2015a:2).

4.4.3 Organisational structure

The Department is headed by the Member of the Executive Council (MEC) who functions as the political head of the organisation. The administrative arm of the organisation is managed by the Head of Department (HOD) who also acts as the Department's Accounting Officer. The WCDoH is a complex and diverse organisation. In order to achieve greater synergy and alignment in the department, line management at macro level is divided into a clinical and administrative management sector. In this structure, the HOD retains overall accountability while the accountability for the management of the clinical services sector is delegated to the Chief of Operations. Each line management structure is discussed separately below.

4.4.3.1 The administrative line functions

The administrative line management comprises the Chief Directorates for Finance and Supply Management, People Management, Strategy and Health Support, Infrastructure and Technical Management, and the Directorate Communications.

Communications, unlike the other directorates, is seated in the Office of the HOD. This directorate is responsible for the regulation of communication between the WCDoH and its internal and external stakeholders as well as the management of complaints about health services received from the public.

The Chief Directorate Strategic Planning and Coordination is responsible for strategic planning, monitoring and evaluation functions and to ensure alignment between the planning and reporting cycles. These functions are critical as they inform the budgetary processes and priorities. This Chief Directorate comprises the following Directorates: Health Impact Assessment; Information Management; Professional Support Services; Pharmacy Services; and Business Development.

The Chief Directorate: Human Resources comprises the following Directorates: Human Resource Management; Labour Relations; Nursing Services; and Human Resource Development. The finance division is headed by the Chief Financial Officer and consists of two Chief Directorates, namely Financial Management and Financial Management Support. The Chief Directorate: Financial Management consists of the directorates Financial Accounting and Supply Chain Management. The Chief Directorate: Financial Management Support comprises only one directorate, namely Management Accounting. The Chief Directorate: Infrastructure and Technical Management comprises the directorates Health Technology; Infrastructure Planning; Engineering and Technical Support; Infrastructure Programme Delivery; and the Tygerberg Hospital redevelopment project office.

The Chief Directorate: Health Programmes oversees the planning, policy development, implementation, and monitoring and evaluation of priority health conditions. This Chief Directorate include the following Directorates: Community-based Programmes; Facility-based Programmes; and HAST (HIV, AIDS, STI and TB).

4.4.3.2 The clinical line functions

The clinical line management sector is responsible for the delivery of health services to the public. It comprises the following Chief Directorates: Rural District Health Services; Metro District Health Services; General Specialist and Emergency Services; Tygerberg Hospital; Groote Schuur Hospital; and the Red Cross War Memorial Children's Hospital.

The Chief Directorate: Metro and Chief Directorate Rural District Health Services oversee the delivery of facility-based district health services across the Western Cape. District Directors report directly to either the Chief Director: Metro or Chief Director: Rural District Health Services.

The Chief Directorate: General Specialist and Emergency Services comprise the following Directorates: General Specialist Hospitals; Emergency Medical Services; and Forensic Pathology Services.

Tygerberg Hospital, Groote Schuur Hospital and the Red Cross War Memorial Children's Hospital render highly specialised tertiary and quaternary health services both provincially and nationally. These institutions are managed by Chief Executive Officers who are supported by a director for clinical services and finance. The Chief Executive Officers report directly to the Chief of Operations.

As at 31 March 2015, the Department employed 31 267 people of which 20 204 was healthcare professionals. Nearly 94.2 per cent of all critical posts were filled (WCDoH, 2016:17-18). The next section will discuss the Chief Directorate: Strategy and Support with specific reference to the Directorate: Information Management and District Health Services because of their relevance to this study.

4.4.4 The Directorate Information Management (IM)

As mentioned, the Directorate: Information Management (IM) is one of the core programmes which fall under the Chief Directorate: Strategy and Support. IM's primary purpose is to collect, integrate, report and present data and information in support of the departmental decision-making processes. To perform this function, the Directorate acts as the central depository for performance data and manages the collation and dissemination of information which used in the departmental planning, budgeting, monitoring and evaluation cycle. Data is collected, amongst others, from the Clinicom and the Primary Health Care Information Systems while reporting is done through Sinjani, the Geographic Information and Business Intelligence Systems (WCDoH, 2013:87). The information management function is of critical importance as it underpins all governance processes in the department. All IM policies, standard operating procedures and tools are developed by this Directorate, while implementation is done through the IM subcomponents located in the various districts and subdistricts.

Critical to all these functions is the Sub-directorate: Knowledge Management. The section comprises a staff of 25 which include, amongst others, a Deputy Director, 5 Assistant Directors, the Internal Compliance Unit (ICU) and the central data repository (Sinjani) controller. Three of the five Assistant Directors oversee the collection of performance information from district health services, regional and central hospitals, and auxiliary services. The other two Assistant Directors are responsibly for training and the Internal Compliance Unit (ICU), respectively. The training section provides training in terms of standard operating procedures, national and provincial data indicators and the use of information systems at facility level. The ICU team comprise 10 Senior Administrative Officers who work directly with facility and management staff to ensure that the reported data is complete, accurate and reliable.

The ICU conducts regular data quality assessments at facility level to ensure that facilities are audit ready and that the department achieves an unqualified audit on predetermined objectives. The Unit utilises an electronic compliance monitoring tool to assess facilities on a range of compliance issues, in particular the findings raised by the Auditor-General. The monitoring tool is updated annually to include the current annual performance indicators and data elements. Based on the assessment results, a remedial plan is developed and implemented at facility and subdistrict levels. This unit ensures that facilities produce good data quality that is fit for decision-making and is audit compliant (WCDoH, 2015d:176).

Another key priority of the Directorate: Information Management is to roll out and strengthen the development of a comprehensive and integrated HIS across the province. This directorate is a trendsetter and its current successes are mentioned above. In the next section, district health services in relation to the unit of analysis are discussed.

4.4.5 District Health Services

As the District Health Services programme was discussed above, this section will provide an overview of the interrelatedness between the Cape Winelands District and the Breede Valley subdistrict in terms of their organisational structure and information management processes.

4.4.5.1 The Cape Winelands District

As mentioned previously, the Breede Valley Subdistrict (unit analysis) is located in the Cape Winelands District which falls under the District Health Services (DHS) programme. The Breede Valley Subdistrict (BVS) together with the Witzenberg, Langeberg, Stellenbosch and Drakenstein Subdistricts form the Cape Winelands Health District (CWD). The CWD has a population of 808 042 people of which only 25.2 per cent have medical insurance. In terms of socio-economic indicators, the CWD is considered to be one of the wealthiest districts in South Africa (Massyn *et al.*, 2014:611).

The DHS programme is divided into 10 subprogrammes: District Management; Community Health Clinics; Community Health Centres; Community-based Services; Other Community Services; HAST; Nutrition; Coroner Services; District Hospitals; and Global Fund.

At operational level, the District Director is supported by Deputy Directors for Finance and Supply Chain Management, Comprehensive Health Services, Professional Support Services and Human Resources. The Assistant Director for Information Management falls under the Deputy Director: Professional Support Services. The Assistant Director: Information

Management is supported by two Senior Administrative Officers who collate and validate the data from the five subdistricts into a district data set.

Data is collected on a monthly basis from the various subprogrammes. In terms of the DHIS policy, the District Director is ultimately responsible for the collection and signing off of data in their district. At provincial level, the province data set is for sign-off by the HOD and submitted to the national department. In the following section, the unit of analysis, the Breed Valley Subdistrict is discussed.

4.4.5.2 The Breede Valley Subdistrict (BVS)

The BVS comprises a district hospital (Brewelskloof TB Hospital¹¹); a community day care centre (Worcester CDC); six clinics (De Doorns, Empilisweni, Orchard, Rawsonville, Sandhills and Touwsrivier); four satellite clinics (De Wet, Maria Pieterse, Overhex and Somerset Street) and five mobile clinics (Bossieveld, Botha/Brandwacht, De Wet, Overhex and Slanghoek) (WCDoH, 2015b:341). The Breede Valley Subdistrict (BVS) has an estimated population of 166 825 people (The Local Government Handbook, 2015).

In 2007, the WCDoH restructured to strengthen the DHS approach and to provide an integrated and seamless health service. To this end, the corporate and clinical functions of district hospitals in subdistricts were expanded to incorporate primary health services. In this way, the planning and management of public health services in the subdistrict fell under the jurisdiction of the Medical Superintendent of the district hospital. In terms of accountability, the Medical Superintendent reports to the District Director.

At subdistrict level, the office of the Medical Superintendent comprises sections for finance, human resources, clinical services, nursing services and primary healthcare services. Information management falls under the finance section and is delegated to a senior administrative officer (SAO). The SAO is supported by a clerk who assists with the collation and validation of subdistrict data. In the next section, the Department's data quality assurance practices and controls are discussed.

4.5 Data quality assurance practices and controls

Due to the routine nature of health data, the WCDoH measures data quality in terms of timeliness, completeness and accuracy (WCDoH, 2013b:4). Similar to the DHIS approach

¹¹ Brewelskloof TB Hospital serves as administrative centre for the BVS.

mentioned above, data quality dimensions are translated into roles and responsibilities which are required from the facility to provincial level.

In order to meet the timeliness requirement, the WCDoH identified fixed dates on which districts and subdistricts have to submit their performance data for the preceding month. The stipulated submission dates allow latitude for data to be correct if discrepancies are detected. On the 7th of each month, PHC facilities are obliged to submit their final data to the subdistrict offices. The subdistrict office, in turn, submits aggregated subdistrict data to the district office on the 15th day of the month. By the last working day of the month, the district office submits aggregated district data to the provincial IM office. Fifteen days later or the 45th day, the provincial office is required, as per DHIS policy, to submit aggregated provincial data to the NDoH (DoH, 2012:24).

