AN INVESTIGATION INTO CAUSES OF DETERIORATION IN HEALTH PHYSICAL INFRASTRUCTURE TRANSITIONED FROM DONOR TO NATIONAL MANAGEMENT

By

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DECLARATION

I, **Bwalya Helena Mutale,** do hereby declare that this dissertation is the result of my own research work under supervision and to the best of my knowledge it contains no material previously published. I have duly acknowledged all sources from which references were drawn.

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APPROVAL

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ABSTRACT

The health sector has seen tremendous increase in the construction and expansion of physical infrastructure. Much of this infrastructure development has been spearheaded by donors who have facilitated the funding and construction of these structures. Presently, most funders are moving away from direct funding and support of such services to an approach that is more predisposed to national ownership to foster sustainability of services. Maintenance of physical infrastructure transitioned to national ownership from donor management has been a challenge leading to a considerable number of physical infrastructure dilapidating to a deplorable state. The study aimed at investigating the issues affecting effective maintenance of physical infrastructure in the health sector as well as to help identify tangible solutions that can be employed to improve maintenance activities.

A mixed methodology approach was used for data collection. Data collection techniques used included interviews, questionnaires and a review of the literature available on the subject matter. The relative importance index was used to determine the ranking of the results of the study.

The study findings revealed that 33% of the respondents in the facilities had no knowledge on minor and routine maintenance activities in both rural and urban settings, while 29% had limited knowledge, another 29% had working knowledge with only 8% having very good maintenance skills. Maintenance plans were in place in most urban facilities as compared to rural areas, however, adhering to maintenance plans was hindered by lack of funding for maintenance activities.

The study recommends improved budget allocation for maintenance activities from the Ministry of Health, use of smart technologies to alert personnel on scheduled maintenance works and reintroduction of patient user fees to assist in increased financial in flow to be allocated for use for minor maintenance works in the facilities.

Key words: Transition, National Management, Maintenance, Physical Infrastructure, Health Centres, Donors.

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ABBREVIATIONS

CIDRZ	Centre for Infectious Diseases Research in Zambia
CIP	Capital Investment Plan
DHO	District Health Office
GRZ	Government Republic of Zambia
JICA	Japanese International Cooperation Agency
LPHO	Lusaka Province Health Office
MHID	Ministry of Housing and Infrastructure Development
MoH	Ministry of Health
MWS	Ministry of Works and Supply
SFH	Society for Family Health

CHAPTER ONE: INTRODUCTION

1.1 Background

Infrastructure is the basic physical and organisational structures needed for the operation of a society like industries, buildings, roads, bridges, health services, governance and many others (Oyedele, 2012). Zambia has in the recent past years benefitted from numerous donor aid and support in various infrastructure developments projects, more especially in the construction of structural infrastructure in the health care sector. Several hospitals, clinics and health posts in urban and rural parts of the country have been built through the support of donor aid from various western donors. These health centres constructed and funded by the donors have benefitted a majority of the Zambia population have access to health care within their local dwelling (Foster and Dominguez, 2010). Another positive that has resulted in the wide spread construction of health centres and posts throughout the country; is the significant decline in congestion in several major hospitals on the number of patients being referred for treatment (Ministry of Health, 2012).

Improvement in the provision of quality health care has been noted due to the high-tech equipment that is installed and used at these facilities to improve in-patient and outpatient care and treatment services (National Health Policy, 2012). Management of these health centres by the donors has resulted in consistent and timely maintenance works being carried on these facilities to ensure that unnecessary destruction and decay to these structures does not hinder the service provision being offered to the communities (Ministry of Health, 2012). For most of these physical infrastructures that have been set up by donors, scheduled maintenance plans have been adhered to as part of the project or program implementation (National Health Policy, 2012).

The focus for most donors is moving away from physical structural construction and management to encouraging local ownership and management to foster sustainability of project or programs through transitioning their projects from donor management to national ownership through the government by fully engaging the relevant ministry from project initiation, completion and implementation (USAID, 2011). However, the occurrence of cracks in the walls, broken taps, damaged and almost falling off ceilings and roofing sheets etc. over time have a detrimental effect on the provision of quality health care, productivity of facility staff and human life overall.

Figure 1 shows a section of a leaking roof and cracked walls at Chelstone Clinic in Lusaka Urban district. This section of the wall and roof has been awaiting renovation for over five (5) year and has been delayed due to lack of funding to conduct the renovation works.

Figure 1: *Section of leaking roof and cracked walls at Chelstone Clinic in Lusaka urban district (Source: Field data)*

The numerous maintenance issues occurring pertaining to physical infrastructure in the health care sector can be controlled and contained to the barest minimum if not eliminated completely if maintenance works and plans are undertaken as per schedule alongside the allocated funds budgeted for maintenance activities (National Health Strategic Plan, 2011).

Maintenance of physical infrastructure in all sectors be it health, roads, ICTs etc. is a critical component of the economy in that it is known to improve outcomes of people using and accessing services from these sectors (IDA, 2015).

The significance of the study assisted in identifying issues that contribute to lack of maintenance of physical infrastructure in health centres transitioned from donor to national management. The study assisted to find solutions to help ensure that maintenance and sustainability of these health centres is addressed and implemented accordingly.

1.2 Statement of the problem

Physical structures in general overtime if not taken care of exhibits signs of dilapidation and this has been known to affect work in terms of poor productivity, efficiency and time management from the health care workers. The issue of lack of maintenance to infrastructure has engaged practitioners and researchers for a long time to find best possible ways to encourage communities and countries to take up maintenance of various infrastructures. In an article by Doman (Aid and the maintenance of infrastructure in the pacific, 2012) he reveals that public infrastructure in most developing countries, is often left to decay due to lack of maintenance. The article further indicates that lack of maintenance strategies and funding are the common causes of non-functional maintenance departments.

According to the national health policy (2012), in Zambia's health sector, the major setback in lack of maintenance of physical structures can be attributed to inadequate funding and non-adherence to maintenance schedules. Maintenance of physical structures can be improved to yield better results if issues of maintenance are taken more seriously. To continuously provide quality health care to the citizens and boost the morale of health care workers, maintenance activities are of utmost importance (Transition of management and leadership of HIV care and treatment programs to local partners, 2011). Therefore, the aim of this study was to investigate the lack of maintenance of physical infrastructure in health centres that have transitioned from donor support to national ownership. The research further proposes improvements that can be made to assist the government manage and ensure that the physical infrastructure is not let down to ruins due to abandoned maintenance processes.

1.3 Research question

How can systems be strengthened in the health centres to ensure that physical infrastructure is maintained timely and adequately?

1.4 Aim and objectives of the research

The main aim of the research was to investigate causes of deterioration of physical infrastructure in health centres transitioned from donor management to national management and develop maintenance strategy for them.

The specific objectives of this research were to;

1. To assess the level of knowledge in maintenance of health facilities.
2. To evaluate existing maintenance strategies in the health facilities to determine the gaps that cause deterioration of physical infrastructure.
3. To develop practical options that will improve maintenance of physical infrastructure in the health facilities transitioned from donor support and managed by Ministry of Health.

It is hoped that these objectives will ensure that health centres benefit from improved maintenance strategies backed up with adequate financial resources. This would ensure that physical infrastructures are maintained and sustained.

1.5 Significance of the study

This study will seek to strengthen already existing maintenance systems as well as identify innovative ways of improving maintenance activities to ensure that physical infrastructure in the health sector are effectively maintained and according to plan. Having noted with concern, on the number of donors abruptly stopping aid support in the construction and implementation of physical infrastructure in the health sector due to financial constraints or focus change, the most sustainable way of providing and maintain already existing physical infrastructure and quality health care in Zambia, is for the government to take the lead in managing programs from inception to implementation with minimal or no dependency on donor aid and build capacity in those assigned to maintain the infrastructure.

1.6 Organisation of the dissertation

The dissertation is organized into seven chapters. Chapter one includes the general introduction to the research. The chapter provides the background of the research, statement of the problem, aims and objectives of the study and significance of the research. Chapter two outlines the review of literature concerning the factors affecting the lack of maintenance of physical infrastructure in health centres that have transitioned from donor to national management. Literature review gives the reader knowledge and ideas that have already been established by other researchers. Chapter three covers the research methodology which highlight the various research methodologies and the justification for the method adopted for the study. The specific methods, techniques, tools and research instruments which were used are outlined. Chapter four includes analysis and discussion of results collectively. Chapter five presents the conclusions and recommendations directed at areas for future studies.

1.7 Summary

This chapter presented the background, aim and objectives of the study. It further presented the benefits of the study and the methodology of the conducting the research. The problem statement was the lack of maintenance of physical infrastructure in the health centres transitioned from donors to national management. The next chapter discusses the literature reviewed regarding maintenance and factors that affect maintenance in transitioned health centres.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The previous chapter introduced the study. It presented an overview of maintenance, and its application in the physical infrastructure in the health sector. This chapter gives a background to the concept of physical infrastructure in the health sector, maintenance of these structures and sustainability of the buildings of health centres transitioned from donor management to country ownership. It discusses the benefits of maintenances as well as identifies measures required to achieve sustainability to ensure that structures are maintained and continue to provide the much-needed services when donors no longer support the management of the facilities. The literature further highlights the negligence and lack of maintenance of physical infrastructure currently obtaining in the health sector in Zambia. The chapter also identifies gaps that have been noted as key factors hindering maintenance and sustainability of physical infrastructure in the health sector.

2.2 Maintenance

According to Lekan et al (2011), all engineering infrastructures are subject to aging, wear and tear in the performance of their functions and deterioration by exposure to outside operating environment. Hence, left to themselves, engineering infrastructures will eventually become inefficient, unreliable and fail. Maintenance is defined as the act of keeping something in good condition by checking or repairing it regularly (Oxford advanced dictionary, 2006). Maintenance works are conducted to infrastructure to maintain, revive and prolong the life of the structure. Maintenance work is defined as the combination of technical and administrative actions taken to preserve or protect a structure, system or equipment to function properly (British Standards Institute, 1974). To increase the quality of maintenance works, maintenance culture has been recognized as an important aspect to this (Sani et al, 2012).

Maintenance culture defines the way of thinking, behavior, perceptions, values and underlying assumptions of a person or group or society that considers maintenance as a matter that is of priority and practices it in their life (Thomas, 2005).

Florence (2011) further asserts that maintenance culture is not universal in nature and is usually derived or learned through a person making maintenance a natural daily practice that can be followed and emulated by others. Therefore, it has been observed through literature that to conduct effective maintenance on infrastructure requires on set maintenance culture from the relevant authorities mandated to conduct maintenance works.

