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Understanding Lack of Full Implementation of ICT systems;
Case study of the Integrated Patient Management System at
the National Health Laboratory

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Statement of Declaration

The work in this dissertation was completed by the author at the University of Botswana between August 2014 and May 2015. It is original work except where due reference is made and neither been nor will be submitted for the award of any other University.

Signed: ....

Date: ....

Acknowledgment

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To all the participants that took part in this study, this dissertation would not have been possible without your input. Thank you all for taking time out of your busy schedules to be part of this study and I hope the findings of this study will contribute in some way to make your work routine more manageable with the ultimate aim of improving healthcare in Botswana.

To my fellow colleagues, thank you all for your understanding, encouragement and support during my studies. I could not have done it without you.

Finally to my immediate family; my parents and sister, you all have been my anchor throughout my studies and without your love, encouragement and support, I would not be here today. Thank you.

Dedication

I would like to dedicate this thesis to my immediate family; my father, mother and sister who have always been there for me from the moment they encouraged me to apply for this course. It has been quite a challenging but worthwhile course which has helped me grow both professionally and personally. This dissertation is dedicated to them.

Abstract

As part of the e-Health strategy in 2004, The Government of Botswana introduced the Integrated Patient Management System (IPMS) designed to link all public health facilities by 2010 and improve patient management. However this objective was not reached and challenges have been observed.

Using a case study at the National Health Laboratory, the main referral laboratory in Botswana, this study sought to identify the causes of the lack of full implementation. The site was selected as not all sections of the laboratory have IPMS implemented. Participants from two sections of the laboratory, namely the Microbiology and Chemistry sections, were interviewed to obtain data.

From this study, it was observed that all participants noted a high frequency of system downtime and a need to improve the infrastructure of IPMS to better serve the facilities. It was noted that from the Microbiology section, IPMS did not meet the scope of requirements needed for their daily work routine whilst the Chemistry section cited a lack of standardised training and retraining schedule on IPMS.

It is hoped that the results of the study will be used to conduct further studies at other public health facilities to identify similarities and differences to those observed at the National Health Laboratory with the goal of improving overall patient care in Botswana.

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List of Acronyms

BHPC – Botswana Health Professions Council

HIV/AIDS - Human Immunodeficiency Virus / Acquired Immune Deficiency Syndrome

ICT - Information and Communication Technology

IPMS - Integrated Patient Management System

NACA - National AIDS Coordinating Agency

CHAPTER 1: INTRODUCTION

1.1 Introduction

This chapter introduces the dissertation and include the background of the study, brief literature review and the problem statement. From the literature review that will be expanded in Chapter 2, the chapter describes the key research question to ask, together with the aims and objectives, what the study aims to achieve.

1.2 Background to the Study

Botswana is an upper middle income Southern African country that has been challenged with the HIV/AIDS pandemic. Despite a population of just over 2 million, according to the National AIDS Coordinating Agency (NACA), the prevalence rate of HIV/AIDS in the country is 18.5% amongst people aged 18 and above with an incidence rate of 1.35%, one of the highest in the world (NACA, 2014).

This combined with the low proportion of healthcare expenditure and human capital has brought about challenges in the healthcare system in the country as compared to countries with similar income levels such as Turkey and Mexico (NACA, 2014). The human resource system in Botswana is also limited with 30 doctors and 282 nurses per 100,000 people according to the 2004 (Botswana's National ICT Policy 2004, 2005). In South Africa, which shares similar income and socioeconomic indicators to that of Botswana, there are 56 doctors and 471 nurses per 100,000 patients (Botswana's National ICT Policy 2004, 2005). According to Nkomazana *et al*, (2014),

there were 1,820 doctors, 9,297 nurses and 296 dentists registered with the Botswana Health Professions Council (BHPC) as at 2014. This gives a density of 4 doctors per 10,000 people and 42 nurses per 10,000 people. The workers are also mostly expatriate based creating a severe local skills shortage. For example, doctors who are Botswana citizens account for only 21% of the total doctors in the country (Nkomazana *et al.*, 2014).

The current healthcare system in Botswana is paper based consisting of personal and medical patient data which are usually kept at individual district level hospitals and laboratories (Bussmann *et al.*, 2006). The results of all tests are also paper based. Although this has been highly praised in the Botswana context, challenges have also been observed (Bussmann et al., 2006).

The public health system is decentralised and the flow of patients is through a referral system that starts with the mobile health posts all up to referral hospitals. Figure 1 describes the hierarchy of the health system in Botswana from the mobile health posts to the National Health Laboratory whose role is to support the public healthcare facilities and provide specialised testing to all peripheral facilities.

Figure 1: Diagrammatic Representation of the Levels of Healthcare in Botswana.
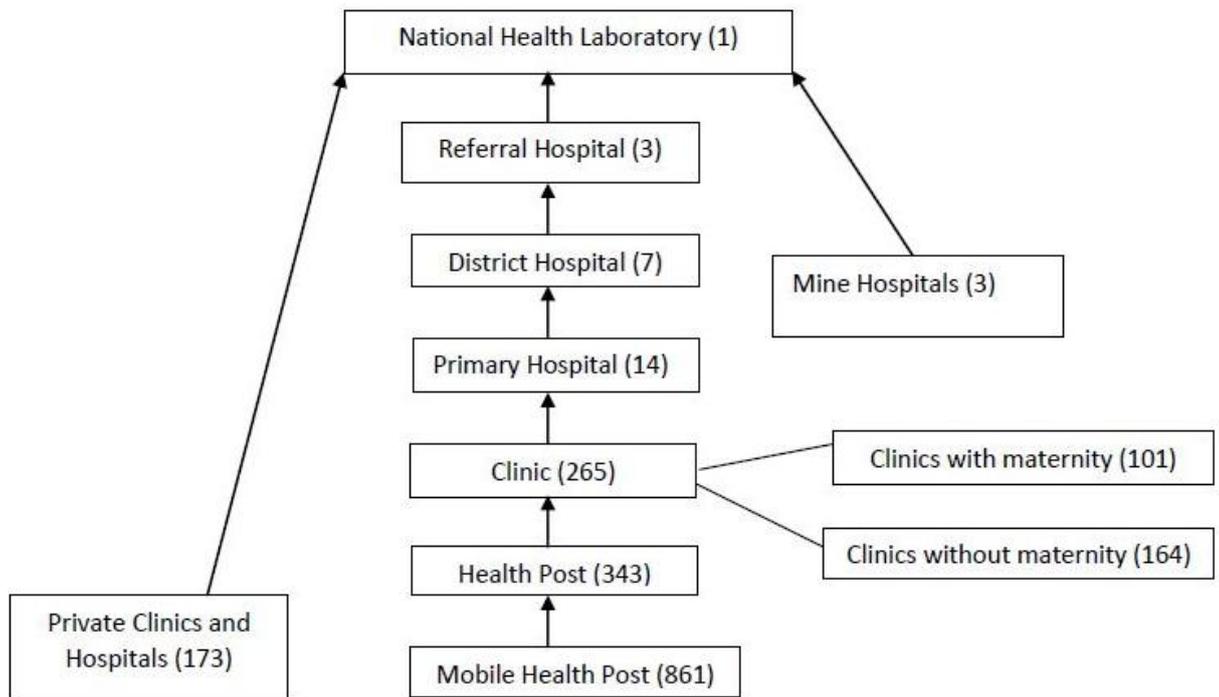
Source: Botswana Ministry Of Health Integrated Health Service Plan (IHSP), 2012; Nkomazana *et.al.,*(2014).

Note: Number in brackets indicates the number each facility countrywide.

The structure of the healthcare system consists of private, public and traditional medicinal care. A majority of the healthcare system is controlled by the public health system that currently has 98% coverage. The Government of Botswana, through the Ministry of Health is mandated to operate and manage the public healthcare system. Mobile health posts are provided to communities that are more than 8 kilometres (km) away from a health facility and were created to account for 5% of the population that live further than 8km from a health facility (WHO, 2008).

In terms of laboratories within the public health system, clinics provide routine and simple testing facilities with more specialised testing referred to primary, district or

referral hospitals. The National Health Laboratory as shown in Figure 1 sits at the top of laboratory testing as they provide specialised testing of samples that cannot be provided at the referral hospital level or below. The National Health Laboratory can also provide specialised testing for private clinics and hospitals especially in matters of public health interest such as outbreaks (WHO, 2008).

1.3 Justification of the study

Given the large geographic area of Botswana, the duplication of patient data, combined with the high risk of misplacing and losing paper results significantly increases the turnaround time of acquiring a patient diagnosis. Another disadvantage is the large amounts of space required to store patient information in a paper based system that can be more effectively used by acquiring healthcare equipment.

The implementation of Highly Active Anti Retroviral Therapy (HAART) in Botswana as a response to the HIV/AIDS epidemic found that given the high numbers of patients enrolled in the program, it would be challenging to record the relevant information using a paper based system (Bussmann *et al.*, 2006). As a result, there was a need to develop a computer based system that would capture, track and monitor patient indicators (such as drug adherence) on a centralised network. The IPMS was introduced in the year 2009, to address these issues. But as at January 2014, the system had only been implemented to a limited extent in Botswana's health sector. In the National laboratory for example, the system has been implemented in the microbiology section but not in the chemistry section. These observations have led to the question of why the system has not been fully

implemented despite its obvious benefits. Existing literature and conventional knowledge points to possible reasons such as poor change management (Lorenzi & Riley, 1999), resistance to change Wadell & Sohal (1998), inadequate supporting infrastructure and high implementation costs (Piotti & Macome, 2007). However, it cannot be immediately assumed that these factors can be used to explain the observed situation at the National Health Laboratory for various reasons.