To promote the accuracy and completeness of data, Operational Managers and IM personnel are tasked to ensure that all forms and registers (source documents) from which data is captured are fully completed; validation violations and outliers are investigated and commented on; and there are no discrepancies between values contained in source documents, data input forms and the data captured in the central provincial data depository (Sinjani). Compliance with the mentioned data quality dimensions is enforced by data sign-off forms whereby the managers of facilities and programmes acknowledge accountability and responsibility for the data they submit.

4.5.1 Capturing and validation of data

Prior to data being captured in Sinjani, the data should be validated. The validation process comprises the profiling of data for inconsistencies which can adversely affect the “fitness for use” of the final data product. The WCDoH makes use of a hybrid paper-electronic data collection system whereby facilities, subdistricts and districts are required to submit and store hard copies of their monthly data. The hard copies are also used by the Auditor-General (AG) to verify the validity, accuracy and completeness of data during their regularity audits. To facilitate the collection of data, data collection tools province-wide are updated annually according to the APP data elements.

Figure 4.1 is an example of the routine monthly report on which facilities manually record their monthly data. The report also states the source documents where the data can be obtained and the minimum and maximum range within which a value must fall.

Table 4.1: Routine Monthly Report

ROUTINE MONTHLY REPORT (PHC)					
SUBDISTRICT	BREEDE VALLEY	FACILITY:			
PERIOD (Mnth/Yr):		CONTACT NUMBER:			
<i>POPULATE FIELD NEXT TO ELEMENT WITH "N" IF SERVICE IS NOT RENDERED BY FACILITY AND A ZERO (0) IF NO PATIENTS WERE SEEN EVEN THOUGH THE SERVICE WAS OFFERED.</i>					
ELEMENT	Source Document	TOTAL	MIN	MAX	COMMENT
District Health Services					
PHC headcount under 5 years	<i>Service Point register</i>		1070	1863	
PHC headcount 5 years and older	<i>Service Point register</i>		4956	9217	
Child under 5 years with diarrhoea with dehydration new	<i>Service Point register</i>		0	5	
Child under 5 years with diarrhoea without dehydration new	<i>Service Point register</i>		0	5	
Child under 5 years with pneumonia new	<i>Service Point register</i>		0	8	
	NAME & SURNAME	DATE		SIGNATURE	
Compiled by:		YY/MM/DD			
Reviewed by (Facility manager):		YY/MM/DD			

Source: Williams, 2016.

At the time of this study, only the larger facilities in the Breede Valley Subdistrict had a data capturer on their staff. This meant that most of the facilities' routine monthly data had to be captured in Sinjani by the clerk at the subdistrict office. The Sinjani information system is discussed in the next section.

4.5.2 The Sinjani: Central data repository system

The Sinjani information system allows for the capturing, extraction and analysis of data. Data can also be entered or edited at ward, facility, subdistrict, district, provincial and national level. Although all provincial data is captured and stored in Sinjani, the WCDoH reports to NDoH through the DHIS system. To ensure that data meets the accuracy, timeliness and completeness dimensions, Sinjani is enabled to generate outlier, validation, timeliness and completeness reports. These reports are discussed below. Where examples of reports are used to supplement the discussion, all reports were extracted in MS Excel format.

As highlighted above, the value recorded against a data element is restricted to a specified value range. Ranges reflect historical data entered into Sinjani for the past 18 months and are automatically calculated. This is a control mechanism to ensure that values entered per data element are accurate and do not fall outside a specified range. If a value does fall outside the range, it will be considered an outlier and a comment should be inserted to explain the discrepancy before it will be accepted by Sinjani. Table 4.2 is an example of a Sinjani outlier report with comments about the deviation in values for the listed data elements.

Table 4.2: An example of an outlier report

Facility	Element	Value	Low Range	High Range	Comment
De Doorns Clinic	Antenatal 1st visit 14 weeks to before 20 weeks	4	11	21	Missed appointments
De Doorns Clinic	BCG dose under 1 year (at birth)	69	0	5	BCG catch-up due to shortage at Worcester Hospital/Worcester day hospital
De Doorns Clinic	Child under 5 years with pneumonia new	27	3	13	Include referrals from Hexkem Pharmacy
De Doorns Clinic	DTaP-IPV-HepB-Hib (Hexavalent) 4th dose	2	6	16	National Shortage
De Doorns Clinic	DTaP-IPV/Hib (Pentavalent) 1st dose	0	13	38	Replaced by Hexavalent
De Doorns Clinic	DTaP-IPV/Hib (Pentavalent) 3rd dose	0	12	37	Replaced by Hexavalent
De Doorns Clinic	DTaP-IPV/Hib (Pentavalent) 4th dose	0	9	19	Replaced by Hexavalent

Source: Williams, 2016.

Similar to outliers, validation rules also enhance the accuracy of data. A validation rule is applicable in situations where one data element is a subset of another data element and the recorded values between the two elements cannot differ, e.g. the data element “Child 12-59 months dewormed” must be less than or equal to “PHC Headcount under 5 years”. This rule is based on the assumption that an under-five-year-old child will receive a deworming treatment as part of the PHC child health package. Hence, the grand total for the data element “PHC Headcount under 5 years” has to be equal to or less than the value recorded against “Child 12-59 months dewormed”. Validation rules are prescribed in the NIDS which is the primary guide for healthcare workers when they capture data. Table 4.3 is an example of a Sinjani validation report, for April 2016, PHC data in the Breede Valley Subdistrict. No violation errors were found by the system for the mentioned month, hence the report is blank.

Table 4.3: An example of a validation report

Integrity: Validation report							
Subdistrict: Breede Valley Local Municipality							
Facility: All							
Start month: Apr-16							
End month: Apr-16							
Display absolute rules: Yes							
Display expert rules: No							
Include Calculated field errors: Yes							
District	Facility	Rule name	Left Description	Left value	Right Description	Right value	Comment

Source: Williams, 2016.

The timeliness report reflects whether or not all PHC input forms (100 per cent) were submitted on time, i.e. the 7th of the month as required in terms of WCDoH data flow policy. Table 4.4 is

an example of a timeliness report which was generated for the Breede Valley Subdistrict for the month of April 2016. Brewelskloof TB hospital registered a “zero” because TB hospitals unlike PHC facilities are required to submit their data on the 10th of each month. In this instance, all PHC facilities submitted all their forms on or before the 7th of the month. Hence, the 100 per cent value is recorded against their name.

Table 4.4: An example of a timeliness report

7th of following month (7 days)			
Breede Valley Local Municipality			
Percentage of forms captured on time			
Subdistrict	Facility	Apr-16	Total
Breede Valley Local Municipality	Brewelskloof TB Hospital	0	0
Breede Valley Local Municipality	De Doorns Clinic	100	100
Breede Valley Local Municipality	De Doorns Non-medical Site	100	100
Breede Valley Local Municipality	De Wet Satellite Clinic	100	100
Breede Valley Local Municipality	Empilisweni (Worcester) Clinic	100	100
Breede Valley Local Municipality	Orchard Clinic	100	100
Breede Valley Local Municipality	Rawsonville Clinic	100	100
Breede Valley Local Municipality	Sandhills Clinic	100	100

Source: Williams, 2016.

The Table 4.5 (below) is an example of a missing forms report which alludes to the completeness of data input forms which were submitted to the subdistrict office. In this instance, completeness is expressed in fraction format. Out of 88 required forms, all 88 were submitted.

Table 4.5: An example of a missing forms report

Missing forms for Primary Health data between Apr-16 and Apr-16				
Elements:				
Facilities:	Breede Valley Local Municipality			
Values:	Filled in over Expected elements			
District	Subdistrict	Facility	Apr-16	Total
Cape Winelands District Municipality	Breede Valley Local Municipality	De Doorns Clinic	88 / 88	88 / 88

Source: Williams, 2016.

Once the data of PHC facilities is validated by the subdistrict office, it is submitted to the various higher levels in the Department. As the reliability and usefulness of data is central to the department’s performance, it should be monitored. In the following section, the AG’s monitoring and reporting of performance information are discussed.

4.6 The monitoring and reporting of performance information

As mentioned, the information management function is concerned with the collation and dissemination of performance data used for planning, budgeting as well as with the monitoring and evaluation of health services in the Western Cape.

In this regard, the Department's Annual Performance Plan (APP) is a critical source document as it determines which data elements will be collected for a given financial year. The APP is aligned with both the national and provincial Departments' medium-term (5 year) strategic goals and objectives. The collected data elements are used to calculate indicators which are used to quantify the provincial health system's performance. The result of this performance is captured in the department's accountability instruments, namely the quarterly and annual reports.

Due to the statutory nature of the planning, budgeting and reporting process, the Department's performance is audited by the AG against the predetermined objectives, indicators and targets as contained in the annual performance report. Prior to the audit, all data for the financial year is locked, hence no alteration can be made to it. The AG audits performance data in terms of validity, accuracy and completeness. Evidence of performance data includes source documentation such as patient folders, service point tick sheets, registers, monthly data input forms, and electronically generated reports. Although the Department in the 2014/15 financial year received a clean audit, the AG raised concerns about the reliability and completeness of school health records, which falls under the district health services' programme (WCDoH, 2015d:229).

For the 2016/17 financial year, districts and subdistricts have to collect 96 data elements which are used to calculate 65 performance indicators. The number of data elements per programme is as follows: district health services (17); district hospitals (21); HAST (24); maternal, child and women's health and nutrition (44); and disease prevention and control (9). Due to the large number of data elements that needs to be collected, the possibility of errors increases. This can affect data quality and/or future audit findings.