2.3 Types of maintenance

To prevent a device or component from failing or to repair normal equipment degradation experienced with infrastructure to ensure it is in proper working order, there are three major types of maintenance programs namely Reactive, Preventative and Corrective maintenance (Operation & Maintenance Best Practices Guide, 2010).

2.3.1 Reactive maintenance

According to Operation & Maintenance Best Practice Guide (2010), Reactive maintenance is basically the "run it till it breaks" maintenance mode. No actions or efforts are taken to maintain the equipment as the designer originally intended to ensure design life is reached.

Advantages of Reactive Maintenance include;

- Low cost
- Less staff
- Disadvantages of reactive maintenance include;
- Increased cost due to unplanned downtime of equipment.
- Increased labor cost, especially if overtime is needed.
- Cost involved with repair or replacement of equipment.
- Possible secondary equipment or process damage from equipment failure.
- Inefficient use of staff resources.

2.3.2 Preventative maintenance

Preventative maintenance is described as the care and servicing by individual involved with maintenance to keep infrastructure in satisfactory operational state by providing for systematic inspection, detection and correction of failures either prior to their occurrence or prior to their development (Dhillon, 2002).

Advantages of Preventative Maintenance include;

- Reduces critical equipment or infrastructure breakdown.
- Allows for better planning and scheduling of needed maintenance works.
- Minimizes production losses due to equipment failures.
- Promotes health and safety of maintenance personnel.
- Disadvantages of Preventative Maintenance include;
- Labour intensive
- Catastrophic failures are still likely to occur.
- Potential for incidental damage to infrastructure in conducting unneeded maintenance.
- Increases in initial costs and is cost demanding.
- Demands more frequent access to equipment or infrastructure.

2.3.2.1 Elements of Preventative Maintenance

Dhillon (2002) asserts there are seven elements of preventative maintenance as illustrated in Figure 2.1;

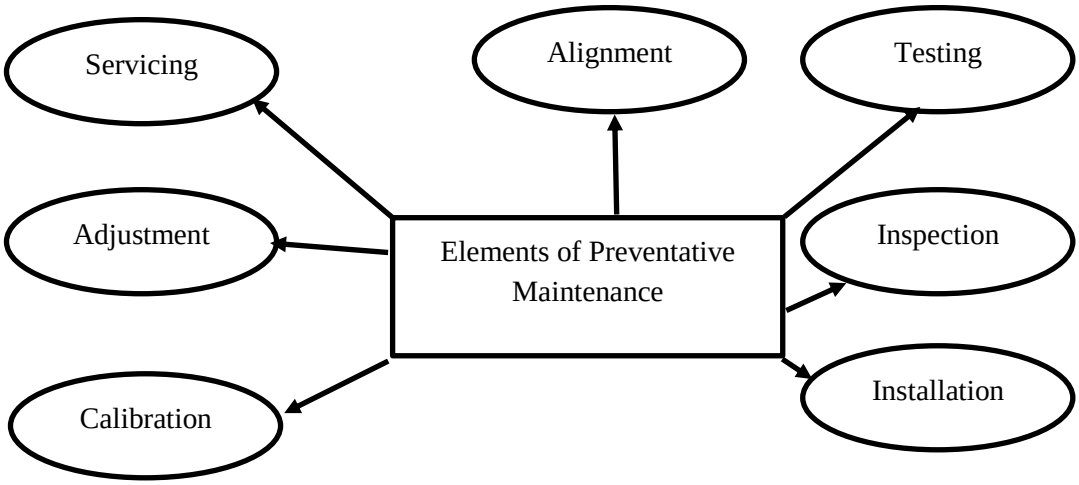

Figure 2.1. *Elements of Preventative Maintenance* *(Source: Dhillon, 2002)*

1. Inspection: This involves the periodic inspection of materials or items to determine their serviceability by comparing their physical, electrical or mechanical characteristics to expected standards.
2. Servicing***:*** This is the cleaning, lubricating, charging or preservation of items periodically to prevent the occurrence of incipient failures.
3. Calibration: This is conducted to determine the value of characteristics of an item by comparison of two instruments, one of which is certified standards with known accuracy to detect and adjust any discrepancy in the accuracy of the material.
4. Testing: This is the periodic testing or checking out to determine serviceability and detection of electrical, mechanical or structural degradation.
5. Alignment: This involves making changes to an item's specified variable elements for achieving optimum performance.
6. Adjustment: Involves making changes to an item's specific variable elements for the sole purpose of achieving optimum performance.
7. Installation: This involves replacement of limited life items or items experiencing time cycles or wear and degradation to maintain the specified system tolerance.

2.3.3 Corrective maintenance

Corrective maintenance is defined as the remedial action carried out due to failure or deficiencies discovered during preventative maintenance to repair infrastructure to its operational state (Dhillon, 2002). Corrective maintenance is usually an unscheduled activity with overall maintenance efforts devoted to this type of maintenance (O&M Best Practices Guide, 2010).

2.3.3.1 Categories of corrective maintenance types

1. Fail – repair***:*** This involves restoring the failed item to operational state.
2. Salvage: This is concerned with the disposal of non-repairable material and the used of salvaged materials from non-repairable equipment or items in the repair, overhaul or rebuild programs.

3. Rebuild: This involves the restoration of an item to a standard as close as possible to the original state in performance life expectancy and appearance.
4. Overhaul: This involves the complete disassembly and examination of all components, repair and replacement of worn or unserviced parts and reassembly and testing to original production guides.
5. Servicing: This is conducted periodically after other corrective maintenance works have been undertaken. Figure 2.2 shows the distinct types of corrective maintenance.

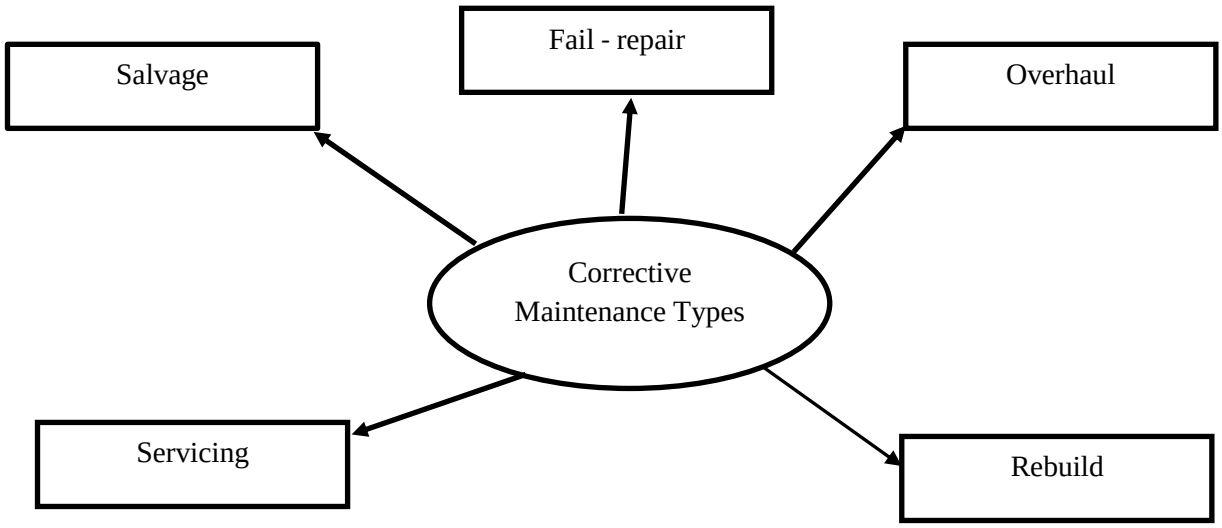

Figure 2.2: *Types of Corrective Maintenance (Source: Dhillon, 2002)*

Advantages of corrective maintenance include;

- Increased component operation life.
- Decrease in equipment or process down time
- Decrease in costs for parts and labour.
- Improved worker and environment safety.
- Improved worker morale.
- Energy savings

Disadvantages of corrective maintenance include;

- Increased investment in diagnostic equipment.
- Increased investment in staff training.

- Savings potential not readily seen by management.

2.4 Elements of effective maintenance management

Improving a maintenance management program is a continuous process requiring progressive attitudes and active involvement from management (Dhillon, 2002). Dhillon (2002) identifies eight (8) elements of effective maintenance management;

1. Maintenance Policy

   This is one of the most crucial elements of effective maintenance management. It is an essential document for continuity of operations and gives a clear understanding of the maintenance management. The document must contain items such as objectives, responsibilities and authorities for supervision, reporting requirements and performance management indices.

2. Material Control

   Material costs account for 30 to 40 percent of total direct maintenance costs (Westerkamp, 1997). Material cost problems can include but not limited to excessive travel time, delays, unmet due dates and many other. To help reduce on material costs associated to maintenance costs, steps such as job planning, coordinating with purchasing and stores departments on equipment needs, and reviewing the completed job can be implemented.

3. Work Order System

   A work order authorizes and directs an individual or a group to perform a given task. A well-defined work order system should cover all maintenance job requested and completed.

4. Equipment Records

   These records or documents are used to document all maintenance works performed, maintenance costs incurred and inventory status. Equipment records are useful when procuring latest items or equipment to determine operating performance trends, troubleshooting breakdowns, making replacements or modifications, identifying areas of concerns and investigating incidents.

5. Preventative and Corrective Maintenance

   The purpose of performing preventative and corrective maintenance is to keep physical infrastructure and equipment in satisfactory condition through inspection and correction of early stage deficiencies.

6. Job Planning and Scheduling

   Job planning includes tasks that are undertaken prior to commencement of maintenance works and this includes, procurement of parts, tools and materials, identification of methods and coordination with other departments. Maintenance scheduling allocates appropriate time required to undertake each maintenance work. Methods such as Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM) are used to assure effective overall time control.

7. Backlog Control and Priority System

   Identification of backlog is important to balance manpower and workload requirements. Determining job priority in maintenance works is necessary as it is not possible to start every maintenance work the day it is requested. In assigning job priorities, it is important to consider factors such as importance of the infrastructure, the type of maintenance required due dates and the length of time the jobs awaiting scheduling.

8. Performance Measurements

   Performance analysis can be used to measure the maintenance department's efficiency and assists in developing plans for future maintenance activities.

