

**THE EVALUATION OF THE HOSPITAL
INFORMATION SYSTEM IN KOPANONG
HOSPITAL**

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ABSTRACT

PROBLEM SPECIFICATION

Health care in South Africa is presently experiencing turbulent times. Diseases like HIV-Aids and Tuberculosis are increasing at a vast rate. This has a large financial impact on all the provincial Departments of Health as new intervention programs have to be developed, while former programs have to be adjusted accordingly. Furthermore, facilities and services have to be adjusted as well, or new services have to be added. This creates escalating financial pressure on the health services. In order to manage the growing pressure on health services, the importance of all patient data to be recorded in order to make informed decisions whenever the need arises and not only at month end is self-explanatory. Data should also be received from a reliable source, such as an effective electronic hospital information system.

The current hospital information system in Kopanong Hospital consists of a manually based system. Activities are counted daily but informed decisions based on the collected data, can only be made at month end. The lack of an up to date management information system gives rise to numerous challenges, concerning the quality of management information, timeliness, accuracy, and completeness of information used for decision making. Nursing staff shortages, computer literacy amongst nursing staff as well as access to computers also have a large influence on data collection.

PURPOSE OF STUDY

The main objective of the study is to evaluate the present hospital information system and to improve the use of computers within Kopanong Hospital. Recommendations were made towards the adoption of a successful integrated hospital information system and to encourage the use of computers in the organisation.

The above-mentioned main objective can be actualized through the following subsequent sub

objectives:

- To define data, information and information systems.
- To obtain insight into the role that management information and information systems play in planning and decision making, by means of a literature review.
- To analyse the need of a computer in the different departments in Kopanong Hospital to manage information more effectively and efficiently.
- To establish whether information is important to managers in the Hospital to make their daily tasks easier.
- To analyse if an integrated information system as well as quality of data is important to Hospital management to manage their departments/organisation.
- To establish the support, that the user of the health information system expects from the health information system unit.
- To make recommendations to enhance the utilisation of the hospital information system for management decisions.

RESULTS AND RECOMMENDATIONS

THE NEED FOR A COMPUTER IN THE DIFFERENT DEPARTMENTS

The respondents saw the following requirements as important in their departments:

- To have a computer program in the department in helping to create a monthly budget.
- To have admission and discharges scanned into the computer as they happen.
- To have a daily disease profile in a department.
- To be able to detect immediately any assets leaving the department on the computer.
- The admission department should be able to trace patient information via SARS or the Department of Internal affairs, for validation and to increase revenue of Kopanong hospital.
- To have any stock received in the departments scanned into the computer for daily and monthly control.

- To have a daily and monthly statement of admissions/discharges/deaths/transfers in-and-out, absconding, refusal of hospital treatment, and day patients.

Recommendations are the following:

- The implementation of a needs analysis on the updating of computers and peripherals.
- The availability of funding for computer equipment.

THE IMPORTANCE OF MANAGEMENT INFORMATION

The following factors were regarded as crucial in the importance of management information:

- Hospital information should be verified before exported to another level.
- The management of hospital information should meet the goals of the Gauteng Department of Health.
- Accuracy of hospital information.
- Trustworthiness of hospital information.
- Completeness of hospital information

Recommendations are the following:

- The creation of a hospital information system project team
- Installation of an electronic hospital information system with standardised provincial programs.
- The implementation of hospital information training.
- The implementation of monthly feedback on unit data to unit managers.
- Ongoing training of hospital information system coordinator.
- Quarterly “bosberaad” for monitoring and evaluation.
- The application of change management.

THE IMPORTANCE OF AN INTEGRATED INFORMATION SYSTEM

The following requirements were seen as crucial in the importance of an integrated information system:

- The system should be easy to use.
- The system should have built-in security and privacy.
- The system must be suitable for users to verify data.
- The user should be able to recall vital signs from a patient when needed from the system.
- The system should have the ability to import and export data from different users and systems (e.g. finance, procurement).

Recommendations are the following:

- The appointment of a network technician.
- Installation of an electronic hospital information system with standardised provincial programs.
- Making internet and e-mail available to all departments.
- Ongoing training of hospital information system coordinator.
- The implementation of a needs analysis on computer training, followed by training sessions.

THE SUPPORT THE USER EXPECTS FROM THE HEALTH INFORMATION SYSTEM UNIT

The respondents expected the following from the health information system:

- There should be a back-up of all hospital information in the hospital information system unit.
- They expect regular communication between the departments and the health information personnel for support.
- There should be a supportive relationship between the hospital information system unit towards the user.
- There should be a reasonable response time of the hospital information system unit.

Recommendations are the following:

- Marketing the hospital information system unit and its benefits.
- The implementation of back-up, of all hospital data on server.
- The implementation of a reward and recognition system on targets achieved.
- The implementation of monthly feedback on unit data to unit managers.

CONCLUSION

It is believed that the object of the study has been met. From the investigation made it is clear that there is a dire need for computers, computer training as well as an integrated electronic hospital information system in Kopanong Hospital. Kopanong Hospital can play a leading role with the implementation of the above in the Sedibeng region.

It is the opinion of the author that should the recommendation be implemented in Kopanong hospital, it will secure a more effective and efficient health service. Furthermore, Kopanong Hospital can become a health service leader in health information technology and gain a sustainable competitive advantage over its neighboring hospitals.

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TABLE OF CONTENTS

<i>Abstract</i>	<i>ii</i>
<i>Acknowledgements</i>	<i>vii</i>
<i>List of tables</i>	<i>xii</i>
<i>List of figures</i>	<i>xiii</i>

CHAPTER 1: NATURE AND SCOPE OF THE STUDY	1
1.1 INTRODUCTION	1
1.2 PROBLEM STATEMENT	2
1.3 OBJECTIVES OF THE STUDY	4
1.3.1 Main objective	4
1.3.2 Sub-objectives	4
1.4 SCOPE OF THE STUDY	5
1.5 RESEARCH METHODOLOGY	5
1.6 LIMITATIONS OF THE STUDY	7
1.7 LAYOUT OF THE STUDY	8

CHAPTER 2: LITERATURE REVIEW OF INFORMATION SYSTEMS	10
2.1 INTRODUCTION	10
2.2 DEFINITIONS	10
2.2.1 Hospital information system (HIS)	10
2.2.2 Health informatics	11
2.2.3 Data	11
2.2.4 Information	11
2.2.5 Input	11
2.2.6 Output	11
2.2.7 Feedback	11
2.2.8 Processing	12

2.2.9	Information system	12
2.2.10	Management information system	12
2.2.11	End user	12
2.2.12	Database	13
2.2.13	Expert system	13
2.3	THE ROLE OF A HEALTH INFORMATION SYSTEM	13
2.4	THE STRUCTURE OF AN INFORMATION SYSTEM	15
2.5	CRITICAL SUCCESSES FACTORS OF AN INFORMATION SYSTEM	17
2.5.1	The concept of an essential dataset	19
2.6	FAILURE OF AN INFORMATION SYSTEM	20
2.7	INFORMATION SYSTEM CHALLENGES: AN END USER PERSPECTIVE	22
2.8	ELEMENTS OF AN INFORMATION SYSTEM	26
2.8.1	Information system staff planning and the managerial function	26
2.8.2	The structure/components of an information system	29
2.8.3	Matching the information system restructuring process with the health service system	33
2.8.4	Management functions of a health system	34
2.9	CONTROL OF INFORMATION SYSTEMS	35
2.10	CHANGE MANAGEMENT	37
2.11	SUMMARY	38
 CHAPTER 3: AN INVESTIGATION INTO THE ORGANISATION		 39
3.1	INTRODUCTION	39
3.2	SOUTH AFRICA'S HEALTH CARE SYSTEM	39
3.3	BACKGROUND TO THE GAUTENG DEPARTMENT OF HEALTH	40
3.4	DEMOGRAPHIC PROFILE	42
3.5	VISION AND MISSION OF THE GAUTENG DEPARTMENT OF HEALTH	43
3.6	THE DEPARTMENTAL STRUCTURE	44
3.7	THE STRATEGIC GOALS AND OBJECTIVES OF THE DEPARTMENT	46

3.8	CATEGORIES OF HOSPITALS IN THE GAUTENG HEALTH DEPARTMENT	48
3.9	THE ORGANISATION UNDER INVESTIGATION	49
3.9.1	History and background of the organisation	49
3.9.2	Services rendered in Kopanong Hospital	51
3.9.3	The purpose of Kopanong Hospital	52
3.9.4	The shared values of Kopanong Hospital	52
3.9.5	Organogram of Kopanong Hospital	52
3.9.6	The dataflow of Kopanong Hospital	54
3.10	CAUSAL FACTORS TO THE STUDY	54
3.11	BACKGROUND TO THE DISTRICT HEALTH INFORMATION SYSTEM	56
3.12	SUMMARY	57
CHAPTER 4:	RESULTS OF THE EMPIRICAL STUDY	58
4.1	INTRODUCTION	58
4.2	GATHERING OF DATA	58
4.3	RESULTS AND DISCUSSION	59
4.3.1	Section 1: Biographical information of respondents	59
4.3.2	Section 2: The need of a computer in your department	62
4.3.3	Section 3: The importance of management information	65
4.3.4	Section 4: The importance of an integrated information system	66
4.3.5	Section 5: The support that the user expects from the health information system unit	67
4.4	SUMMARY	67

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS	70
5.1 INTRODUCTION	70
5.2 CONCLUSIONS	70
5.2.1 General information	70
5.2.2 The need for a computer in the various departments	71
5.2.3 The importance of management information	72
5.2.4 The importance of an integrated information system	72
5.2.5 The support the user expects from the health information system unit	72
5.3 RECOMMENDATIONS	73
5.4 SUMMARY	76
REFERENCES	77
ANNEXURE 1: QUESTIONNAIRE	83

LIST OF TABLES

Table 2.1:	Examples of the challenges and opportunities that business managers face in managing information systems and technologies to meet business goals	23
Table 2.2:	Positive and negative impacts of information systems	24
Table 3.1:	Organisational structure and functions of each Chief Directorate/Division	45
Table 3.2:	Strategic goals and objectives	46
Table 3.3:	The category of hospitals available in the Gauteng health department	48
Table 4.1:	Age groups of respondents	59
Table 4.2:	Management levels of respondents	60
Table 4.3:	Level of computer experience	61
Table 4.4:	Access to a computer	61
Table 4.5:	Attitude towards a computer	62
Table 4.6:	The need of a computer in the different departments	64
Table 4.7:	The importance of management information	65
Table 4.8:	The importance of an integrated information system	66
Table 4.9:	The support that the user expects from the health information system unit	67

LIST OF FIGURES

Figure 1.1:	Summary of the structure of the study	6
Figure 2.1:	The three fundamental reasons for all business applications of information technology	15
Figure 2.2:	Specific types of major information systems as well as the level of organisation and business function that each supports	16
Figure 2.3:	The information filter	18
Figure 2.4:	An illustration of an essential dataset	19
Figure 2.5:	The major components of information technology management	28
Figure 2.6:	The components of a health information structure	30
Figure 2.7:	Database development	32
Figure 2.8:	Examples of information system controls	36
Figure 3.1:	Map of South Africa indicating Gauteng	41
Figure 3.2:	The Sedibeng area	50
Figure 3.3:	The organogram of Kopanong Hospital	53
Figure 3.4:	The dataflow of a district hospital	54

CHAPTER 1

NATURE AND SCOPE OF THE STUDY

1.1 INTRODUCTION

According to Killingsworth, Newkirk and Seeman (2006:119), the emphasis in the health care industry is expected to continue on cost containment and cost reduction. The hospital environment is complex and dynamic and therefore subject to high degrees of instability which, in turn, has significant influences on information systems design. Subsequent research has shown that investing in information and technology leads to organisational profitability (Clerkin, 1997:387). In fact, research has indicated that a significant increase in costs associated with hospitalisation can be attributed to inefficient utilisation of health care resources. With major changes taking place in the delivery of health care, it is believed that effective health care can only be delivered with substantial application of information technology. Hospital managers, therefore, have to utilise information technology as a competitive weapon.

The strategic goals and objectives of the National Department of Health indicate, that in order to secure value for money the National Department of Health has to: 1) provide an effective and efficient integrated management information system (MIS) to support decision-making, monitoring and clinical care 2) implement, monitor and evaluate communication strategy across the organisation and with the public. The Gauteng Department of Health, therefore, has aligned its strategic goals and objectives until 2010 accordingly (National Department of Health, 2006a:5).

Openness and transparency is one of the eleven Batho Pele principles meaning that citizens should be told how national and provincial departments are run, how much they cost, and who is in charge. These principles were implemented by the Gauteng Department of Health in order to market the health service to the citizens of South Africa and to be open and transparent about the operations of the department. The question is how the Gauteng Department of Health will be able to do that, without an effective hospital information system. With unlimited demands and limited

resources in the public sector, the quality of data is of the utmost importance. In the public sector, where the National Department of Health must take care of those with low or no income, tailor-made plans influenced by quality data are needed for strategic planning and decision making.

An effective hospital information system will allow the Gauteng Department of Health to allocate resources in a manner that will strengthen the efforts to position Gauteng as a globally competitive province. In order to adhere to the recommendations of the Human Rights Commission, as from budget year 2007/2008, all hospital information will be made public on the Gauteng Health website for all the citizens to scrutinize it. The Gauteng Department of Health has, therefore, an obligation to keep the public informed on government activities and how their tax money is spent.

The objective for the research is to evaluate the present hospital information system and to make recommendations to implement an electronic information system in Kopanong hospital. This could assure that quality data will be received at any specific time and that all patient activities will be captured electronically as they happen (bar coding and radio frequency identification tagging). Managers will, furthermore be able to have proper asset and inventory control through radio frequency identification tags. Ultimately this should lead to more informed decision making.

Recommendations were made towards the implementation of a hospital information system. With the encouragement of using computers to collect data electronically into a hospital information system, the organisation will be able to compete as a leader in the health business globally.

1.2 PROBLEM STATEMENT

Diseases like HIV-Aids and Tuberculosis are increasing at a vast rate in South-Africa. This has a large financial impact on all the provincial Departments of Health as new intervention programs have to be developed, and previous programs have to be adjusted accordingly. Furthermore, facilities services have to be adjusted as well or new services have to be added. This creates an increasing financial pressure on the health services. Managing the growing pressure on health

services, it is thus important that all patient data should be recorded in order to make informed decisions whenever the need arises and not only at month end. Data should also be received from a reliable source, such as an effective electronic hospital information system.

Being a non-profitable entity, it is also of uttermost importance that hospitals receive quality data, as the budget received from the Gauteng Health Department is directly dependent on the operations in the previous financial year. This can only be proved if quality data is collected on a daily basis. The current hospital information system in Kopanong Hospital consists of a manually based system. Activities are counted daily but informed decisions based on the collected data, can only be made at month end. The lack of an up to date management information system gives rise to numerous challenges concerning the quality of management information, timeliness, accuracy, and completeness of information used for decision making.

Nursing staff shortages also have a large influence. Mostly departments are operating with skeleton staff and no ward clerks, which could be useful in data collection. Nurses can, furthermore not be kept legally accountable for data collection as it is outside their scope of practice. Logically more attention is given to patient care. This results that data is frequently not recorded and simple calculation mistakes are made. Record keeping overall, is therefore a challenge due to staff shortages.

Computer literacy amongst nursing staff and the availability of computers are also still a challenge. Staff members are sent on training regularly, but the challenge is to apply the knowledge gained in the work place. Many departments do not have computers yet and managers are also not yet computer literate. It is therefore, unfair to put pressure on staff members to collect data electronically. A summarisation of the whole situation at Kopanong Hospital:

- No computer culture presently exists in the organisation.
- There is still a fear towards the use of computers.
- Staff members do not have the necessary insight to realise that daily tasks could be handled more effectively and efficiently with a computerised system.
- Supervisors are mainly not yet computer literate.

- No electronic hospital information system does exist.
- Decisions can not be made when the need arises, only at month end.

The Gauteng Provincial Government (2007:127) states that about 300 hospitals are not providing sufficient monthly data and many hospital managers are still not using data to manage their units or the organisation as a whole. Managers must use data to manage their institutions, as this will lead to better forecasting, planning, monitoring and evaluation, which will result in the improvement of service delivery. There is thus a need to educate hospital management in the utilisation of health information systems.

1.3 OBJECTIVES OF THE STUDY

1.3.1 Main objective

The main objective of the study is to evaluate the present hospital information system and to improve the use of computers within Kopanong Hospital. Recommendations will be made towards the adoption of a successful integrated hospital information system and to encourage the use of computers in the organisation.