4.7 Summary

The Breede Valley Subdistrict is part of the greater Western Cape Department of Health which is responsible for the delivery of health services in the province. The Department was discussed in terms of its mandate, vision and mission, organisational structure, and data

quality assurance practices. Core programmes responsible for the gathering of performance data and relevant to the aims of this study were also highlighted.

The case study forms the basis for the data gathering and analysis in Chapter 5, and the discussion of results in Chapter 6.

CHAPTER 5: DATA GATHERING AND ANALYSIS

5.1 Introduction

According to Welman, Kruger and Mitchell (2005:2), research is the process of obtaining scientific knowledge through the use of various objective methods and procedures. This chapter specifically deals with the selected methodology and research design in order to answer the research objectives, as stated in Chapter 1. The discussion will focus on the research design, the unit of analysis, sampling design and methods, data conceptualisation as well as data collection and data analysis.

5.2 Research design

As indicated in Chapter 1, the purpose of this study was to assess the data quality of performance information generated in the health sector of the Breede Valley Subdistrict for evidence-based decision-making. To investigate this research question, a descriptive case study research design was decided upon. According to De Vos, Strydom, Fouché and Delport (2011:37), a descriptive case study enables the researcher to describe, analyse and interpret a particular phenomenon in order to produce a detailed description of such cases.

5.3 The unit of analysis: a brief description of context

Bless, Higson-Smith and Kagee (2006:72) defined the unit of analysis as the person, object or event that is studied in order to collect data and draw conclusions. In this study, the unit of analysis is the Breede Valley Subdistrict (BVS). As mentioned in the previous chapter, the BVS forms part of the greater Cape Winelands Health District. The CWD renders a geographically demarcated primary healthcare service through the following fixed healthcare facilities: Worcester Community Day Care Centre (CDC) and the De Doorns, Empilisweni, Orchard, Rawsonville, Sandhills and Touwsrivier Clinics. Each facility is managed by an operational manager who reports to the PHC manager and who, in turn, reports to the subdistrict medical superintendent.

As mentioned previously, each facility, on a monthly basis, submits its performance data to the subdistrict office for quality assessment and comments. Once all errors have been

corrected (which means there are no outliers and/or validation rule violations without valid comments and no outstanding input forms or data elements, and the data corresponds with data on the input forms) the data is submitted for final sign-off to the PHC manager and/or medical superintendent. The subdistrict's data (disaggregated by facility) is captured in the WCDoH's central data repository, Sinjani. From here, the various subdistrict data sets are aggregated into the district and provincial data sets. At the district and provincial levels, the data is again checked and corrected before sign-off by the district director and Head of Department respectively.

The purpose of the subdistrict office can be described as follows: Information Management is not only to ensure data flow and data quality but also to assist district management in the use of data for monitoring and evaluation purposes and the coordination and management of ICT support services in the subdistrict. These functions are performed by a Senior Administrative Officer and a clerk in the BVS.

Besides the data quality checks performed at subdistrict, district and provincial levels, the WCDoH also deploys the Information Compliance Unit to facilities across the Western Cape. This Unit conducts planned visits to facilities and assesses compliance with information management processes, aims to improve compliance with standard operating procedures, policies and procedures, and prepares facilities to be audit ready. As the researcher is part of this Unit, he was able to verify and validate data captured in questionnaires and interviews.

In the following paragraph, the sampling design and sampling methods will be discussed.

5.4 Sampling design and sampling methods

In qualitative studies, specific individuals, groups and settings are deliberately chosen where specific processes are most likely to occur. Hence, key informants were selected based on their position or experience, or because they were more knowledgeable about the subject under investigation than other regular group members (De Vos *et al.*, 2011:37; Welman *et al.*, 2005:204). To this end, a non-probability, purposive sampling method was decided upon as it would best serve the purpose of this study. In order to address the research question and facilitate the collection of data, the respondents were selected from the following two groups:

- The first group consisted of the PHC Manager and Medical Superintendent as they are representative of the decision-makers who base their decisions on data supplied by the

facilities in the subdistrict. Semi-structured interviews were conducted with this group. This sample was appropriate to the extent that it allowed the researcher to gather data about the actual use of the data and perceptions of the quality of information in decision-making processes; and

- The second group consisted of the eight (8) Operational Managers who collect and validate data at the most basic level of the organisation. They are in the best position to comment on the factors (negative or positive) that determine the quality of data at the point of collection. Questionnaires were administered to this group.

5.5 Data collection

Data from primary and secondary sources were collected and analysed in order to answer the research question.

5.5.1 Data collection methods

According to De Vos *et al.* (2001:321), case studies operate within a larger context and require the use of multiple information sources to provide an in-depth description of a specified case. In lieu of the limited number of cases in case study research, researchers should use a mix of data sources to corroborate findings.

In this study, a combination of empirical and non-empirical methods were used to collect data. An empirical approach was adopted to collect primary data from the management cadre in the BVS. Secondary data was collected from the Department's annual plans, reports and data quality assessments. The literature review and documents formed the non-empirical component of this study.

Secondary data

In Chapter 1, the theoretical framework was developed to address the research objectives of this study. Chapters 2 and 3 contain the literature review which informed this thesis. Various books and journal articles were consulted to identify and define key concepts which underpin this study. These included sources on the development and use of evidence in public sector decision-making processes, evidence-based decision-making models, the development and implementation of an e-government and e-health system, the development and limitations of

HIS in developing countries, an analysis of the South African e-health landscape and legislative framework, and an examination of data quality dimensions and frameworks applicable to national statistical offices and health data/records.

Data quality frameworks discussed included the International Monetary Fund's Data Quality Assessment Framework (IMF, 2006), the United Nation's Generic Data Quality Assessment Framework (UN, 2012), the South African Statistical Quality Assessment Framework (SASQAF) (StatsSA, 2008), the health data quality model of Canadian Institute for Health Information (2009), the Weiskopf & Weng (2013) framework for electronic health records, and the CARTA model (Heeks, 2008) for e-government systems. The CARTA model also informs the empirical phase of this study.

The result of the findings from the different data sources culminated in the research findings, a discussion and recommendations. The latter will be discussed in Chapter 7.

Primary data collection

Questionnaires and semi-structured interviews were designed around questions pertaining to the research question. The five CARTA data quality dimensions as defined by Heeks (2006) were used, firstly, to gauge the respondents' perception about the quality of data they produced, and, secondly, to adapt the framework to include a Likert scale to test their attitude towards each dimension.

In order to conduct this research, the researcher had to apply for ethical clearance via the Research Ethics Committee: Human Research (Humanities) of Stellenbosch University and to the Western Cape Provincial Health Research Committee. See Appendix A for letter of approval from the Western Cape Provincial Health Research Committee.

Due to time constraints, the researcher administered the questionnaire in person to the Operational Managers. During the semi-structured interviews with the PHC manager and Medical Superintendent, the researcher made voice recordings and took reflective notes. Prior to the collection of data, the purpose of this study was explained to the respondents and they also had to complete a consent form indicating their willingness to participate in this study. See Appendix B for a copy of the consent form. Appendices C, D and E are copies of the questionnaire and semi-structured interview questions administered to the key informants.

5.5.2 Data analysis

Data analysis is the process to reduce data to “an intelligible and interpretable form” to study and test variables and to draw conclusions (De Vos *et al.*, 2011:249). As mentioned, this study applied qualitative approach to analyse documents, semi-structured interviews and questionnaires.

5.7 Summary

The research question and Heeks’s data quality framework served as basis for the development of the data collection tools. This chapter focused on the research design, sampling methods, data collection and data analysis. In the next chapter, the research findings are presented and discussed.

CHAPTER 6: PRESENTATION OF RESEARCH FINDINGS

6.1 Introduction

In the previous chapter, the data gathering and analysis methodology applicable to this study were discussed. In this chapter, the research findings are presented and discussed by linking the empirical and non-empirical data gathered in relation to the case study which was presented in Chapter 4 and the literature study contained in Chapters 2 and 3.

According to Phillips (2012:13), the outcomes-based approach enabled the South African government to monitor and evaluate the impact of its policy and decision-making processes through the analysis of key performance indicators. To ensure a “healthy and long life for all South Africans”, the South African government relies on performance information to monitor and evaluate health outcomes. In the health sector, the gathering of performance information is governed by the DHMIS policy. This policy is specifically aimed at collecting health data to monitor the achievement of national health goals and objectives. At facility level, these goals and objectives are translated into annual performance targets which must be achieved by the personnel. The purpose of this study was to assess whether or not the performance data collected in the Breede Valley can be used for evidence-based decision-making purposes.

To answer this question, data was collected through questionnaires which were administered to the Operational Managers of fixed health facilities in the Breede Valley Subdistrict. Semi-structured interviews were also conducted with the Primary Health Care Manager and the Medical Superintendent of the Subdistrict. In the next section, the research results are presented.

6.2 Presentation of research results

Different data collection tools were used to collect primary data from key informants in the subdistrict. Questions were structured in such a way so as to gain an in-depth understanding of the value and relevance the interviewees and respondents attribute to the performance information they collect. Two of the selected Operational Managers were not available and did not complete the questionnaire. The results of the interviews with the Primary Health Care Manager and the Medical Superintendent are presented in Section 6.2.1 and 6.2.2 respectively, while the responses of the Operational Managers (OMs) are presented at 6.2.3.

6.2.1 Interview results: PHC Manager

Question 1: Briefly describe your role as PHC Manager in the collection of performance data?