Firstly studies that have been conducted to establish factors influencing the lack of full implementation or challenges to the implementation of ICT related change have mostly been conducted in the developed world for example, (Gichoya, 2005). Botswana being a developing country faces environmental, economic and other factors that are different from those of the developed countries. Insights from contingency theory framework (e.g., Otley, 1980) would have it that organizational systems are products of environmental factors. The successful implementation of ICT systems in organizations is therefore likely to be influenced by the environment within which it is implemented.

Secondly, social theories would also posit that the success of any organizational system is not independent of the perceptions of the organizational actors. Hofstede (1984, 1991) for example argues that culture is very influential in organizational actors' perceptions. This paper thus argues that since the culture in Botswana is likely to be different from the one prevailing in Countries where similar studies were conducted, it remains a possibility that the results in Botswana will be different. Other theories, such as for example social construction theory (Berger and Luckman, 1967) also support this view.

Thirdly, the system being implemented was not developed in Botswana specifically to address Botswana's problems but is a more generic one. This factor creates the likelihood of a mismatch between the system and the organization which may further lead to implementation challenges.

There is therefore a need to conduct a Botswana based study in order to generate insights into why the system has not been fully implemented at the National Health Laboratory.

1.4 Brief Literature Review

ICT in developed countries were quick to adopt patient management systems in their healthcare systems but in developing countries, the uptake rate has been very slow (Suter, Oelke, & Adair, 2009). Many reasons can be attributed to this such as the constantly changing financial and political conditions that make it very difficult to invest in the necessary infrastructure in the medium to long term (Tachinardi, Guiterrez, & Moura, 1994). Therefore in developing countries, the implementation of patient management systems has the potential to reduce the inefficiencies observed in healthcare provision.

As a result of the challenges faced in the healthcare system, The Government of Botswana has developed the National ICT Policy in 2004 that also included an e-Health Policy based on the National Health Strategy of 2004. These policies fit into the objectives of Botswana Vision 2016 Goals of a compassionate, just and caring nation (Botswana's National ICT Policy, 2005).

One of the major goals of the e-Health policy was to develop and implement an Integrated Patient Management System (IPMS) that was to link all health facilities in the country into one network by giving each patient a unique Identification code to improve healthcare service and provision (Botswana's National ICT Policy, 2005). IPMS would together with the Botswana ICT Policy create a platform to incorporate ICT based systems in public healthcare provision country wide.

The cost of this implementation was estimated to be P120 Million and was planned to be fully operational by the year 2010 (Botswana's National ICT Policy, 2005). One factor that can be attributed to the lack of full integration of IPMS is a perceived negative attitude to the system that has created a resistance to change of IPMS against the paper based system (Hatch & Cunliffe, 2006). The introduction of ICT in the healthcare industry and its perceived ease of recording and storing information over the paper based system has made healthcare workers seem susceptible to possible job losses. Efforts are therefore made to block the implementation of an ICT based change as workers may feel their role within the organisation will become obsolete (Lorenzi & Riley, 1999).

1.5 Problem Statement

Although IPMS has been implemented in the primary hospitals, it has not been fully integrated by all facilities within the public healthcare system such as laboratories which are still utilising the paper based method of receiving and dispatching of results thus creating inefficiencies that would have otherwise been absent by having a fully

integrated patient management system. However, without any evidence, it is difficult to explain the lack of uptake of the IPMS in other sections of the health sector.

This study will aim to investigate the reasons why IPMS has not been fully integrated using a case of the National Health Laboratory, the main referral laboratory in Botswana, as an example.

1.6 Key Research Question

This study will attempt to answer the question, "Why has IPMS not been fully implemented in all sections at the National Health Laboratory, the main referral testing facility in Botswana?" It is expected that based on the results and analysis of this question, recommendations can be made to better facilitate IPMS into all health facilities across Botswana.

1.7 Objectives of the Study

The aim of this study is to establish the factors contributing to the lack of full implementation of IPMS at the National Health Laboratory. Within this aim the objectives are the following;

- Identify the benefits and challenges facing scientists and technicians working with IPMS at the National Health Laboratory.

- Determine the level resistance of change has had in implementation of IPMS at the National Health Laboratory.

- Make recommendations on how to improve IPMS at the National Health Laboratory that will lead to full implementation.

1.8 Scope of study

The scope of this study would comprise of all health facilities in Botswana with an emphasis on the public healthcare system.

1.9 Structure of Dissertation

The structure of the following dissertation will comprise of five chapters. Chapter 1 will introduce the background of the study, a brief literature review and the expected knowledge gap that is to be filled as a result of the study. Chapter 2 will provide a critical review of the known literature in the subject matter. The methodology section will be covered in Chapter 3 that will illustrate the research design, data collection methods and how the data was analysed. The results of the data analysis and its interpretation related to the Literature review will be covered in Chapter 4. Chapter 5 will relate the results obtained in Chapter 4 to develop conclusions, recommendations and the direction future studies should undertake. This Chapter will also discuss directions for future research and the limitations of the study.

1.10 Conclusion

Chapter 1 provided a background to the demographics of Botswana and the main health challenges faced; in particular, the shortage of human resources in the field and the manual paper based system of reporting patient results.

To improve healthcare provision, the Government of Botswana implemented an ICT that would link all health facilities on a single network with the aim of full implementation by 2010. The chapter provided a brief literature review of some of the challenges faced by implementing an ICT system in healthcare provision and also described the key research question for the study, the objectives and the scope that the study can be applied to all health facilities in Botswana with particular emphasis on the public healthcare system.

CHAPTER 2: REVIEW OF RELATED LITERATURE

2.1 Introduction

Chapter 2 provides a critical review of the challenges faced in integrating ICT in healthcare systems. It will be divided by reviewing the literature on organisational change and the challenges faced in implementing and managing change. The chapter also looks at resistance to change and the main challenges of ICT based change in organisations with a particular emphasis in the healthcare sector. Finally Chapter 2 provides some practical examples of ICT related change in Africa that have been successful or have encountered some challenges and what can be learnt going forward when designing and implementing new systems.

2.2 Theoretical Framework

Quality healthcare provision is viewed by Governments as a high priority sector in improving the socio-economic status of a population (Soriyan *et. al.*, 1999). The introduction of ICT in the healthcare system is to allow for greater flexibility to change and reduce costs associated with healthcare as patient turn-around time is reduced (Caldwell, Chatman, O'Reilly III, Ormintson & Lapiz, 2008). ICT also eliminates the need for paper and its storage, thus saving valuable space which can be utilised directly towards healthcare provision.

2.2.1 Organisational Change and Change Management

As healthcare and technology continue to improve, the ability of an organisation to change and adapt is critical to its success. This highlights the need for a well integrated and efficient process of organisational change and change management. Organisational change defined by By (2005), is the process of continual organisational direction, structure and capabilities to meet the needs of both internal and external customers. The internal customers refer to the employees of the organisation while the external customer consists of the clients from which revenue is generated. Organisational change is used to resolve any current organisational crisis (By, 2005). In addition to this, majority of organisational change is usually discontinuous and reactive to external factors out of control of the organisations (Agocs, 1997; By, 2005; Wadell & Sohal, 1998).

In recent times, the speed and pace of organisational change has been much greater due to a more competitive business environment, globalisation and the pace of technological changes (By, 2005). Therefore, organisations need to become more open in accepting change as part of seeking competitive advantage and adapt to dynamic external environment (Agocs, 1997; Wadell & Sohal, 1998). The main effects of organisational change to the workers are mainly; threat of job security, loss of control in the work process and disruption of a normal routine. Human behavioural science has shown that even though humans may observe a long term benefit to a particular change, the short term benefits may result in the sabotage or slow uptake of the proposed change (Agocs, 1997; Dent & Goldberg, 1999).

The processes of organisational change and change management must therefore be carefully managed and include all parties to ensure a smooth process of implementation (Dent & Goldberg, 1999). The team dynamics before and during the process of organisational change will either facilitate or discourage the proposed organisational change. According to By (2005), up to 70% of all organisational change fails to be fully implemented. This is further supported by del Val & Fuentes (2003), with up to two thirds of all corporate change failing to be fully implemented. Apart from employees, organisations also resist change due to factors such as inertia, high capital and sunk costs in implementing change (del Val & Fuentes, 2003).

Organisational change is also perceived by workers as a way of top level managers to view their day to day activities and thus have more control (Lorenzi & Riley, 1999). This perception can then lead to workers severely restricting the process and in some cases, sabotage the entire process. Therefore, role of the management in the change is crucial to successfully implementing any change in an organisation (Lorenzi & Riley, 1999). Lorenzi & Riley (1999), also identified the most common factors for failure in organisational change including the lack of communication, existing organisational culture, poor training on the new system, technology challenges and poor leadership.

Change management is the process that occurs when an organisation moves towards it stated vision (Lorenzi & Riley, 1999). This process is continuous and can be triggered by a number of factors, one of which is technology. The process of change naturally brings about a resistance to change (Dent & Goldberg, 1999).

Wadell & Sohal (1998), define resistance to change in an organisation as an expression of reservation normally arising from a response or reaction to change.