1.3.2 Sub objectives

The above-mentioned main objective can be actualised through the following subsequent sub objectives:

- To define data, information and information systems.
- To obtain insight into the role that management information and information systems play in planning and decision making by means of a literature review.
- To analyse the need of a computer in the different departments in Kopanong Hospital to manage information more effectively and efficiently.
- To establish whether information is important to managers in the Hospital to make their daily

tasks easier.

- To analyse if an integrated information system as well as quality of data is important to Hospital management to manage their departments/organisation.
- To establish the support, that the user of the health information system expects from the health information system unit.
- To make recommendations to enhance the utilisation of the hospital information system for management decisions.

1.4 SCOPE OF THE STUDY

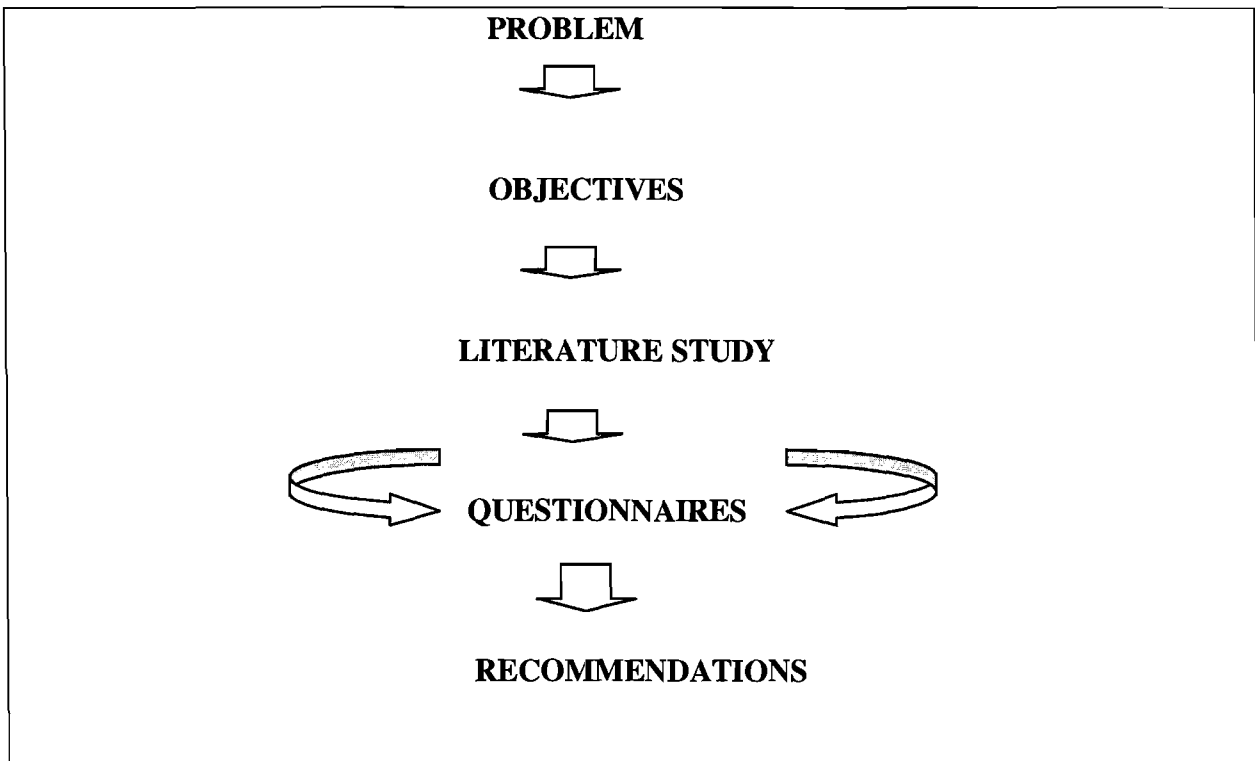
The focus of this study is on the utilisation of a hospital information system in Kopanong Hospital. Kopanong Hospital is part of the Sedibeng district of the Gauteng Health Department. The Sedibeng district is one of six (6) districts of the Gauteng province. Sedibeng consists of the following sub districts: Emfuleni, Midvaal and Lesedi. The study is limited to Kopanong hospital within the Sedibeng region. Kopanong Hospital is located in Vereeniging in the Vaal Triangle and consists of 218 usable beds and 456 staff members (counted 28/2/07). The hospital is situated in a residential area (Duncanville) bordering an industrial area. Townships and informal settlements form an important part of the patient load of the hospital.

The organisational structure and the history of Kopanong Hospital will be discussed in more detail in Chapter 3.

1.5 RESEARCH METHODOLOGY

The basic research process followed in this study is summarised in Figure 1.1.

Figure: 1.1: Summary of the structure of the study



As illustrated in figure 1.1, the study starts with a problem that must be solved. The objectives are evolving out of the problem statement of the study. With the help of a literature study, an empirical research is done through the handing out of structured questionnaires. Lastly recommendations will be made towards the adoption of a successful integrated hospital information system and to improve the use of computers in the organisation.

The research methodology consists of the following aspects:

- The execution of a literature study restricted to the application of an information system within a hospital environment.
- The execution of an investigation into the organisation starting with a picture of the South African health care structure, from the National Health Department, the Gauteng Department of Health, the Sedibeng district and lastly to the organisation under investigation - Kopanong Hospital.

- The execution of an empirical study which will investigate ways to identify the main objective as well as the sub-objectives of the study. Action research will be applied due to the mere fact that the Chief Executive Officer (CEO) of Kopanong Hospital will be involved in the development of a structured questionnaire. This ensures that the information gathered through the empirical investigation is relevant to the expectations of the management, the end user.
- Questionnaires will be handed out to staff members, ranging from junior management, middle management and to top management level to complete.
- Information extracted from the questionnaires will be statistically analysed by the Statistical Consultation Services of the North-West University. Recommendations will then be made about future strategies, as well as aspects included in the main objective and the sub objectives of the study.

1.6 LIMITATIONS OF THE STUDY

The research is limited to the usage and the availability of computers in the different departments in Kopanong Hospital in the Sedibeng district.

The development of an integrated hospital information system is limited to the fact, that limited funds are available for buying of computer equipment in Kopanong Hospital.

Another limitation would be that the Gauteng Department of Health has not yet assigned a contract to a company for the installation of an electronic hospital information system in Kopanong hospital.

The computer literacy of nursing managers in Kopanong Hospital was at the point of the study relatively low. In the sample used for the empirical study most of the participants (41%) were between the ages of 40 to 49. The management of resistance to change will thus be an important factor to be addressed.

No other limitations are placed upon this dissertation and the research is executed with the

permission of the CEO of Kopanong Hospital.

1.7 LAYOUT OF THE STUDY

The layout of the study can be summarised as follows:

Chapter 2

Chapter 2 will concentrate on the literature research, which will include the role of a health information system as well as the structure of an information system. Critical success factors as well as failures and system challenges of a health information system will be described. Elements of an information system and the steps of matching the information system restructuring process with the health service system as well as the support of the management functions will be described. Controls of an information system for monitoring and maintaining quality and security of the input, output, and storage activities will be highlighted. The reader will also be guided on how to manage the change in the organisation through the application of different change theories.

Chapter 3

Chapter 3 will be an investigation into the organisation. This chapter will start with an introduction and a picture of the South African health care structure, from the National Health Department, the Gauteng Department of Health, the Sedibeng district and lastly to the organisation under investigation - Kopanong Hospital.

Chapter 4

In chapter 4 the development, design and the structure of the questionnaire for the empirical study as well as the data gathering process will be discussed. The results of the empirical study will be presented and discussed.

Chapter 5

In chapter 5 conclusions and recommendations will be made to Kopanong Hospital on the present hospital information system, which is paper-based, moving towards an electronic and integrated Hospital information system in the near future. The recommendations will be based on the literature study that was done by the researcher, as well as the results of the empirical study that was conducted within Kopanong Hospital, and the author's knowledge and experience as hospital information system coordinator of Kopanong Hospital.

CHAPTER 2

LITERATURE REVIEW OF INFORMATION SYSTEMS

2.1 INTRODUCTION

South Africa has seen many achievements in the strengthening of its health management information system. One of the challenges remains rather to get managers at the various levels of the health system to use the available information optimally in order to inform decision making. The decisions are required around all aspects of the health system including identification of health needs and priorities, health systems and service planning, monitoring progress in implementation and evaluation of the impact of interventions, health policy, programme design and resource allocation. Because of the increasing international emphasis on result based management and performance-based funding, the need for sound data generated through reliable and transparent information systems is growing. The aim of this chapter is to familiarise the reader with the concept of information systems, its challenges, its roles and also how to manage the inevitable change in the organisation.

2.2 DEFINITIONS

2.2.1 Hospital information system (HIS)

A hospital information system, variously also called a clinical information system (CIS), is a comprehensive, integrated information system designed to manage the administrative, financial and clinical aspects of a hospital. This encompasses paper-based information processing as well as data processing hardware. As an area of medical informatics the aim of a hospital information system is to achieve the best possible support of patient care and administration by electronic data processing (Shortliffe & Perrault, 2001:329).

2.2.2 Health informatics

In her/his research on public health informatics, O'Carroll, Yasnoff, Ward, Ripp & Martin (2003:5) defines Health informatics as the systematic application of information and computer science and technology to public health practice, research, and learning. It is the demonstration of how organisations can use information and technology to bring their strategic goals from theory into practice.

2.2.3 Data

Stair and Reynolds (2003:5) state that data consists of raw facts. When these facts are organised or arranged in a meaningful manner, they become information.

2.2.4 Information

Stair and Reynolds (2003:5) concur that information is a collection of facts organised in such a way that they add additional value beyond the value of the facts themselves.

2.2.5 Input

Laudon and Laudon (2001:7) define input as the capture or collection of raw data from within the organisation or from its external environment for processing in an information system.

2.2.6 Output

Output is the distribution of processed information to the people who will use it or to the activities for which it will be used (Laudon & Laudon, 2001:7).

2.2.7 Feedback

Feedback is described as the output, according to Laudon and Laudon (2001:7), which is returned

to the appropriate members of the organisation to help them evaluate or correct input.

2.2.8 Processing

According to Laudon and Laudon (2001:7), processing is the conversion, manipulation, and analysis of raw input into a form that is more meaningful to humans or end users.

2.2.9 Information system

Laudon and Laudon (2001:7) define an information system as the interrelated components working together to collect, process, store and disseminate information to support decision making, coordination, control, analysis, and visualisation in an organisation.

2.2.10 Management information system

O'Brien and Marakas (2007:599) describe a management information system as a system that produces pre-specified reports, displays, and responses on a periodic, exception, demand, or push reporting basis. Lippeveld, Sauerborn and Bodart (2000:1) emphasise that good management is a prerequisite for increasing the efficiency and effectiveness of health services. The need to do more with less is especially important, because the health sector faces ever increasing demands while receiving stagnant or decreasing resources. According to Tanner and Lengeler (1993:2), there is ample evidence that interventions lose a great deal of their theoretical effectiveness, also called efficacy, if they are delivered by poorly run health services. The challenge for health systems is, therefore, to optimise the management of service delivery in a way that minimises losses in effectiveness (Tugwell, 1985:340).

2.2.11 End user

O'Brien and Marakas (2007:594) describe an end user as anyone who uses an information system or the information it produces.

2.2.12 Database

A database is an integrated collection of logical related data elements. A database consolidates many records previously stored in separate files so that a common pool of data serves many applications (O'Brien & Marakas, 2007:594).

2.2.13 Expert system

An expert system can be defined as a computing system capable of representing and reasoning about some knowledge-rich domain, with a view toward solving problems and giving advice (Clerkin, 1995:398).

2.3 THE ROLE OF A HEALTH INFORMATION SYSTEM

The role of a health information system is to timely generate, analyse and disseminate sound data for public health decision making (World Health Organization, 2006:25). A health information system is part of the health care system and can be viewed as an integrated effort to collect, process, report and use health information and knowledge to influence policy making, programme action and research (World Health Organization, 2006:25).

Visser, Barron and Dudley (2005:67) remark that it is not because countries are poor that they cannot afford good health information; it is because they are poor that they cannot be without it. All governments need good quality information on which to base policy and management decisions. The need is particularly acute where resources are limited and the cost of unwise allocation of funds is very high. However, useful information is often unavailable in resource-poor developing countries due to an under investment in the systems for data collection, analysis, dissemination and use. As a result, decision makers are unable to make decisions based on objective and verifiable information.

According to Burn and Shongwe (2004:70), reliable and timely information is an essential foundation for public health action. Information is crucial for the identification of health needs

and priorities, for health systems and service planning, to track progress in implementation and evaluate the impact of interventions, and to make evidence-based decisions on health policy, programme design, and resource allocation.

Haux (2006:268) considers the following lines of development for hospital information systems as important:

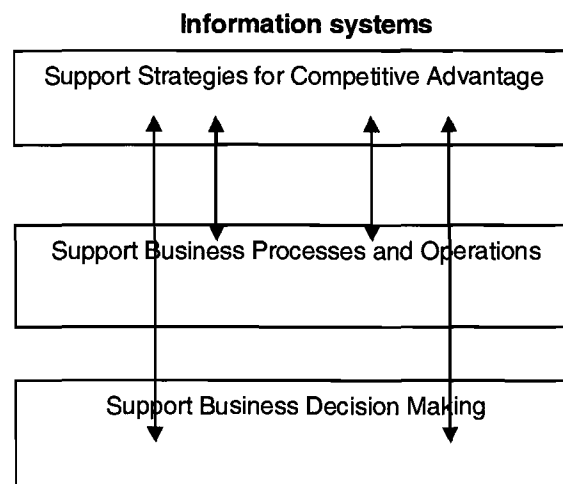
- The shift from paper-based to computer-based processing and storage, as well as the increase of data in health care settings.
- The shift from institution centred departmental and later hospital information systems towards regional and global hospital information systems.
- The inclusion of patients and health consumers as hospital information systems users, besides health care professionals and administrators.
- The use of hospital information systems data not only for patient care and administrative purposes, but also for health care planning as well as clinical and epidemiological research.
- The shift from focusing mainly on technical hospital information systems problems to those of change management as well as of strategic information management.
- The steady increase of new technology to be included ubiquitous computing environments and sensor-based technologies for health monitoring.

Haux (2006:270) furthers that the relevance of good hospital information systems for high level quality of care is obvious, as without having appropriate access to relevant data, practically no decisions on diagnostic, therapeutic or other procedures can be made with fatal consequences for patients. But hospital information systems are also an important cost factor. Approximately 10% of the gross domestic product (GDP) of nations is devoted to health care and approximately 5% to information and communication technology. The health care information communication and technology industry has achieved considerable economical relevance progress in the field of health information systems and is rather directly correlated with more quality and efficiency of care, where with more efficiency of care, may in future mean that care will remain affordable (Haux, 2006:270).

2.4 THE STRUCTURE OF AN INFORMATION SYSTEM

O'Brien and Marakas (2007:9) illustrate the three fundamental reasons for all business applications of information technology as shown in figure 2.1. These reasons are found in the three vital roles that information systems can perform for a business enterprise: firstly the support of its business processes and operations, secondly the support of decision-making by its employees and managers and thirdly the support of its strategies for competitive advantage.

Figure 2.1: The three fundamental reasons for all business applications of information technology



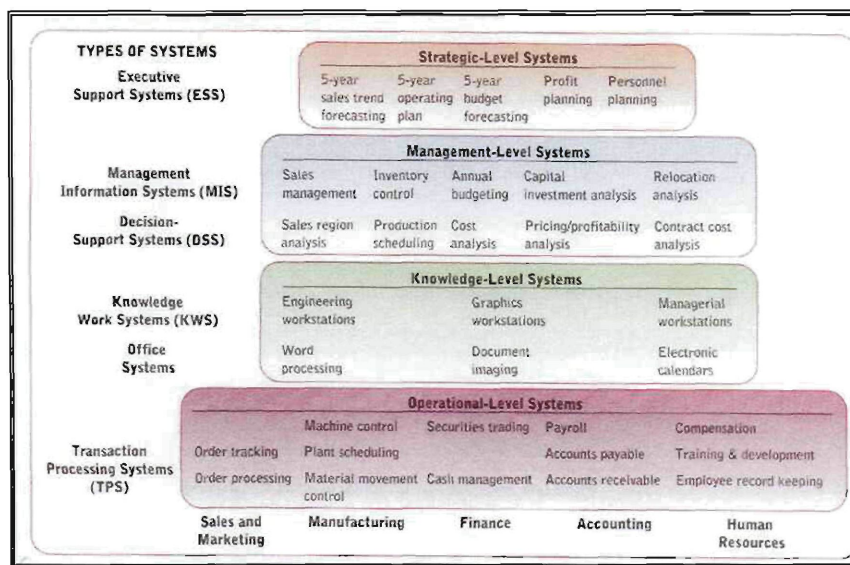
Source: O'Brien and Marakas (2007:9)

Figure 2.1 illustrates how at any moment, information systems are designed to support business processes, and operations may also be providing data to, or accepting data from, systems focused on business decision-making or on achieving competitive advantage. According to O'Brien and Marakas (2007:9), an organisation is constantly striving to achieve integration of their systems to allow for information to flow freely through them, thus adding greater flexibility and business support than any of the individual system roles could provide.