As Primary Health Care Manager her role is to oversee that all facilities under her jurisdiction submit their monthly performance data (also referred to as routine monthly data) according to the Department's data flow policy. During her monthly operational managers' meeting, Subdistrict Information Management (IM) has a slot where data quality queries are raised and rectified. This also serves as an opportunity for the Information Management component of the Subdistrict to engage with Operational Managers on data-related matters such as the introduction of new tick sheets and the interpretation of data definitions. During her visits to health facilities, she always stresses the need and importance of data collection.

Question 2: As the PHC Manager, how do you integrate performance data into your planning and decision-making processes?

Once the data has been signed off by the District Director, she is supplied with an updated Excel-based "responsiveness tool" which reflects the extent to which the subdistrict has reached its set targets for a given month. The subdistrict targets form part of the overall district targets. The tool indicates the daily average per data element and per facility and compares it to the required daily average required to meet the district's APP targets.

By comparing the average headcount and the number of patients seen by a professional nurse, she is able to transfer staff to facilities where there is an increase in headcount and in doing so alleviates the pressure on that facility. This information she also uses to motivate for more posts in the subdistrict. In cases where the subdistrict is underperforming on certain targets, e.g. immunisations, she might consider instituting special campaigns to meet the target. The "responsiveness tool" allows her to prioritise and plan primary health services in the subdistrict.

By studying the tool, she is also able to identify trends in the burden of disease which is very useful when it comes to the planning of services which the community requires. During the district's quarterly morbidity and mortality meeting the subdistrict's data is further discussed and analysed. Without the routine monthly data, planning and the justifications of decisions would be an arduous task.

Question 3: How do you review the completeness and accuracy of your data?

She does not review data and accepts that the final data set presented to her for sign-off by the Subdistrict IM Unit as a true reflection of work delivered by the facilities. She also scrutinises the data and if she has queries, she will raise it with the IM Unit.

The completeness and accuracy of data are governed by the department of Health's data flow policy. According to this policy, all facilities are required to submit their routine monthly data on the 7th of each month to the subdistrict IM Unit. They then capture the data in Sinjani where further data quality checks are performed. If there are any outliers, incomplete forms or validation errors, the data is sent back to the facility to be corrected. Once corrections are done, the data is submitted to her for sign-off.

Prior to the submission of data, Operational Managers (OM) are also required in terms of the policy to check the accuracy and completeness of their data on a weekly and monthly basis. For this purpose, they collate weekly and monthly summaries. Once these processes are completed, the data should be relatively complete and accurate.

Question 4: Does the collection of data add value to the workload of clinical staff?

Yes and no. On the one hand, it allows OMs to measure their performance in the achievement of APP targets while, on the other the data, collection requires the completion of so many forms and OMs find it difficult to balance their clinical functions with their various administrative tasks.

Question 4.1: In your view, what factors negatively impacts on the clinical staff's perception of the data collection process?

Data collection places an extra burden on the OMs especially when some still have to travel 2 hours per day just to get to their facilities. Due to the daily clinical workload most of her facility managers check their data after hours or over weekend. Furthermore, not every facility in the subdistrict has a dedicated Information Clerk, which means that the OMs are solely responsible for the collation of monthly data. In general, staff sees data collection in a negative light and as a compliance exercise that simply has to be done. As PHC Manager, she does not dwell too much on the negative side of things and as far as possible tries to keep her staff motivated.

Question 5: *Healthcare 2030* stresses the use of ICTs. What is the current state of ICT roll-out in your facilities and what obstacles do you experience?

All facilities are connected to the PGWC computer network but the problem is capacity. Some facilities use only the paper-based system and rely on neighbouring facilities that do have the capacity to capture the data onto the computer. The lack of capacity includes the general use of computers and specific software such as Sinjani to capture data. There is a definite need to upskill staff in this regard. If each facility also had a data clerk, the adoption of new information technologies would also increase.

Question 6 (6.1 to 6.5): On a scale of 0 to 10 (0 = not important, 10 = very important), how would you rate the importance of the following data dimensions? Completeness, accuracy, relevance, timeliness and appropriateness of presentation.

She scored all data quality dimensions a 10, as it is very important if the data is to give a true reflection of the health services the data reflects. Data quality is also covered by the department's data flow policy. The performance data submitted meets these standards. Timeliness is often a problem as transversal health programmes sometimes submit their data late and this again impacts on the data submitted by the subdistrict to the district. For this reason, it is important to have the buy-in of all role players when it comes to data collection.

Question 7: Any further comments you would like to add?

Current performance data captured in BVS meets the standards set by the Department. The responsiveness tool which is derived from the performance is useful in that it allows her to measure the achievement of performance and performance targets and it fosters accountability in the system.

6.2.2 Interview results: Medical Superintendent

Question 1: Briefly describe your role as Medical Superintendent in the collection of performance data?

As manager, he is not directly involved in any data collection and only signs off the data as stipulated by the Department's data flow policy.

Question 2: As the Medical Superintendent, how do you integrate performance data into your planning and decision-making processes?

Routine monthly data is primarily used to measure the achievement of APP targets. The element "patients seen by professional nurse and doctor" indicates the number of patients seen and is used to determine the workload of each of the mentioned categories. Performance data gives only numerical values and is used with caution because it is

inaccurate and does not reflect what they as managers want to see or can use in their daily decision-making processes.

The data does not speak to the complexity of patients and just gives an indication of the number of patients seen. Today patients have multiple diseases, e.g. diabetes with heart failure or HIV with TB, which require them to take eight (8) or more medications. To consult with such patients takes time and the data does not reflect this. If the data is taken on face value, it might seem that nurses and doctors are not working hard enough while they are in fact dealing with complex patients. This is even more so when compared to fifteen years ago. The same goes for headcounts which do not reflect the different services one patient might get during one visit and the time these services require from the nursing staff. The data is insufficient and does not meet the end user's demands.

Similarly, the APP targets also have limitations because it is an estimation of the number uninsured population versus insured population versus total population, while in reality the population profiles differ from clinic to clinic and between regions, i.e. rural and urban. APP targets are skewed and are not used to determine services. It is just a target. To determine services, an in-depth analysis is made of a health facility of which routine monthly data is only one of the sources taken into account. Yes, we use the data – knowing that it has limitations and does not address the issues relevant to strengthen clinical practice.

Question 3: How are posts allocated in your district?

Posts are not determined locally but by Head Office in Cape Town. At provincial level, the monthly performance data is used to determine budgets and because the data is skewed, it leads to discrepancies in budget allocations. For example, headcounts, which is a major consideration, can be artificially increased due to an over service of patients (i.e. one patient receiving different services during one visit), and might indicate that a facility is particularly busy whilst it is existing patients who are treated. We need data to inform our decision-making processes but it must be relevant and accurate.

Question 4: Does the collection of data add value to the workload of clinical staff?

No. It consumes clinical time which is used to collect inaccurate data. Staff is overwhelmed by the sheer volume of work and pressured to meet deadlines. The data does not help clinical staff to deliver better services.

Question 5: *Healthcare 2030* stresses the use of ICTs. What is the current state of ICT roll-out in your facilities and what obstacles do you experience?

We are currently rolling out what we have. All facilities are being connected to the PHCIS system, clinical staff is using SharePoint to share protocols and patient information, and an electronic scripting system was also implemented. Upgrading of equipment is, however, constrained by limited finances and remains a challenge.

There is a need for more e-health technology but developing such technologies is a very slow process.

Another challenge is equipping staff with the required skills to use technology effectively. It is particularly difficult when facility staff is already overstretched to find time to equip them.

Question 6: Any further comments you would like to add?

Data can immensely assist in decision-making but then it must be relevant and accurate. The current data collection processes are driven by external factors and not by the clinical care of patients. There are so many targets to achieve but which are irrelevant to improve the quality of clinical services rendered. There is, however, light at the end of the tunnel. Currently, the data collection process is under review at a very high level in the Department but it will take some time before changes will filter through.

6.2.3 Questionnaire results: Operational Managers in the Subdistrict

The Operational Managers (OMs) in the Subdistrict responded as follows to the questionnaires:

Question 1 and Question 1.1: In what format is performance data collected at your facility? What data collection tools do you use in your facility to collect data?

All respondents indicated that data is first captured through a paper-based system before it is transferred to Sinjani, the Department's central data repository. Data about services rendered is recorded on standardised tick sheets, registers, patient folders and surveys, and questionnaires. Only 33 per cent of the respondents capture their data electronically. Where data is not captured electronically on site, it is captured at the subdistrict IM office or at Worcester or De Doorns Clinics who have a dedicated information staff. This places an extra strain on the mentioned facilities as they have to capture their own data as well as the other facilities' data. Some operational managers who are computer literate are currently being trained by the Subdistrict office to capture their data on site in Sinjani.

Question 2: Who is primarily responsible for the capturing of performance data at your facility?

All OMs indicated that they are responsible for the collation and submission of data collected at their facilities. The clinical staff complete the various tick sheets, forms and registers, while the OM collates and verifies the data. In cases where a facility does have an Information Clerk, the collation and verification process is conducted by the Administrative Clerk and the OM only performs spot checks to ensure the data is accurate and complete.

Question 3: How do you review the accuracy and completeness of data collected at your facility?

One OM indicated that due to time constraints, she does not review her data prior to submission and depends on the subdistrict IM office to alert her to any discrepancies which might be present. The rest of the respondents indicated that they perform spot checks by comparing the source documentation with weekly and monthly summaries of the data. During the review process, attention is given to elements where they might be underperforming according to the APP targets. In instances where data is captured on site, the minimum and maximum value ranges generated by the Sinjani software immediately identify discrepancies in values which should be corrected.

Question 4: What computer hardware does your facility use to capture data?