2.2.2 Resistance to Change

Resistance to change of any new system is common within organisations. According to Lorenzi and Riley (1999), humans are naturally resistant to changes imposed on them, for example installing a software upgrade. Wadell & Sohal (1998), demonstrated resistance to change can be divided into two main factors; rational and non rational. Rational factors are attributed to differences of opinion between the employees' and managements' assessment of the desired change (Wadell & Sohal, 1998). Non-rational factors are usually based on factors that are solely based on employees' preferences or routine and not on the economic benefits of the change (Wadell & Sohal, 1998). An example of this is refusing to change office space simply because it differs from the normal work routine. In addition to this, political and management factors play a role in the level of resistance experienced by an organisation.

Resistance to change can also be described by a spectrum ranging from low scope that aims to improve a current working process with no change in the organisational structure to high scope that is more radical and requires a change of the working processes and organisational structure to seek competitive advantage (del Val & Fuentes, 2003). An existing organisational structure and culture may make it difficult for a worker to feel that they play a role within an organisation (Haines & Donald, 1998; Lorenzi & Riley, 1999). As a result, the worker may seek to acquire some

control on an existing system. Therefore, if there is a change in the existing system and the worker perceives they will have little to no control on the new system, efforts will be made to slow down the implementation due to the resistance to change experienced by the worker (Dent & Goldberg, 1999).

One of the methods to measure the levels of resistance in the implementation of a new system in an organisational setting is through action research (Haines & Donald, 1998). This entails the continuous measurements and assessments of current activities undertaken within an environment and developing ways of improving activities or solving any problems in a dynamic environment. Action research relies on individually evaluating all members involved in rendering the service.

The main reason for resistance observed in any organisation change is that it requires effort and time to learn. A majority of the workers may not want to be involved as they may view their time could be better spent at accomplishing other tasks. del Val & Fuentes (2003), demonstrated that the level of resistance to change is dependent on the level of employee participation in the planning and implementation of the intended change. The more the employees are heavily involved in the process of change, the lower the level of resistance to change will be experienced as employees feel they are in control of the process; as opposed to being forced to adopt the system from upper management (del Val & Fuentes, 2003). The managers also need to show the employees a high degree of competency in implementing and sustaining the change to minimise the level of scepticism (By, 2005).

Literature from Agocs (1997), has shown that resistance to change is a complex phenomenon as many factors are at play that are not as a result of human factors alone. There is little literature to demonstrate the role of other factors that, when included with human factors, prove the complexity of resistance to change.

2.2.3 ICT Based Challenges in Organisations

The typical organisational structure has been identified as a challenge towards the introduction of ICT related changes (Lucas, 2008). It is rigid in nature with little room for adaptability, a key component in the dynamic nature of ICT as technology continues to improve (Lucas, 2008). It was noted by Piotti & Macome (2007), that ICT implementation projects have a big influence on the organisational environment and existing workflow. During the process, little is done to change the organisation to complement the new system which contirbutes to the failure of many ICT triggered change (Wadell & Sohal, 1998). In the healthcare setting, change in healthcare systems especially towards ICT can be implemented in small teams or groups to minimise failure rates (Caldwell *et al.*, 2008).

Llutch (2011), cited the lack of literature available on healthcare workers and the impact organisational structure has on the time required to implement ICT based change. The same study showed that failure rate of such systems is between 5-20% attributed to technical factors such as a manufacturing defect. The majority of the failure of a full implementation is mainly due to socio-technical factors, implying a clash of roles between the workers and the system (Llutch, 2011; Piotti & Macome, 2007).

Lorenzi & Riley (1999) noted that as more powerful information systems are developed, more varied groups of individuals will interact and be involved in the process regardless of the sector the system plans to be implement. Healthcare is a complex organisation made up of various professionals (such as doctors, nurses, laboratory staff) and stakeholders (such as Governments, private healthcare, and medical insurance) with each having their own interests (Golden, 2006). Therefore, the ability for healthcare workers to provide the service and integrate ICT into their scope of duties is the key to success (Cramp & Carson, 2001; Caldwell *et al.*, 2008).

2.2.4 Potential of ICT Based Change in Healthcare

The potential advantages of ICT in the healthcare system include improved dissemination of public health information, harmonisation of information, better patient consultation in rural areas via tele-medicine, facilitation of research activities, enhanced monitoring of outbreaks and improved patient treatment turnaround time (Lucas, 2008). These advantages are particularly advantageous in developing countries, where there are large geographical areas to monitor, a high rural population and low numbers of health care workers compared to developed countries (Lucas, 2008; Soriyan *et al.*,1999).

The potential for ICT in the healthcare industry to improve service delivery and lower costs is high. However, there has been limited independent analysis on the existing systems to best integrate the necessary changes as technology advances (Lucas, 2008).

The growth of the ICT industry and development has been driven by the demand of the global market with the main customers in the developed countries. Whilst this may be advantageous to its continued potential and success, this creates a significant disadvantage for smaller markets and clients. In the developing world, this is a key disadvantage as developed countries have had experience in utilising ICT technology thus creating a 'digital divide' between the two groups of countries on both a cost base and level of innovation (Lucas, 2008; Llutch, 2011).

An example of this is that doctors in developed countries will be able to easily access a computer with high speed internet access and up to date medical information, commanding a small annual fee (Llutch, 2011; Lucas, 2008). In developing countries, this is seldom the case where the doctor would not be able to easily access a computer and earn significantly less than a doctor in a developed nation (Lucas, 2008).

2.2.5 Challenges of ICT Based Change in Healthcare in Africa

In Africa, ICT integration of healthcare systems has been slow primarily due to the lack of readily available and appropriate software packages on the market (Soriyan *et al.*, 1999). The packages are mainly suited to the European and American culture and standards of living which are different to that of Africa. As a result, a software package undergoes major modification which may render the process too expensive for governments in developing nations to implement. The long term solution to this problem is to develop locally developed of which there is little to no capacity to do so (Soriyan *et al.*, 1999).

It was also found that semi-obsolete ICT products which are approaching the end of their product life cycle are sold at a lower cost to developing nations, making them expensive to operate, maintain and replace in the long term (Piotti & Macome, 2007). Small scale success in ICT based organisational change, during a trial phase does not usually lead to long term benefits when systems are scaled up to regional or national level. Combined with cost overruns and poor implementation programs, these are major contributing factors to the poor implementation of ICT based changes in an organisation (Lucas, 2008).

Long term implementation and success is dependent on factors such as the robustness of the electronic equipment, availability of technical staff and adequate financial support for maintenance and upgrades of systems (Blantz, 2010; Lucas, 2008). These factors are not seen as major challenges in developed nations but are play a major role in the success or failure of an ICT implementation program and can be an obstacle in the implementation process.

The costs of implementation and sustainability of ICT systems in the healthcare sector is high, requiring long term capital outlay and support (Piotti & Macome, 2007). This can be difficult to source from governments in developing countries where resources are limited; also politically due the short–term planning of governments the full benefits will not be observed until after the government of the day have completed their term in office. According to Piotti & Macome (2007), the average healthcare expenditure per capita in Africa is between $4.60- $9.60, which is well below the $35-$40 WHO recommended minimum for quality healthcare provision. In many developing countries, meeting the WHO recommended minimum would mean

spending their annual budget on healthcare alone which would not be feasible (Lucas, 2008). Therefore, there is a need for external funding from donor organisations and the private sector to assist developing countries' governments, particularly in long term ICT implementation stages after successful trials (Lucas, 2008).

A typical example of the challenges facing the implementation of ICT in healthcare sector in the developing world is the SATELLIFE project piloted in Uganda, Kenya and Ghana as described by Lucas (2008). The project involved the use of Personal Digital Assistants (PDA) handed to health care workers connected directly to the Ministry of Health in Uganda through the existing mobile telephone network. The aim of the project is to encourage the rate of full completion of patient health forms and relay the information to the Ministry of Health in real time to improve health care delivery. The PDA created a 2-way communication network that allowed patient information and treatment information to be fed and relayed in real time to the Ministry. The project was initially trialled in two districts in Uganda with a planned roll out across the country. After the trial analysis, the percentage of completed forms increased to 100% from the national average of 63%. The users of the PDA also enjoyed a higher rate of job satisfaction compared to the existing system resulting in a higher morale and better service provision (Lucas, 2008).

A cost benefit analysis was performed and found that the project had a 25% greater benefit than the existing paper based method. However, the cost of personnel and equipment each was three times that of the existing system and the cellular costs incurred were twice that of the fuel costs needed to transport the forms to the Ministry

of Health headquarters. The Government therefore decided not to go ahead with the full implementation citing high sustainability costs (Lucas, 2008).

Another example is in South Africa when a private company started an urban centre ambulance care service to subscribed customers or clients in an affiliated medical heath scheme. Subscribed patients who were ill, are taken to an affiliated clinic and charged a flat fee of R42 per visit, where laboratory tests were conducted. Based on the results, a computerised clinical information system would devise a diagnosis and the best course of treatment required for the patient. The system relied on the health care workers following a strict adherence to the system that is able to track patient numbers, monitor drug dispensation and revenue streams. The benefit of the service was that staff costs on affiliated clinics were slashed by half when compared to a conventional small private clinic and patients were able to access a healthcare worker much faster (Lucas, 2008).

The main disadvantages of the service were that it selected areas where clients would be able to afford the service, leaving other areas to the government healthcare system thus creating an ethical challenge. A major disadvantage of the system was that due to the strict adherence of the system required to lower costs, healthcare workers, although skilled to treat the patient, felt de-skilling taking place therefore lowering the overall morale (Lucas, 2008).