2.5 Maintenance of physical infrastructure in the Zambian health centres.

Hospital and health centre maintenance is constantly needed to maintain a clean and healthy environment for members of staff and patients accessing services from these places. It is paramount for medical facilities to ensure requests for maintenance are submitted accordingly and followed up for eventual implementation. Preliminary research investigations conducted by this researcher through interviewing assigned staff responsible for noting and assessing maintenance needs in the health centres was undertaken in selected few health centres in Lusaka urban district. This prior investigation was conducted to gain clear insight on maintenance procedures in the health centres sector. The findings indicated;

- The district health office (DHO) has zonal maintenance technicians that respond to minor facility repairs.
- The DHO is not mandated by MoH to conduct any construction, major maintenance and rehabilitation to building structures.

- The health centres do not have maintenance technicians on site, zonal maintenance technicians are responsible to attending to maintenance requests in their assigned zones.
- Physical infrastructure assessed, and dimmed needing maintenance is reported to the district maintenance department and request for maintenance works are submitted to the Lusaka Provincial Health Office (LPHO) for further management.
- The DHO maintenance technicians assess the extent of the infrastructure needing maintenance. If the task cannot be managed by the DHO, this is escalated to MoH for further management. Escalation continues to Ministry of Housing and Infrastructure if MoH cannot oversee the maintenance works. Ministry of Housing and Infrastructure receives and assesses maintenance needs, prepares the budget and if funds are available issue tenders to contractors that can offer the service for maintenance or rehabilitation. This whole maintenance escalation process takes years to be implemented and the delay was hugely attributed to limited or no budget funding allocation for maintenance works.
- It was also noted donors do not provide their maintenance policy and usually conduct maintenance activities independently without involving the health centre staff responsible for assessing maintenance works.
- There are no skills transfer on maintenance works conducted by the donors to the district or MoH members of staff. The reason attributed to this that, most MoH, LPHO and DHO personnel are reluctant and unwilling to be mentored or trained if the donor does not give allowances for attending the training.
- A major contributing factor to lack of maintenance of infrastructure in the health centres is the non-existence of financial resources for maintenance works.
- Imprest monies given to the health centres for facility upkeep is so little and cannot cover most maintenance needs identified.
- The facilities do not involve the community or private corporate entities to lobby for maintenance human resource or funding for maintenance project.
- It was observed most health centre personnel attitude exhibited lack of maintenance culture and unwillingness to improve on maintenance activities in their centres.

- The findings above indicate there is need to address issues and challenges facing maintenance activities in health centres and this includes the need for better understanding of public policy on maintenance in the health sector.

2.5.1 Maintenance of physical infrastructure in the health sector

Infrastructure serves a central delivery mechanism in achieving sustainable economic development and in the generation of quality social-economic development in the country (Zambia Development Agency, 2014). Physical infrastructure consists of telecommunications, sewerage and water systems, roads, railways, airports, airline, education and health. In this study, the focus is on social infrastructure in the health sector. Health infrastructure is critical to the development of any economy and society. In the health sector, government efforts and resources have been supplemented by donor finances in further developing the hospitals, clinics and other rural health centres (De Kemp et al, 2011). The reality is that all the elements and components that make up an engineering infrastructure unavoidably deteriorates with time due to inherent defect in design and construction and affects user activities and this overtime requires maintaining (Amusan, 2010).

Maintenance-free or self-sustaining infrastructure is highly desirable but not feasible (Lekan, 2012). The inadequacy of maintenance of infrastructure in developing country's cities has profound consequences for economic and social development. The ability of these cities to support productive public economic activity is severely hampered by inadequate service delivery, deteriorating infrastructure often caused by poor maintenance (Zakaria et al, 2012). The main aim of infrastructure maintenance is to preserve a building in its initial effective state and in most developing countries maintenance of building infrastructure in rural and urban settlements is inadequate and usually nonexistent (Zawawi et al, 2010).

Most governments in developing countries including Zambia have poor infrastructure maintenance systems due to, lack of maintenance policies, insufficient funding and therefore rely mostly on donor support for such services (Parliamentary Committee Report, 2014). Donors in most cases have funded the construction of new building infrastructure projects instead of maintaining or refurbishing already existing infrastructure because this has been a more tangible asset that is mostly appreciated and highly favoured by most donor aid recipients (Dornan, 2012).

Preference usually decided by the government has been more on the construction of new structures as opposed to refurbishing existing health centres due to the excessive cost of maintenance, limited financial resources and other pressing expenditure needs which extend to both rural and urban settings (Kaku,2017). It is argued that one major weak link in managing health infrastructure in Africa and Zambia is that of maintenance (De kemp, 2011). Lekan (2014) asserts that the sustainability of any infrastructure and equipment is dependent on maintenance; therefore, donors seek to assist in developing good maintenance systems should put measure below that is;

- Ensuring that in the budget funds for maintenance are put in place but it is essential that funds budgeted for maintenance are not allocated to other areas when expenditure needs outstrip the budget.
- Developing a culture of maintenance which requires having the right artisans, technicians, technologist and engineers to provide the necessary skills.

A major problem in the health sector is the dilapidated status of most facilities, which has affected safety of users and patients (Report on the Health Care Sector and Business Opportunities in Zambia, 2013). Western donors in supplementing government efforts of developing health infrastructure, especially in building infrastructure have provided this support through the concept of aid. Aid is defined as economic assistance from one country to another usually from the developed world to the less developed countries (Pettinger, 2012).

The Centre for Infectious Diseases Research in Zambia (CIDRZ) has assisted the government of Zambia in the construction of new infrastructure in the form of building ART health centres (MoH Joint Annual Review Report, 2011). The assistance rendered by CIDRZ to the Ministry of Health is designed to expand and upgrade infrastructure and health services in health centres in various parts of Zambia. The National Health Policy of 2012 states that the Zambian health sector faces challenges such as low funding, poor infrastructure and obsolete equipment have a major bearing in effective and efficient health care service provision in Zambia. Furthermore, inadequate and inequitable distribution of health infrastructure across the country has continued to present major challenges to the health sector. Aid funders and in most

cases, being the implementing partners of projects have supported Ministry of Health financially in the construction of health centres in urban and rural areas within the country to assist in the delivery of social services to the citizens (Bennett et al, 2013).

The Zambian government health budget is not adequate to meet the infrastructure expenditures requirements, even if government decided to raise funds from the users of the health facilities in both urban and rural areas this is not possible due to the very low-income disposal of most of the population (Yamamoto et al, 2012).

The development of health care infrastructure for communities in both urban and rural has brought health services closer to the people, enabling health care services to be easily accessed (Parliamentary Report, 2014). The construction of new health centres has reduced the number of patients going to general hospitals because health centres are increasingly providing the necessary basic health services that result into patients being cured and do not see the need to go to the hospitals hence reducing the congestion in general hospitals and this has further resulted in access to quality health care for most Zambians (Zambia-USA Chamber of Commerce, 2013).

The construction of health infrastructure has resulted into modern equipment being installed in health centres which has resulted into improved provision of health services and care to patients (National Health Policy, 2012). Donor support in the health sector is essential in the short run but when its prolonged it creates a dependence syndrome among the third world countries it is therefore proposed that it is essential for the recipient country to start developing new avenues of financing this important social infrastructure (Dornan, 2012)

2.5.2 Health infrastructure maintenance policy in Zambia

In general, the health care infrastructure in Zambia is in a desperate state of refurbishment and development needs (Report on health sector and business opportunity in Zambia, 2013).

With regards to the National Health Strategic plan 2011 -2015 under the Infrastructure and equipment component, the core elements that were monitored included;

- Capital Investment Plan (CIP) developed and under implementation, with significant support from MOH/GRZ and partners.
- Construction of new health facilities and staff houses continued.
- Construction of maternity units and mothers' waiting shelters continued.
- Engagement of provincial equipment engineers for maintenance of medical equipment.

Unfortunately, no considerations or plans were incorporated to factor in physical infrastructure maintenance towards the already existing buildings in the strategic plan. Maintenance policies are critical to the conduct of maintenance works (Dhillon, 2002), however, currently the country has no maintenance policies formulated and in use by either MoH or MWS.

2.6 Management of donor funded health infrastructure

To cover the infrastructure gap and improve access to quality and affordable infrastructure, the government has been inviting the private sector and NGOs to participate in the construction, rehabilitation and maintenance as well as financing on public infrastructure and services (Health Sector Performance Review Report, 2011). This entails that after a certain period the physical infrastructure constructed will be transferred to MoH for further management to allow for national ownership (JICA, 2000). To this effect, a transition period of transferring the management of health infrastructure funded by donor countries to national ownership is of the essence to the program.

In Tanzania, the government has put major emphasis in ensuring that the local managers are well trained as a way of preparing them to take over any foreign or donor lead project. The training of local managers ensures that the sustainability of foreign or donor funded projects is ensured when transitioning to national ownership (Aulick, 2012).

In the mining sector in Chile, it was observed that to have a successful transition to national ownership, more national financial resources were required with a parallel reduction of external assistance from donors until total transition is implemented (A Guide on Transition Mine Action Programmes to National Ownership, 2013). This means that the government as recipients of these projects, need to step up in providing financial resources to sustain the programs while donors slowly reduce their funding towards the project thus assisting in creating a self-sustaining program.

For instance, Oxfam (2010) is helping governments in developing countries that are susceptible to conditions that donors put forward before they start supporting a country by letting the countries decide what type of assistance the donors assist recipient countries with. This is a key requirement to ensuring sustainability of the projects when donors decide to transition to local ownership. When governments take the lead and participate in project implementation and management of development processes, this allows for accountability for development outcomes to the citizens and citizens appreciate the government efforts more.

2.7 Challenges faced in managing transitioned physical infrastructure

Several authors have cited many reasons as contributing factors to challenges being experienced during the transitioning of infrastructure management from NGO management to national ownership such as;

- Lack of maintenance funds to support maintenance works from the responsible ministries and departments. Maintenance is often regarded as a necessary expense that belongs to the operating budget and should be balanced with the annual work schedule that has been decided (Financial Factor Affecting Maintenance Management in Safety and Health Practices, 2012).
- During project implementation, the government as major stakeholders is not fully involved and engaged in the implementation of activities and are more focused on actual structures being completed on time there by leaving much of the responsibilities of the works being done to be managed by thee donor (Paris Declaration, 2005).

- Lack of integrating transition plans into the project implementation stage with emphasis on capacity building local personnel to foster continuation and reduce any negative impact (Paris Declaration, 2005).
- Scarcity of trained man power caused by experienced staffs that have migrated in search of greener pastures within the diaspora therefore leading to over dependency on expatriates (Aulick, 2012).