Eighty-four per cent of the respondents indicated that their facilities do have computers and printers. Computers are regularly updated and most have Intel i7 microprocessors. Computers are primarily located at reception where the PHCIS software is used to capture headcounts, open folders and make appointments. If computers are located in service areas, they are used in a limited way as no services are electronically scanned and are recorded manually. One OM indicated that she does not have any computer hardware and captures and collates her data manually.

Question 5: What computer software does your facility use to capture data?

All computers use Microsoft software such as MS Office and Outlook. Other health-specific software includes ETR.NET which is used to capture TB data and the PHCIS system. The PHCIS allows for the scanning of services but that module still needs to be rolled out.

Question 5.1: Are your computers networked?

Yes. Where facilities have computers, they are connected to the PGWC network.

Question 6: How would you rate the computer literacy levels of your personnel?

For computer literacy, 66 per cent of the respondents gave their staff a 3 out of 5, while 33 per cent scored their staff a 1 out of 5. On the question of whether staff can use the PHCIS system, the highest score was a 3 out of 5 (33 per cent scored 1, 33 per cent scored 2, and 33 per cent scored 1). Amongst staff, there were also variances with doctors and administrative staff displaying higher levels of computer literacy compared to the nursing staff. OMs attributed this to a lack of capacity and/or training but more fundamentally because nursing staffs' focus is patient care and not data collection. Nursing staff are not required to use computers because it is done for them. Blood results, for example, are sent to the OM's email address who then distributes it to the relevant service point. Similarly, at reception, the Administrative Clerks make patient appointments on behalf of the clinical staff.

Question 7: Does the Department of Health have any Standard Operating Procedure (SOP) in place to ensure the accuracy and completeness of data submitted by your facility? If yes, please briefly explain this process.

Yes. Data collection and data quality are governed by a departmental SOP. This SOP requires data to be submitted to the subdistrict office by the 7th of each month. The data is submitted with a compliance monitoring instrument which is a checklist to assess the completeness of data sets submitted. Once submitted, the data is captured in Sinjani, which verifies the data further for outliers, completeness and validation errors. If errors are detected, the data is returned to the facility to be corrected. Corrections are effected from Sinjani, data input form to source document. A copy of the final data is kept at the facility for safekeeping and audit purposes.

Question 8: Please indicate the reasons why your facility collects data about services rendered.

Sixty-six per cent of the respondents identified the achievement of performance targets, the monitoring of health risks and the evaluation of current services or projects as the major reason why data is collected. The respondents agree that the focus is on the achievement of targets which has little to do with their primary function which is quality patient care.

Question 9: On a scale of 0 to 10 (0 = not important, 10 = very important), how would you rate the importance of the following data quality dimensions? Completeness, accuracy, relevance, timeliness and appropriateness of presentation.

All respondents agreed that completeness, accuracy, relevance, timeliness and appropriateness of presentation are very important dimensions and that the departmental SOP complies with all of the dimensions.

OMs, however, questioned the relevance of the targets set per facility based on population estimations. Some OMs felt that targets do not make provision for the migration of patients, especially seasonal workers. This is something over which facilities have no control but it still results in them underperforming on targets. Other facilities, due to the migration of patients, overperform again and, consequently, staff at such facilities are rated higher in terms of their work performance and qualify for performance bonuses. The achievement of APP targets contributes to 40 per cent of clinical staff's performance reviews. An OM also complained that 12 out of a nursing component of 29 indicated that they are not interested in being assessed. Those who refused see it as a senseless exercise because, for the current financial year, they have not met their individual targets. It is not that these nurses are failing in their duty but more a case that there simply is not enough patients to meet the set targets. Three OMs also expressed the view that some facilities are artificially inflating their data to "look good" and qualify for performance bonuses.

Question 10: Any further comments you would like to add?

The focus should be on patient care and there is a need to ease the administrative burden placed on clinical staff. APP targets should be realistic. Currently, targets are not achievable and this demoralises staff. To ease the administrative burden, OMs recommended that programme managers and IM staff must visit facilities more often to provide support and guidance in the data collection process. This is lacking as facilities are left to their own devices and drowning under the administrative burden. More monitoring of data is required as it will alert OMs to the need for data to be accurate and complete. One OM recommended that all facilities should be subjected to internal information compliance audit and that OMs should evaluate each other's data. This would enhance the integrity of the collected data.

6.3 Interpretation of results

To interpret the research results presented in section 6.2, the case study of the Breede Valley Subdistrict will be linked to the literature reviewed in Chapters 2 and 3. In order to facilitate the

discussion of the research results, the findings will be grouped according to themes encapsulated in the research objectives of this study. The themes are evidence-based decision-making, data quality assurance and the use of ICTs.

6.3.1 Evidence-based decision-making

The literature study revealed that governments globally are required to demonstrate to the internal and external stakeholders improved decision-making, governance, accountability and tangible results. According to Strydom *et al.* (2010) and Nutley *et al.* (2008:13), the practice of EBM places the best available evidence at the disposal of decision-makers to determine 'what works' and 'how well it works'. By using objective evidence, governments are able to strategically better manage and implement policies, programmes and policies. To facilitate the use of evidence, the South African government adopted the outcomes approach which allows it to do backward planning in order to achieve planned outcomes. According to Mogaswe and Moodley (2012:19), the outcomes approach shifted the focus from outputs to outcomes which have an impact on people's lives. Through the outcomes approach, government can determine the extent to which inputs are translated into outputs, outcomes and impacts. During each phase of the conversion process a feedback loop is created which generates evidence to which decision-makers otherwise would not have had access. Government's objectives, outcomes and targets are contained in the MTSF which informs the national and provincial departments' annual performance plans. According to the PHC Manager, the provincial performance is further broken down into district and subdistrict targets. To monitor the achievement of targets, performance data about performance indicators are collected monthly.

The FMPPI is part of the Government-Wide Monitoring and Evaluation Framework which regulates the collection and use of programme performance information. Performance information is contained in departments' administrative and financial records; social, economic and demographic statistics; and other sources such as departmental surveys (National Treasury, 2011:4). Performance information, firstly, measures how successfully government converts inputs into outputs to achieve stated outcomes, and, secondly, provides the evidentiary feedback loop needed to set baseline targets required for future planning and budgetary processes. The interviewees and respondents confirmed that the Department has an annual performance plan, as well as a data flow policy in place which governs the collection and validation of performance information. The data flow policy ensures that the performance data collected at Subdistrict level is timely, accurate and complete (WCDoH, 2013b:4). The collected data elements inform the provincial performance indicator data sets. Aggregated

provincial performance information is captured into quarterly and annual reports which are submitted to the political and administrative heads of the Department. Provincial and National Treasury use these reports to determine the value-for-money of departmental activities against the objectives set out in the departments' strategic and annual performance plans (Treasury, 2007:4, 7).

Strydom *et al.* (2010:8) asserts that in practice "evidence" is largely used in an instrumental way, i.e. as a solution to a perceived performance gap. The study revealed that performance information is used to measure the conversion rate within the result chain and to provide managers with direct control over the achievement of outcomes. The Medical Superintendent confirmed that the information they are required to collect at Subdistrict level serves little or no purpose other than the chasing of performance targets. As clinicians, they are concerned with patient care. The data they collect is mere numerical values which serve an "external" purpose and do not speak to the complexity of the patients to whom they attend. It is the researcher's opinion that clinicians seek information that can assist in the diagnosis and treatment of patients. The information that is collected should improve clinicians' conceptual understanding the causes and/or circumstances which impact on patients' health.

According to Nutley *et al.* (2008:32), a conceptual use of evidence can lead to a re-evaluation of what was considered to be the root cause of a problem in the first place. The Medical Superintendent alluded to the fact that patients today are more complex than fifteen years ago. This complexity requires a new approach to healthcare. The conceptual understanding of the causes of disease fifteen years ago are profoundly different from what is experienced today. Performance information, in its current form, is primarily used to meet a political agenda and it is not rigorous enough to inform decision-makers' conceptual understanding of societal problems. Nutley *et al.* (2008:38) assert that evidence-based decision-making is never a linear process but an iterative and interactive process, as new evidence alters how a societal problem was initially framed.

Segone (2008:34) and Strydom *et al.* (2010:3) caution that evidence-based decisions are intrinsically value-driven and that the technical analysis of a problem should not promote a one-sided solution to a societal problem. Decisions about which evidence should inform decisions must be weighed up against the interests and institutions represented in the decision-making process. Head (2010) identify four evidentiary bases, namely the political, the scientific, the organisational (implementation) and the client/stakeholder, which should be aligned in order for a decision to be considered relevant and evidence informed. There was general consensus among the respondents that a need exists for more clinical data and less performance data. In this regard, the WCDoH envisages a business intelligence system that

addresses both the financial and clinic information needs of the organisation (WCDoH, 2014:119).

Nutley *et al.* (2008:210) contend that the way evidence is used also determines how it is incorporated in the decision-making processes at meso or organisational level. As the BVS derives its mandate from the national and provincial departments, it has little or no decision-making autonomy. The Medical Superintendent explained that decisions about human resource and budget allocations are determined by the provincial department. In instances where evidence is used instrumentally, the embedded research model is applicable. According to this model, “relevant” evidence is entrenched through governance structures, procedures, protocols and guidelines. Consequently, this model does not allow for a high degree of professional autonomy. The success of this model is dependent on staff that are trained in using the various protocols and guidelines. The latter is further enforced by performance appraisals and compliance audits.

The research-embedded model provides a fair description of how evidence is used in the BVS. Through the use of performance information to measure performance, accountability for the achievement of outcomes has become a salient feature of the public health sector. Furthermore, the outcomes approach integrates planning from the strategic to the individual employee level. Hence, the public health setting is bureaucratic with the locus of control and the decision-making power seated at the national and provincial departments of health. It is the author’s opinion that the respondents’ questioning of the “relevance” of performance information is related to the need for more clinical data that directly impacts on their areas of control.