2.3 Summary

Chapter 2 provided a critical review of challenges faced in implementing ICT related change in organisations. In order to seek competitive advantage, organisations need to constantly change to keep up with the external environment. The continuous innovation of ICT has accelerated the rate of organisational change in recent times. Therefore, change management is implemented to move the organisation towards the stated vision. The process of change management is likely to bring about resistance to change to both employees and the organisation. Most of the time, change management is unsuccessful due to factors such as existing organisational culture, poor communication and inadequate training. To the employee, the main reasons for rejecting organisational change are loss of control, threat of losing their jobs and disruption of a normal routine. Resistance to change is complex as it is involves human, political, external and organisational factors. Human behavioural studies have shown that humans prefer to work for short term benefit than long term benefits and can therefore work to delay or sabotage altogether the intended change.

CHAPTER 3: METHODOLOGY

3.1 Introduction

The Methodology section of this study is discussed that includes; the research approach taken, the relevant philosophy related to the study and how the data were collected, analysed and interpreted to make a final conclusion and recommendation.

3.2 Restatement of Research Question

This study will attempt to answer the question, "Why has IPMS not been fully implemented in all sections at the National Health Laboratory, the main referral testing facility in Botswana?" It is expected that based on the results and analysis of this question, recommendations can be made to better facilitate IPMS into all health facilities across Botswana.

3.3 Research Philosophy

For research to be conducted, it is important to understand the philosophy selected by the researcher. According to Blumberg, Cooper & Schindler (2011), there are two main research philosophies; positivism and interpretivism (Hatch & Cunliffe, 2006). These philosophies are based on the fundamentals of ontology and epistemology.

Ontology is concerned with the assumptions made about what we perceive as 'reality'. Ontology asks whether the reality we see is objective or subjective. As described by Hatch & Cunliffe (2006), examples include the daily activities of an adult. For example, when an individual writes a report, will they describe 'what' is really happening or what they 'think' is happening? Therefore ontology relates to how an individual views reality. If an individual views reality as a result of living through a particular experience or activity, they have subjectivist ontology whereas an individual, who views reality as independent of those who live in it, is said to have objectivist ontology.

Based on an individuals' background, culture, ideals and perceptions activities viewed by one to be objectivist may be viewed as subjectivist to another which creates conflicts among individuals. Therefore, amongst the research community, it is difficult to unanimously decide on which approach is the best for conducting research.

Blaike (1993) describes epistemology as 'the theory or science of the method or grounds of knowledge." It deals with ways of describing how an individual gains information on the nature of the world. The questions raised from epistemology allow for individuals to ask questions such as "How do humans generate knowledge" or "how to determine good from bad and what criteria will be used to analyse the reality." (Blumberg *et al.,* 2011).

According to Hatch & Cunliffe (2006), an individual can either have positivist or interpretivist epistemology. Positive epistemology assumes that research can be

conducted using scientific measurements whilst interpretive (or antipositivist) epistemology acquires information is gathered through the experiences of the individual in a particular environment (Hatch & Cunliffe, 2006).

Based on ontology and epistemology there are three main research paradigms that can be used to conduct research: Positivism, interpretivism and realism (that shares aspects of positivism and interpretivism).

Positivism is a research philosophy that is based from natural sciences with three basic principles as described by (Blumberg *et al.,* 2011);

- Research is value free
- The researcher is independent and takes the role of an objective analyst
- Social world exists externally and viewed objectively

The development of a theory begins by hypothesising fundamental laws. From the theory a prediction is made to test a particular observation with the aim of either supporting or rejecting the original hypothesis. As a result, positivism is focused on obtaining facts by directly observing an activity or experience and using quantitative methods where data is collected and analysed.

Interpretivism, however, assumes that the social world cannot be analysed or better understood by simply applying the principles of natural sciences. Therefore a different approach should be taken. Blumberg *et al.,* (2011) prescribe the following assumptions hold true for interpretivism;

- The social world is constructed and given meaning by people and

- Research is driven by interests

- Researcher is part of the observation.

Therefore, intrepretivism as opposed to positivism uses social constructs rather than fundamental laws from natural sciences to better understand the complexities of the social realities that exist in the world. Researchers with an interpretivist approach actively engage with participants to solve a specific problem or understand a particular phenomenon.

Realism combines both philosophies from interpretivism and positivism. Social sciences can utilise approaches from positivism to understand social behaviour and to better understand human behaviour.

Based on the three paradigms described above, the research study will therefore take an interpretivism approach as the data that will be obtained from the participants will be based on how the participants view the social world; in this case, their workplace. Based on the subjective realities of the participants, an interpretation will be developed that will be of benefit to the participants to solve their real life challenges faced in the environment.

3.4 Research Approach and Research Design

The research design selected was a case study. Yin (2009), described a case study as an "empirical inquiry that investigates a contemporary phenomenon within real-life

context, especially when the boundaries between phenomenon and context are not clearly evident" (p. 18). According to Yin (2009), there are three main drivers in selecting the research design; the type of research question, the extent of control the researcher has to behavioural events and the degree of focus on contemporary versus historical events.

The key research question asked in this study was "Why has IPMS not been fully implemented at the National Health Laboratory, the main referral testing facility in Botswana?" Questions with "How or "Why" are explanatory studies with the aim of understanding the links over a period of time compared to recording frequencies or incidents of a particular event. Case studies, therefore, are ideal when the researcher has no control over aspects of the area of study and also allows for the collection of characteristics that are specific to a particular setting (Yin, 2009). In this case, the researcher had no control over the staff behaviour to IPMS at the National Health Laboratory and also an objective of the study was to understand, within the organisational structure of the NHL, why IPMS has not been fully integrated.

To answer the research question for this study requires detailed information and case study design allows for this to be achieved (Stake, 1995). Another distinct advantage of case studies is they can be conducted on small sample sizes, such as the National Health Laboratory that had fewer than 6 members of staff per section at the time of data collection (Kaplan & Duchon, 1988).

The case study approach also allowed for direct observation and behaviour of the participants that gave further insight as to the processes taking place within the

organisational environment. This provided information that would have been missed using other research approaches (Stake, 1995; Yin, 2009).

Primary data was collected from interviews conducted with scientists and technicians working at the National Health Laboratory in the Microbiology and Chemistry sections in the form a of semi structured interview. An interview is a method of collecting primary data from a case study approach design that involved receiving an answer (Yin, 2009). The interview as a method of collecting data was advantageous as it focused primarily on the topic for the case study and also provided more insight that would otherwise have been missed by other primary data collection methods such as a questionnaire (Yin, 2009).

Interviews allowed both the researcher and participant to expand and elaborate on points discussed providing a better range of data for analysis (Yin, 2009). The questions asked to the participants were designed to meet the objectives of the study but followed an open ended and conversational format that allowed for follow-up questions or any source of information, necessary to meet the objectives of the study.

The research design selected was ideal to identify the specific challenges faced at the National Health Laboratory that forms the aim of the study. The research design was based on Markus (1981) that analysed the level of implementation progress of two departments within the same organisation.

The Chemistry section within the National Health Laboratory was selected as IPMS has been fully implemented and Microbiology section does not have IPMS. The responses were recorded to ensure as much information related to the study was analysed.

The study therefore based on previous studies and literature used case study approach to collect data given the lack of control of the participants, small sample size and the type of descriptive data required for analysis.

3.5 Research Methodology

3.5.1 Sample Population

The population of the study was scientists and technicians working at the National Health Laboratory. The scientists and technicians were the appropriate individuals to sample as they were end users of IPMS and formed a major section of individuals that were not integrated fully to the system within the public healthcare system.

3.5.2 Sample Size

A total of 6 participants from the National Health Laboratory took part in the study; 4 out of 5 Microbiology section and 2 out of 3 from the Chemistry section. One officer in the Chemistry declined to be part of the study and one officer in the Microbiology section was on leave at the time of data collection. The total number of officers in

Microbiology and Chemistry sections at the time the study was conducted was 5 and 3 respectively.

3.5.3 Pilot Data Collection

A pilot study was initially conducted to test the validity and reliability of the questions proposed determine participant interest and willingness to answer the questions after which, where necessary, the responses were analysed and applied to all the participants. The results of the pilot were used to shorten the duration of the interview for each participant.

3.5.4 Data Collection Tools

Data was collected from the participants in the form of a semi structured interview and recorded for analysis. A semi structured interview allowed for follow-up questions to be asked and gather more information based on the response of the participants (Bariball and While, 1994). The semi-structure interview format was selected as it allowed the participants to express their opinion freely. A dictaphone was utilised to record the interview from the participants for data analysis.

3.5.5 Data Analysis Methods

Primary data was individually analysed by identifying key words to determine similarities and differences between participants in the study. Each participants' response on the questions was tabulated to find key words used to gather results.

3.6 Reliability, Accuracy and Trustworthiness

All the data collected was conducted in good faith from both the researcher and participants to generate literature to better implement healthcare systems in Botswana and improve knowledge on the challenges being faced. The interviewer recorded observations throughout the interview to ensure the reliability of data. Furthermore, the questions posed to them were only shown prior to the interview with all interviews conducted on the same day to minimise the likelihood of any bias.

3.7 Ethical considerations

Permission was granted by the National Health Laboratory management to conduct the study and participants from Microbiology and Chemistry section were interviewed within two working days. Permission was also granted by the University Of Botswana to conduct this study. All the data obtained from this study was solely used for the purpose of generating knowledge in this study.

No patient or sample information was obtained nor used for the study. To ensure confidentiality, the participants were asked not to identify themselves and thus remained anonymous.

3.8 Summary

In summary, an explanatory research design was used to collect data from scientists and technicians in the Microbiology and Chemistry sections at the National Health

Laboratory. A semi-structured interview was conducted with each participant and the results were individually analysed and be grouped to form descriptive analysis for the study.