2.8 Transitioning donor services to national management

The role of donors in developing the infrastructure is tied with the eventual transfer of the health centres to national management. It is expected that when the health infrastructure and equipment is transferred to local personnel quality management is of the essence. The Paris Declaration on Aid Effectiveness of 2005 encourages the transfer of donated infrastructure and equipment to local health management as the best way of ensuring management of health services as the key to sustainability and country ownership (Millennium Challenge Corporation, 2011).

According to an article on sustainability of grant aid projects (2011), donors in supporting project implementation focus particularly on developing countries that have major weakness in areas such as construction, health, sanitation, water supply, development of human resources and many others. In these areas mentioned, donors are aware that these are considered as low profitability areas difficult to address through loans. The article furthers states that prior studies which confirm details of request from partner nations, the size of plans and project expenses are undertaken by the donor. Donors also take charge of stimulating implementation in which they monitor the appropriate implementation of the grant aid after exchange of notes between the donor government and the partner country's government. Donors further monitor follow up activities after completion of the grant aid projects to maintain and foster sustainability of the projects or programs (JICA, 2000).

2.8.1 Factors affecting maintenance of building structures

Several factors exist that have contributed to lack of maintenance of building structures such as lack of awareness on the importance of maintenance, insufficient funding for maintenance and repair activities by the government (Sanyal, 2008). According to Talib et al (2014), they identified ten (10) major factors affecting maintenance of infrastructure as listed below;

1. Lack of preventive maintenance method.
2. Insufficient funds to maintain the buildings.
3. Lack of building maintenance standard procedures.
4. Poor work rectification done on buildings.
5. Non-response to maintenance request.
6. Unavailability of skilled appointed maintenance personnel.
7. Low concern of future maintenance of existing maintenance team (on behalf of building owner).
8. Lack of communication between maintenance contractor, clients (owners) and users.
9. Non-availability to replacement parts and components.
10. Lack of understanding the importance of maintenance work.

The major reason for these factors affecting maintenance of infrastructure is due to the insensitivity to this issue of maintenance at the decision-making level within the government and lack of planning and rational budgeting for maintenance activities (Zakaria et al, 2012). Furthermore, in most developing countries, health facility administrators lamented that monies received by most facilities could not suffice to pay for the needed drugs and medicines and availing funds for maintenance activities (Halbwachs, 2013). In Malaysia, it was noted that regular maintenance of buildings in the public sector was a problem due to late identification of most faults and health care buildings presented the biggest challenge to maintain because of their complex engineering services (Zawawi et al, 2010).

2.9 Benefits of maintenance of physical infrastructure

In developing countries, maintenance is of the essence and this can be seen by the way they maintain buildings which are over 100 years old (Zawawi et al, 2010). This shows how they value the investments in infrastructure development.

Taking a leaf from the way the western world places significance on maintenance we can deduce the following as benefits of maintenance;

- Maintenance of building infrastructure prolongs the life of the structure and therefore it is paramount that maintenance works, and inspections are carried out regularly. The University Teaching Hospital (UTH) is managed by MOH as a separate unit from other health centres is expected to carry out regular repairs of the physical infrastructure in response to requests from each department (Sustainability of Grant Aid Projects, 2011).
- The UTH can conduct timely maintenance works due to the direct funding that the institution receives from MoH unlike the clinics and health posts.
- Adequate maintenance is prerequisite for sustainable infrastructure. Maintenance is not only corrective or preventative because it monitors and inspects asserts and reduces the risk of failure (Ondiege et al, 2013).

A financially backed maintenance plan will always ensure that maintenance works are undertaken as and when they occur. In Malaysia, the development plan allocation for repair and maintenance works increased from RM296 million during the Eighth Malaysian Plan to RM1,079 million in the Ninth Malaysian Plan because the country believes that building maintenance is a crucial factor that ensures that elements of a building are in an acceptable standard to perform its required function (Nik-Mata et al, 2011).

2.10 Sustainability of the physical infrastructure

Sustainability has increasingly become a conscious policy for most donors implementing projects and programs (Sabbil and Adam, 2015). Billions of dollars' worth of building investment is being initiated world over while little emphasis is placed on the aspect of maintenance of such infrastructure (Lekan, 2012).

Most donors are currently seeking projects that they believe recipients will be able and willing to sustain after donor funding is no more (Millennium Challenge Corporation, 2011).

Sustainability is defined as that which can be continued for a long time, (Oxford Advanced Learner's Dictionary, 2006), therefore sustainability is an ideal that encourages local communities and the government to take the lead in managing the needs and interest of the locals to ensure that the infrastructure maintenance needs are addressed. The aim of the Zambian government in both the Sixth National Development Plan (SNDP) and the national vision 2030 is to achieve availability of reliable and affordable public infrastructure services for sustained economic development (SNDP, 2010).

According to Oswald and Ruedin's article (2012) on empowerment, sustainability and phasing out support, there are five (5) principles that donors and NGOs must observe during transition to achieve sustainability of projects such as;

1. Transparency

   There must be transparent communication and timelines of activities to ensure that all stakeholders are kept abreast on how the transition process will be implemented.
2. Inclusion

   All stakeholders need to be included at all stages of the transition process with roles and responsibilities clearly outlined.
3. Predictability

   Projects must use project performance and impact to assist in making decisions in relation to the transition process.
4. Obligation

   Donors must identify and effectively manage the risks and opportunities associated with the transition process to cushion the local owners as the take ownership of services.
5. Sustainability

   Implementing partners must inclusively design project interventions that have self-sustaining systems such as skills and knowledge transfer plans.

The principles mentioned above can also be adopted when transitioning physical infrastructure management from NGOs to national management for the Zambian setting. The sense of structure ownership must be instilled into communities to further hence the management and maintenance of the structures.

2.11 Factors affecting sustainability of physical infrastructure after transition to national management.

Sustainability of infrastructure is a huge challenge for most countries faced with transition. This has been necessitated by severe budgetary pressures in many donor countries due to reduced flow of funds available to support continued scale up of international programs (Swidler and Watkins, 2008). Many donors have and are considering best ways of deploying their resources efficiently while others are graduating some countries from their list of aid recipients (Bennett et al, 2012). Lack of good project design that fails to incorporate the local beneficiaries and the government at project inception and implementation has contributed to poor maintenance service works that assist in prolonging the life of the physical structures in at the health facilities (Hosifi, 2012).

Sustainability has been identified as a biggest problem concerning most projects transitioned because most of these projects have proved to be viable only if the donors are supporting them financially (Lartey, 2010). Irregular and poor maintenance of the infrastructure required to manage the maintenance activities is a major contributing factor affecting of infrastructures (Hosifi, 2012). Other factors that have been identified as sustainability challenges include;

- High staff turnover of skilled personnel to carry out the maintenance works (Ondiege, 2013).
- Misappropriation of funds allocated for maintenance works due to selfishness from those entrusted to supervise service works.
- Financing for maintenance work is inadequate and, in some cases, nonexistent due to limitations in funding and irregular funding from the government (Adedamola, 2012).

- The poor maintenance culture and inadequate resource allocation in the past have been identified as the main inadequacies in the development, management sustainability of national infrastructure in Zambia (Muya et al, 2017).

2.12 Benefits of sustainability

Sustainability is achieved when a service is maintained by the recipient once donor support is phased out (Hosifi, 2012). Sustainability can be enhanced by addressing the costs of services after transitioning through efficiency of operations, diversifying funding sources and shifting appropriate staff from donor programs to the civil services (Partnership framework in supporting of South Africa's National HIV & AIDS and TB report, 2012). Benefits of sustainability include;

- Trained staffs ensure that the service is continued even after the donors stop providing support.
- Local communities can continue with the services or program with support and supervision from the trained staff that donors ensured were capacity built during the transition phase.
- Communities can support themselves financially without depending on donor aid through local resource mobilization.

2.13 Summary literature findings.

The summary findings in the literature reviewed indicated that;

- Cost of maintenance is high (Sanyal, 2008). Most facilities are unable to raise funds for the operation and maintenance of the health centre structures and are forced to rely on donors for the maintenance expenses. Maintenance budgets if incorporated in the operational budget of each of the health facilities would help to quicken the process of maintenance works unlike relying on a substantial chunk of money allocated to MOH for all facilities (Kaku, 2017).
- There is lack of skilled maintenance workers, few artisans available and government limitations on workforce that is hired (Ondiege et al, 2013).
- Lack of alternative sources of funds to assist in carrying out maintenance works (Halbwachs, 2013. Facilities do not have other means to raise income to assist in

maintenance. The current imprest that is disbursed by the government in most cases is used for purchasing cleaning and stationary materials for the facility (Kaku, 2017).

- Local beneficiaries or communities are not involved in the maintenance of structures and believe it is the responsibility of the local authorities through MOH's maintenance department (Phiri, 2017).
- The focus in most developing countries is more on the construction of new infrastructure and rehabilitating old structures with less emphasis on preventative and corrective maintenance (Dornan, 2012).
- Maintenance policies are not in place in the facilities (Phiri, 2017).
- Prior to their removal, user fees supplemented procurement of various essential drugs, supplies and equipment – based on local priorities (Kaku, 2017).

2.14 Summary

This chapter examined a range of available literature on maintenance of physical infrastructure in the health sector. It has been observed that to achieve effective structural infrastructural sustainability, national governments need to take greater responsibility and control of its developmental programs. To establish true ownership, the government needs to develop a vision for promoting shared growth, build country systems for mobilizing financial and human resources as well as technical skills to have strong capacity and ownership of projects.

A key strategy that donors are undertaking to ensure that transition management of structural infrastructure to national ownership is effected with less resistance from national government is strengthening capacity building in transition and sustainability management to those identified from the government to oversee implementing policies and manage public resources. Leadership, human resource and finance management were identified as core elements to support transitioning of services from donor management to national management in the public service delivery sector and these can also be adapted to fit our Zambian setup.

One major observation noted was the scarcity of literature on how governments in developing countries are managing to maintain the countries' physical infrastructure in the health sector without donor support. The chapter reviewed available literature on how to foster sustainability after transition of services and physical infrastructure to national management. The literature further revealed that funding for maintenance activities is a major challenge hindering physical infrastructure maintenance.

Table 2.1 Summarizes the literature that was reviewed and provides objectives of those studies the methodology used and conclusion and comments. Chapter 3 examines the research methods employed to achieve the objectives of the study.