6.3.2 Data Quality Assurance

According to Wager *et al.* (2009:88), data are “raw facts about people, places, events and things” which have no intrinsic meaning but once it is aggregated and processed into information, it gains meaning and can be used in decision-making processes. The quality of the information is directly related to the quality of data which underpins it. Heeks (2007:74) states that the major cause of poor quality data is human interaction during the capture, input, process and output phases of the information cycle. Wager *et al.* (2009:88) contend that the health sector is data intensive and is prone to systemic and random errors which can adversely affect the quality of information produced.

According to Blackstone (1993:3) and Wikipedia (2015b), a data product is “fit for purpose” if it can be used for business operations, decision-making and planning purposes. Loshin (2011:39) agrees that a data product is “fit for purpose” if it aligns with the dimensions which are relevant to the organisation’s analytical processes and if it enables the organisation to measure a specific organisational standard. Dimensions can be either intrinsic, i.e. accuracy, or contextual, which relates to the completeness and timeliness of data. The contextual dimensions of data are determined by the business policies of the data-producing agency (Loshin, 2011:132). Häyrynen *et al.* (2007) found that completeness and accuracy are the most frequently assessed dimensions in the health sector.

The study revealed that performance information is primarily collected to measure the achievement of performance targets. The PHC manager also uses this information to determine the workload of nurses to plan for campaigns and to measure the burden of disease in the Subdistrict. Dimensions important to the WCDoH are timeliness, completeness and accuracy (WCDoH, 2013b:4). The PHC manager indicated that the Department has a data flow policy in place which regulates the timeliness, completeness and accuracy of performance data. Once the OMs have submitted their data to the district office, it is captured in Sinjani where it is further profiled for anomalies and inconsistencies. Once verified, the performance data is “fit for purpose”, i.e. timely, complete and accurate. From the district office, the data is submitted to the District and Provincial Offices as required by the DHIS policy (DoH, 2012:24).

In terms of SASQAF, quality statistics can be classified as national statistics if they meet the requisite design criteria and deductions can be made from the data (StatsSA, 2008:3). The framework uses 7 quality dimension, namely relevance, accuracy, timeliness, accessibility, interpretability, coherence and integrity against which to assess to quality of the statistics. The DHMIS policy redefined these dimensions into roles and responsibilities to strengthen the delivery of timely and accurate performance data (DoH, 2011:25-27). The SASQAF data quality dimensions serve as benchmark against which to measure the reliability and usefulness of performance data. Data quality assurance frameworks define and assess a data product against predetermined dimensions in order to improve the quality of the final product (Zhu, 2014:12).

According to Redman (1998:79-82, cited in Parker *et al.*, 2006), data quality assessments are a necessity because without it organisations run the risk that poor quality data can compromise the information required for decision support. Data quality assurance practices ultimately assist authorities to measure whether the data they produce meets both the current and future information demands of the organisation. The study revealed that the OMs see data collection

as a tedious process which impacts negatively on their clinical time. A major frustration is the overwhelming amount of forms which should be completed. The data collection and assurance practices are seen as compliance exercises, i.e. something that has to be done.

Despite this negative sentiment towards the data collection process, the OMs indicated that the data quality of their performance information meets all the dimensions of Heeks' CARTA framework. This framework was reworked into a series of questions which were posed to the OMs. These questions afforded OMs the opportunity to self-assess the data quality of the information they submit. Concepts such as completeness, accuracy, relevance, timeliness and appropriateness of presentation were familiar and easily understood. It is the author's opinion that these concepts are inculcated through the departmental SOP and the control mechanisms built into the Sinjani system. OMs, however, raised concerns about the "relevance" of performance information as it only provided a measurement of how far they have come to reach their annual performance targets. Due to the non-achievement of performance targets, clinical staff at one facility recused themselves from annual performance assessments because they knew that they did not meet their individual targets and therefore do not qualify for a performance bonus. Similarly, the PHC Manager highlighted that meeting performance targets is only one of the criteria used to motivate for more posts. A lot is therefore at stake when targets are not met and this ultimately has a profound influence on the data quality that is produced at facility level.

Heeks (2007:83) contends that users' perceptions of data irrelevance, non-use, and fear of punishment or rewards being withheld can either negatively or positively affect data quality. Hence, data in the public sector is never neutral and is shaped by those who handle it. Interviewees and respondents agree that the data they collect are of little relevance to their primary function which is patient care. In such instances, the mentioned author contends that the probability increases that users may misrepresent the data to receive more favourable outcomes. The author, however, is of the opinion that the internal data quality assessments performed by the Internal Compliance Unit (ICU) as well as the regularity audits by the Auditor-General (AG) to a large extent mitigate such a risk. For the 2014/2015 financial year, the Department received a clean audit and AG only raised concerns about the reliability of school health record. The latter also attests to the fact that OMs strictly adhere to departmental data quality assurance practices.

6.3.3 ICT in the health sector

According to Mayer-Schönberger and Lazer (2007:12), information is the foundation on which the modern government bases its decisions and processes. The WHO (2007:v-vi) and Mutale *et al.* (2013) agree that information is key to inform policies, the allocation of scarce resources, and the achievement of strategic goals and objectives in the health sector. A health information system (HIS) collects data and converts the data into information that can be used for health-related decision-making (WHO, 2010:44). The FMPPI requires departments to have a PI system in place that enables decision-makers to use the information for EDM purposes (Treasury, 2011:1). The WCDoH's Sinjani system, which is described in Chapter 4, is one such system. The Sinjani system allows the department to capture, extract and analyse performance information. The PHC Manager stated that each month performance data is loaded onto Sinjani where the data is electronically profiled for inconsistencies. Once data queries have been corrected, the data is aggregated into reports that can be used for decision-making purposes.

Except for one OM, the OMs reported that they all have access to computers and all of them are connected to the PGWC computer network. Software used in the clinics includes MS Office, Sinjani and ETR.Net which is TB-specific software. The Medical Superintendent, however, highlighted that upgrading computer hardware is limited due to budget constraints. Despite the latter, new information and communication technologies are continually being rolled out but finding the time to upskill staff remains a challenge. In this regard, all OMs scored their personnel not higher than a 3 out of 10 for computer literacy.

In such instances, Heeks (2007:219) points out that the organisation should focus on implementing technology that is designed with the end users in mind. Heeks refers to the latter as hard-soft gaps which should be closed in order to find a fit between system design and the environment in which an information system must operate. To achieve this, the buy-in of system designers and end users are required. Heeks (2007:222) further advises that ICTs should be introduced modularly and increased incrementally as users become familiar with new technology. Closing the gap also requires end users to accept responsibility to be upskilled in order to fully appreciate the new technology. The Medical Superintendent also pointed out that the Subdistrict personnel are running at full capacity and there is not opportunity to upskill staff. It is the opinion of the author that if the Department is serious about the training of personnel, special arrangements have to be put in place to allow for the upskilling of personnel.

The study also revealed that the major driver for the use of ICTs in the WCDoH is *Healthcare 2030*. *Healthcare 2030* is part of the Western Cape government's strategy to use ICTs as a core enabler to improve its internal management processes and how it delivers services to the public. The study found that the WCDoH is currently experimenting with interoperable business solution which will greatly enhance the use and dissemination of information in the department. Besides the Sinjani information system which reports on performance information, the department uses other systems to record the clinical history of patients.

The department uses a unique patient identifier to collect and analyse clinical information about patients. This enables clinicians to view a patient record irrespective of where the patient is treated. Clinical information systems include the PHCIS system which collects and manages information about patient visits to PHC facilities, the Clinicom System which records hospital encounters, an electronic scripting service, a Picture Archiving and Communication System and Radiology Information System (PACS/RIS), an Enterprise Electronic Content Management System (ECM), and a complete databases of HIV and TB patients. To achieve greater interoperability between the various systems, the Department is currently consolidating all information processes into a single business intelligence system.

Achieving a single business solution will be a major feat for the province as it will signify that back-end systems are fully integrated into and there is unrestricted flow of information inside the department. The latter is synonymous with the final phase of e-government maturity (UN, 2008:8). The Western Cape government's e-services are currently operating at the emerging e-service level. (PGWC 2015:4).

The study revealed that the WCDoH's situation is not dissimilar from the rest of the country. Masilela, Foster and Chetty (2014:18) state that the South African public health sector is characterised by differing levels of e-health equity, expenditure and maturity across and within provinces, a lack of interoperability and communication between disparate systems, expensive broadband connectivity, the absence of a national master patient index and identification system, and limited capacity in the public sector for implementation. In Chapter 3, reference was made to the Corporate Governance Information and Technology Policy Framework (CGITPF) which was enacted to achieve the implementation of electronic services across South Africa. Cloete (2012:132) contends that the CGITP reaffirms the South African government's commit e-government but fails to state how it will be achieved. Thakur and Singh (2013:49) attribute the deterioration of e-service to a lack of political leadership and the inability of government to appreciate how government can be improved for the better.

6.4 Summary

This chapter provided an overview of the results obtained from the semi-structured interviews and questionnaires which were distributed to key informants in the Breede Valley Subdistrict.

All respondents were in agreement that they need data to measure their performance against but that data should speak to the quality of patient care delivered and not merely be a chasing of targets which is used as a reward or punishment instrument. Currently, there is a disjuncture between the data that they perceive to be relevant and that which they are currently collecting. There is general consensus that the information they collect places an unnecessary strain on already overworked staff and does not add value to their primary function which is patient care.