These fundamentals can be applied to Kopanong Hospital, the organisation in which the research is conducted, as the emphasis on cost containment and cost reduction is expected to continue in the health care industry and hospital managers seek to harness information technology as a

competitive weapon. The hospital environment is complex and dynamic and therefore subject to high degrees of instability which, in turn, has significant influences on information systems design (Killingsworth *et al.*, 2006:119). In figure 2.2 as seen below Laudon and Laudon (2001:41) illustrate the specific types of major information systems as well as the level of organisation and business function that each supports.

Figure 2.2: Specific types of major information systems as well as the level of organisation and business function that each supports



Source: Laudon and Laudon (2001:41)

In figure 2.2 Laudon and Laudon (2001:41) illustrate that an organisation has an executive support system at the strategic level, management information systems and decision support systems at the management level, knowledge work systems and office systems at the knowledge level, and transactional processing systems at the operational level. The systems at each level, in turn are specialized to serve each of the major functional areas.

Clerkin (1995:398) also mentions that the flexibility of an expert system allows communication directly between the hospital information database and the admission department database or between the hospital information system and a human hospital bed assigner. Therefore, the expert

system decreases information transfer and retrieval time. It also decreases the profitability of communication error and it retains the flexibility of a human expert system by providing the user with options and it formalises the decision-making process with attempts to maximise the needs / availability match and minimise the workload fluctuation.

2.5 CRITICAL SUCCESS FACTORS OF AN INFORMATION SYSTEM

According to Goodhue (1995:1827), it seems reasonable that if users rated systems high, then it must be improving the performance of the organisation.

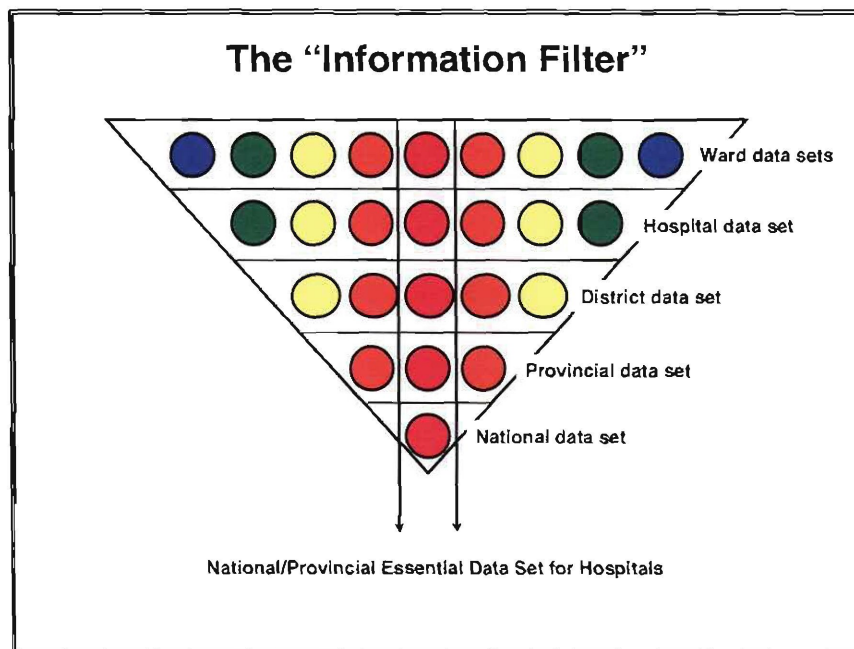
Garrido, Raymond, Jamieson, Liang and Wiesenthal (2004:23) find that the success of a hospital information system depends on a number of critical factors:

- The commitment of senior leadership to implement clear targets and expectations.
- The change to operational processes, job roles, and organisational culture requires resources and strong and consistent support of leadership.
- All levels of management should be clearly informed and accountable for the key actions that need to be undertaken to maximize system benefits.
- The timely implementation of the inpatient information system is imperative due to the consequent impact of delays on benefits realisation is costly.
- Senior management needs to partner with users to take advantage of the efficiencies introduced to the workflow of the information system.
- Internal policies must require physicians and frontline staff to comprehensively and accurately code all hospital discharges and procedures.
- Workflow must be redesigned to incorporate and leverage the systems functionality.
- Ongoing education to health care professionals, health informatics/medical informatics specialists to have sufficient skills and knowledge to systematically process data, information and knowledge.
- The evaluation of success after implementation.
- Regular system maintenance.
- Data collection needs to be standardised; however, it should be flexible so that a facility or

district would be able to collect data in a way which is meaningful or relevant to them.

In addition, Foltz (1993:347), states that good tools should be present for easy collection, collation and reporting of data. Hurtubise (1984:87), furthermore, emphasizes that regular feedback on data as well as information should be given in the form of information team meetings. According to Husein (1993:587), each level of the essential dataset must include all the data elements of the essential dataset at the level above as seen in figure 2.3.

Figure 2.3: The information filter



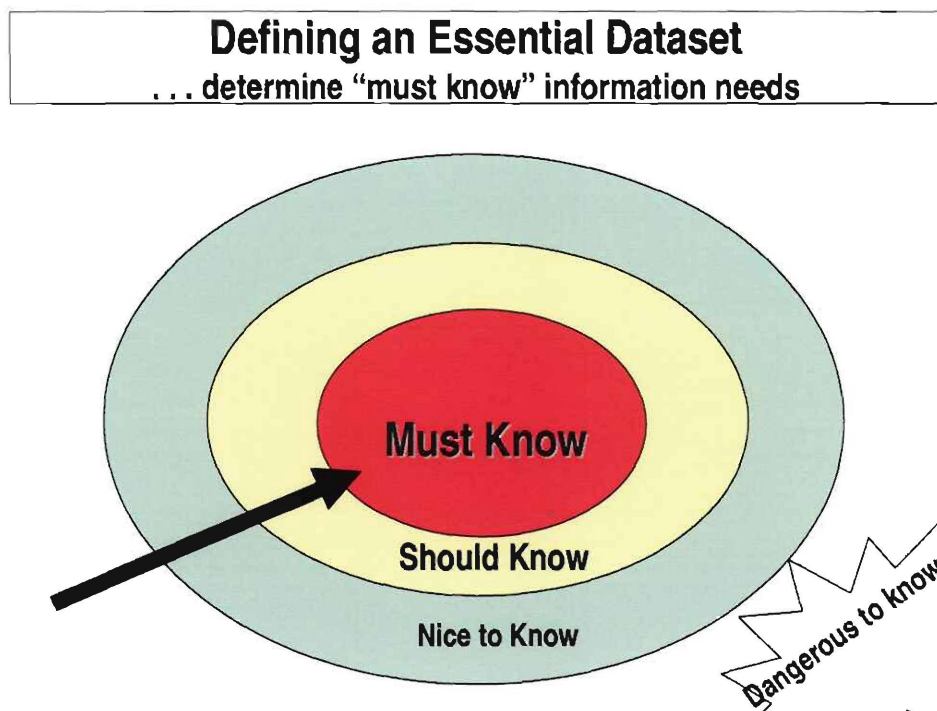
Source: Husein (1993:587)

The information filter in figure 2.3 demonstrates that at each level a different set of data are being collected, depending on the needs of that level, but only a core group (essential dataset) is being sent to another level. To strengthen a hospital information system, therefore, the essential dataset (the raw data required to generate information) should be small, clear and with standardised definitions (De Kadt, 1989:511).

2.5.1 The concept of an essential dataset

According to Garnick, Hendricks and Comstock (1994:168), an essential dataset is the collection of sufficient data so that all the absolutely necessary information and some of the valuable (but not absolutely necessary) information required in providing an excellent health service can be obtained. The authors added that it should be a small enough amount of data so that only a little staff time is used to collect it and so that it is likely to be collected accurately. As shown in figure 2.4 information can be divided into several categories.

Figure 2.4: An illustration of an essential dataset



Source: Garnick, Hendricks and Comstock (1994:168)

Figure 2.4 explains clearly what type of information is needed to deliver an excellent health service:

- **Must know:** This is absolutely necessary information required in decision making to improve service provision.
- **Should know:** This is valuable information but not essential to improve the services.
- **Nice to know:** This is information of general interest, but is of little or no help in improving the service.

In order to adhere to the principle of an essential dataset, the system should, therefore, only collect “**Need to know**” information.

According to Wainwright and Waring (2000:250), key information and technology successes in health care can be described as six (6) components:

- Clarity about national standards.
- Unique identifiers for health care purposes (National health system number).
- Sharing arrangements for administrative details of the population (administrative registers).
- A basic language for health (read codes and health care resource groups).
- National health system-wide telecommunications system
- A framework for security and confidentiality (secure encryption and access).

2.6 FAILURE OF AN INFORMATION SYSTEM

Unfortunately, health information systems in most countries are inadequate in providing the needed management support (World Health Organization, 1987:13); Lippeveld, Foltz & Mahouri, 1992:15). Most health care providers in developing countries equate information systems with filling endless registers with names and addresses of patients, compiling information on diseases weekly or monthly and sending out reports without adequate feedback. Furthermore, Sandiford, Anett and Cibulskis (1992:1080) stated that data received are often not helpful for management decision making, because it is incomplete, inaccurate, untimely, obsolete

and unrelated to priority tasks and functions of local health personnel. Information systems tend to be “data-driven” instead of action driven.

Sandiford *et al.* (1992:1080) also mention other factors that could lead to the failure of an information system:

- Systems that are developed without the support of the business strategy.
- Poor system planning as well as project management.
- Poor customer analysis.
- End user not involved in system planning.
- Poor financial planning.
- The implementation of control systems in order to reduce development defects.
- The buying of software or hardware which does not support the customer’s needs and which might be too technical.
- The installation of incompatible technology.
- The development of unstructured software which is not maintainable.

The view of the World Health Organization on information system failures is the following (World Health Organization, 1994:8):

- Irrelevance of the information gathered.
- Data collection tends to focus on disease reporting and only partially addresses management objectives at the health unit level or at the patient/client level.
- Data that are needed are frequently not collected, e.g. appropriate indicators to monitor continuity of care of individual patients or clients are rarely included in the health information system.
- The common denominator of the observations mentioned by the World Health Organization (1994:8) is a lack of a consensus between producers and users of data at each level of the health care system regarding the information needed.

According to Wainwright and Waring (2000:250), concerns are also raised over this rhetoric

relating to the ambition of the technological infrastructure and the organisational change needed to accommodate such massive modernisation. These include:

- The slow uptake of the national health system as a preferred communications system.
- Problems with the implementation of the national health system number.
- Slow adoption of read codes and problems to secure electronic transfer of patient information.
- Low functionality of patient administration systems.
- Low number of order communication systems, seen as the hub of an integrated patient based system.
- No integrated financial systems.
- The virtually non existent information management and technology support for clinicians at the point of delivery of care.
- Lack of clear management objectives.
- No clear prioritisation in terms of objectives, goals and benefits.

2.7 INFORMATION SYSTEM CHALLENGES: AN END USER PERSPECTIVE

The challenges and opportunities that business managers face in managing information systems and technologies to meet their business goals, are illustrated in table 2.1 (O'Brien & Marakas, 2007:17).

Table 2.1 illustrates the scope of the challenges and opportunities facing business managers and professionals in effectively managing information systems and technologies. Success in today's dynamic environment depends heavily on maximizing the use of internet based technologies and web enabled information systems to meet the competitive requirements of customers, suppliers and other business partners in the global marketplace. Table 2.1 also emphasises that information systems and their technologies must be managed to support the business strategies, business processes, and organisational structures and culture of the business enterprise. The reason for this is because computer based information systems, though heavily dependent on information technologies, are designed, operated, and used by people in a variety of organisational settings

and business environments. The goal of many companies today is to maximise their customer and business value by using information technology to support their employees in implementing cooperative business processes with customers, suppliers and other stakeholders.

Table 2.1: Examples of the challenges and opportunities that business managers face in managing information systems and technologies to meet business goals

The Business Enterprise Strategies/Processes/ Structure/Culture	Information Technology	Customer Value Business Value
Business/ IT Challenges	Business /IT Development	Business/IT Goals
Speed and flexibility requirements of product development, manufacturing and delivery cycles.	Use the internet, intranets, and the web as the primary information and technology structure.	Give customers what they want, when and how they want it, at the lowest cost.
Reengineering and cross-functional integration of business processes using internet technologies.	Diffusion of web technology to internet work employees, customers and suppliers.	Co-ordination of manufacturing and business processes with suppliers and customers.
Integration of e-business and e-commerce into the organisation's strategies, processes, structure and culture.		Marketing channel partnerships with suppliers and distributors.

Source: O'Brien and Marakas (2007:17)

Laudon and Laudon (2001:30) raise the following questions:

- How can organisations ensure that their information systems are used in an ethical and socially responsible manner?
- How can we design information systems that people can control and understand?

Although information systems have provided enormous benefits and efficiencies, they have also introduced new problems and challenges of which managers should be aware. Table 2.2 describes some of the problems and challenges of information systems.

Table 2.2: Positive and negative impacts of information systems

Benefits of information systems	Negative impact
Information systems can perform calculations or process paperwork much faster than people.	By automating activities that were previously performed by people, information systems may eliminate jobs.
Information systems can help companies learn more about patterns and preferences of their customers.	Information systems may allow organisations to collect personal details about people that violate their privacy.
Information systems provide new efficiencies through services such as automated machines	Information systems are used in so many aspects of everyday life that system outages can cause shutdowns of businesses or transportation services, paralysing communities.
Information systems have made possible new medical advances in surgery, radiology, and patient monitoring.	Heavy users of information systems may suffer repetitive stress injury, techno stress, and other health problems.
The internet distributes information constantly to millions of people across the world.	The internet can be used to distribute illegal copies of software, books, articles, and other intellectual property.

Source: Laudon and Laudon (2001:30)

As shown in table 2.2, it is important that managers make informed decisions that are sensitive to the negative as well as the positive consequences of information systems. Managers will also be faced with ongoing problems of security and control. Information systems are so essential to business, government and daily life, that organisations must take special steps to ensure that they are accurate, reliable and secure. An organisation invites disaster if it uses systems that don't

work as intended, that don't deliver information in a form that people can interpret correctly and use, or that have control rooms where controls don't work or where instruments give false signals. Information systems must be designed so that they function as intended and so that humans can control the process (Laudon & Laudon, 2001:30).

According to Herbst, Burn and Nzimande (2002:11), there are still a number of challenges facing the availability of reliable health and management information in South Africa. These include the following:

- Inadequate investment in the hospital management information system.
- There is a lack of an information culture, possibly because of a generation of managers who have had insufficient training or experience in hospital management information systems.
- Clear policies and guidelines are needed to guide data management processes and standardise practice at all levels of the system.
- Managers lack access to integrated, good quality data on which they can base management decisions.
- There is a lack of integration of hospital information systems, as aggregated data cannot be extracted from hospital patient administration systems.
- There is also a lack of the integration of the TB electronic register with a notifiable diseases information system. TB makes up 95% of all notifiable diseases in South Africa, yet more than half of all new TB cases are not reported through the disease surveillance system.
- There is inadequate availability of data from other government departments and the private sector in order to obtain a comprehensive picture of the population related indicators.
- There is inadequate feedback to lower levels of the health system. Many managers are uncertain of what kind of feedback is required. They need guidance and support in establishing and strengthening feedback mechanisms.

Wainwright and Waring (2000:251) state that it is difficult to see how the ambitious infrastructure project defined in the national health system information management and technology strategy could have realistically been expected to deliver direct to end user benefits, within the anticipated timescales. The result is a series of iterations toward a theoretically perfect

solution which may never do an adequate job for the operational user. The strategy has been characterised by preoccupation with technological issues, standards and procurement procedures. The most critical strategic obstacle to the progress in the national health system is the cultural gulf which exists between management and clinicians.

According to the National Health Information System Project trainer manual (2007), the benefits of a health information system are the following. It stimulates a health worker to:

- Know what programs are trying to achieve by setting local targets.
- See how well they are progressing towards achieving targets by analysing data into indicators.
- Monitor trends and compare programs with others in the similar catchment areas.
- Document, analyse and use information to improve efficiency, quality and coverage of public health clinics services at all levels.
- Improve effectiveness of planning, organisation and management functions.
- Develop a culture of information use.