Table 2.1: *Literature Review Summary*

Author	Year	Title	Objective	Methodology	Conclusion/Comments
Suwaibatul Islamiah A. S. and Hakim A.M.	2011	Key Factors in Developing Maintenance Culture of Public Asset Management, International Building & Infrastructure Technology Conference	The objective was to identify key factors in developing maintenance culture in public asset management	Qualitative research using literature review	The paper reviews the key factors needed in developing maintenance culture of public assets management, internal building and infrastructure technology.
Stephen J. Thomas	2005	Improving Maintenance Reliability Through and Cultural Change. Industrial Press Inc.	To assess maintenance reliability through cultural change	Explanatory	The book gives insight into the importance of maintenance and how culture can help in maintenance implementation.
Florence	2011	An Empirical Analysis of Asset Replacement Decisions and Maintenance Culture in Some Government Organizations Located in Ogbomoso and Ilorin Metropolis as Case Study. Journal of Management and Society	The objective of the study was to assess the level of maintenance culture in Ogbomoso and Ilorin metropolis in assert replacement.	Case study	The study indicates that maintenance culture needs to be addressed and understood by all to effectively implement maintenance activities in a workplace or setting
British Standard Institution BS 3811	1974	Glossary of General Terms Used in Maintenance Organization, London	Provides definitions on most commonly used maintenance terms in the engineering world.	Explanatory	Provides me industrial meaning to most used maintenance terms
Hafizi Zakaria, Kadir Arifin, Shaharuddin Ahmad and Kadaruddin Aiyub	2012	Financial factor affecting maintenance management in safety and health practices	The aim of the study was to present the current scenario of maintenance management in safety and health practice based on financial factor.	Case study	The study concluded that the maintenance management had realized their role towards the need of budget for every maintenance plan in safety and health practices.

Author	Year	Title	Objective	Methodology	Conclusion/Comments
Sanyal, D	2008	A Search for Eco-Friendly Building Materials for Sustainable Urban Mass Housing. World Congress on Housing. Kolkalta India.	To establish eco-friendly sustainable building materials for easy maintenance of infrastructure.	Case Study	Provides insight into available eco-friendly building materials that foster easy and sustainable maintenance.
Amar Bhattacharya, Mattia Romani and Nicholas Stern	2012	Infrastructure for development: meeting the challenge Policy paper Centre for Climate Change Economics and Policy Grantham Research Institute on Climate Change and the Environment	To investigate the effects of climate change on physical infrastructure.	Explanatory	The research highlights that climate change does have an impact on the physical infrastructure and periodic maintenance of infrastructure is of the essence.
Olufemi Adedamola Oyedele	2012	The Challenges of Infrastructure Development in Democratic Governance.	The objective was to identify the challenges that are faced in infrastructure development in democratic governance especially in developing nations	Explanatory	The research emphasises on the need to establish internal revenue generation to assist in infrastructure development.
Amusan Lekan M, Owolabi Dele, Ogunde Ayodeji and Tunji-Olayeni, P	2011	Sustainability Strategies in Engineering Infrastructure-Maintenance in Developing Countries Selected State in South Western Nigeria.	The study researched into sustainability strategies that can be adopted in engineering infrastructure maintenance.	Case Study	The study identified sustainable approaches to maintenance of engineering infrastructure and if these approaches could be observed would lead to increased productivity among maintenance workers, reduction in accidents, incidences of rework and waste would be eliminated and there by producing quality job output.

Author	Year	Title	Objective	Methodology	Conclusion/Comments
OECD	2005	The Paris Declaration on Aid Effectiveness and the Accra Agenda for Action.	The objective of the meeting was to take far reaching and monitorable actions to reform the way aid is delivered and managed in developed and developing countries	Explanatory	Provides solutions on effective aid implementation and management
N. E. M. Nik-Mata, S. N. Kamaruzzamanb, M. Pitta	2011	Assessing the Maintenance Aspect of Facilities Management through a Performance Measurement System: A Malaysian Case Study	To assess maintenance activities in the public sector	Case study	The study addressed the need to improve maintenance of facilities in the public sector through performance management systems.
Peter Ondiegge, Jennifer Mbabazi Moyo & Audrey Verdier-Chouchane	2013	Developing Africa's Infrastructure for Enhanced Competitiveness	To examine the link between infrastructure development and competitiveness in Africa in greater detail.	Explanatory	The report examined the state of infrastructure, challenges to infrastructure development in Africa, including its regulatory environment and it provides an analysis on the impact of infrastructure development on Africa's competitiveness and provides the way forward.
B.S Dhillion	2002	Engineering Maintenance, A modern Approach.	The purpose of this book was to provide insight in the tools, strategies and several types of engineering maintenance available	Explanatory	This book provides in depth guide and knowledge on engineering maintenance.

Author	Year	Title	Objective	Methodology	Conclusion/Comments
O&M Best Practices Guide	2010	Types of Maintenance Programs	This guide provides a detailed discussion on the types of maintenance programs that can be undertaken.	Explanatory	This guide is a comprehensive reference guide for all individuals or organisations intending to undertake physical infrastructure maintenance.
Westerkamp, TA	1997	Maintenance Manager's Standard Manual	The purpose of this book was to explain the maintenance standards to maintenance technicians and engineers and encourages adhering to these standards	Explanatory	This book provided all necessary information about maintenance standards needed in building maintenance for technicians and engineers.
Matthew Dornan	2012	Aid and the maintenance of infrastructure in the pacific.	This report was intended to address the effects of aid and the challenges that it provides in the maintenance of infrastructure specifically in the pacific.	Explanatory	The report indicates that most donors prefer the construction of new infrastructure unlike rehabilitation or maintaining already existing infrastructure.
Sara Bennet, Suneeta Singh, Sachiko Ozawa Nhan Tranad and JS Kang.	2013	Sustainability of donor programs: evaluating and informing the transition of a large HIV prevention program in India to local ownership	The aim of the research was to create a detailed logic model for the transition of programs from donor funding to national governments.	A qualitative approach using literature review and interviews.	The study reviewed that it is unusual for donor supported projects in low and middle income countries to carefully plan transition processes and prospectively evaluate them.

Author	Year	Title	Objective	Methodology	Conclusion/Comments
CIDRZ	2011	CIDRZ Newsletter	A Written article highlighting the services rendered to MoH by CIDRZ in HIV Care services and infrastructure construction in supported facilities.	Explanatory	The article gave insight into donor support given to MoH to provide services to communities in various parts of the country.
Mundia Muya, Edward Lusambo, Suzzane Rattary, Ian Banda, Christopher Mubemba, Sylvester Hibaajene, Inambao Mang'elele, Garry Mukelabai and Kaluba Chisanga	2012	Infrastructure Report card framework, Engineering Institute of Zambia	The report addressed the need to have robust infrastructure in Zambia. It also highlighted the poor maintenance culture and inadequate resource allocation.	Explanatory/Collaborative	The report provides guidance and criteria assessment for infrastructure monitoring and grading.
Lartey W. Emmanuel	2000	Evaluation of donor funded social service infrastructure development projects in Lusaka compounds/townships.	The purpose of the study was to evaluate the performance of programmes and the level of involvement of the target population groups in the identification, design, implementation and monitoring of two donor funded projects in the compounds/townships of Lusaka district.	Qualitative approach by questionnaires, face to face interviews and physical inspection of the existing infrastructure facilities.	The study concluded that donors have contributed significantly to the provision of social service infrastructure facilities.

Author	Year	Title	Objective	Methodology	Conclusion/Comment
Government of the Republic of Zambia	2012	National Health Policy	The policy outlines the Zambian governments direction on the development of the health sector and in the provision of equitable access to health services.	Explanatory	The policy highlights the set-out measures to guide strategies and programmes in the health sector
Shimomura, Y, Ohno, K and Nagua, M	2005	True ownership and policy autonomy: Managing Donors and and Owning policies.	The objective of the case study was to analyze the experiences of three East Asian Countries in managing aid relationships and development processes.	Case study	The study assisted in contributing to deepening the understanding of ownership of programs in Asia. It also cast light on the different nature and levels of ownership.
Zambia Development Agency	2014	Infrastructure Sector Profile	The report informs the potential investors on the infrastructure deficient and requirements in Zambia.	Explanatory	The report provides insights into potential areas that need infrastructure investments.
Ministry of Health	2012	Joint Annual Review 2011, Health Sector Performance Review.	The report shows reviews on the performance of the health sector in Zambia for the fiscal year of 2011.	Explanatory	The report is a valuable tool for monitoring and evaluating the performance of all health service in the health sector.
Sani, S.I. A, Mohammed A. H, Misnan M. S and Awang M.	2012	Determinant factors in development of maintenance culture in managing public asset and facilities.	This research aimed at reviewing the determinant factors which influence the development of maintenance culture.	Qualitative research using literature review	The determinant factors were identified in the development of the maintenance culture and these include; leadership, communication, rewards and recognition, team work, training and education, motivation, involvement, empowerment, policy systems strategies, work planning and organisation structure.

Author	Year	Title	Objective	Methodology	Conclusion/Comment
Talib, R, Ahmed, A. G, Zakaria, N and Sulieman, M. Z	2014	Assessment of Factors Affecting Building Maintenance and Defects of Public Buildings in Penang, Malaysia	The objective of the study was to assess the factors affecting maintenance and defects of public buildings in Penang.	Case study	The study concluded that lack of preventative maintenance, insufficient funds to maintain the buildings, lack of building maintenance components were the major reasons of factors affecting maintenance of public buildings in Penang.
Costa Hosifi	2013	The Sustainability of Donor Funded Projects in Malawi	The aim of the study was to evaluate the sustainability of donor funded projects in Malawi with particular focus given to food security projects.	Qualitative research using literature review.	The research concluded that Sustainability was determined by how much the implementation process empowered the communities to sustain the development initiatives after the projects had been phased out.
Yamamoto, K, Asako, K, Kasarawa, T and Kawasaki, H.	2012	Sustainability of Grant Aid Projects	The aim of the evaluation was to assess the ability of developing countries that have comparatively low income levels to manage grant aid projects.	Explanatory	The evaluation concluded that the strategies identified to improve sustainability require flexible consideration according to needs, not only at the time of planning, but also during and after project implementation based on the project management systems in the partner country
Adam Ahmed Soliman Sabbil and Omer Haroun Mastour Adam	2015	Factors affecting project sustainability beyond donor support. The case of area development scheme in Umkadada locality north Darfur state, western Sudan.	This research aimed at studying the main factors affecting the sustainability of Donor funded projects, in Darfur, with particular emphasis on the Area Development Scheme (ADS) in UmKadada Locality/ North Darfur State.	Case Study	The results achieved revealed that despite the withdrawal of the foreign assistance, the project existed and performed some activities. Such results were attributed to the approach adopted by the project which promotes the direct involvement of beneficiaries in all project phases.