CHAPTER 4: RESULTS

4.1 Introduction

This chapter presents a detailed view of the results based on the Methodology section of Chapter 3 addressing the research questions and objectives of the study. The results will also provide an interpretation of the data that will be used to propose recommendations be made to better implement IPMS at public health facilities that will be discussed in Chapter 5.

4.2 Data Presentation and Analysis

Data was collected through interviews from 4 participants in the Microbiology section and 2 in the Chemistry section at the National Health Laboratory was collated and a summary view of the results to the questions posed to each participant are described in Appendix 4.

4.2.1 Microbiology Section

4.2.1.1 Overview

The National Health Laboratory is located opposite Princess Marina Hospital, the largest hospital in Botswana. The Microbiology section is located on the first floor of the building. The section consists of four laboratory scientists, one laboratory technician and two health care auxiliaries who facilitate in the preparation of media

and reagents necessary to conduct laboratory testing countrywide. The section has not implemented IPMS. The key roles performed by the section are to test referred specimens, prepare media for peripheral healthcare facilities (such as primary hospitals and clinics), mentoring to peripheral laboratories and is the section responsible for conducting testing and surveillance for Measles, Rubella and Polio countrywide.

The number participants in the study from the Microbiology section were four consisting of three laboratory scientists and one laboratory technician. The roles that were described amongst all the participants included, testing of referred samples from primary and clinical laboratories together with Measles and Rubella testing plus surveillance. Routine testing is seldom performed in the section. One participant included the role of the section in mentoring and training peripheral laboratories. All the participants confirmed that IPMS has not been implemented in their section and that a manual, paper based system is the method of disseminating results to the requesting facilities.

4.2.1.2 Current Method of Disseminating Results

The Microbiology section disseminates results to requesting facilities by means of a manual system that is paper based as mentioned by one participant,

"We use a manual, paper based system to disseminate results. No computers are involved." – Participant 1.

Samples that require testing are forwarded to the laboratory from the requesting facility accompanied with a case investigation form. Upon arrival, an officer will verify the information on the form, inspect the sample has arrived in good condition and log the information into the section's specimen receiving log. The log will have variables such as the date of receiving of sample, type of sample (for example stool, blood or urine), requesting facility and receiving officer. Each test that the section offers has a separate receiving log. The samples are then tested with the results generated sent to the requesting facility either by post, messenger from the requesting facility or if required urgently, by phone or fax.

With regards to Measles and Rubella surveillance, upon receiving of the sample and logging into the sectional records, the results are generated with four copies made; one is kept in the laboratory for record purposes, one is sent to District Health Management Team (DHMT) of the requesting facility, one is sent to the requesting facility itself and one sent to the Ministry of Health Epidemiological Unit (EPI Unit) for surveillance records. In addition, to meet the World Health Organisation (WHO) standards, the results are input into a database designed by the WHO for data harmonisation purposes in conjunction with the EPI Unit to ascertain if the set targets for surveillance are being met.

The disadvantages mentioned by the participant were that the current method of dissemination resulted in a high frequency of lost or misplaced results that never arrive at the requesting facility with another participant noting the long duration of the requesting facility, with results taking longer than one week to arrive at the requesting facility. Participant 1 stated,

"In most cases, the results get lost…or they rarely get the relevant requesting clinician."

Participant 3 added to this by saying,

"Usually the results don't arrive at the facility because they get lost."

These two factors contribute to long turnaround time for patient diagnosis thus affecting treatment outcomes. Another disadvantage of the current system is participants noted the lack of sample tracking accountability during the transportation of the samples to the laboratory. One participant further elaborated on the high frequency of missing information on a most case investigation forms which form a vital component of surveillance. One participant cited the high storage spaces needed to keep paper records of results which could otherwise be used for laboratory equipment.

4.2.1.3 Participants Views and Perceptions to IPMS

When asked if the participants would like to see IPMS implemented in their section, all four participants responded 'yes' as it would allow for results to be transmitted in real time, reducing patient turnaround time and a decrease in the frequency of lost results in transit.

"…if you use IPMS, the clinician will be able to easily access a result; that is if the system is up. If the system is down, we still have to go back to the manual system which proves to be very disruptive." – Participant 1.

As described in the last part of the statement from Participant 1, some of the challenges the participants felt IPMS currently faces its frequent system downtime as a result of infrastructural challenges across the country such as electricity and internet connectivity that slow down the rate of implementation across the country.

When asked why they think IPMS has not been implemented in their section, two of the participants stated that IPMS, in its current state, is catered for routine testing of samples and because the section performs mainly referred testing with seldom routine testing, IPMS was deemed not necessary in their daily work routine.

"We are not doing any routine samples….I don't think we need it." – Participant 2.

The participant with this statement doubted the necessity of IPMS within the current scope of duties.

Another participant noted that they would like to see IPMS implemented in the section once all requesting health facilities from Health Posts to referral hospitals are also connected to ensure real-time transmission of results and duplication of data.

"It will be very difficult to introduce IPMS for a handful of facilities and the remainder retain the paper based system." – Participant 1.

Participant 1 indicated the unavailability of IPMS in other facilities, particularly those located in remote areas and whether working on IPMS had the potential of duplicating the current workload.

When asked if IPMS would make their work routine easier or more difficult three of the four participants stated there would be an increase of workload as results from the Measles and Rubella testing results would be duplicated into two separate systems; IPMS itself and a database created by the World Health Organisation for Measles and Rubella surveillance that is the globally accepted method of surveillance. Participant 3 stated,

"We would have the WHO database, IPMS and the paper system. Why should we duplicate the same thing? In fact it's more than duplicating."

To improve the system the participants cited the need to avail all necessary infrastructure for IPMS to all facilities to improve efficiency and patient management. Participants also noted the need to adequately train all staff on how to use the system, reduce the system downtime and have an appropriate independent backup system to IPMS should it be unavailable.

The participants were also asked to describe if they feel there is any resistance to change towards IPMS. Three participants felt there is no resistance to change towards IPMS with one participant not willing to provide an answer.

"There is no resistance to change. It seems the need for IPMS is more suitable in situations where you need urgent results, like a hospital setting." – Participant 1.

4.2.2 Chemistry Section

4.2.2.1 Overview

The Chemistry section of the National Health Laboratory is located on the ground floor of the building. The section consists of one laboratory scientist, one laboratory technician four health care auxiliaries who assist in the receiving, reporting and dispatch of results to the requesting facilities. The roles of the section include the testing of routine chemical and hormonal testing from requesting facilities (in particular from Princess Marina Hospital), facilitate the outsourcing of tests that cannot be performed in-country to South Africa and conduct confirmatory tests from peripheral facilities.

The Chemistry section participants consisted of one laboratory scientist, who was also the head of the section and one laboratory technician. Some of the roles in their section included routine testing of chemical and hormonal markers for patient diagnosis and treatment. The participants were not working at NHL at the time of IPMS implementation however one participant stated that IPMS was implemented in the Chemistry section in 2005. Both participants confirmed that IPMS has been implemented in their section and is the current method of dissemination of results.

4.2.2.2 Current method of disseminating results

For requesting facilities that are connected to IPMS, samples that require testing in the Chemistry section are initially registered and logged onto the system at the requesting facility. The sample together with the request form is then transported to the National Health Laboratory and is first manually logged in a log book. Information captured on the log book include patient name, a unique Patient Identification Number (PID) determined by IPMS, sample type, time of receipt in the section and the test required. The sample is then loaded onto the appropriate Chemistry analysing machine and the results are generated. At the end of the day, the results are input into IPMS for immediate access by the requesting facility and clinician. The Chemistry analysers in the section are also linked to IPMS that when required, can automatically update the results for requested deemed urgent. Participant 1 summarised the process by saying,

"We still log and receive samples into a book at the initial stage. However resulting, capturing and dispatch of results is performed online."

For facilities that do not have access to IPMS, the sample is received together with the case investigation form. The sample is then logged into the section's receiving log and processed on the Chemistry analysers. After analysis, copies of the results are sent back to the requesting facility by post. At the same time the results together with the respective case investigation forms are logged into a section results log for record keeping. Information on the results log includes variables such as the PID, type of test, and the officer who performed the test. Phone calls can be used to

disseminate results deemed urgent and allow the clinician to start patient management. The process is similar to that in the Microbiology section described in 4.2.1.2.

4.2.2.3 Participants views and perceptions to IPMS

During the transition period towards IPMS, the participants displayed a high level of excitement and enthusiasm towards IPMS as it was believed that it would reduce the workload in their daily routine with particular reference to the duplication of patient information on different log books within the section.

"The whole thought of having an online system of operation was very exciting because we were bogged down with the volumes of duplicating information on multiple log books." – Participant 2.

In terms of the duration of training of IPMS, one participant took one week with another participant taking two weeks to become conversant with IPMS. One participant noted that there was an initial resistance to change towards IPMS especially from individuals who felt they were not computer literate and patient confidentiality may be compromised however their initial fears were allayed, according to the participant and all individuals were welcoming of IPMS once it was implemented in the section. Participant 1 lamented;

"Obviously there will be resistance to change. Some people were not computer literate and others felt some people would be able to retrieve confidential information."

Since IPMS implementation, both participants expressed a decrease in the daily workload as results are released in real time and the Chemistry analysing machines are interfaced onto the system.

"It (IPMS) has reduced the turnaround time drastically." – Participant 2.

This has allowed for improved patient management and also the machines used to analyse the results are linked to the system hence turnaround time has been significantly reduced. The participants also noted the improvement in accessing patient history on the system to better predict and diagnose a patient illness in future.