2.8 ELEMENTS OF AN INFORMATION SYSTEM

2.8.1 Information system staff planning and the managerial function

O'Brien and Marakas (2007:544) assert that the success or failure of an information services organisation rests primarily on the quality of its people. Managing information services functions involves the management of managerial, technical and clerical personnel as illustrated in figure 2.5.

The chief information officer (CIO) oversees all the use of information technology in the organisation and brings them into alignment with strategic business goals. The chief information officer does not direct day-to-day information service activities, he or she concentrates on business information and technology planning and strategy. The CIO also works with the chief executive officer (CEO) and other top executives to develop strategic uses of information technology in electronic business and commerce that help make the firm more competitive in the

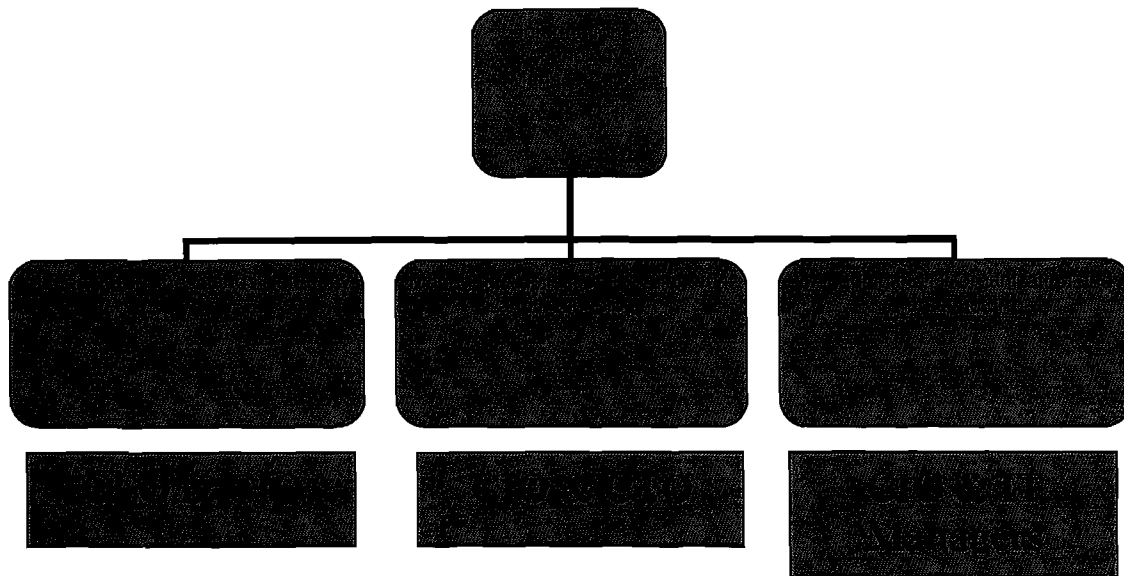
marketplace.

The chief technology officer (CTO), according to O'Brien and Marakas (2007:545), manages all information technologies as a technology platform for integrating internally focused or externally facing business applications. He or she is in charge of all information technology planning and deployment. This includes internet, intranets, and a variety of electronic commerce and collaboration technologies, as well as integrated enterprise software for customer relationship management, enterprise resource planning, and supply chain management.

Other people involved in information systems are:

- E-commerce architect – he or she designs an internet solution from concept through implementation and develops their e-commerce sites.
- Technical team leader –he or she has knowledge of web languages and databases as well as project management and leadership skills.
- Practice manager- he or she has skills of information and technology assessment as well as business development.
- System analyst – he or she is able to apply problem solving and critical thinking skills to the design of new systems.

Figure 2.5: The major components of information technology management



Source: O'Brien and Marakas (2007:538)

Figure 2.5 illustrates one popular approach to managing information technology in a large company. This managerial approach has three major components (O'Brien & Marakas, 2007:538):

Managing business and IT strategy – Led by the chief executive officer and the chief information officer, proposals are developed by business and information and technology managers and professionals for using information and technology to support the strategic business priorities of the company. This business/information and technology planning process aligns information and technology with strategic business goals. The process also includes evaluating the business case for investing in the development and implementation of each proposed business/ information and technology project (O'Brien & Marakas, 2007:538).

Managing application development and technology – This is the primary responsibility of the chief executive officer and the chief information officer. This area of information and technology management involves managing the processes for information systems development and

implementation, as well as the responsibility for research into the strategic business uses of new information technologies (O'Brien & Marakas, 2007:538).

Managing the information technology organisation and infrastructure - The chief information officer and the information and technology managers share responsibility for managing the work of information and technology professionals who are typically organised into a variety of project teams and other organisational sub units. They are also responsible for managing the information and technology infrastructure of hardware, software, databases, telecommunications networks, and other information and technology resources, which must be acquired, operated, monitored and maintained (O'Brien & Marakas, 2007:538).

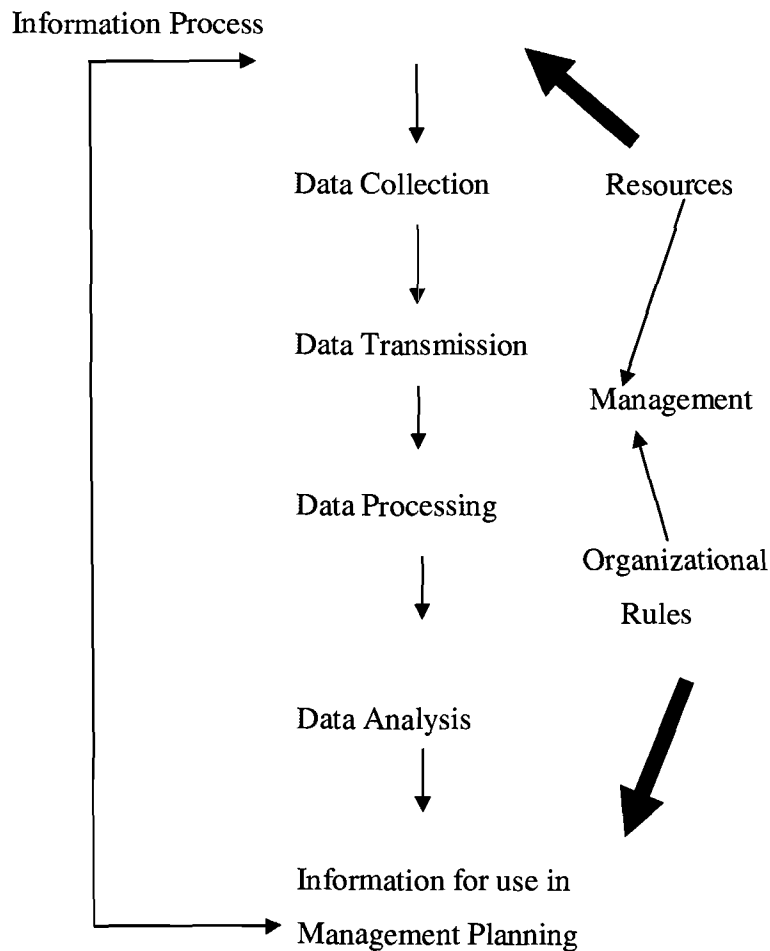
2.8.2 The structure/components of an information system

The health information system is a system that provides specific information support to the decision-making process at each level of an organisation (Hurtubise, 1984:28).

Helfenbein (1987:2) states that a health information system first of all is a "system". Like each system it has an organised set of interrelating components which can be grouped under two entities: the information process and the health information system management structure. Through the information process, raw data (inputs) are transformed into information in a "usable" form for management decision-making (outputs).

Figure 2.6 illustrates the information process and how it can be broken down into the following components: 1) data collection, 2) data transmission, 3) data processing, 4) data analysis, and 5) presentation of information for use in planning and managing the health services.

Figure 2.6: The components of health information structure.



Source: World Health Organization (1987:6)

Figure 2.6 illustrates the information process and how it can be broken down into the following components: 1) data collection, 2) data transmission, 3) data processing, 4) data analysis, and 5) presentation of information for use in planning and managing the health services. In order to make the information process efficient, a health information system management structure is required to ensure that resources are used in such a way that the information process produces high quality information in a timely fashion.

Thus, designing or redesigning health information systems will need to address in a systematic manner each of these components of both the information process and the management structure.

The ultimate objective is that health information systems provide specific information support to the decision making process within the health system at large (Sollenberger, 2006:29).

According to De Geyndt (1994:24), monitoring and evaluating the process ensures that the right mixture of inputs produces the right type of outputs in a timely manner. For example, the information needed is continuously changing with changing planning and management needs. This will, in turn, affect data collection and other components of the information process.

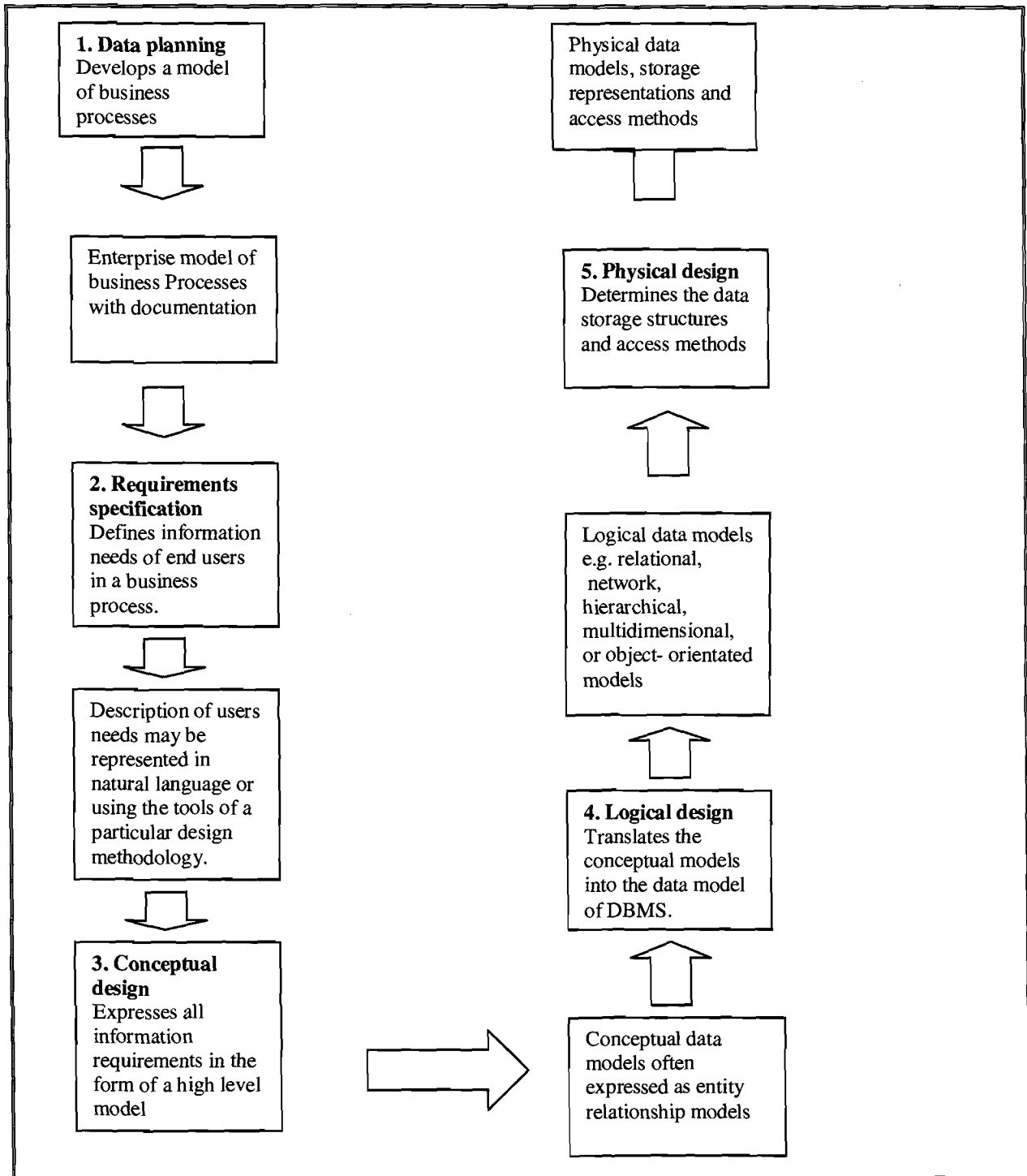
Lippeveld *et al.* (1992:19) explain that a health information system can generate adequate and relevant information only insofar as each of the components of the information process has been adequately structured.

In order to make the information process efficient, a health information system management structure is required to ensure that resources are used in such a way that the information process produces high-quality information in a timely fashion.

This structure can be further broken down into two components: 1) health information system resources (e.g. planners, managers, statisticians, epidemiologists, data collectors), 2) a set of organisational rules (e.g. staff responsibilities, supply management procedures, computer maintenance procedures).

Figure 2.7 illustrates that database development involves planning and database design activities.

Table 2.3: Database development



Source: O'Brien and Marakas (2007:171)

Data models that support business processes are used to develop databases that meet the information needs of users (O'Brien & Marakas, 2007:171). Figure 2.7 illustrates that database development may start with a top-down data planning process. Database administrators and designers work with corporate and end user management to develop an enterprise model that defines the basic business process of the enterprise. Then they define the information needs of end users in a business process such as purchasing/receiving process that all businesses have. Next, end users must identify the key data elements that are needed to perform their specific business activities. This involves developing entity relationship diagrams (ERDs) that model the relationships among the many entities involved in business processes. Entity relationship diagrams are simply graphical models of various files and their relationships contained within a database system (O'Brien & Marakas, 2007:171).

End users and database designers could use database management or business modelling software to help them develop entity relationship diagrams models for the purchasing/receiving and other business processes using enterprise resource management (ERM) or supply chain management (SCM) software. End users are a major part of the data modelling process where the relationships between data elements are identified (O'Brien & Marakas, 2007:171).

Each data model defines the logical relationships among the data elements needed to support a basic business process. Data models then serve as logical frameworks (called schemas and sub schemas) on which to support the business processes of the organisation base, the physical design of databases and the development of application programs too. A schema is an overall logical view of the relationships among the data elements in a database, while the sub schema is a logical view of data relationships needed to support specific end user application programs that will access that database (O'Brien & Marakas, 2007:171).

2.8.3 Matching the information system restructuring process with the health service system

Sandiford *et al.* (1992:1078), as well as De Kadt, (1989:505), describe the health information restructuring process as a challenging and complex undertaking, particularly in the context of government bureaucracies in developing countries. Failures tend to be more than successes.

The health information system restructuring process can be broken into six steps:

Step 1: Identifying information needs and feasible indicators.

Step 2: Defining data sources and developing data collection instruments for each indicator selected.

Step 3: Developing a data transmission and processing system.

Step 4: Ensuring use of the information generated.

Step 5 and 6: Planning for health information resources and developing a set of organisational rules for health information system management.

The four initial steps deal with the development of the information generating process. The two last steps involve setting up the health information system management structure necessary to ensure generation and use of information. This approach is to carefully match each of the health information restructuring steps with the existing health services system. Within the chosen subsystem and for each of the health information systems restructuring steps, particular attention needs to be given to ensure that the information can be made available and is used for decision making at the appropriate concentration level(from periphery to the centre) and for the identified management functions (patient/ client, health unit and health systems).

2.8.4 Management functions of a health system

According to Sapirie (1997:13), the objective of health systems management is to coordinate and provide planning and management support to the service delivery levels. Some examples of generally accepted health systems management functions are:

- Establishment of health policies and legislation.
- Intersectoral coordination.
- Strategic planning and programming.
- Budgeting and financial resource allocation.
- Organisation of the system, including referral mechanisms.
- Personnel development including continuing education.