Although performance data is recorded monthly, the data is one-dimensional and therefore of limited use. Clinical staff, however, continue collecting performance data because they see it as part of their fiduciary duty. The underlying negative perceptions of those who collect the data have serious implications for the reliability to use performance information for evidence-based decision-making purposes. Chapter 7 will provide a summary of this study and make recommendations based on these findings.

CHAPTER 7: SUMMARY, RECOMMENDATIONS AND CONCLUSION

7.1 Summary of the Study

Chapter 7 provides an overview of the key points discussed in the previous chapters, including the literature review, the research methodology used, the findings, and the recommendations based on the findings.

7.1.1 Introduction

According to Cloete (2003:29, cited in Ndlovo, 2015:119), government departments collect and use performance information to plan and report at operational and strategic level about their various activities. Performance information provides the feedback or evidence required to assess how far departments have come to achieving their strategic objective and whether or not corrective action is required. The quality of performance information is ultimately determined by the quality of the data which informs such information. Poor quality data not only undermines decision-making processes but can lead to inappropriate action and wrong priorities being set.

The aim of the study was to assess the data quality of performance information generated in the Breede Valley Subdistrict for evidence-based decision-making.

7.1.2 Theoretical framework

Chapter 2 provided a theoretical framework which explained the use of information in evidence-based decision-making. Key concepts such as evidence-based decision-making, e-government and e-health were discussed. Attention was also paid to how the South African Government uses performance information to generate evidence about the performance of programmes, projects and policies. It was noted that the evidence which policymakers and managers use to base their decisions on is only as useful as the quality of the data which informs such evidence. To this end, various data quality frameworks were explored. This chapter also highlighted how ICTs have increased the use of information in the planning and delivery of public services. Chapter 3 focused on the legislative framework which enable e-services and how performance information is used in the governmental planning cycle. Reference was also made to the barriers which inhibit the development of e-services, in particular e-health in South Africa. The theoretical framework was used as basis to develop the data collection tools employed in the empirical phase of the study.

7.1.3 Case study of the Breede Valley Subdistrict

In Chapter 4, the Breede Valley Subdistrict was discussed as part of the greater Western Cape Department of Health (WCDoH) in terms of its mandate, vision and mission, organisational structure, and how it collects and monitors performance information. Special attention is paid to core programmes such as district health services and the Information Management Directorate which have a direct bearing on the data collection process in the unit of analysis. The role of the national District Health Information Policy was also discussed and how it impacts on the data management processes at provincial, district and subdistrict levels.

7.1.4 Data gathering and analysis

Chapter 5 provides an overview of the data gathering and analysis processes that were conducted in this study. A purposive sampling method was used to select key informants who use and collect performance information in the unit of analysis. Primary data was gathered from the semi-structured interviews and the questionnaires administered to key informants. The literature review in Chapters 2 and 3 constituted the secondary data sources.

7.1.5 Research Findings

The data collected from the primary and secondary sources indicate that the department has policies and protocols in place to gather performance information and that the current information is underpinned by quality data. At subdistrict level, various data elements are collected monthly to calculate performance indicators. These indicators are used as benchmarks to measure how far the Subdistrict has progressed in reaching its annual performance targets. All respondents indicated that quality data can immensely assist in improving the delivery of health service. Current performance information, besides measuring for the achievement of annual performance, has little value in terms of improving patient care. Consequently, the collection of performance information is seen a compliance exercise which increases the administrative burden of clinicians. This negative perception ultimately affects the data quality of the information product which is delivered. The Department is currently able to mitigate this risk by enforcing compliance with its internal data quality assurance practices.

7.2 Summary of research findings

The objective of this study was to assess the data quality of performance information generated in the Breede Valley Subdistrict for evidence-based decision-making. The study

aimed to assess the quality of performance information and if it can be used for decision-making purposes.

7.2.1 Objective 1: Evidence-based decision-making

The first objective of this study was to describe evidence-based decision-making and how it is used to improve the delivery of public service. Evidence about the delivery of public services is generated through performance information which reflects key performance indicators relevant to the achievement of government's overall programme of action.

The WCDoH measures its performance through annual performance targets which are aligned with the national and provincial departments' strategic objectives and goals. The study revealed that the provincial Department has a data flow policy in place which regulates the capturing of performance information. This evidence also informs the quarterly and annual reports whereby the Department accounts to provincial and national oversight bodies about services rendered in a given financial year.

Performance information allows government departments to monitor the achievement of goals and objectives and to measure the value-for-money aspect of government policies, programmes and projects.

7.2.2 Objective 2: The implementation of an e-Health strategy

The second objective was to describe the implementation of the national e-health strategy. The study revealed that all facilities in the Breede Valley Subdistrict are connected to the provincial government's electronic network. The PHCIS system is currently being rolled out to all facilities. Other software used include Microsoft Office, Sinjani, SharePoint and an electronic scripting system. A major obstacle to the further implementation of electronic services is the low level of computer literacy amongst personnel. The study also found that the primary users of information and communication technologies at facility level are the Administrative Clerks and the Operational Managers. Performance information is captured by using a hybrid paper/computer-based system.

7.2.3 Objective 3: Data quality assurance practices in the department

The third objective was to determine how data quality practices were performed in the Subdistrict. The study found that the department has a data flow policy in place which regulates the completeness and accuracy of performance information. A two-tier approach is followed which imparts responsibility on both the facility and Subdistrict. At facility level, the

OM checks the data, signs it off and submits it to the Subdistrict office. At subdistrict level, the data is captured in Sinjani which further profiles it for errors and anomalies. Once all errors are corrected, the data is transferred to the higher levels in the department. The reliability and usefulness of the collected performance information are tested annually by the Auditor-General of South Africa. The study revealed that performance information has little or no value to the clinicians who collect it because the information does not speak to the quality of patient care.

7.2.4 Objective 4: The national Department of Health's strategic plan and Healthcare 2030

The fourth objective of this study was to determine whether there is alignment between the national and provincial strategic plan. This objective ties in with objective 1 (considered in 7.2.1). The study found that health priorities are set nationally and then filtered through to provincial, district and subdistrict levels. The DHMIS policy further authorises the Director-General of the national Department of Health to determine a national indicator set in order to measure the achievement of national health goals and priorities.

7.3 Recommendations

A limitation of this study is the fact that it was limited to the Breede Valley Subdistrict. Further research on a larger scale needs to be conducted to gain a representative opinion about the relevance and the quality of performance information collected in the Western Cape Province.

The research findings of this study revealed that the collection of performance information is perceived as laborious and irrelevant to improving patient care. Despite this negative perception, the data quality of performance information is still useful and reliable enough to measure the achievement of performance targets against. This is an indication that the current control mechanisms are effective and should be strengthened. This includes enforcing the departmental data flow policy; improving the visibility of the information Compliance Unit, especially at facilities that present regular data quality issues; and appointing data clerks at all facilities to collate and verify data. To inculcate an information management culture, personnel control measures can be implemented. This includes the provision of training and supervision to new employees and using disciplinary measures to align personnel's behaviour with organisational objectives when warranted (Heeks, 2007:85).

7.4 Conclusion

The data quality of performance information in the Breede Valley Subdistrict meets the quality criteria for its intended purposes. The department has a policy in place which outlines the various roles and responsibilities of officials and ensures that performance data meets the required quality standards. The study found that performance information is primarily used to measure the achievement of targets and outcomes and does not provide information about the quality of patient care rendered. The study revealed that the department is in the process of developing financial and clinical business intelligence systems. It is foreseen that once the clinical system is operational, it will address the needs of the clinical staff. The study also revealed that there is a dire need for Information Clerks who can assist OMs in the collation and verification of data. This will help to foster an information management culture within the WCDoH and address the perception that data collection is an unnecessary burden.

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APPENDICES

APPENDIX A: APPROVAL TO CONDUCT THE RESEARCH



STRATEGY & HEALTH SUPPORT
Health.Research@westerncape.gov.za
Tel: +27 21 483 6857; fax: +27 21 483 9893
5th Floor, Norton Rose House, 8 Kleibek Street, Cape Town, 8001
www.westerncape.gov.za

REFERENCE: WC_2016RP37_183
ENQUIRIES: Ms Charlene Roderick

Stellenbosch University
Matieland
Private bag x1
Cape Town
7535

For attention: Mr Heinrich Marais

Re: Assessing the data quality of the Breede Valley Sub district for evidence-based decision-making.

Thank you for submitting your proposal to undertake the above-mentioned study. We are pleased to inform you that the department has granted you approval for your research.

Please contact **Surina Neethling on 023 348 8102** to assist you with any further enquiries in accessing the following sites:

De Doorns Clinic
Empiisweri (Worcester) Clinic
Orchard Clinic
Touws River Clinic
Worcester CDC

Kindly ensure that the following are adhered to:

1. Arrangements can be made with managers, providing that normal activities at requested facilities are not interrupted.

2. Researchers, in accessing provincial health facilities, are expressing consent to provide the department with an electronic copy of the final feedback (**annexure 9**) within six months of completion of research. This can be submitted to the provincial Research Co-ordinator (Health.Research@westerncape.gov.za).
3. In the event where the research project goes beyond the estimated completion date which was submitted, researchers are expected to complete and submit a progress report (**Annexure 8**) to the provincial Research Co-ordinator (Health.Research@westerncape.gov.za).
4. The reference number above should be quoted in all future correspondence.