With regard to the current challenges of IPMS, both participants noted the high frequency of system downtime, with one participant stating the system is not working for a "few hours, every other day", with another participant stating "three working days a month and at the end of the Financial Year". Another challenge is the inability of IPMS to create new fields within the system to keep up with the rate of new analytical tests demanded by the doctors. One participant noted that the process of adding new fields on IPMS can take up to six months for IPMS to create the necessary fields from the moment it is demanded by doctors. During this period, a manual paper based system is utilised to disseminate the results which may increase the turnaround time.

"For tests that are not included on IPMS, the manual system is used to report results." – Participant 1.

The participants in the Chemistry section also indicated some ways of improving IPMS throughout the healthcare system. Both participants indicated there is a need for all health facilities to have access to IPMS to improve patient management and improve human resource capacity within the system starting from the end users to IPMS technical support staff. Another suggestion was for periodic re-training for users on IPMS and standardised training for new users on IPMS. This will minimise the amount of 'on the job training' that affects overall productivity of new individuals on IPMS. Participants also cited the lack of consultation with users in public health facilities during its implementation process that could have mitigated the current challenges faced.

"I'd be happier if they (developers of IPMS) involved us, the end users." – Participant 1.

In order to keep up with the rates of new requests from doctors, one participant suggested that some scientists, who work within the public healthcare system, be given authorisation to create new fields of testing on IPMS. This will reduce the transition time from the moment new requests are demanded to the period they are implemented on IPMS.

4.3 Discussion

From the results, it has been observed across both the Microbiology and Chemistry sections that by fully implementing IPMS at the National Health Laboratory, productivity and normal work routine can be significantly improved. This literature matches that of Lucas (2008) that ICT systems are designed with the goal of improving productivity and efficiency.

Despite the potential of increasing productivity and efficiency, challenges have been observed within the NHL context. One possible reason is that IPMS was better designed to capture routine testing than specialised testing. Participants in the Microbiology section noted that their duties seldom involve routine testing of samples and felt there was no need for IPMS to be implemented in their section.

This was interpreted as indicating the participants were of the perception that the system was irrelevant or not suitable for the type of work they were involved in. This interpretation is consistent with Dent & Goldberg (2009), that demonstrated the efforts an employee will make to resist a new system when the perceived drawbacks outweigh the potential benefits. The participants' response also points out the lack of consultation or control in the design and implementation of IPMS further exacerbating the resistance to change experienced of IPMS in the Microbiology section. This finding is consistent with del Val & Fuentes (2003), that found that the level of employee participation in designing a new system is directly related to the level of resistance expected during implementation.

Another issue that was identified was that the end users were not conversant with IPMS and the introduction of computers in general within their work routine. This pointed out to poor change management planning that should have included a plan to make end-users comfortable using a computer before introducing IPMS. This observation links with By (2005), that demonstrated up to 70% of all organisational change and change management plans fail to be implemented. The participants' response towards IPMS at the National Health Laboratory is a case and point that is consistent with the study.

Other participants cited that IPMS could not be fully implemented because of supportive infrastructure inadequacies. In this regard, remote locations which are supposed to exchange information with the lab were not connected to the system for various reasons. This finding is consistent with the view that infrastructure is important for successful implementation of ICT systems (Lucas, 2008). Llutch (2011), went on to explain that the major factors that affect ICT related change at infrastructure level include socio-technical factors and conflict between workers and the system to be implemented.

Furthermore, inadequate infrastructural requirements could be due to lack of changing the organisational structure to suit an ICT system that is introduced (Waldell & Sohal, 1998). Furthermore Piotti and Macome (2007), demonstrated that implementing ICT projects can have a big influence on the organisational environment and existing workflow. The Microbiology section also stated that IPMS will be beneficial once the necessary specialised fields are included on the system to fit the structure of the section. The Chemistry section were more welcoming of IPMS

as the existing structure and workflow was more closely related to the overall aim of IPMS, which is to improve patient management within public health facilities.

It was interesting to note that although the Microbiology section felt there was no resistance to change towards IPMS, participants argued that the implementation of IPMS, in its current state, would significantly increase their workload as data would have to be entered on two new database platforms. This can be a clear indication of anxiety and possible signs of resistance of change. The Chemistry section stated that there was an initial resistance towards IPMS especially from individuals who felt their job security was under threat from computer based systems.

These findings are consistent with literature on resistance to change in particular with Drew and Goldberg (1999) that showed individuals are likely to resist a change that is enforced on them. It should also be noted that the responses from both sections could not isolate a single contributing factor that was a result of changing from a manual to an ICT based system. This observation demonstrated that resistance to change is complex to understand independently and many factors are at play that is not as a result of human factors alone (Agocs, 1997).

The Microbiology section noted a high percentage of incomplete forms necessary for surveillance. This was not surprising as a similar trial conducted in Uganda showed that the national percentage of complete forms was 63% (Lucas, 2008). The same trial conducted after the implementation of an ICT linked system a 100% form completion rate was observed improving service provision and job satisfaction amongst the participants. Therefore if modified to include surveillance fields

necessary to study showed that IPMS has the potential to eliminate the possibility incomplete forms to improve surveillance within the Microbiology section.

An important challenge that was observed across both sections was high system downtime of IPMS and the duplication of patient data and results on a manual paper based system. Literature from Soriyan *et al.,* (1999) and Llutch (2011) confirmed the digital divide between developing and developed nations. Developing nations have shown a slow uptake rate of ICT systems in healthcare primarily due to the high cost of investment and the rigidity of software package built to suit the socio-economic status of developed nations.

 The success of an ICT based change is dependent on several factors that include availability of technical staff, constant maintenance of infrastructure and adequate long term financial support as described by Blantz (2010). It is clear from the study that not all these factors are in place with the result being observed as the frequent downtime of IPMS which can prove to be an obstacle towards achieving full implementation across all health care. This is clearly demonstrated by the lack of adding specialised fields of testing at a pace that meets that of the demands requested by the doctors, which can take up to 6 months to update, as mentioned by the Chemistry section participants. This gives the section no choice but to revert to a paper based method of reporting and dissemination of results compromising patients' outcomes and increasing the workload of individuals as a redundant manual system is created.

The study also demonstrated the lack of full implementation of IPMS in the country prescribed by the Botswana ICT Policy of 2004 of linking health facilities to IPMS by 2010. This is shown by the participants' suggestion across both sections to avail the necessary infrastructure to requesting facilities before IPMS can become beneficial. Although there is a distinct advantage of ICT systems linking health facilities across large geographical areas, it also emphasised the need for continuous long term financing and implementation strategies to meet this objective, failure to which include cost overruns and contribute to a failed project (Blantz, 2010; Lucas, 2008). It is likely that IPMS implementation throughout Botswana experienced a gap in the medium to long term of either financial or strategic support leading to the partial implementation currently observed.

4.4 Summary

Chapter 4 presented the results of the interviews from participants working in the Chemistry and Microbiology sections of the National Health Laboratory to analyse the level of implementation of IPMS. The results were further analysed and linked to the aims of the study.

CHAPTER 5: DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

In this chapter, the results in Chapter 4 is further analysed and related to the literature in Chapter 2 of this study to come up with a conclusions and recommendation going forward in terms of implementing IPMS across the laboratory and within the public healthcare system. The chapter also covers the limitations of the study and future research directions.

5.2 Restatement of Research Objectives

The aim of the study was to establish the factors that contributed to the lack of full implementation of at the National Health Laboratory based on the research question, "Why has IPMS not been fully implemented in all sections at the National Health Laboratory, the main referral testing facility in Botswana?"
The objectives of the study were to;

- Identify the benefits and challenges facing scientists and technicians working with IPMS at the National Health Laboratory.

- Determine the level of resistance of change has had in implementation of IPMS at the National Health Laboratory.

- Make recommendations on how to improve IPMS at the National Health Laboratory that will lead to full implementation.

5.3 Have the Research Objectives Been Met?

From Section 1.6, the key research question was to establish why IPMS has not been fully implemented at the National Health Laboratory. The results from Section 4.2 indicate the primary reason for the lack of full implementation of IPMS across NHL was the scope of work in the Microbiology section differed to that of the Chemistry section. It was observed that IPMS is more suitable for routine testing than specialized testing. The Microbiology section mainly performs specialized testing and seldom routine testing requiring specialized fields to be included in IPMS that is currently not available. As a result the Microbiology section felt that IPMS was not geared towards their work processes and its implementation, in its current state would significantly increase the workload in the section. The Chemistry however perform routine testing on a daily basis and felt that IPMS has been beneficial to their existing workflow and its implementation has significantly reduced the workload and improved patient outcomes. The findings indicate that the differences of function between the Microbiology and Chemistry sections at NHL could explain the lack of full IPMS implementation. The key research question has therefore been partially fulfilled.

Another objective of the study was to understand the benefits and challenges of IPMS facing the National Health Laboratory. A key finding of the study described in 4.2 was IPMS yielded several benefits that outweighed the limitations and challenges

that are in place. Some of the benefits include real time dispatch of results to the requesting facility, reduced workload and better monitoring of patients' history at the click of the button to improve treatment outcomes. A significant challenge that was faced with IPMS is the frequency of system downtime, slow rate of updating new fields of testing and the presence of a redundant manual system to cater for the facilities that are not connected to IPMS. Lack of underlying infrastructure and services such as electricity and internet connectivity also emerged as challenges. This particular objective has therefore been met by the study.