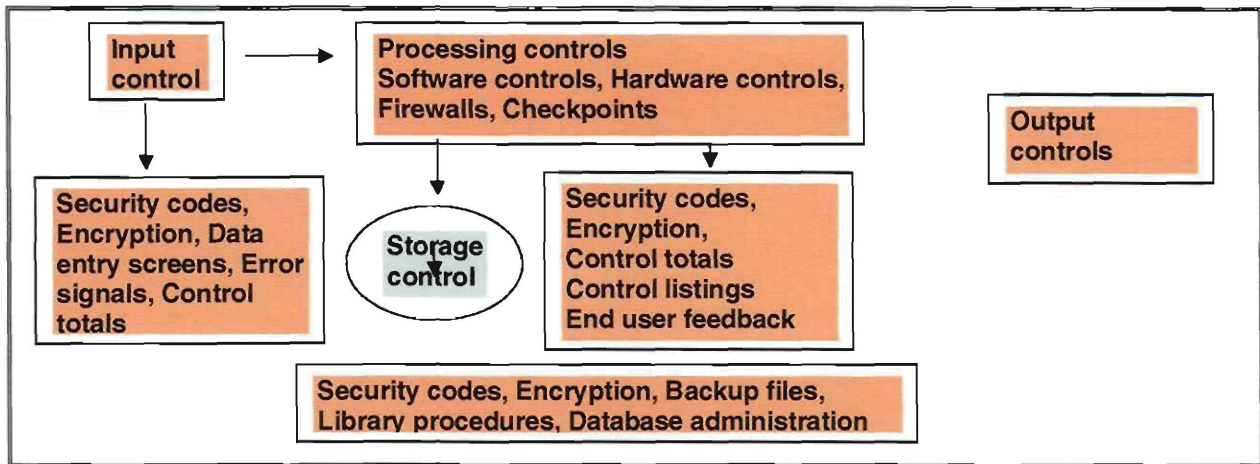
- Resource management, including finance, personnel and information.
- Distribution and management of equipment, supplies and medicine.
- Disease surveillance.
- Protection of the environment.
- Supervision of the health services.

The introduction of the Public Finance Management Act (PFMA) and the change to a medium-term budget cycle whilst improving budgeting and financial management at national and provincial spheres of government has increased the need for accurate financial information which is linked to other health status, resources and performance indicators. Collectively, these requirements have contributed to an increased need for accurate information at all levels of the South African health system (Shaw, 2005:633).

2.9 CONTROL OF INFORMATION SYSTEMS

Information system controls are methods and devices that attempt to ensure the accuracy, validity and propriety of information system activities. Information system controls must be developed to ensure proper data entry, processing techniques, storage methods, and information output. The controls as illustrated in figure 2.8 are thus designed to monitor and maintain the quality and security of the input, processing, output, and storage activities of any information system (O'Brien & Marakas, 2007:527).

Figure 2.8: Examples of information system controls



Source: O'Brien and Marakas (2007:527)

Figure 2.8 illustrates that information system controls are designed to monitor and maintain the quality and security of the input, processing, output, and storage activities of an information system. Information system controls are needed to ensure the proper entry of data into a business system and thus avoid the (GIGO) garbage in, garbage out syndrome. This includes passwords and other security codes, formatted data entry screens, and audible error signals. Computer software can include instructions to identify incorrect, invalid, or improper data as it enters the computer system.

According to Draper (2001:40), the successful implementation of privacy policies should not be forgotten as it relates to treatment and healthcare operations. The involvement of a wide representation of clinicians is vital to understanding where protection is being routinely and non-routinely used and how it is being disclosed. The entity must implement policies and procedures to identify the persons or classes of persons in the entity's workforce who need access to protected health information, to perform their duties, categories of protected health information to which such person or classes need access and conditions, as appropriate, that would apply to such access. Striking the balance of "need to know" for appropriate treatment and protecting patient privacy may potentially be a challenging element for privacy and compliance professionals.

By actively involving the clinical staff in defining, developing, and implementing policies and procedures, the entity has a much better chance of facilitating the cultural change necessary to be compliant with the final privacy standards.

Wyatt (1995:175) mentions that duplication of data raises the need for standards to bridge between islands of automation: technical standards for data interchange between computers and “semantic standards” which should ensure that “asthma” on one system does not translate “bronchitis” on another system. Areas need to be defined clearly on the meaning of terms.

Leonard, Lin, Dalziel, Yap and Adams (2004:175) state that the encryption of data has become an important way to protect data and other computer network resources. Passwords, messages, files, and other data can be transmitted in unscrambled form and unscrambled by computer systems for authorised users only.

2.10 CHANGE MANAGEMENT

Lewin’s force field theory, according to Ting-Ting (2006:489), posits that changes occur in three stages: 1) unfreezing, 2) moving, 3) refreezing, i.e.:

- Unfreezing – motivating individuals by getting them ready for change.
- Moving – encouraging individuals to adopt a new perspective that enables them to perceive that the current situation can be improved.
- Refreezing – reinforcing new patterns of behaviour.

Strategies should be devised to strengthen the driving forces and to weaken the restraining forces. In the moving stage open communication and participation in developing the change in perspective should be encouraged. Once individuals feel actively involved and personally committed to a project, they will be more likely to support its successful implementation. In the refreezing stage, the change is maintained by providing continued assistance and support to people using the system.

According to Haug, Beatriz, Rocha and Scott (2003:121), the complexity theory suggests that organisations are complex adaptive systems. Based on this theory, the Institute of Medicine defines a hospital as a set of connected or interdependent parts or agents – including caregivers and patients – bound by a common purpose and acting on their knowledge.

Complexity theory proposes that when a complex adaptive system, such as a hospital, faces discontinuous change, it will move to the edge of chaos where the organisation is more capable of change. Three system control parameters that can alter the pattern of relationships to make change more possible can be manipulated to ensure that the organisation does not move into total disequilibrium. These parameters are: Increase connections amongst agents, increase velocity of information flow, and increase diversity of cognitive schema. Increasing these parameters facilitates the agent's understanding of an organisation's environmental and organisational changes, including different mission and goals, stakeholder demands, standards, regulations and community expectations. To these environmental and organisational changes, processes and information are added. A new pattern of relationships among agents emerges and is sustained over time when these parameters are supported.

2.11 SUMMARY

In this chapter the reader was introduced to the concept of information systems. A literature research on definitions as well as the role and the structure of an information system was done to explain the basic concepts of an information system. Further discussed was the importance of an information system in a hospital and the influence this has on efficient management and decision-making in the organisation. This is followed by the success factors as well as the failures of an information system. The challenges, the composition and the requirements of an information system in a hospital situation are also mentioned in this research. The chapter is concluded with the management of change in the organisation after an information system is implemented.

CHAPTER 3

AN INVESTIGATION INTO THE ORGANISATION

3.1 INTRODUCTION

This chapter describes the structure of the national, provincial, district and organisational background of the health system in South Africa. The organisation under investigation is Kopanong Hospital, which is situated in the Gauteng province in the Sedibeng district in the town of Vereeniging. The chapter further explores the background of Kopanong Hospital, the services delivered by this institution, the dataflow as well as the causal factors to the study.

3.2 SOUTH AFRICA'S HEALTH CARE SYSTEM

The South African health care system is structured into four layers:

- Primary health care (clinics)
- District hospitals
- Regional hospitals
- Tertiary (academic) hospitals (Gauteng Provincial Government portal, 2006:17).

This structure was developed to address cost effective health care to all citizens (on appropriate level) to ensure a better health for all citizens. The above-mentioned layers are also present in the health regions of the Gauteng province. The regions are the following:

- Sedibeng (of which Kopanong hospital is part)
- Metsweding district municipality
- City of Johannesburg
- Erkhuleni metropolitan municipality
- City of Tswane
- Mogale city municipality

- Soweto
- Randfontein local municipality and Westonaria

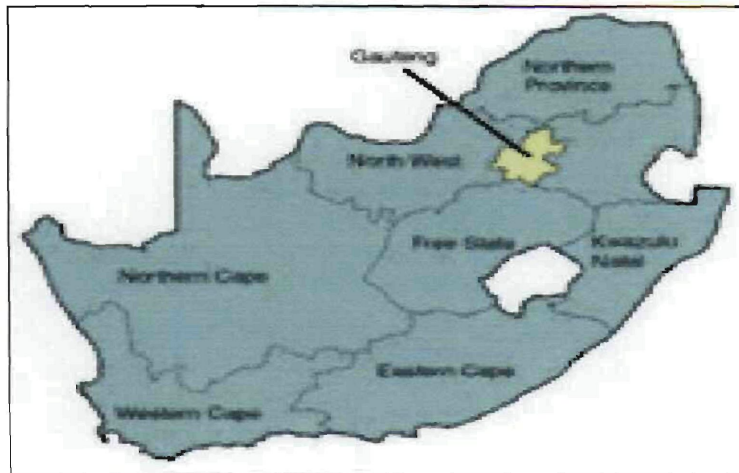
3.3 BACKGROUND TO THE GAUTENG DEPARTMENT OF HEALTH

The Gauteng Province consists of different departments of which the health department is one of them (Gauteng Department of Health, 2006:14). The different departments are the following:

- Agriculture, Conservation and Environment
- Education
- Gauteng Shared Service Centre
- Housing
- Office of the Premier
- Social Development
- Community Safety
- Finance and Economic Development
- Health
- Local Government
- Public Transport, Roads and Works
- Sports, Arts, Culture and Recreation

The province of Gauteng is the economic heartland of the country, contributing to approximately 33% of the gross domestic product of South Africa in 2002. See Figure 3.1 (Gauteng Department of Health, 2006:5). In this context, the Gauteng Department of Health (GDH) strives to maintain the health of those responsible for sustaining the economy by subscribing to the vision of “Health for a Better Life” through the provision of a modern health care system. The goals of the system strive for good health as the main return on investment (ROI). The objective for this goal includes building a quality health care service responsive to the communities’ expectations and needs, financial viability, financial fairness (the poor are not left worse off) and a reduction of inequalities in service delivery (Gauteng Department of Health, 2006:29).

Figure 3.1: Map of South Africa indicating Gauteng



Source: Gauteng Department of Health (2006:5)

As shown in figure 3.1, the Gauteng Province covers just over 17 000sq km - approximately 1.4% of the total land surface of South Africa. It is the smallest of the nine provinces (Gauteng Department of Health, 2006:5).

In the Sesotho languages 'Gauteng' means 'place of gold', which is appropriate, as the province has its economic and historic roots in the thriving gold industry that was sparked off by the discovery of gold in Johannesburg in 1886.

The Province has a highly developed transport and communications infrastructure, excellent financial institutions and a well-serviced urban environment. Although it is highly urbanized, there are also several natural tourist attractions. A significant portion of South Africa's past is manifested in the Province where sites such as the Union Buildings, the Voortrekker Monument and more recently, the Newton Cultural Precinct in Johannesburg, document the country's rich cultural and historic heritage (Gauteng Department of Health 2006:5).

Gauteng has developed a special urban and industrial character that is uniquely African. In recent

years, this energy has been directed towards developing a province for the new millennium, a smart province that is globally competitive. The Gauteng Provincial Government has re-aligned its focal economic sectors from low value added production to more sophisticated sectors such as information technology, finance and business (Gauteng Department of Health, 2006:54).

3.4 DEMOGRAPHIC PROFILE

The people of Gauteng, according to the Gauteng Department of Health (2006:12), constitute 19.7% of the total South African population, making the province the second largest populated province after Kwazulu-Natal.

The 2001 census revealed a total of about 8.8 million people in South Africa of which 5.4% were foreign born. The 2005 mid-year population estimates showed an increase in the population to a total of 9 million. The high population growth of 20.3% between 1996 and 2005 was contributed to by both in-migration in search of employment and the natural increase (population growth) (Gauteng Department of Health, 2006:12).

Based on the 2001 census, Gauteng's population is predominately made up of black Africans (73.8% of the total) followed by whites (19.9%), coloureds (3.8%), and Asians (2.5%). There is a slight predominance of men over women (50.3% vs. 49.7%), which differs from the rest of South Africa, where women are in the majority.

Gauteng has relatively more people (72%) in the 15 to 64 years age group, compared to the national average of 63%. Only 23.6% of the population was under 15 years and 6.2% over 60 years of age.

Furthermore, Gauteng is the most densely populated province in South Africa, with the majority of the population living in urban areas. Urbanisation in the province has diverse characteristics, demonstrated by densely populated informal settlements on the periphery of the formal areas as well as peri-urban communities that are generally sparsely populated and situated far from economic active areas.

According to census 2001, 23.9% of households in Gauteng live in informal housing as compared to 16.4% for South Africa as a whole. The percentage of Gauteng households without toilets is low (3.6%) as compared to for the country as a whole (13.6%). Improved access to running water, sanitation and health services has reduced infectious diseases as the major cause of death in childhood. There remains a relatively small area with poor sanitation and limited access to piped water, located in the mainly rural Metsweding district municipality. This poses a potential threat for outbreaks of water-borne diseases and other health crises.

In the 1995 and 1999 household surveys, the medically uninsured population of Gauteng has increased from approximately 59.7% in 1995 to 73.1% in 1999. This results in additional pressures on the public health care system in the province, as this sector of the population are the main users of public health facilities. In addition, with the escalating costs of medical aid, we are likely to witness greater numbers of the population having to turn to the public sector for their health needs (Gauteng Department of Health,2006:12).

A review of the health status of the population of Gauteng shows a complex and wide scope of conditions or illnesses related to poverty, malnutrition, emerging and re-emerging communicable diseases such as HIV and AIDS, and tuberculosis. Poverty is also the major contributor to trauma and violence. In addition, there is a high prevalence of chronic diseases due to a particular lifestyle, such as hypertension, diabetes and mental illness.

3.5 VISION AND MISSION OF THE GAUTENG DEPARTMENT OF HEALTH

The vision of the Gauteng Department of Health is: “Health for a better life” and the mission statement is as follows (Gauteng Department of Health, 2006:31).

“The Gauteng Department of Health aims to promote and protect the health of the people of South Africa, especially those most vulnerable to illness and injury. Through innovative leadership and management the Department provides quality health services and strives to:

- Ensure a caring climate for the service user.
- Implement best practice health care strategies.
- Create a positive work environment for staff.
- Provide excellent and appropriate training for health workers.
- Listen to, and communicate with our communities and staff.
- Establish management systems for effective decision making.
- Forge partnerships with others.
- Obtain the greatest benefit from public monies”.

The strategy of the Gauteng Department of Health is driven by the following principles:

- Patient or client entry through the appropriate level.
- Focus on meeting stakeholder expectations at all service contact opportunities.
- Take health to the people through community based health services.
- Focus on prevention and promotion of healthy living.
- Contribution to National and Provincial strategic initiatives (Gauteng Department of Health, 2006:34).

3.6 THE DEPARTMENTAL STRUCTURE

In table 3.1 the organisational structure of the Health Department is illustrated in top-down manner, from the member of the executive council to the chief financial officer (Gauteng Department of Health, 2006:9).

Table: 3.1: Organisational structure and functions of each Chief Directorate/Division

Position	Function	Chief Directorate	Directorate
MEC (member of executive council)	Political leadership of the department		
Head of the Department (HOD)	The accounting officer for the department performs functions in terms of existing legislation unit Provides leadership to the department		Communications & PR Strategic support & performance management Interdepartmental AIDS
Chief of Operations (COO)	Ensures efficient, cost-effective and comprehensive health services in Gauteng	Health Services Support	Public Health Provincial Health Legal Services Clinical & Service Development
	Provide strategic and technical advice and guidance to senior management	Resource Management	Resource Human Management Labour Management Information Management Human Resource Development Administration Support and Systems
	Responsible offices for services within a Region Strategic support to ensure implementation of programmes	Health Regions A,B,C	Metro & District Council Area Services System Support
Chief Financial Officer (CFO)		Ensures efficient cost-effective financial management for the health services in Gauteng	Financial management Revenue and control Management Internal control Financial projects Commissioning management

Source: Gauteng Department of Health (2006:9)

Table 3.1 illustrates the organisational structure of the Gauteng Department of Health as well as

their different functions of the directorate and the chief directorate involved. The organisational structure involves the MEC (Member of Executive Council), Head of the Department (HOD), Chief of Operations (COO) and the Chief Financial Officer (CFO).

3.7 THE STRATEGIC GOALS AND OBJECTIVES OF THE DEPARTMENT

Illustrated below in table 3.2 are the strategic goals and objectives until 2010 for the Gauteng Department of Health (Gauteng Department of Health Strategic plan, 2003:87). As shown in table 3.2 it is clearly indicated that in order to secure value for money the Department of Health realizes that it has to: 1) provide an effective and efficient integrated management information system (MIS) to support decision making, monitoring and clinical care and 2) implement, monitor and evaluate communication strategy across the organisation and with the public.