Author	Year	Title	Objective	Methodology	Conclusion/Comments
Katy Oswald and Laurent Ruedin	2012	Empowerment sustainability and phasing out support to empowerment processes.	Report on the importance of encouraging sustainability and phasing out of projects by donors.	Explanatory	The report indicates that donors should work with existing organisations from the beginning, agree a clear exit strategy and emphasis capacity building of local partners and look for synergies among projects, governments and donors
L M Mufalali, MP; Dr B Chituwo, MP; C J Antonio, MP; E C Musonda, MP; M Simfukwe, MP; S T Masebo, MP; M Habeenzu, MP; and L Lingweshi, MP.	2014	Report of the committee on health, community development and social services for the fourth session of the eleventh national assembly.	The aim of the committee was to carry out detailed scrutiny of certain activities being undertaken by Ministries of Health and Community Development, Mother and Child Health, departments and/or agencies under their portfolio and make appropriate recommendations to the House for ultimate consideration by the Government.	Explanatory	The report provided a review of the Progress made by Zambia towards achieving the health-related millennium development goals.
Ann Swidler and Susan Costs Watkins	2008	Teach a man to fish: The sustainability doctrine and its social consequences.	The aim of the study was to analyze the social consequences of the commitment to sustainability in donor funded AIDS programs.	Qualitative research using surveys, interviews and ethnographic data.	The study concluded that projects for community mobilization frequently fail to achieve their goals and that resources are sometimes diverted from their intended beneficiaries.
Hans Halbwachs	2013	The importance of maintenance and repair in health facilities of developing economies.	The purpose of this document was to address the importance of maintenance in health facilities in developing economies	Explanatory	It provided guidance on how to conduct effective maintenance plans and schedules in health facilities.

Author	Year	Title	Objective	Methodology	Conclusion/Comments
Ahmad Zawawi, Emma Marinie Syahrul Nizam Kamaruzzaman, Azlan Shah Ali and Raha Sulaiman	2010	Assessment of building maintenance management in Malaysia: Resolving using a solution diagram.	The aim of the study was to examine the process of building maintenance and management in Malaysia with the aim of identifying factors causing poor maintenance in various types of buildings.	Explanatory	The results of the research concluded that the most important factors causing poor maintenance in various types of building is lack of adequate funding, non adherence to maintenance schedules, late identification of most faults and lack of skilled man power to conduct specialized maintenance works.
Keith Aulick	2011	Three partner transition model	To implement a three partner transition model in the management of health services in Tanzania	Case study	The study provides overview of the different approaches to localization through the three partner transition model.
Sarah T. Lucas	2011	Principles into practice: Country ownership	The objective of the policy paper was to provide a focused mandate aimed at reducing poverty through economic growth.		The policy paper considers the implementation of the U.S global development policy which emphasises on country ownership of programs

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

To achieve the research, aim and objectives, appropriate methods were adopted for the study. This chapter present a detailed explanation supporting the choice of research methodology used for the study. The chapter further includes the research methodology, research design, research methods sampling technique and characteristics of the sample.

3.2 Research methodology

The research methodology is a framework that offers both strategies and grounding for conducting the research study (O'leary, 2010). It describes the research plan, the techniques and methods. Methodologies are crucial to the research process and provide researchers with legitimated knowledge which eventually is used to show the outside world the knowledge acquired and produced after conducting the research (Ghosh, 2011). This is done by providing answers to why a research study has been conducted in the manner specified, how the research problem has been defined, how the hypothesis was formulated, type of method adopted for data collection, what data has been collected and how this data has been analyzed. The methodology adopted for this research was designed to assist in understanding the problem and find workable solutions to answer the research questions.

3.3 Research methods

In the pursuit of truth and gaining knowledge, research is undertaken to contribute to the existing stock of knowledge (Jonker and Pennink, 2010). Research methods are the techniques used to collect and analyze data (Welman and Kruger, 2001). Methods of data collection include interviewing, surveying, observation and unobstrive methods, while methods for analysis comprise of quantitative and qualitative strategies (Neville, 2007). Research methods are central to the conduct of research and offer the choice of direction that the researcher can take towards the conduct of the research and thus achieving the objectives (Dawson, 2007).

Below are some of the various research methods that can be used. The research methodology for this study included the research design, population, sample size, data collection, instrument design and the method of data processing and analysis. The stages below were followed.

Stage 1: Literature review

The secondary data of the research was collected through literature review. Literature review was the focus on defining and assessing the maintenance culture and maintenance of physical infrastructure in transitioned health centres. It included review of journals, relevant books, reports and conference papers with regards to current local and foreign on maintenance of physical infrastructure. The review of literature was done for the researcher to understand the subject, recognize what other researchers have previously achieved and to prepare the research methodology appropriate for the study. Due to scarcity of literature on maintenance of physical infrastructure in transitioned health centres, the internet was the main electronic source of secondary data.

Stage 2: Study design

This stage involved designing an approach that would allow for the collection of relevant data. A mixed method approach was taken in conducting this research. This is where qualitative and quantitative method were used simultaneously. Primary data using structured interviews was collected through visiting selected transitioned health centres and self-administered questionnaire were used.

Stage 3: Data collection

After development of the questionnaire, it was distributed, and the target respondents were maintenance officers from transitioned health centres. Interviews were also conducted with a Non-Governmental Organisation (NGO) that assists Ministry of Health (MoH) in the provision of health services in Zambia, MoH and Ministry of Works and Supplies (MWS).

The data collected was to help obtain the perspectives of why there is the lack of maintenance of physical infrastructure in transitioned health centres.

Stage 4: Data analysis

The data collected was analyzed using the Statistical Package for Social Sciences (SPSS). This was used to identify the major factors that have influenced the lack of maintenance of physical infrastructure and suggest recommendations for the improvement of maintenance and maintenance culture.

3.4 Research design

A research design is a plan, structure and strategy of investigation conceived in order to obtain answers to research questions or problems (Kumar, 2011). The research design assists the researcher to communicate to others the proposed design, how the data will be collected as well as details on how the respondents will be selected, procedures on how the data will be collected and analyzed and in addition how the findings will be communicated to the others (Walliman, 2011). Kumar (2011) further asserts that the research design includes an outline of what the researcher will do to conduct and finalise their research. The research design for my research was structured in a way that would guide my research to find solutions that would help improve the maintenance of physical infrastructure for health centres transitioned from donor management to MoH. A comprehensive research plan was drafted and included the following activities in a logical sequence;

- Identification of the research topic.
- Definition of the research problem.
- Review of the Literature available on the research matter.
- Creation of the data collection tools.
- Research data analysis.
- Detailed summary of conclusion and recommendations.

There are several research designs available for diverse types of research projects. The choice of research design that the research intends to apply depends on the nature of the problem posed by the research (Dawson, 2007). Walliman (2011) identified the following below as some of the common research design;

3.4.1 Historical

This type of research design aims at a systematic and objective evaluation and synthesis of evidence to establish facts and draw conclusions about past events (Walliman, 2011). The purpose of this design is to find solutions based on the past to inform the present and probable future trends. This design was not suitable for my research due to the difficulties encountered in accessing data on past maintenance activities undertaken by MoH only without donor support.

3.4.2 Descriptive

This design relies on observation as a means of collecting data. It attempts to examine research situations to establish what the norm is, and what can be predicted to happen again. Depending on the type of information sought by the researcher, participants can be interviewed, questionnaires distributed, and visual records made (Welman and Kruger, 2001). This design was found to be suitable for my research as it is easy to conduct and provides more control over the research. A closed questionnaire and structured interviews were employed as the sole data collection tools.

3.4.3 Correlation

In research design, correlation is used to examine relationships between two concepts. The relationship must be causal in that changes in one part must cause changes in the other (Brewerton and Millward, 2001). This design was found not suitable for this research because it is difficult to implement.

3.4.4 Comparative

This design is used to compare past and present or different parallel situations where the researcher has no control over events (Wellington, 2015).

The purpose of comparative design is to explore and test what conditions are necessary to cause certain events and to understand the likely effects of making certain decisions.

3.4.5 Experimental

The experimental research design endeavors to isolate and control every relevant condition which determines the events investigated and then observes the effects when the conditions are altered (Bryman, 2004). Monitoring of the conditions occurs when changes are made to an independent variable and affects the dependent variable. This design was found not to be suitable for the study as it is expensive and time consuming.

3.4.6 Simulation

The research involves devising a prototype that can be manipulated to measure effects. This design has some similarities with the experimental design the difference is that it provides a more artificial environment in that it does not work with original material (Saunders et al, 2009). This design was found not suitable as it would be difficult to implement.

3.4.7 Evaluation

This research design is intended for use when dealing with complex social issues. It aims to move beyond "just getting the facts," by trying to make sense of the various human, political, social, cultural and contextual elements involved (Walliman, 2011). The purpose of evaluation research design is to observe project works from initiation to implementation focusing on the accomplishment of the objectives. This design is not suitable for this research as it requires rigorous project monitoring over an extended period.

3.4.6 Action

This design deals with taking prompt action to a specific problem. Solutions are identified, implemented and constant monitoring and evaluation is conducted to see if the solutions have taken an effect (O'Brien, 2001).

Action research design depends on observation and behavioral changes in the research matter. This design was found not suitable for this research because it would be expensive to implement.

3.4.6 Ethnological

This research design focuses on people and it is interested in how research participants interpret their own behaviour rather than imposing a theory from the outside (Neville, 2007). This design is challenging to implement in that the cultural background and assumptions of the research may interfere in the interpretation of the final research results. This design was found not suitable due to its complexity and rigid requirements.

3.5 Research approaches

There are two basic approaches to research, the quantitative approach and qualitative approach (Kothari, 2004).

3.5.1 Quantitative Approach

A quantitative approach in research involves the use of statistics to interpret data that is in numerical form (Kothari, 2004). Research data that is collected through questionnaires or structured interviews can be manipulated using statistical software to interpret results (Dawson, 2007). Quantitative data can be measured more or less accurately mathematically due to its number content (Jonker and Pennink, 2010). The benefit of a quantitative research is that the study can be replicated for verification and reassurance by another researcher (Kothari, 2004).

3.5.2 Qualitative Approach

In a qualitative approach, the focus is to understand, explain, explore, discover and clarify solutions, feelings, perceptions, attitudes, values, beliefs and experiences of the research (Kothari, 2004). Qualitative research depends on carefully defined meanings to words, variables and developed concepts (Walliman, 2011).

Data that is collected in a qualitative research is usually not numerical in nature and does not use statistical analytical packages as key analysis tools (Wellington, 2015).