Another objective of the study was to determine the extent to which resistance to change played a role in the implementation of IPMS at the National Health Laboratory. The Chemistry section participants noted some degree of resistance to change from a manual, paper based system to an ICT based as part of their daily work routine that stemmed from perceived inability to work with computers and possible intrusion of confidential patient information.

The Microbiology Section participant felt that resistance to change was not a factor in the implementation of IPMS however conflicting accounts between the known benefits of the system and the duplication of their current workload to a second database. This could indicate some resistance to change from the staff in the Microbiology section that was only observed upon analysis of the responses. The study however, was not able to determine the extent. A major role in this could be due to a standardised IPMS being controlled externally to that of the National Health Laboratory as a mandate from the Ministry Of Health across all public health facilities. As a result there could be some external factors that could be at play; the extent to

which is not known. This research objective was therefore not met to the level expected in the study.

The final objective of the study was to suggest ways implementing IPMS that will lead to its full implementation at the National Health Laboratory and all public health facilities at large. The results of the study observed challenges that are specific to both the Microbiology and Chemistry section. One in particular was the lack of the relevant infrastructure for IPMS in some requesting health facilities across Botswana. In addition, the Chemistry section lamented the slow update of fields on IPMS to keep up with the requests made by doctors. The result is the creation a redundant manual paper based system which increases the workload on both sections compromising patient treatment outcomes. A suggestion to overcome this would be to facilitate communication channels between the creators of IPMS and the end users on a regular basis. This will provide a forum on which ideas can be exchanged to use the system that will benefit all and also. Recommendations will be further elaborated in Section 5.6. The research objective has been met.

5.4 Summary of Research Findings

From section 1.6, a main objective of the study was to identify the benefits and challenges of IPMS workers face at the National Health Laboratory. A key finding of the study as described in 4.2 was IPMS yielded several benefits that outweighed limitations and challenges that are in place. Some of the benefits included, real time dispatch of results to the requesting facility, reduced workload and better monitoring of patients' history at the click of button to better improve treatment outcomes. A

significant challenge that was faced with IPMS is the high frequency of system downtime, the slow rate of updating and the presence of a redundant manual system to cater for facilities that have no access to IPMS. This particular objective has been met in the study.

The role of resistance to change was also examined and it was observed that resistance to change did play a role in the implementation process of IPMS. In the Chemistry section, there was initial resistance from some staff who felt incompetent when working with computers and felt that their job was under threat. The initial fears were quickly allayed once the participants saw the benefits of IPMS and were fully welcoming of the change. In the Microbiology section, although participants stated there is no resistance observed, should it be implemented, anxiety towards IPMS was displayed by the participants. There was conflicting accounts of the increased efficiency as a result of IPMS but participants also felt the workload would significantly increase should it be implemented. This could indicate some form of resistance to change that was subtle to observe but difficult to admit during the interview process.

 Given the fact that IPMS is controlled externally, it was difficult to ascertain the level of resistance to change that is a result of the internal processes of the section. As a result further studies need to be conducted, with particular emphasis on the Microbiology section, on the role the perceived resistance to change observed in this study has played a role in its implementation. The objective has therefore been partially met.

5.5 Limitations of the Study

One possible limitation of the study was that the data collection from the researcher may have affected participants' response given it was an interview. Related to this, the researcher was known to all the participants which could have affected the results reported. A major limitation of this study is the small sample size. A total of six people were interviewed from two sections of an organisation. It is therefore possible that findings may have been different if a different sample group or larger sample sizes were used. As a result the results of this study cannot be used to infer that the same factors hindering NHL's lack of implementation countrywide. In addition the study was a case study of NHL and excluded other stakeholders utilising IPMS such as doctors, nurses and health care auxiliaries that deliver samples to the laboratories. It is possible that these stakeholders may have different opinions and views on IPMS.

Another limitation is that the results were not conclusive to pinpoint the primary reason that could fully explain why IPMS was not fully implemented. Instead the results only indicate the scope of work between the Chemistry and Microbiology sections, resistance to change and infrastructural challenges had potential to "disturb" the implementation of a new ICT system at NHL.

5.6 Recommendations

5.6.1 Infrastructure and long term sustainability

It was noted that one major challenge was the lack of the relevant infrastructure necessary to implement IPMS, in particular internet connectivity and electricity. With regards to electricity supply, a possible recommendation from the study is for the Ministry to Health to source alternative sources of power, in particular renewable energy sources, such as solar power at health facilities. Given the large geographical area and low population density of Botswana, it may not be feasible to connect all inhabited areas to the National grid, however solar power to inaccessible or low population areas outside of major cities and towns would be able to provide sufficient electricity to power the necessary infrastructure for IPMS to become operational.

With regards to internet connectivity required by IPMS, the government can look to exploit the technology of the existing telephone and satellite network to link remote health facilities to the system. By doing so, patient results can be sent back to requesting facilities in real-time, increasing efficiency ultimately improving patient management and treatment outcomes.

In addition to this, to cover for financial or technical shortfalls, the Government can also seek Public Private Partnerships (PPP) to develop strategies suitable to Botswana on how best to implement IPMS and improve patient management in the country.

5.6.2 Minimising resistance to change on IPMS

Another challenge that arose from the study is the resistance to change experienced by members during IPMS implementation. To address this, the study recommends developing a more holistic implementation plan with an emphasis on displaying the benefits IPMS over a manual paper based system across all stakeholders in the healthcare system and the easier workload it will present. This will allow for greater cooperation between the end users and the Ministry Of Health during the implementation of IPMS and a faster uptake.

Another suggestion that can reduce the level of resistance to change is for the Ministry of Health to conduct a review of the existing public health organizational structure and processes to determine if the current structure is able to adapt to an ICT related change such as IPMS. Literature from Section 2.2.1 has shown that although technology has changed to meet the demands of the external environment, the structure of an organization seldom changes. Therefore it is important that going forward a review is performed to ensure that IPMS is catered for on both a technological and organizational structure level.

5.6.3 Creation of standardised training plans and two-way communication between administrators and end users

The study noted the lack of a standardized training and re-training plan on IPMS. A suggestion to overcome this is to establish regular communication channels between the end user and the creators of the IPMS software. By doing so, each party will be aware of the challenges faced by their counterparts while working with the system

and come up with amicable solutions that will result in improved patient management. For example, by establishing communication links, the creators may be able to identify that IPMS is not user-friendly and can propose suggestions, with feedback from end users on how to improve the system. Communication with the end users can play a significant role in reducing the impact of resistance to change, as the end users will feel they play a crucial role in its implementation and daily use. Moreover, the two-way communication between administrators and end users can be used to alleviate any concerns end users may have with respect to maintaining patient confidentiality.

Another suggestion is to create frequent initial training and refresher courses of IPMS to cater for newly employed staff and the refresher course to make for any updates schedule. To ensure its be cost effective and sustainable, a further suggestion towards the training is to create blocked schedule dates, for example every quarter, to allow for other facilities across the country to participate and give their feedback to the implementers of the system.

To cater for the slow uptake of new queries on IPMS, the study suggests allowing some individuals within the public healthcare system to have authority to add variables on IPMS as doctors increase more requests. This will enable the system to keep up with the demand for new requests and minimise the need to revert to a paper based system of reporting prior to its inclusion in the system. The study also emphasises the need of acquiring the right infrastructure, ensure adequate training and appropriate maintenance and upgrade schedule to minimise downtime and fully optimise IPMS and improve health service delivery.

5.7 Directions for Future Research

Future studies based on this research may include directly testing resistance to change of workers towards IPMS and also introduce studies throughout the facilities to understand if IPMS meets the scope of duties currently in place as from this study there is some duplication taking place. Studies can also be conducted to identify the staff complement available to provide support to IPMS and assess any human resource shortage.

Given the overwhelming response on the high downtime of IPMS future studies can be geared to analyse the average downtime of IPMS and its effect on the workflow and turnaround time for patient management. Studies can also be conducted to assess the feasibility of merging results obtained on IPMS into a surveillance database to reduce the amount of duplication of information into multiple databases.

Future studies can also include using larger samples, for example from multiple health laboratory facilities. Larger studies, based on the results of this study will be able to reach a statistically significant level to infer on the population of individuals who use IPMS on the level of implementation together with the benefits and challenges IPMS brings about in their day to day duties.

The results of the study indicated that the level of resistance to change experienced at the National Health Laboratory could be a result of external factors. As a result, future studies can look at a cross-sectional view of various stakeholders (doctors and nurses) to identify the benefits and challenges faced by using IPMS. IPMS works to

collaborate various stakeholders in order to improve patient management and it is would be important to evaluate each stakeholder's opinions and views towards its structure. Related to this, studies can also look at the current organisational structure of health facilities and determine if it IPMS fits within the organisational work processes. Using this understanding strategies can be develop to ascertain if the organisational structure needs to be overhauled, or altered to suit IPMS and for all users to benefit.

5.8 Summary

The integration of ICT in the healthcare system in developing countries has posed a significant challenge. Some of the factors include, poor planning and maintenance of infrastructure and inadequate long term planning of services to ensure sustainability.

Due to the large geographic area and sparse population the Government of Botswana introduced the Integrated Patient Management System (IPMS) to link all public health facilities before 2010. However this aim has not been achieved and the aim of this study was to analyse why and draft recommendations, using two sections of the National Health Laboratory as a case study. Participants in the study noted that the high frequency of system downtime, poor infrastructure layout and lack of end user consultation in the implementation. These factors all contributed to a slower turnaround time and poorer patient management. It was also noted that all participants would like IPMS to be included to their work routine.