Table: 3.2: Strategic goals and objectives

Overall strategic goals	Strategic objectives
<p>Improve the health status of the population of Gauteng</p>	<ul style="list-style-type: none"> • Improve Child Health • Improve nutritional status of vulnerable groups • Reduce maternal mortality • Reduce mortality from cervical and breast cancer • Strengthen the Tuberculosis control programme • Reduce the incidence of STDs (Sexual transmitted diseases) and HIV zero-prevalence and the impact of AIDS • Improve quality of life for people living with AIDS • Reduce the prevalence and complications of prevalent non communicable diseases • Reduce the prevalence and complications of prevalent communicable diseases • Promote mental well-being and improve early diagnosis, treatment and support to people with mental illness • Reduce incidence and impact of trauma and violence • Promote healthy lifestyles

Overall strategic goals	Strategic objectives
Improve Health Services	<ul style="list-style-type: none"> • Strengthen Primary Health Care • Revitalization of hospital services • Ensure rapid and effective Emergency Care • Provide efficient and effective clinical support • Provide quality hotel facilities efficiently • Improve quality of care
Secure better value for money	<ul style="list-style-type: none"> • Provide conducive work environment and effective organisation for staff • Enable the equitable appropriate recruitment and deployment of staff • Ensure alignment of staff skills and competencies with strategic objectives • Ensure appropriate high quality tertiary training • Provide effective labour management • Ensure effective and efficient systems for procurement and management of assets and consumables • Construction, refurbishment and maintenance of infrastructure and equipment • Implement and review risk management plan • Establish, implement and update regularly the Fraud prevention plan • Ensure revenue generation and retention • Improve financial management • Provide an effective and efficient integrated management information system (MIS) to support decision making, monitoring and clinical care • Implement, monitor and evaluate communication strategy across the organisation and with the public • Community participation to support institutional, sectoral and intersectoral programmes • Develop and implement clear policy and legislative framework for health care

Source: Gauteng Department of Health Strategic plan (2006:87)

As shown in table 3.2 one of the Gauteng Health Department's strategic objectives is to provide an integrated management information system. This is one of the reasons why the study was done to see whether staff at Kopanong Hospital is ready for these changes.

3.8 CATEGORIES OF HOSPITALS IN THE GAUTENG HEALTH DEPARTMENT

According to the Gauteng Department of Health (2006:59), there are six types of hospital categories in Gauteng; see table 3.3 below. The hospitals are also identified by name.

Table: 3.3: The category of hospitals available in the Gauteng Health Department

Category	Hospitals
Central hospitals	Chris Hani Baragwanath Johannesburg Pretoria Academic Garankuwa
Dental schools	Wits, Pretoria and Medunsa
Regional and district hospitals	Helen Joseph, Kalafong, Natalspruit, Leratong, Tembisa, Tambo Memorial, Coronation, Sebokeng, Pholosong, Far East Rand, South Rand, Edenvale, Carletonville, Yusuf Dadoo, Heidelberg, Pretoria West, Kopanong, Germiston
Psychiatric hospitals	Weskoppies, Sterkfontein, Tara, Cullinan
Specialised hospitals	Sizwe

Source: Gauteng Department of Health (2006:59)

Table 3.3 describes the different hospitals that are present in the Gauteng Department of Health, as well as the category they are placed in. The category varies from central hospitals, dental schools, regional and district hospitals, psychiatric hospitals and specialised hospitals.

3.9 THE ORGANISATION UNDER INVESTIGATION

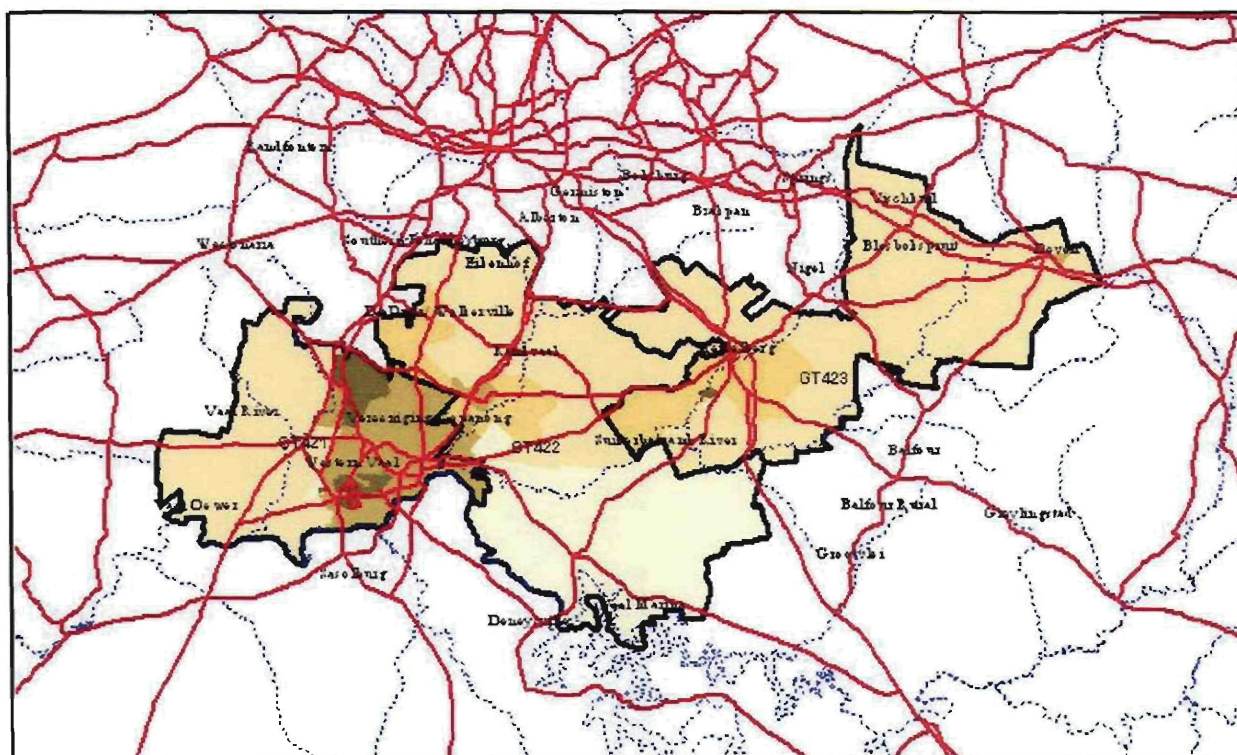
3.9.1 History and background of the organisation

In 1966 the Administrator of Transvaal, Honourable S.G.J van Niekerk opened the Vereeniging Hospital. The hospital was acclaimed “A Modern Imposing Hospital”. In the early 1990s the hospital was at the forefront with its expansion programme and new theatres and a modern X-ray department were built. The completed additions extended patient capacity to 368 beds, costing 2.5 million rand. At that stage the hospital was serving the Vaal Triangle and was treating 2500 out patients and 2800 casualties per month. The hospital boasted at that stage with theatres of the laminar flow design and three of the most modern X-ray rooms. A complete list of consultants served the needs of the people of this industrial, coal mining and steel producing area. A well planned nurse’s home was built next to the hospital which accommodated 180 nurses in its seven storeys. After the election in 1994 the Gauteng Department of Health decided to eliminate the duplication of services and divided the hospitals into:

- Level 1- District hospitals
- Level 2- Regional hospitals
- Level 3- Academic hospitals

Vereeniging Hospital was renamed to Kopanong Hospital on 12 July 1997 by Mr. Amos Masondo (MEC of Health). Kopanong Hospital was also reclassified as a level one district hospital, with 248 approved beds. Figure 3.2 illustrates the Sedibeng area (indicated in dark yellow).

Figure 3.2: The Sedibeng area



Source: Gauteng Department of Health (2006)

As illustrated in figure 3.2 the Sedibeng area consists of three (3) hospitals:

- Sebokeng Hospital (regional hospital)
- Kopanong Hospital (district hospital)
- Heidelberg Hospital (district hospital)

Kopanong Hospital is located in Vereeniging in the Vaal Triangle surrounded by Emfuleni and Midvaal municipalities. Kopanong Hospital consists of 215 usable beds with a personnel corps of 456 (counted 28/2/07). The hospital is situated in a residential area (Duncanville) bordering on an industrial area. Townships and informal settlements form an important part of the patient load of the hospital. Kopanong Hospital's referral hospital is Sebokeng Hospital. The catchment population of the Sedibeng region consists of: 1) Emfuleni -762 210, 2) Midvaal -73 466.

This equals up to a total of 835 676 people in the Sedibeng region. This is 83% of the total

amount of the population in the Sedibeng region without medical aid (District hospital information system department Sedibeng 25/2/2007). The total population of Sedibeng is 918 325 (District hospital information system, Sedibeng department 27/2/2007).

3.9.2 Services rendered in Kopanong Hospital

The services in Kopanong hospital is provided by general medical officers and health workers. There are no specialists except the sessional ear, nose and throat specialist, a paediatrician, an obstetrics consultant and a psychiatrist rendering services on a sessional basis for clinical support and capacity building. The following services are provided by the hospital:

- 24 hours Casualty
- Comprehensive care management and treatment clinic
- Dental services
- Gateway clinic
- General surgery
- Gynaecology, reproductive health (Obstetrics, Antenatal clinic, Termination of pregnancy, Medico legal services. and Prevention of mother to child treatment)
- Infection control
- Internal medicine
- Medical Out patient
- Occupational Therapy
- Orthopaedic
- Pharmacy
- Physiotherapy
- Psychiatric servicesSocial work services
- Speech therapy
- Step-down facility
- Sterilization programme
- Theatre

- X-ray department

The patient profile is mainly people without medical aids but the hospital also caters for people with medical aids.

3.9.3 The purpose of Kopanong Hospital

The purpose of Kopanong Hospital is to provide a level one hospital based health care at general practitioner level including primary health care. The mission of Kopanong Hospital is:

“Life is taking responsibility. Good health is our responsibility, today and forever.”

The Vision of Kopanong Hospital is: “Your health is our business”.

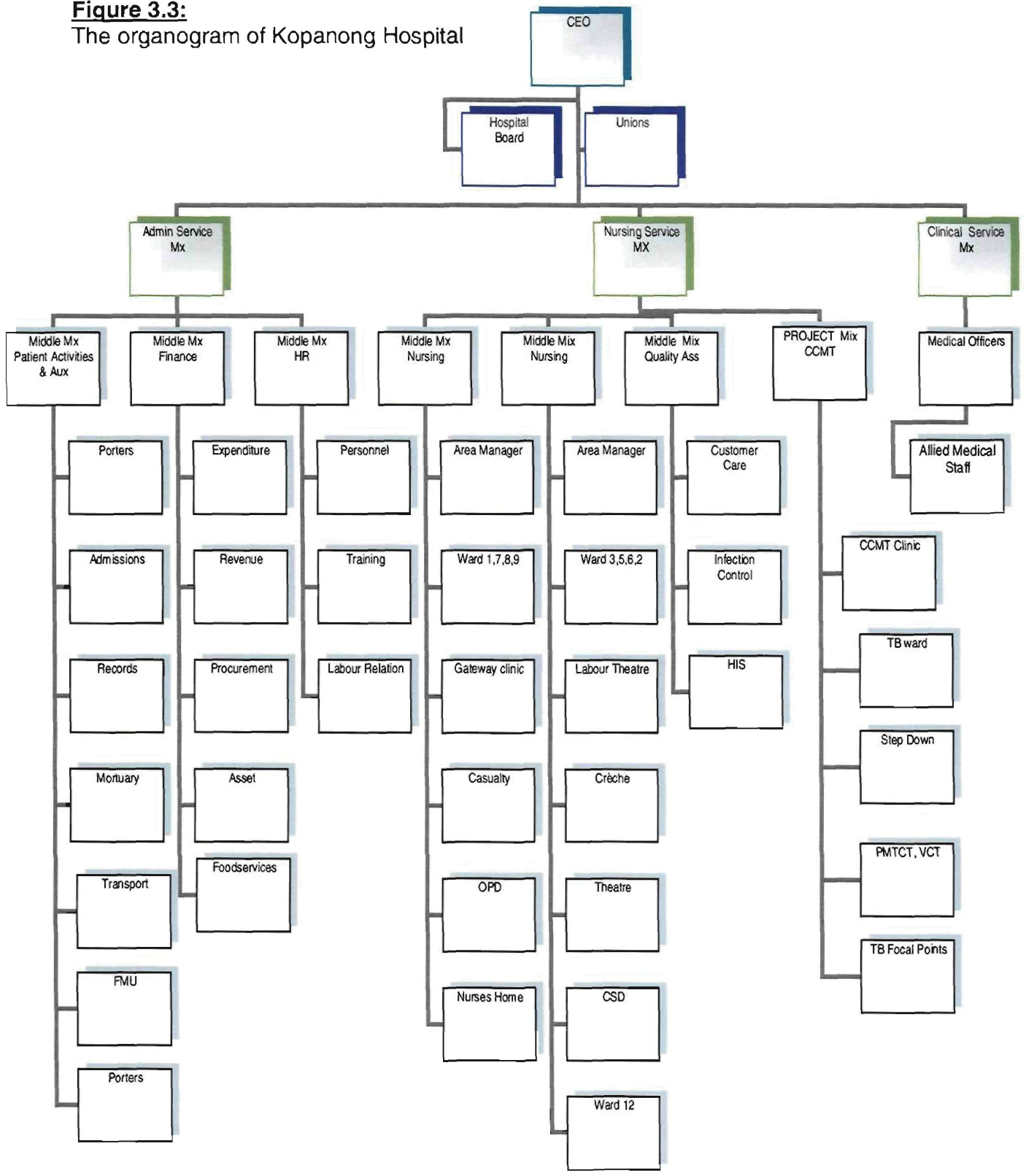
3.9.4 The shared values of Kopanong Hospital

The shared values of the institution are the adherence to the Batho Pele Principles and the patients’ rights charter. The adherence to the core business of total patient care is to ensure better health services for the population of Sedibeng, as well as to implement quality of service, through creating a motivational climate.

3.9.5 Organogram of Kopanong Hospital

Figure 3.3 illustrates the organisational structure of Kopanong Hospital (Chief Executive’s Office, 2007).

Figure 3.3:
The organogram of Kopanong Hospital



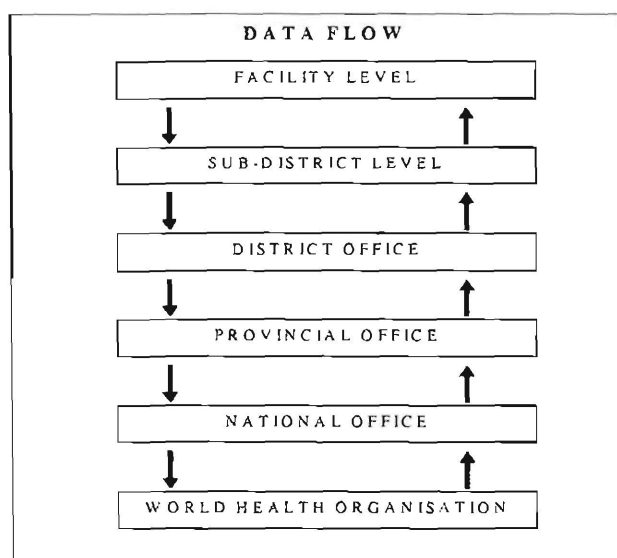
Source: Chief executives office (2007)

Figure 3.3 describes the organisational structure of Kopanong Hospital. This is divided into the medical and paramedical division, followed by the nursing departments and the administration and support division (Chief Executive’s Office, 2007).

3.9.6 The dataflow of Kopanong Hospital

In figure 3.4 the dataflow of Kopanong Hospital is illustrated. This dataflow is established by the Gauteng Department of Health (Gauteng Department of Health, 2006:34).

Figure 3.4: The dataflow of a district hospital



Source: Gauteng Department of Health (2006:34)

As shown in figure 3.4 data flows from the facility level, to the sub-district office, to the district office, to the provincial office, to the national office and at last to the World Health Organization. This flow of information happens on a monthly basis.

3.10 CAUSAL FACTORS TO THE STUDY

Data in Kopanong Hospital is presently still collected manually and paper-based on a prescribed spreadsheet. Due to this process data can not be extracted out of a system at any point in time. Managers have to wait until month-end before they have access to the previous months' data. The hospital information system committee meets on a monthly basis. Data of the previous month will then also be discussed; interrogated and managerial decisions will be made accordingly. Due to a national nursing staff shortage and the absence of ward clerks it is difficult to expect quality of data as well as timely submission. Most of the wards in Kopanong Hospital do not have computers yet. There is thus no intranet, internet or e-mail connection between the hospital information system and the wards, which makes communication and feedback rather difficult. Feedback has to be given via a hard copy, during meetings or a personal visit, which is time consuming. Manual based collection causes serious deviations as data is either not captured or calculation faults do appear.

According to Hlongwa (2007:2), the Gauteng Department of Health is going to launch a pilot project on smart cards for patients with chronic diseases (e-health). The smart cards will be used at hospitals and community health care centres to enable the Department of Health to capture and keep patient data of patients. This comes after the department realised that long queues and waiting times are a result of patients going to the wrong facilities for assistance and treatment. Implementing an information and technology system to leverage efficiency is one of the Gauteng Health Department's goals.