3.5.3 Mixed Method

Mixed method types of research are defined as studies that are products of the pragmatist paradigm that combine the qualitative and quantitative approaches within the different phases of the research process (Tashakkori and Teddlie, 2008). Mixed methods allow the researcher to develop research protocols in stages and it further offers more than one way of looking at a situation, facilitates varied perspectives and allows for triangulation (O'Leary, 2010). Welman and Kruger (2001) assert that mixed methods allow for the use of both methods and helps to overcome either of their shortcomings. The research approach adopted for this study was that of the mixed method approach. Qualitative methods were used to gain insight of the underlying factors limiting and affecting the maintenance of physical infrastructure in transitioned health centres managed by MoH. Quantitative methods provide quantified numerical data to assist in addressing maintenance issues and identifying probable solutions that can assist in improving maintenance on infrastructure in the transitioned health centres.

3.6 Sources of data

Research uses data as the raw material to assist in making conclusions to an issue (Walliman, 2011). There are two types of data a researcher can collect, primary and secondary data (Kumar, 2011). Primary data is data that has been observed, experienced or recorded close to the event and is nearest that one can get to the truth (Ghosh, 2011). Secondary data is data from written sources that interprets or record primary data (Kothari, 2004). Methods of collecting primary and secondary data are different in that primary data is originally collected, while secondary data involves compilation of existing data (O'Leary, 2011). For this research both primary and secondary data collection were used to concurrently.

3.6.1 Primary data

Primary data are the first and most immediate recordings of a situation (Walliman, 2011). Primary data assists the researcher to have prior background insight into their research area before conducting a fully-fledged research (Dawson, 2007). Primary data can be collected from the researchers own observation, interviews, questionnaires, focus groups and case studies (Dawson, 2007; Kothari, 2004; Kumar, 2011; O'Leary, 2011; Walliman, 2011).

3.6.1.1 Types of primary data collection methods

A. Observation Method

Observation is a way of watching and listening to an interaction as it takes place. This method is commonly used when he researcher is interested in the behaviour than in the perceptions of the individual (Kumar, 2011). There are two types of observation namely participant and non-participant. Participant observation occurs when the researcher participates in the activities of the group being observed. Non-participant observation occurs when the researcher does not get involved in the activities of the group but is only a passive observer to the group (Kumar, 2011).

Advantage of observation method

- The information obtained mainly relates to what is currently happening.

Disadvantages of observation method

- When individual or groups become aware that they are being observed, they
- There is always a possibility of observer bias.
- Interpretation drawn from observations may vary from observer to observer.

B. **Questionnaire**

These are the most popular type of primary data collection method by most researchers (Dawson, 2007). There are three basic types of questionnaires namely, closed-ended, open-ended or a combination of both.

B.1 Closed-ended Questionnaire

This type of questionnaire is used to generate statistics in quantitative research. Close ended questionnaires have already predefined answers that the respondent answers to. These questionnaires follow a set format and can be scanned straight into a computer for ease of analysis. A Likert scale was used in this study to allow for respondents to indicate answers according to the predefined list. Likert scale is used to measure attitudes to set statements put by the questionnaire (Wilkinson and Birmingham, 2003).

B.2 Open-ended Questionnaire

Open-ended questionnaires are used in qualitative research, although some researchers will quantify the answers during the analysis stage. These questionnaires have blank sections for respondents to write an answer on to and allow for recording of any response to a question provided by the respondent. Ghosh (2011) noted that data analysis is more complex with open ended questionnaires due to the non-standard answers to the questions in it.

B.3 Combination of both

A combination of both questionnaires is used by many researchers because they capture the qualitative and quantitative data requirements of the subject area being researched on.

According to O'Leary (2011) while questionnaires can offer much to the production of knowledge, easy use, straight forward and in expensive to use, they have several advantages and disadvantages.

Advantages of questionnaires

- It is less expensive.
- Reaches a larger number of respondents.
- Allows for comparison.

- Represents an even larger population.
- Generates standardized, quantifiable.
- Can be confidential and even anonymous.
- Very little training is needed to develop them.

Disadvantages of questionnaires

- Gathering in depth data can be difficult
- Often difficult to get a representative sample to respond to the questionnaire
- Needs proficiency in statistical analysis
- May require going back to respondents if more data is required
- Capturing the quantifiable data required may be a challenge

C. Interviews (Kumar, 2011)

Interviewing is a commonly used method of collecting information from people. An interview involves an interviewer reading questions to respondents and recording their answers. Furthermore, it is a way of obtaining detailed information about a topic or subject (Wilkinson and Birmingham, 2003). This method allows for the researcher when interviewing respondents, the freedom to decide the format and content of questions to be asked, wording of questions, decision on how the questions will be asked and the order in which they are to be asked.

C.1 Types of Interviews

According to Kumar (2011), interviews are classified into distinct categories such as unstructured and structured interviews.

C.1.1 Unstructured interviews

These types of interviews provide complete freedom in terms of content and structure. The interviewer is free to order their questions in whatever sequence, words used and the way the questions are explained to the respondent. Unstructured interviews are prevalent in both quantitative and qualitative research the only difference is in how information obtained through them is used.

Dawson (2007) emphasizes that researchers need to remain alert, recognizing valuable information and probing for more details.

C.1.2 Structured Interviews

In structured interviews the researcher asks predetermined set of questions, using the same wording and order of questions as specified in the interview schedule. An interview schedule is defined as a written list of questions, open ended or closed prepared for use by an interviewer in a person- to- person interaction, by telephone or by any other electronic media. The main advantage of structured interviews is that it provides uniform information which assures the compatibility of data and it requires fewer interviewing skills than does unstructured interviewing.

There are five stages to developing and effective use of interviews (Wilkinson and Birmingham, 2003) and these include and are depicted in Figure 3.1;

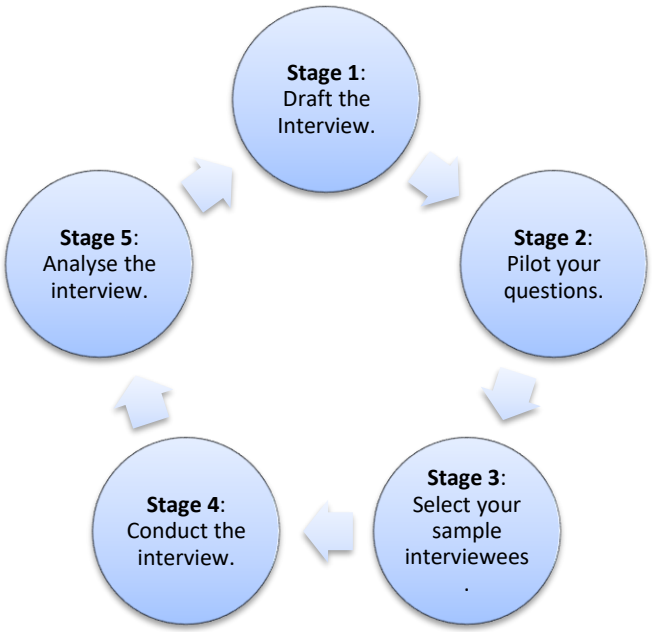

Figure 3.1: *Stages of developing an effective use of interview*

Stage 1: Draft the interview

This involves the construction of questions that the interviewer would like to ask. The number, type and format of the question is determined by the design structure of the interview.

Stage 2: Pilot your questions

This involves the actual testing of the interview questions with a select few people to assess whether the interview questions are clear or need any revisions. Piloting assists in identifying, eliminating and correcting any imperfections noted before the actual interview is conducted.

Stage 3: Select your sample interviewees

Wilkinson and Birmingham (2003) recommend that extra care must be taken when selecting the sample group of interviewees. The research question or questions can be used to help in identifying probable interviewees. Open ended questions are encouraged to be used as these provide more information than do closed questions from the interviewees.

Stage 4: Conduct the interview

This is the actual and final interview conducted with the credible interviewee. To ensure effective communication is taking place between the interviewer and interviewee, the interviewer may need to restate part or all the interviewees' responses to make any clarifications to statements that may have been said.

Stage 5: Analyze the interview

This is the final stage of the interview which involves consolidating the data collected and structuring it in a way that it can be analyzed. The analysis involves grouping the responses to each question from all interviewees to make comparison between respondents easy. This approach of grouping allows for issues and concerns to be easily identified and quantified.

According to O'Leary (2011) like any other data collection method, interviews have their advantages and disadvantages too.

Advantages of interviews include;

- It is useful for collecting in depth information
- It allows for non-verbal as well as verbal data
- They are flexible enough to allow the researcher to explore tangents
- Questions can be explained
- Interviews are structured enough to generate standardized quantifiable data

Disadvantages of interviews are;

- Lack of respondent anonymity
- It is a very expensive method especially when large and widely spread geographical sample is taken.
- Resisting the urge to lead your respondent to give you the answer that you need.

D. **Focus groups**

Focus groups are referred to as discussion groups or group interviews (Dawson, 2007). A group of people come together to discuss some certain issues. The facilitator introduces the topic, asks specific questions, controls digressions and stops break away conversations.

Advantages of focus groups

- Can receive a wide range of responses during one meeting
- Participant interaction is useful to analyze
- Helps people to remember issues they might have forgotten

Disadvantages of focus groups

- Some people may be uncomfortable in a group setting and nervous about speaking in front of others
- Not everyone may contribute to the discussion
- Some researchers may find it difficult or intimidating to moderate a focus group.

- It is difficult to extract individual views during the analysis.
- Other people may contaminate an individual's view.

For this study, primary data was collected through the use a combined questionnaire and face to face interviews. Environmental Health Technicians (EHTs) were the main target group for the questionnaires in the health centres because they are trained and equipped with the knowledge to professionally and competently assess maintenance needs particularly for those in the health centres. The questionnaire was administered to facility in charges in health centres that did not have EHTs. Face to face interviews were conducted with various stakeholders responsible for maintenance of infrastructure in health centres at the district health office and MoH. CIDRZ and SFH are the NGOs that were interviewed to get more information on how the transitions were carried out to ensure that MoH continues with the maintenance of the physical infrastructure that have been transitioned from donor management to MoH. In research methods, it is recommended for a combination of methods to be used as these helps to overcome the different weaknesses inherent in all methods employed (Dawson, 2007).

3.6.2 Secondary data

Secondary data collection involves the collection of information from studies that other researchers have done through review of literature documented on the subject matter (Saunders et al, 2009). This review of literature assisted the researcher to have background understanding to issues associated with this study. Secondary data is often used to compare with primary data that may have been collected to triangulate the findings.