Recommendations to better implement IPMS in future include; standardised training for all end user staff and inclusion of necessary fields into IPMS as soon as new tests are created for patient care.

It is hoped that this study will pave the way for further more studies to be conducted countrywide to see the differences and similarities to that observed at the National Health Laboratory.

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Appendices

Appendix 1: Case Study Questions guide for Chemistry Section at NHL

- Occupation and current job description at NHL.
- Describe some of the clinical tests you perform on a routine basis in your section.
- How are the results of these tests disseminated to the doctor for treatment? Please describe.
- When was IPMS implemented in your section?
- Before IPMS was implemented fully how were the results disseminated to the doctor
- Have you been trained on using IPMS?
- When you first heard that IPMS was coming, did you have any worries/misgivings/concerns? Please explain.
- In your opinion, describe the advantages and disadvantages of IPMS over the old system.
- What were some of the challenges you expected when changing from the old system to IPMS
- What were some of the challenges you faced when changing from the old system to IPMS.
- What are some of the challenges you currently face with IPMS
- Has IPMS made your work routine easier compared to the old system
- In your opinion, do you think there is resistance to change towards IPMS?
- If yes or no, please explain.
- Do you have any suggestions as to how they could have implemented IPMS better?
- Any final comments or statements regarding IPMS?

Appendix 2: Case Study Questions Guide for Microbiology Section at NHL

- Occupation and current job description at NHL
- Describe some of the tests you conduct on a routine basis in your section
- How are the results of these tests disseminated to the doctor? Please describe.
- Describe the advantages and disadvantages of the existing system
- Are you utilising the new system IPMS in any of your routine testing
- Why has the section not implemented IPMS for routing testing
- What are some of the challenges you face with the current system of disseminating results
- Would you like to see IPMS implemented in your section?
- What are some of the challenges you are facing with regards to implementing the system in the section?
- What are some of the benefits you expect should IPMS be implemented in your section?
- What are some of the challenges you expect should IPMS be implemented in your section?
- Do you believe that IPMS will make your normal work routine easier?
- In your opinion, do you think there is resistance to change towards IPMS?
- If yes or no, please explain.
- What are some of the steps that should be taken to ensure IPMS is well integrated in your section.
- Any final comments or statements regarding IPMS or the current system?

Appendix 3: University Of Botswana Authorization Letter to Undertake Study

Faculty of Business

Corner of Notwane	Pvt Bag 00701	Tel: [267] 355 2234
and Mobuto Road,	Gaborone,	Fax: [267] 318 5102
Gaborone, Botswana	Botswana	E-mail: business@mopipi.ub.bw

UNIVERSITY
of
BOTSWANA

10 April 2015

To: Whom It May Concern

RE: MBA DISSERTATION – CHARLES MUTHOGA

This is to confirm that Charles Muthoga is an MBA student at the University of Botswana. As part of the fulfilments to complete the program, he is required to undertake a dissertation which he is currently registered for. His research is a case study evaluating the level of implementation of the Integrated Patient Management System (IPMS) at the National Health Laboratory.

He is at the stage of data collection and therefore humbly requests that you form part of his study by answering a few questions that form his case study. He therefore needs your assistance in order to complete her dissertation in April 2015. Please do feel free to contact me if you need further information or clarification.

Thanking you in anticipation

Prof. O. Othata
Research Project Supervisor
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Appendix 4: Summary of Interview Responses from Staff of Microbiology Section at the National Health Laboratory.

Question	Participant 1 response	Participant 2 response	Participant 3 response	Participant 4 response
Job Occupation	Laboratory Scientist.	Laboratory Scientist.	Laboratory Scientists.	Laboratory Technician.
Description of Roles	- Testing of referred samples. - Mentoring of periphery laboratories. - Measles and Rubella testing and surveillance.	- Testing of referred samples.	- Testing of referred samples. - Measles and rubella testing and surveillance.	- Testing of referred samples. - Measles, Rubella and Polio testing and surveillance.
How are results disseminated from your section to the requesting facilities?	- Manual, Paper Based.	- Manual Paper Based system. - Results sent by post. - Collected by drivers of facility of requesting facility. - Phone call if considered urgent.	- Manual Paper Based. - Results sent by post. - Collected by the driver of the requesting facility.	- Manual, Paper Based. - Phone call if request is urgent.
What are the Advantages of the current system of disseminating results?	- For measles and rubella testing, current system meets globally accepted standards of reporting.	- None mentioned.	- One day turnaround time from sample testing to disseminating of results.	- Case investigation forms required to perform surveillance are sent together with samples.
What are the disadvantages of the current system of disseminating results?	- Difficult to track sample as it transferred to laboratory for testing. - Patient results are usually lost en route to the facility by post. - Case investigation form for surveillance often incomplete.	- Results are sometimes lost during postage. - Frequent request to resend results as they are not received by the referring doctor.	- One week turnaround time to some facilities if sent by post. - Results are frequently lost via post.	- Large volumes of space taken up by files containing patient results. - Samples not received on time - Results are usually lost via post.
Would you like to see IPMS installed in your section?	- Yes. On condition that each facility that requires services from NHL is also connected to IPMS, otherwise it would bring about duplication of data.	- Yes. Only if specialised testing fields are included on IPMS.	- Yes.	- Yes.
Would the implementation of IPMS in your section increase or decrease your current workload	- It would increase the workload as it would involve inputting data in two separate databases	- It would increase the workload as data would be input on two databases. - IPMS also does not guarantee that the results will be viewed by the requesting doctor.	- It would decrease the work routine as the results would be available in real time as soon as testing is completed	- Yes, only if variables required to perform surveillance are included. Otherwise it would duplicate workload

Appendix 4: (continued): Interview Responses from Staff of Microbiology Section at the National Health Laboratory.

Question	Participant 1 response	Participant 2 response	Participant 3 response	Participant 4 response
Do you have IPMS implemented in your section?	- No.	- No.	- No.	- No.
If no, why?	- The section rarely conducts routine testing of samples which would require IPMS - Specialised testing of some samples not catered for on IPMS	- The section performs tests for referred samples	- The section performs tests for referred samples	- No response.
In your opinion do you feel there is resistance to change towards IPMS?	- No response.	- No response.	- No. People are very welcoming of IPMS.	- No.
What are the current challenges IPMS faces in your normal work routine	- System downtime	- IPMS does not meet scope of work in the section and system downtime.	- Infrastructural challenges such as electricity and internet accessibility. - System downtime approximately once a month with a day turnaround to rectify	- System downtime - Infrastructure challenges.
What are some of the steps that should be taken to fully integrate IPMS in your section?	- Avail all IPMS infrastructure, space and equipment across the country. - Provide adequate training to all end users and IT support staff. - Ensure well maintained infrastructure and due maintenance to reduce downtime.	- Improve infrastructure of IPMS. - Ensure sufficient backup of IPMS should it go down.	- Reduce the downtime IPMS experiences. - Provide IPMS to all facilities in the country.	- Communicate and consult with end users of IPMS to improve its output. - Training of staff, in particular end users. - Develop a sufficient backup independent of IPMS. - Improve IPMS infrastructure.
Final Comments?	- IPMS is crucial to patient management which is not the main focus of the section which is to collect information for surveillance and provide specialised and referral tests.	- IPMS cannot replace the manual paper based system and both goes hand in hand.	- No response.	- IPMS would be beneficial towards better case management if all health facilities are connected.

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Appendix 5: Summary of interview responses from staff of Chemistry Section at the National Health Laboratory.

Question	Participant 1 response	Participant 2 response
Job occupation	Laboratory Technician.	Laboratory Scientist and Head of Chemistry Section.
How are results disseminated to the requesting facilities?	- Requests and dissemination of results performed using IPMS.	- Results disseminated through IPMS.
Describe the previous system of disseminating information	- Manual, paper based system.	- Manual, paper based system.
What was the duration of IPMS training?	- 1 week with no re-training since.	- 2 weeks with no re-training since.
What were your initial thoughts when you heard IPMS was implemented in your section?	- Excited as the amount of duplication of information would be reduced improving turnaround time.	- Looking forward to IPMS as it was expected to reduce workload by minimising duplication of patient information in log books.
What are the advantages of IPMS over the previous system of disseminating results?	- Results are released in real-time - Better turnaround time for results improving patient management and outcome.	- Real time dissemination of results to the requesting facility and doctor. - Analysing machines interfaced to IPMS therefore faster turnaround time - Repeat Patient information and results history are easily accessed.
What are the Challenges IPMS currently faces?	- System downtime on a regular basis, on average a few hours every other day. - Not all facilities are not connected to IPMS therefore results are disseminated using the manual, paper based system.	- System downtime forces section to revert to manual system usually 3 working days a month on average and also the end of financial year - Some variables requested by doctors for testing not available on IPMS therefore must revert back to manual system.
Has IPMS made your work routine easier or more difficult since its implementation?	- It has made work routine easier.	- It has made the work routine easier.
In your opinion do you feel there is resistance to change towards IPMS when it was being implemented?	- No response.	- Initially as there was some fear that patient confidentiality would be compromised with an online system - Some users were not computer literate and were concerned they would struggle to adapt to IPMS
What are some of the steps that should have been taken to fully integrate IPMS in your section?	- Increase human resource capacity to reduce system downtime - Roll out IPMS to all facilities countrywide to reduce turnaround time and improve patient management	- Allow some individuals to increase variables of testing to keep up with doctor requests as it takes at least 6 months to have requested changes on IPMS. - Conduct IPMS training for new staff to avoid in-job training that is not sufficient. - Re-train existing staff on changes made to IPMS.