According to Gauteng Department of Health's business requirement workshop (20/6/2007), information and technology is the number one item on the auditor's list and a new system will be proposed e-health with the smart card implementation.

Rapidly escalating health care costs have resulted in annual medical aid premium increases significantly in excess of CPIX. Company contributions to medical aid funds comprise some 10% of payroll cost. Individuals may spend as much as 30% of their income on medical aid premiums. This situation limits access to private health care to the extent that the majority of employees are

unable to afford these services.

This situation could cause that more and more patients would make use of the public sector if not properly managed. It would thus have a greater impact on the public sector, which would mean that public as well as the private health care would have to be managed effectively and efficiently. Effective management will improve the quality of health care delivered and increase access by facilitating sustainable cost containment. Managed health care would also encourage better health by incentivising promotive, preventative and rehabilitative care, particularly in an outpatient or ambulatory setting (Goodman, 1986:5). Due to the above-mentioned facts the study should establish the gap analysis where the organisation is presently, and where it will want to be in future.

3.11 BACKGROUND TO THE DISTRICT HEALTH INFORMATION SYSTEM

According to Braa, Monteiro and Sahay (2004:347), the priority areas in the development of the National health information system in South Africa were administration and finance with the National Health Care Management Information System (NHC/MIS) being one of the components. A tender to carry this work forward was published in 1996; however, it was cancelled and provinces were given the go ahead to acquire the National Health Care Management Information System using the initial specifications. Most of the provinces started with the implementation of the National Health Care Management Information System (NHC/MIS) at hospitals and concurrently the committee initiated a Public Healthcare Monitoring System. They also developed a public healthcare form and they identified the cluster, health monitoring and evaluation as the programme responsible for the coordination of this system.

The strategy to develop the District Health Information System was led by a task team that comprised officials from the directorates, National Health Information System and District Health System as well as other professionals with a history of working on District Health Systems development. The work of this task team culminated in the development of the District Health Information System guidelines in 1998. Some of the members of the task team, specifically those from the Health Information Pilot Project (HISPP) were simultaneously

involved in district health information system pilot projects.

The programme was renamed the District Health Information System (DHIS) Software and is currently implemented in all provinces using Provincial Essential Dataset (EDS). The District Health Information System Software itself is free and released into the public domain called "Open Source" software, where the software is distributed for free and complete with all source codes. To date various functionalities such as Tuberculosis, environmental health, emergency medical services, and hospital essential dataset are being captured on the software.

The District Health Information System program is also used at Kopanong Hospital. The monthly compiled data is entered into the District Health Information System programme and then sent to the Sedibeng district. At the Sedibeng district the data is compiled per district and then sent to central office Johannesburg, where data is compiled as Gauteng Health's data. From that point the data is exported to national health and then to the World Health Organization.

As part of the implementation several provinces started defining their first Essential Datasets (EDS) previously called Minimum Dataset (MDS) in 1997 and 1998. The results from a survey of existing datasets, combined with recommendations from a National health information system South Africa (NHIS/SA) working group, resulted in a national Essential Dataset for Public health care clinics, being adopted by the National health information system South Africa (NHIS/SA) in April 1999. The Essential Datasets (EDS) for Primary Health Care is still in use and contains 20 compulsory and 18 optional items. All nine provinces have during the last three years developed their own Essential Datasets for both Primary Health Care and hospitals. Almost all provinces are also currently using or are about to implement version 2 of their Essential Datasets(EDS), having revised the dataset after gaining experience on what is useful or not or after getting new stakeholders (Braa *et al.*, 2004:348).

3.12 SUMMARY

This chapter provides a historical background of South Africa's national as well as the provincial health care structure. The Gauteng Health Department's demographic profile, vision and mission, values as well as the department's structure is discussed. The strategic goals and objectives of the Gauteng Department of Health, the categories of hospitals and their services offered are also mentioned. A historical background of Kopanong Hospital is provided with the causal factors that have led to the study. The chapter is concluded with the present situation in Kopanong Hospital regarding a hospital information system and the use of computers.

CHAPTER 4

RESULTS OF THE EMPIRICAL STUDY

4.1 INTRODUCTION

The development and design of a questionnaire to collect data for the empirical study is of vital importance. In this chapter the development, design and the structure of the questionnaire for the empirical study as well as the data gathering process will be discussed. The results of the empirical study of the five different sections will be presented and discussed from higher to lower values in each section.

4.2 GATHERING OF DATA

A comprehensive questionnaire was designed to evaluate five sections with 42 questions on the basis of a seven-point Likert scale. The target population of this research was the top management, middle management and junior management of Kopanong Hospital. The techniques used to distribute and complete the questionnaires include: distribution of questionnaires by hand and followed up by telephone calls. Throughout the data collection process a major challenge was to persuade all the staff members involved to complete the questionnaire.

Each questionnaire was sent with a cover letter that guaranteed the confidentiality of the respondents' data, as well as a return envelope in order to make it as easy as possible for respondents to take part in the research. Employees were requested to place the completed questionnaires in the Hospital information postbox in the registry department. Questionnaires were numbered from one to forty-one in order to keep track of the respondents. Overall, 41 questionnaires were handed out and 37 usable questionnaires were received back.

The data was statistically analysed by the Statistical Consultation Service of the North-West University. The arithmetic mean and standard deviation for each question was determined.

4.3 RESULTS AND DISCUSSION

4.3.1 Section 1: Biographical information of respondents

The results of section 1 of the questionnaire are presented in this section. Refer to Appendix 1 for the detailed questionnaire.

GENERAL INFORMATION-AGE

In table 4.1 the age groups are presented. A total of 37 questionnaires could be employed for analysis.

Table 4.1: Age groups of respondents

Age group (years)	Frequency	Percent (%)
< 29	6	16
30-39	10	27
40-49	15	41
50-59	6	16
60+	0	0
Total (n)	37	100

The majority of the respondents were between the ages of 40-49 (41 percent), 16 percent were under the age of 29, 27 percent were between 30 to 39 years old, and 16 percent were between 50 to 59 years old. 43 percent of respondents are below the age of 40, which will minimize the resistant to change.

MANAGEMENT LEVEL

Table 4.2 illustrates the management level of the participating managers.

Table 4.2: Management levels of respondents

Management level	Frequency	Percent (%)
Top management	4	11
Middle management	12	32
Junior management	20	54
Total (n)	37	100

A total of 54 percent of the respondents are on a junior management level, 32 percent were in middle management and 11 percent were in a top management position. This indicates an ideal distribution of the management levels in driving the change management process.

COMPUTER EXPERIENCE

The level of computer experience of the respondents is presented in table 4.3.

Table 4.3: Level of computer experience

Experience	Frequency	Percent %
No experience	7	18.9
Limited experience	17	45.9
Experienced	13	35.1
Total (n)	37	100

A total of 45.9 percent of the respondents have limited computer experience, 35.1 percent have computer experience and 18.9 percent have no experience at all.

ACCESS TO A COMPUTER

Table 4.4 presents the current access to a computer by the respondents.

Table 4.4: Access to a computer

Access to computers	Frequency	Percent %
No access	9	24.3
Limited access	4	10.8
Direct access	24	64.9
Total (n)	37	100

Overall, 64.9 percent of the respondents had direct access, 10.8 percent had limited access, while 24.3 percent had no access at all.

ATTITUDE TOWARDS COMPUTERISATION

Table 4.5 presents the attitudes of the respondents towards a computer.

Table 4.5: Attitude towards a computer

Attitude	Frequency	Percent %
Totally unnecessary	0	0
Not sure	1	2.7
Important	16	43.2
Critically important	20	54.1
Total n=	37	100

A total of 37 questionnaires were gathered and 54.1 percent of the respondents indicated that they found computerization critically important, 43.2 percent found it important and 2.7 percent were not sure.

4.3.2 Section 2: The need of a computer in your department

In this section, the respondents had to indicate their perception of the need of computers in their respective departments. The results are subsequently presented from the highest to the lowest ranked questions (See table 4.6). Refer to Appendix 1 for a detailed layout of items.

The eight highest ranked questions:

The eight questions, which were evaluated the highest, are subsequently illustrated from the highest to the lowest arithmetic mean value: Having a computer program in the department in helping to create a monthly budget (Question 9: \bar{x} =6.56); To have admission and discharges scanned into the computer as they happen (Question 12: \bar{x} =6.31); To have a daily disease profile in a department (Question 5: \bar{x} =6.29); To be able to detect immediately any assets leaving the department on the computer (Question 10: \bar{x} =6.29); To have different departments interlinked with each other (Question 14: \bar{x} =6.28); The admission department should be able to trace patient information via SARS or the Department of Internal affairs, for validation and to increase revenue of Kopanong Hospital (Question 15: \bar{x} =6.2); To have any stock received in my

department scanned into my computer for daily and monthly control (Question 8: \bar{x} =6.17); and To have a daily and monthly statement of admissions/discharges/deaths/transfers in-and-out, absconding, refusal of hospital treatment and day patients (Question 3: \bar{x} =6.11).

Table 4.6: The need of a computer in the different departments

Item	Question	n	Mean	Standard deviation
Q2.9	Having a computer program in the department in helping to create a monthly budget.	34	6.56	0.66
Q2.12	To have admission and discharges scanned into the computer as they happen.	35	6.31	1.183
Q2.5	To have a daily disease profile in a department.	35	6.29	0.987
Q2.10	To be able to detect immediately any assets leaving the department on the computer.	35	6.29	0.987
Q2.14	To have different departments interlinked with each other	36	6.28	0.944
Q2.15	The admission department should be able to trace patient information via SARS or the Department of Internal affairs, for validation and to increase revenue of Kopanong Hospital.	35	6.2	1.53
Q2.8	To have any stock received in my department scanned into my computer for daily and monthly control.	35	6.17	1.175
Q2.3	To have a daily and monthly statement of admissions/discharges/deaths/transfers in-and-out, absconding, refusal of hospital treatment and day patients.	35	6.11	1.051
Q2.13	To have patients identified with an identification band which is linked to the computer	35	6.09	1.597
Q2.11	To be able to see on my computer if a patient is leaving the department and locate his/her position.	35	6.03	1.403
Q2.4	To have the daily and monthly inpatient days calculated automatically.	35	6	1.372
Q2.7	To plan my daily activities on the computer, e.g. staff allocations, monthly change lists, leave and sick leave.	35	5.91	1.269
Q2.1	To have the daily and monthly bed occupancy rate calculated automatically by the program.	35	5.77	1.61
Q2.16	To be able to call up data from my computer from a specific date and time to make informed decisions.	36	5.72	0.741
Q2.2	To have the daily and monthly average length of stay calculated automatically by the program.	35	5.71	1.601
Q2.6	To have the computer program calculate the medication doses automatically.	33	5.67	1.451

The eight lowest ranked questions:

The eight questions, which were evaluated the lowest, are subsequently illustrated from the highest to the lowest arithmetic mean value: To have patients identified with an identification band which is linked to the computer (Question 13: \bar{x} =6.09); To be able to see on my computer if a patient is leaving the department and locate his/her position (Question 11: \bar{x} =6.03); To have the daily and monthly inpatient days calculated automatically, (Factor 4: \bar{x} =6); To plan my daily activities on the computer, e.g. staff allocations, monthly change lists, leave and sick leave (Question 7: \bar{x} =5.91); To have the daily and monthly bed occupancy rate calculated automatically by the program (Question 1: \bar{x} =5.77); To be able to call up data from my computer from a specific date and time to make informed decisions, (Question 16: \bar{x} =5.72); To have the daily and monthly average length of stay calculated automatically by the program (Question 2: \bar{x} =5.71); and To have the computer program calculate the medication doses automatically (Question 6: \bar{x} =5.67).

4.3.3 Section 3: The importance of management information

In table 4.7 the importance of management information in Kopanong Hospital is presented. The results are subsequently presented from the highest to the lowest ranked questions.

Table 4.7: The importance of management information

Item	Question	n	Mean	Standard deviation
Q3.10	Hospital information should be verified before exported to another level.	35	6.4	0.847
Q3.9	The management of hospital information should meet the goals of the Department of Health.	35	6.4	0.847
Q3.8	Accuracy of hospital information.	35	6.26	0.95
Q3.4	Trustworthiness of hospital information.	35	6.11	0.9
Q3.7	Completeness of hospital information	35	6.09	1.197
Q3.3	Timeliness of hospital information.	34	6	0.953
Q3.5	Hospital information must be easy to access.	35	5.97	1.124
Q3.1	Relevancy of hospital information.	35	5.89	0.993
Q3.2	Flexibility in the use of hospital information.	34	5.82	1.114
Q3.6	The cost of hospital information must be low.	35	5.51	1.197

The respondents ranked the 10 questions as follows (subsequently presented from highest to the lowest arithmetic mean value): Hospital information should be verified before exported to another level (Question 10: \bar{x} =6.4); The management of hospital information should meet the goals of the Department of Health (Question 9: \bar{x} =6.4); Accuracy of hospital information (Question 8: \bar{x} =6.26); Trustworthiness of hospital information (Question 4: \bar{x} =6.11); Completeness of hospital information (Question 7: \bar{x} =6.09); Timeliness of hospital information (Question 3: \bar{x} =6); Hospital information must be easy to access (Question 5: \bar{x} =5.97); Relevancy of hospital information (Question 1: \bar{x} =5.89); Flexibility in the use of hospital information (Question 2: \bar{x} =5.82); and The cost of hospital information must be low (Question 6: \bar{x} =5.51).

4.3.4 Section 4: The importance of an integrated information system

In table 4.8 the importance of an integrated information system in Kopanong Hospital is illustrated.

Table 4.8: The importance of an integrated information system

Item	Question	n	Mean	Standard deviation
Q4.5	The system should be easy to use.	35	6.49	0.702
Q4.2	The system should have built-in security and privacy.	34	6.32	0.768
Q4.1	The system must be suitable for users to verify data.	35	6.23	0.69
Q4.3	The user should be able to recall vital signs from a patient when needed from the system	35	6.09	0.951
Q4.4	The system should have the ability to import and export data from different users and systems (e.g. finance, procurement).	35	6.03	0.785

The results are subsequently presented from the highest to the lowest ranked arithmetic mean value: The system should be easy to use (Question 5: \bar{x} =6.49); The system should have built-in security and privacy (Question 2: \bar{x} =6.32); The system must be suitable for users to verify data (Question 1: \bar{x} =6.23; The user should be able to recall vital signs from a patient when needed from the system (Question 3: \bar{x} =6.09); and The system should have the ability to import and export data from different users and systems (e.g. finance, procurement, pharmacy) (Question 4:

\bar{x} =6.03).

4.3.5 Section 5: The support that the user expects from the health information system unit

In table 4.9 the support that the user expects from the health information system unit in Kopanong Hospital is presented.

Table 4.9: The support that the user expects from the health information system unit

Item	Question	N	Mean	Standard deviation
Q5.4	There should be a back-up of all hospital information in the hospital information system unit.	35	6.57	0.739
Q5.1	To expect regular communication between the departments and the health information personnel for support.	34	6.29	0.836
Q5.2	There should be a supportive relationship between the hospital information system unit towards the user.	35	6.26	0.701
Q5.3	There should a reasonable response time of the hospital information system unit.	35	6.14	0.733

The results are subsequently presented from the highest to the lowest ranked arithmetic mean value: There should be a back-up of all hospital information in the hospital information system unit (Question 4: \bar{x} =6.57); To expect regular communication between the departments and the health information personnel for support (Question 1: \bar{x} =6.29); There should be a supportive relationship between the hospital information system unit towards the user (Question 2: \bar{x} =6.26); and There should a reasonable response time of the hospital information system unit (Question 3: \bar{x} =6.14).

4.4 SUMMARY

The study has formulated a measuring questionnaire in order to evaluate the present hospital information system of Kopanong Hospital. Highlights of the study are:

- Participants were extremely helpful in completing the questionnaire in their working time,

despite the severe staff shortage.

- The CEO of Kopanong Hospital was involved in developing the cover letter as well as a user friendly questionnaire.
- The registry department was so kind in receiving all the completed questionnaires for the author.