Yours sincerely

 A.J. HAWKRIDGE
DR A HAWKRIDGE
DIRECTOR: HEALTH IMPACT ASSESSMENT
DATE: 14/9/2016.
CC: L PHILLIPS DIRECTOR: CAPE WINELANDS

APPENDIX B: CONSENT FORM



UNIVERSITEIT • STELLENBOSCH • UNIVERSITY
jou kennisvennoot • your knowledge partner

STELLENBOSCH UNIVERSITY CONSENT TO PARTICIPATE IN RESEARCH

TITLE OF THE RESEARCH PROJECT:

Assessing the data quality of health information in the Breede Valley Subdistrict for evidence-based decision-making.

REFERENCE NUMBER: 1245713

RESEARCHER: Heinrich Marais

ADDRESS: School of Public leadership, Stellenbosch University

CONTACT NUMBER: 0824924220

Dear Colleague

My name is Heinrich Marais and I am a registered student at Stellenbosch University. I would like to invite you to participate in a research project entitled: *Assessing the data quality of health information in the Breede Valley Subdistrict for evidence-based decision-making*. This research is conducted as part fulfilment towards a Master's degree in Public Administration.

Please take some time to read the information presented here, which will explain the details of this project and contact me if you require further explanation or clarification of any aspect of the study. Also, your participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part. To further protect your privacy, all your responses will be codified. Access to this information will also be limited to myself and my research supervisor.

This study has been approved by the **Humanities Research Ethics Committee (HREC) at Stellenbosch University** and will be conducted according to accepted and applicable national and international ethical guidelines and principles.

Reliable and timely information has become the foundation for the planning and delivery of public health services. Furthermore, public demands for greater accountability and evidence-based decision-making have increased the need for good quality data. This study seeks to assess the data quality generated in the Breede Valley Subdistrict as a reliable source for

evidence-based decision-making. The results of this study will provide the WCDoH with a baseline indication of how far the districts have progressed towards the realisation of evidence-based decision-making (EDM), and what steps need to be implemented to realise this goal. In addition, the study will assist subdistrict management to identify local risks to the realisation of EDM. As line managers, you are best placed to give an insiders' view of the data quality generated and used in the sub district.

It is also expected that other government departments might replicate this study to test the reliability of their data for EDM and/or monitoring and evaluation (M&E) purposes.

A copy of the final research product will be made available to:

The Director
Information Management
Department of Health
Dorp Street
Cape Town
8000

If you have any questions or concerns about the research, please feel free to contact myself or my research supervisor, Ms Naomi Burger.

Heinrich Marais
Cell: 0824924220
Heinrich.marais@westerncape.gov.za

Ms Naomi Burger
School of Public Leadership
Stellenbosch University
Ph: 021 918 4442
Burger, NM, Ms nmb1@sun.ac.za

RIGHTS OF RESEARCH PARTICIPANTS: You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research subject, contact Ms Maléne Fouché [mfouche@sun.ac.za; 021 808 4622] at the Division for Research Development.

You have the right to receive a copy of the Information and Consent form.

If you are willing to participate in this study, please sign the attached Declaration of Consent and hand it to the investigator.

Yours sincerely
Heinrich Marais
Principal Investigator

Declaration by participant:

By signing below, I agree to take part in a research study entitled ***Assessing the data quality of performance information generated by the health sector in the Breede Valley Subdistrict for evidence-based decision-making*** and conducted by ***Heinrich Marais***.

I declare that:

- I have read the attached information leaflet and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.
- I may be asked to leave the study before it has finished, if the researcher feels it is in my best interest, or if I do not follow the study plan, as agreed to.
- All issues related to privacy and the confidentiality and use of the information I provide have been explained to my satisfaction.

Signed at (*place*) on (*date*) 2016.

Signature of participant

I declare that I explained the information given in this document to _____
[He/she] was encouraged and given ample time to ask me any questions. This conversation
was conducted in [Afrikaans/*English/*Xhosa/*Other] and [no interpreter was used/this
conversation was interpreted into _____ by _____].

Signature of Investigator

Date

APPENDIX C: INTERVIEW QUESTIONS: PHC MANAGER

Semi-structured interview questions: PHC Manager of Breede Valley Subdistrict

1. Briefly describe your role as PHC Manager in the collection of performance data?

2. As the as PHC Manager, how do you integrate performance data into your planning and decision-making processes?

3. How do you review the completeness and accuracy of your data?

4. Does the collection of data add value to the workload of clinical staff?

4.1 In your view, what factors negatively impact on the clinical staff's perception of the data collection process?

5. *Healthcare 2030* stresses the use of ICTs. What is the current state of ICT roll-out in your facilities and what obstacles do you experience?

6. Data Quality dimensions

Data quality dimensions refer to the intrinsic qualities which are important to an organisation in order to use the data for its intended purpose.

On a scale of 0 to 10 (0 = not important, 10 = very important), how would you rate the importance of the following data dimensions. Please circle the relevant value.

6.1

Completeness: refers to the degree to which all the data required by the user is present in the information system.										
0	1	2	3	4	5	6	7	8	9	10
Does your data meet this criteria: YES or NO ?										
What strategy would you recommend to improve the completeness of data?										

6.2

Accuracy: refers to the level of errors or incorrect data present within the system.										
0	1	2	3	4	5	6	7	8	9	10
Does your data meet this criteria: YES or NO ?										
What strategy would you recommend to improve the accuracy of data?										

6.3

Relevance: refers to the degree to which the data is necessary to complete a particular user function or action.										
0	1	2	3	4	5	6	7	8	9	10
Does your data meet this criteria: YES or NO ?										
What strategy would you recommend to improve the relevance of your data?										

6.4

Timeliness: refers to the degree to which data can be delivered by the information system within a required time frame.										
0	1	2	3	4	5	6	7	8	9	10
Does your data meet this criteria: YES or NO ?										
What strategy would you recommend to improve the timeliness of data?										

6.5

Appropriateness of presentation: refers to the degree to which the data produced by the information system is accessible and intelligible to the end-user										
0	1	2	3	4	5	6	7	8	9	10
Does your data meet this criteria: YES or NO ?										
What strategy would you recommend to improve the appropriateness of presentation of data?										

7. Any further comments you would like to add?

Thank you for participating in this study.

APPENDIX D: INTERVIEW QUESTIONS: MEDICAL SUPERINTENDENT

Question 1: Briefly describe your role as Medical Superintendent in the collection of performance data?

Question 2: As the Medical Superintendent, how do you integrate performance data into your planning and decision-making processes?

Question 3: How are posts allocated in your district?

Question 4: Does the collection of data add value to the workload of clinical staff?

Question 5: Healthcare 2030 stresses the use of ICTs. What is the current state of ICT roll-out in your facilities and what obstacles do you experience?

Question 6: Any further comments you would like to add?

Thank you for participating in this study.

APPENDIX E: INTERVIEW QUESTIONNAIRE FOR OPERATIONAL MANAGERS

1. In what format is performance data collected at your facility? Mark your answer with an X.

Paper-based	
Computer-based	

1.1 Please indicate which of the following paper-based data collection tools do you use in your facility.

Standardised tick sheets	
Service point registers	
Patient folder	
Observations	
Questionnaires	
Other, please indicate	

2. Who is primarily responsible for the capturing and collation of performance data at your facility?

All officials	
Operational Manager	
Designated official	

3. How do you review the accuracy and completeness of data collected at your facility?

4. What computer hardware does your facility use to capture data?

5. What computer software does your facility use to capture data?

5.1 Are your computers networked?

YES	
NO	

6. How would you rate the computer literacy levels of your personnel? Read the following statements and then select the most appropriate box by marking it with an X. (5 = strongly Agree; 1 = Strongly Disagree).

My staff is computer literate.	5	4	3	2	1
My staff understands and can use the Primary Health Care Information System (PHCIS).	5	4	3	2	1

Please add further comments:

7. Are you aware of any data flow policy that the Department of Health has in place? If yes, please briefly describe the collection and management processes you are required to follow.

8. Please indicate the reason(s) why you think your facility collects performance data about services rendered. Mark your answer(s) with an X.

To monitor the achievement of performance targets	
To monitor health risks and trends	
To evaluate current services/projects	
To plan for new services/projects	
To evaluate new policies	
To evaluate implementation processes	
Other, please specify	

9. **Data Quality dimensions**

Data quality dimensions refer to the intrinsic qualities which are important to an organisation in order to use the data for its intended purpose.

On a scale of 0 to 10 (0 = not important, 10 = very important) how would you rate the importance of the following data quality dimensions. Please circle the relevant value.

9.1

Completeness: refers to the degree to which all the data required by the user is present in the information system.										
0	1	2	3	4	5	6	7	8	9	10
Does your data meet this criteria: YES or NO ?										
What strategy would you recommend to improve the completeness of data?										

9.2

Accuracy: refers to the level of errors or incorrect data present within the system.											
0	1	2	3	4	5	6	7	8	9	10	
Does your data meet this criteria: YES or NO ?											
What strategy would you recommend to improve the accuracy of data?											

9.3

Relevance: refers to the degree to which the data is necessary to complete a particular user function or action											
0	1	2	3	4	5	6	7	8	9	10	
Does your data meet this criteria: YES or NO ?											
What strategy would you recommend to improve the relevance of your data?											

9.4

Timeliness: refers to the degree to which data can be delivered by the information system within a required time frame.											
0	1	2	3	4	5	6	7	8	9	10	
Does your data meet this criteria: YES or NO ?											
What strategy would you recommend to improve the timeliness of data?											

9.5

Appropriateness of presentation: refers to the degree to which the data produced by the information system is accessible and intelligible to the end user.										
0	1	2	3	4	5	6	7	8	9	10
Does your data meet this criteria: YES or NO ?										
What strategy would you recommend to improve the appropriateness of presentation of data?										

10. Any further comments you would like to add?

Thank you for your time to complete this questionnaire.