Highlights of the results are the following:

- The attitude of the participants towards computerisation was extremely positive (97.3%), although, 57 percent of the participants were above the age of 40. Participants do realize the need for computerisation, although access in the organisation is still limited and only 35.1 percent are computer experienced.
- Participants are in real need of a computer, because they realize that they will be able to do their jobs more effectively and efficiently. Participants would like to be interlinked internally as well as to external departments such as SARS. To have proper inventory control and a realistic picture of the daily activities such as bed occupancy rate or admissions was also rated high.
- Participants did realize the importance of management information as the following items/statements such as: verification of data before exported to another level, the fact that hospital information should meet the goals of the Gauteng Department of Health, and the accuracy, trustworthiness, completeness of hospital information, were rated as more important than the other statements.
- Participants were also very positive toward an integrated information system and rated the following items as high. They felt that the system should be easy to use, it should have built-in security and privacy, must be suitable for users to verify data, user should be able to recall vital signs from a patient when needed from the system and lastly the system should have the ability to import and export data from different users and systems.
- The final highlight of the study was that the user felt that there should be a back-up of all hospital information in the hospital information system unit as well as regular communication between the departments and the health information personnel for support; last, but not least a reasonable response time is expected of the hospital information system unit.

In refining and polishing the measuring questionnaire it will contribute to determine the state where the organisation is at present and where it wants to be in future. This should result in Kopanong Hospital having a sustainable and competitive position in the Sedibeng region. Kopanong Hospital should be able to deliver an effective and efficient low cost provider health service.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

In this final chapter conclusions and recommendations were made to Kopanong Hospital on its present hospital information system, which are paper based, but moving towards an electronic and integrated hospital information system in the near future.

The recommendations will be based on:

- The literature study that was done by the researcher.
- The results of the empirical study that was conducted within Kopanong Hospital.
- The author's knowledge and experience as hospital information system coordinator of Kopanong Hospital.

5.2 CONCLUSIONS

The arithmetic mean of the evaluation of the sections and questions by all staff members that participated in the survey indicates a general criterion against which the present hospital information system can be measured. An arithmetic mean of $x=6.12$ was computed. However, this criterion requires supplemental research to fine down the instrument as a measuring tool.

If one compares the sections and questions relatively with each other, the following conclusions may be drawn from this study.

5.2.1 General information

More than half (54.1%) of the staff members of Kopanong Hospital that participated in the

research study agreed that computerisation in the organisation is critically important in order to deliver an effective and efficient health service. The challenge is rather that only 64.9 percent have direct access to a computer and only 35.1 percent of the participants are computer literate. This indicates that it is rather difficult for staff members to practice and improve their computer skills as access is not freely available.

Another factor which is a great concern is having electronic information readily available when demanded, which could save a lot of time, especially with the present nursing staff shortage nationally. The organisation is currently too dependent on paperwork.

A total of 57 percent of the participants were above the age of 40 indicating that some change management theories might have to be applied.

5.2.2 The need for a computer in the various departments

The need for a computer in every department/office to make daily tasks easier was measured as very positive. Staff members in Kopanong Hospital have a positive attitude towards and realising the need for a computer to be more efficient at work. This is a positive starting point for the organisation, but funding ought to be made available.

A major concern, however, is that staff members do not yet realise the importance of having a hospital information system, and how to use this information in decision making. "To have the daily and monthly bed occupancy rate calculated automatically by the program" was ranked the lowest in this section. It seems that the participants are not really sure what to do with this information on a daily basis.

Participants felt that to have access to a computer in the department to create monthly budgets of their units, were more important. They also indicated that daily patient activities such as admissions and discharges should be captured electronically as they happen. Participants were overall interested to have more control of what is happening in their departments, e.g. asset control and inventory control. In order to be more effective and efficient, participants felt that it is

important to be interlinked to other departments, for ordering or cancellation of services.

5.2.3 The importance of management information

From the study it manifests that the importance of management information was evaluated positively, although participants were not too sure why the cost of information should be kept low. This could be due to the fact that the participants have not yet experienced an electronic information system where decisions can be made hands-on and not only at month end. Another factor could be that managers do not understand the meaning of an essential dataset. “Relevancy of hospital information” and “Flexibility in the use of hospital information”, were not seen as important as the other sub factors in this section. This could be due to the mere fact that managers do not realize yet the power of information to make informed decisions. Data verification before exported to another level was seen as most important and the fact that, through this process, the goals of the Gauteng Department of Health must be met.

5.2.4 The importance of an integrated information system

The importance of an integrated information system was evaluated high by the participants. Managers felt that the system should be user friendly and that the system should be able to verify data. The participants also felt strong about built-in security and privacy in the hospital information system, as the patients’ rights have to be protected and information of different management levels might be confidential. Again data verification was rated as important to have a realistic output of what is really happening in a specific department. The recalling of vital signs of patients and the inter linkage between different departments was important to the participants.

5.2.5 The support the user expects from the health information system unit

From the study it further manifests that the participants expect to be highly supported by the health information system unit and to have open communication channels at all times. Participants feel that there should be a back-up of all hospital information at all times. There should be a supportive relationship between the hospital information system unit and the end user

in order to have a sound information system.

It is the opinion of the author that this instrument should be used, but in an adjusted form once an electronic hospital information system has been implemented in Kopanong Hospital. The staff members will then be able to give more valuable inputs towards the research, as they will be more knowledgeable and experienced on electronic health information systems. They will also know what they really demand from such a system to run the health business with a sustainable competitive advantage in order to move from an emerging to a well developed global leader in health business.

An additional benefit that Kopanong Hospital can derive from undergoing the diagnosis is that by filling out the questionnaire they were given the opportunity to air their opinions about aspects that are otherwise usually ignored or simply not discussed, but are most important for the current and the future of the organisation. The instrument also ignited a new interest and consciousness amongst the participants of Kopanong Hospital. For the organisation as a whole, this instrument can also benefit to highlight the resource strength and show where to improve on the opportunities and weaknesses.

5.3 RECOMMENDATIONS

General recommendations will be given supported with the purpose, the responsible person as well as the time frame.

Action	Purpose	Responsible person	Target date
The implementation of a needs analysis on the updating of computers and peripherals	<ul style="list-style-type: none"> • To be able to establish the required equipment. • To prevent duplication. • To establish inventory hands-on. 	Network technician	Done November 2007
The appointment of a network technician	<ul style="list-style-type: none"> • To have network support in the organisation. • In-service training on network issues. • Prevention and monitoring of malicious software. • The installation of new network structure and maintenance thereof. • Repair 	Chief Executive Officer	January 2008
The creation of a hospital information system project team	<ul style="list-style-type: none"> • Analysis and analysis of hospital data. • Advising the Chief Executive Officer. • Verification of data. • Making informed management decisions to benefit the organisation. 	Hospital information system coordinator	Done February 2006

Action	Purpose	Responsible person	Target date
The availability of funding for computer equipment	<ul style="list-style-type: none"> • Create more access points. • Establishing an effective and efficient hospital information system. • Enhance the use of computers. 	Assistant-director finance	31 March 2008
Installation of an electronic hospital information system with standardised provincial programs	<ul style="list-style-type: none"> • Having timely and reliable information. • Following trends and patterns of information. • Establish a more effective and efficient health service. • Ensure better inventory and asset control, as well as patient movements. • Informed decision making 	Head of Gauteng Department of Health	Pilot study of selected hospitals in Gauteng to be finished March 2008.
Making internet and e-mail available to all departments	<ul style="list-style-type: none"> • Ensure effective and efficient flow of communication. • Encourage staff to research relevant topics. • Keeping staff abreast on newest technologies. 	Chief Executive Officer (approval) Network controller (implementation)	April 2008
Marketing the hospital information system unit and its benefits	<ul style="list-style-type: none"> • Implementing an electronic advertising system. • Marketing of unit during open days. • Availing of poster material. • Monthly feedback on data highlights at management meetings. 	Hospital information system coordinator in collaboration with Provincial office.	January 2008

Action	Purpose	Responsible person	Target date
The implementation of back-up, of all hospital data on server	<ul style="list-style-type: none"> • To reduce downtime. • Current data reliable and save. 	Network controller	April 2008
The implementation of a needs analysis on computer training, then followed by training sessions	<ul style="list-style-type: none"> • More effective and efficient health service. 	Training officer	January 2008
The implementation of hospital information training	<ul style="list-style-type: none"> • More accurate and timely information. • The encouragement of informed decision making. • Encouragement of analytical and innovative thinking. 	Hospital information system coordinator	Ongoing
The implementation of a reward and recognition system on targets achieved	<ul style="list-style-type: none"> • Create a positive motivational climate. • Encourage staff to go the extra mile. 	Hospital information system coordinator	April 2008
The implementation of monthly feedback on unit data to unit managers	<ul style="list-style-type: none"> • Informed and empowered managers. • More accurate and timely information. 	Hospital information system coordinator	January 2008
Ongoing training of hospital information system coordinator	<ul style="list-style-type: none"> • Better support, service and training to end user. • Employees to be on frontline of newest technology. 	Chief Executive Officer and training officer	Ongoing
Quarterly bosberaad for monitoring and evaluation	<ul style="list-style-type: none"> • Exchanging of ideas. • Improvement of the use of computers. • Positive competition between units. 	Chief Executive Officer	Quarterly

Action	Purpose	Responsible person	Target date
Change management	<ul style="list-style-type: none"> Make employees positive towards computerisation and technology. 	Hospital information system coordinator in collaboration with top management	Ongoing

5.4 SUMMARY

Recommendations were made for the successful development and implementation of a hospital information system and the use of computers in Kopanong Hospital. From the study it is clear that the use of computers has to be encouraged to collect data electronically into a hospital information system for the organisation to be able to compete as a leader in the health business globally as well as in the Sedibeng region.

The conclusion can thus be made that the set objectives have been met. The author is of the opinion that if the recommendations are implemented in Kopanong Hospital, it will lead to a successful future in hospital information and decision making. Kopanong Hospital could become the leader in health information and gain sustainable competitive advantage amongst other role players.

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ANNEXURE 1: QUESTIONNAIRE

Purpose of the questionnaire

The purpose of this survey is to examine the need of an electronic health information system and the use of computers in Kopanong Hospital. According to Shortliffe and Perrault (2001:329), a health information system is an integrated system designed to manage the administrative, financial and clinical aspects of a hospital.

You are invited as a prospective participant to complete this questionnaire.

Prospective participants are requested to focus on the following aspects:

- Participation in the completion of this questionnaire is voluntary and anonymous. To complete this questionnaire should not take longer than thirty (30) minutes.
- Please use a black pen to complete the questionnaire.
- The researcher strives to maintain absolute confidentiality and anonymity and therefore encourages participants to answer this questionnaire with honesty.

Outlay of the questionnaire

Section 1: General information about the participant.

Section 2: The need of a computer in your department/unit.

Section 3: The importance of management information.

Section 4: The importance of an integrated information system.

Section 5: The support the user expects from the health information system unit.

Thank you kindly for completing this questionnaire .Your answers and comments are valued. After completion place the questionnaire in the hospital information system box in the registry department.

Section 1: General information about you

Indicate with a cross (X) the answer of your choice.

1. What is your age? _____

2. In what post level are you?

Top management	<input type="checkbox"/>
Middle management	<input type="checkbox"/>
Junior management	<input type="checkbox"/>

3. What experience do you have in computers?

No previous experience	<input type="checkbox"/>
Limited experience	<input type="checkbox"/>
Experienced	<input type="checkbox"/>

4. Do you have easy access to a computer?

No access	<input type="checkbox"/>
Limited access	<input type="checkbox"/>
Direct access	<input type="checkbox"/>

5. What is your attitude towards computerisation?

Totally unnecessary	<input type="checkbox"/>
Not sure	<input type="checkbox"/>
Important	<input type="checkbox"/>
Critically important	<input type="checkbox"/>

Section 2: The need of a computer in your department

Please tell us whether you think a computer is important in your department/office to make your daily tasks easier. Indicate clearly between less and more important. Indicate with a cross (X) the answer of your choice.

Not important **Not sure** **Important** **Critically important**

1	2	3	4	5	6	7
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1. To have the daily and monthly **bed occupancy rate** calculated automatically by the program.

1	2	3	4	5	6	7
---	---	---	---	---	---	---

2. To have the daily and monthly average **length of stay** calculated automatically by the program.

1	2	3	4	5	6	7
---	---	---	---	---	---	---

3. To have a daily and monthly statement of **admissions/discharges/deaths/transfers in-and-out, absconding, refusal of hospital treatment and day patients.**

1	2	3	4	5	6	7
---	---	---	---	---	---	---

4. To have the daily and monthly **inpatient days** calculated automatically.

1	2	3	4	5	6	7
---	---	---	---	---	---	---

5. To have a daily **disease profile** of my department/s.

1	2	3	4	5	6	7
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6. To have the computer program calculate the **medication doses** automatically.

1	2	3	4	5	6	7
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7. I would like to plan my **daily activities** on the computer, e.g. staff allocations, monthly change lists, leave and sick leave.

1	2	3	4	5	6	7
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8. To have any **stock received** in my department scanned into my computer for daily and monthly control.

1	2	3	4	5	6	7
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9. To have the computer program help me in creating a **monthly budget** of my department/s.

1	2	3	4	5	6	7
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10. To be able to **detect any asset leaving my department/s** on my computer immediately as it happens.

1	2	3	4	5	6	7
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11. To be able to see on my computer **if a patient is leaving the department** and **locate** his/her position.

1	2	3	4	5	6	7
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12. To have **admissions and discharges** scanned into the computer as they happen.

1	2	3	4	5	6	7
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13. To have **patients identified** with an identification band which is linked to the computer.

1	2	3	4	5	6	7
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14. To have different departments **interlinked** (e.g. ordering of meals, medication, or cancellation of services), to make my daily tasks easier.

1	2	3	4	5	6	7
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15. The admission department should be able to **trace patient information** via SARS or the Department of Internal affairs, for validation and to increase revenue of Kopanong Hospital.

1	2	3	4	5	6	7
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16. To be able to **call up data** from my computer from a specific date and time to make informed decisions.

1	2	3	4	5	6	7
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17. Mention other reasons why you would like to have a computer in your department/office.

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Section 3: The importance of management information

Please tell us whether you think that information is important to manage your department/office to make your daily tasks easier. Indicate clearly between less and more important. Indicate with a cross (X) the answer of your choice.

Of no importance	Not very important	Not important	Not sure	Somewhat important	Very important	Critically important
1	2	3	4	5	6	7

1. Relevancy of hospital information.

1	2	3	4	5	6	7
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2. Flexibility in the use of hospital information.

1	2	3	4	5	6	7
---	---	---	---	---	---	---

3. Timeliness of hospital information.

1	2	3	4	5	6	7
---	---	---	---	---	---	---

4. Trustworthiness of hospital information.

1	2	3	4	5	6	7
---	---	---	---	---	---	---

5. Hospital information must be easy to access.

1	2	3	4	5	6	7
---	---	---	---	---	---	---

6. The cost of hospital information must be low.

1	2	3	4	5	6	7
---	---	---	---	---	---	---

7. Completeness of hospital information.

1	2	3	4	5	6	7
---	---	---	---	---	---	---

8. Accuracy of hospital information.

1	2	3	4	5	6	7
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9. The management of hospital information should meet the goals of the Department of Health.

1	2	3	4	5	6	7
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10. Hospital information should be verified before exported to another level.

1	2	3	4	5	6	7
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Section 4: The importance of an integrated information system

Please tell us whether you think that an integrated information system is important to manage your department/organisation to have quality of data. Indicate clearly between less and more important. Indicate with a cross (X) the answer of your choice.

Of no importance	Not very important	Not important	Not sure	Somewhat important	Very important	Critically important
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1	2	3	4	5	6	7
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1. The system must be suitable for users to verify data.

1	2	3	4	5	6	7
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2. The system should have built-in security and privacy.

1	2	3	4	5	6	7
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3. The user should be able to recall vital signs from a patient when needed from the system.

1	2	3	4	5	6	7
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4. The system should have the ability to import and export data from different users and systems (e.g. finance, procurement, pharmacy).

1	2	3	4	5	6	7
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5. The system should be easy to use.

1	2	3	4	5	6	7
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Section 5: The support that the user expects from the health information system unit

Indicate in this section the supporting service you expect from the health information system unit. Indicate with a cross (X) the answer of your choice. If you have any suggestions how this service should be delivered, please indicate in question 5.

Of no importance **Not very important** **Not important** **Not sure** **Somewhat important** **Very important** **Critically important**

1	2	3	4	5	6	7
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1. I expect regular communication between the departments and the health information personnel for support.

1	2	3	4	5	6	7
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2. There should be a supportive relationship between the hospital information system unit towards the user.

1	2	3	4	5	6	7
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3. There should a reasonable response time of the hospital information system unit.

1	2	3	4	5	6	7
---	---	---	---	---	---	---

4. There should be a back-up of all hospital information in the hospital information system unit.

1	2	3	4	5	6	7
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5. How would you better the function of the hospital information system unit?

Give your inputs.

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THANK YOU FOR YOUR TIME