To have a good and broader literature cover that is enough to inform the audience, it is paramount to read extensively in the area of the research study (Neville, 2007). O'Leary (2010) further asserts that the main reason for undertaking a review of literature is to;

- Inform the audience of what is happening in the field of research.
- To establish the credibility, capabilities and knowledge of the researcher.
- To argue the relevance and significance of the research question.

- To provide context for the methodological approach by identifying and discussing methods and approaches that have been used by other researchers.

3.6.2.1 Sources of secondary data

Numerous sources of secondary data exist the main being documentary sources such as written and non-written materials (Walliman, 2011). Below are some of the secondary data sources grouped into categories (Kumar, 2011);

E. Government or semi-government publications.

Several government and semi government organization collect data on a regular basis in various areas and publish the data for use by members of the public and interested groups. Examples of such publications include census, labour force surveys, health reports, economic forecast and demographic information.

F. Earlier research

This is for some topics that have had a number of research studies that have already been done by others can provide the researcher with the required information.

G. Personal records

Some people do write historical and personal records in documents such as diaries or journals. These can also be used as they may provide information that the researcher may need.

H. Mass media

This includes reports or journals published in newspapers, magazines, on the internet and many others. Brewer and Millard (2001) advises the researcher to be careful when using secondary data as there may be problems with the availability, format and quality of data.

The extent of problems that may be encountered while using secondary sources varies from source to source. Kumar (2011) identifies the following as issues that the researcher needs to keep in check when using secondary data;

1. Validity and reliability

   Validity of information may vary from source to source, for example information obtained from a census is more valid and reliable than that obtained from personal diaries.

2. Personal bias

   The use of information from personal diaries, newspapers and magazines have been associated with the problem of personal bias due to writers who in most cases have exhibited less thoroughness and objectivity when compared to research reports.

3. Availability of data

   Beginner researchers I included in most cases assume that the required data will be available. Kumar (2011) advises that such assumptions are to be avoided and it is important to make certain that the required data is available before further proceeding with the research.

The researcher for this study did consider the factors above and ensured that only verified and approved literature was reviewed and incorporated into this document extracted from trusted online sources, the school library and government departments visited during the research period.

3.7 Secondary data sources utilized

Secondary data for this study was extracted mainly from mass media, journals and government publications. These sources of data provided the most and recent up to date information on the maintenance of public physical infrastructure, transition of management from donors to national ownership, factors affecting maintenance of infrastructure in the public health sector and monitoring of maintenance schedules. Journals were a useful source of information on what others have done their results and analysis in relation to my study. Government publications such national health policy and national health strategic plans were a great resource of information too as these enabled the research to gain knowledge on the plans that the government has identified to foster maintenance of public infrastructure.

Books on infrastructure maintenance were used in this research as they provided detailed information on literature that was largely documented in the previous chapter. This review of literature assisted in clarifying the research question, aim and objectives.

3.8 Sample size

Sampling is defined as the process of obtaining information about an entire population by examining only a part of it (Kothari, 2004). In this research a sample size of thirty (30) transitioned health centres was selected due to the time constraint and geographical distances that were needed to be covered to conduct this research. The geographical coverage included, Western, Lusaka and Eastern provinces of Zambia. Ten (10) health centres in each of the three (3) provinces were visited of which five (5) were rural based while the remaining five were urban centres. The difference in the geographical settings assisted in having a broader and wider coverage on maintenance issues in the various locations. The disproportionate stratified sampling technique was utilized so as to allow any minority to be represented.

3.9 Research population

Population in research methodology is understood to be objects, phenomena, cases, events or activities specified for sampling (Brynard and Hanekom, 2005). For this study, the population consisted of all the subjects responsible for maintenance activities at the health centre and these included the health centre in charges and environmental health officers. Maintenance technicians and managers from DHO, MoH and Ministry of Works and Supplies were part of the population size. Two NGOs Centre for Infectious Disease Research in Zambia (CIDRZ) and Society for Family Health (SFH) were also part of the population.

3.10 Ethical considerations

The information obtained for this study was solely collected to assist with this study. No information pertaining to an individual or institution was used for any other purpose without their consent.

Permission to use data that was obtained from the facilities was approved by DHO and MoH. The research was voluntary and therefore no one was forced to disclose the requested information. The study had no direct benefits for the individual study participants, but it was hoped that the information gathered would benefit the nation through consideration of improving maintenance of physical infrastructure in the public health sector without dependency on western donors.

3.11 Limitations

In undertaking this study, the following limitations were encountered;

- Due to limited time and accessibility restrictions from a few DHOs to visit some health centres, the study could not adequately capture the targeted study population.
- Another major limitation of the study was the scarcity of literature on maintenance of physical infrastructure in the Zambian health sector.
- Because data was being collected in three different provinces, the geographical location and distance of the health infrastructures made it difficult for the questionnaires to be collected on time.
- Most of the respondents were very busy and thus some were not able to have the time to complete the questionnaire.
- Another challenge was the financial constraints to facilitate the study, as this is a self-sponsored study.

3.12 Summary

This chapter describes the methodology used to conduct this research. It brought forward the various methodologies that could be adopted for research purposes. The chapter presented aspects of the methodology chosen and their justification. Aspects of the methodology including population, sampling method, data collection instruments were discussed. The chapter further presented an explanation of how the research problem was investigated and described the tools used to carry out the investigation. Primary data was collected through questionnaires and structured interviews and secondary data through surveys of related studies. The internet was established as the main source for secondary data while books and journals were the paper based sources. Chapter four provides an analysis and discussion of the data collected.

CHAPTER FOUR: RESULTS AND DATA ANALYSIS

4.1 Introduction

This section intended to investigate the lack of maintenance of physical infrastructure in health centres transitioned from donor to national management, by having various tests on the variables related to the research problem. It determined the knowledge of information about physical infrastructure maintenance, level of usage of maintenance schedules and furthermore found out the opinions on improvement on maintenance of physical infrastructure this was evidenced with the help of qualitative data. This section analyzed data using semi-structured questionnaires surveying three different provinces using a triangulated approach of both quantitative and qualitative data from Eastern, Western and Lusaka provinces to investigate the maintenance and sustainability of physical infrastructure in health centres transitioned from donor to national management in some parts of Zambia. A probability value (Pr) of 0.05 was used to determine the significance of relationships that had a significant relationship with maintenance and sustainability of physical infrastructure in health centres as determined by Pearson chi-square test of association while Likert analysis among others were used to scaling responses in the survey research on investigating the lack of maintenance and sustainability of physical infrastructure in health centres.

4.2 Background characteristics of respondents

This section started by capturing the demographic and socio-economic characteristics which included age group population, district setting and highest educational level of the respondent. The findings are shown in the Tables 4.2, 4.2a, 4.2b, 4.2c and 4.2d.

Table 4.2d further revealed that most of the respondent 71 percent attainted diploma level while others who said they had certificates and degrees were represented by four (4) percent and 25 percent respectively on the question addressing education level. Furthermore, there was an equal representation of respondents as they were 50 percent each of males and females. Most of the respondents were from eastern province (38 percent) followed by western province (33 percent) and Lusaka was the least at 29 percent, in which the rural location had most of the respondents at 71 percent compared to those in the rural at 29 percent.

Table 4.2: *Frequency and percentage distribution of respondents by District Setting*

District setting	Frequency	Percent
Rural	**17**	**71**
Urban	**7**	**29**
Total	**24**	**100**

Table 4.2a: *Frequency and percentage distribution of respondents by Gender*

Gender of Respondent	Frequency	Percent
Male	**12**	**50**
Female	**12**	**50**
Total	**24**	**100**

Table 4.2b: *Frequency and percentage distribution of respondents by Age of Respondents*

Age of respondent	Frequency	Percent
21-29	**4**	**17**
30-39	**11**	**46**
40-49	**8**	**33**
50-59	**1**	**4**
Total	**24**	**100**

Table 4.2c: *Frequency and percentage distribution of respondents by Profession.*

Profession	**Frequency**	**Percent**
Sister in Charge	**2**	**8**
EHTs	**11**	**46**
Clinician	**5**	**21**
Nurses	**3**	**13**
Pharmacy tech	**1**	**4**
Other	**2**	**8**
Total	**24**	**100**

Table 4.2d: *Frequency and percentage distribution of respondents by Educational Level*

Educational Level	**Frequency**	**Percent**
Certificate	**1**	**4**
Diploma	**17**	**71**
Degree	**6**	**25**
Total	**24**	**100**
Province		
Eastern	**9**	**38**
Lusaka	**7**	**29**
Western	**8**	**33**
Total	**24**	**100**

Table 4.2a represents the frequency and percentage distribution of the male population from age 21-59 by their background characteristic in terms of demographic and socioeconomic. As can be seen in Table 4.2b, most of the respondents were in the age group 30-39 represented by 46 percent followed by those in age group 40-49 with 33 percent. The minority of the respondents were in the age group 50-59 and 21-29 represented by four percent 4 and 17 percent respectively. Table 4.2 also revealed that 71 percent of the respondents resided in rural areas and 29 percent resided in urban areas. Most donor support and infrastructure set up targets the vulnerable communities and these are mostly found in the rural areas thus the higher representation recorded in the rural settings. Response rate in most of the urban centres was very low and therefore, it can be concluded that most of these respondents were rural residents.

4.2 Part A.1: Univariate analysis

Univariate analysis is the simplest form of quantitative analysis. The analysis is carried out with the description of a single variable in terms of the applicable unit of analysis (Ackoff and Russell, 1962). Univariate analysis is performed when we want to explore each variable in a data set, separately. It looks at the range of values, as well as the central tendency of the values. It describes the pattern of response to the variable. Data analyzed through univariate analysis will be presented using Pie-Charts.

The findings in Figure 4.1 indicates, that 38 percent of the respondents indicated that donors manage the infrastructure and equipment fairly, while 42 percent indicated that the services were good, and 21 percent responded that there is excellent management of infrastructure when the infrastructure is managed by the donors. The findings indicate that donors were conducting management of infrastructure and equipment accordingly and efficiently.

Figure 4.1*: Assessing how donors manage infrastructure and equipment at the facility*.

Respondents were asked to select the relevant response on how often donors were conducting maintenance surveys of the facility or equipment, in Figure 4.2, 17 percent responded semi-annually and annually respectively while 38 percent indicated surveys were only done quarterly. Other respondents at four percent indicated monthly surveys were conducted and 25 percent of them were unsure whether donors did conduct maintenance surveys in the facilities.

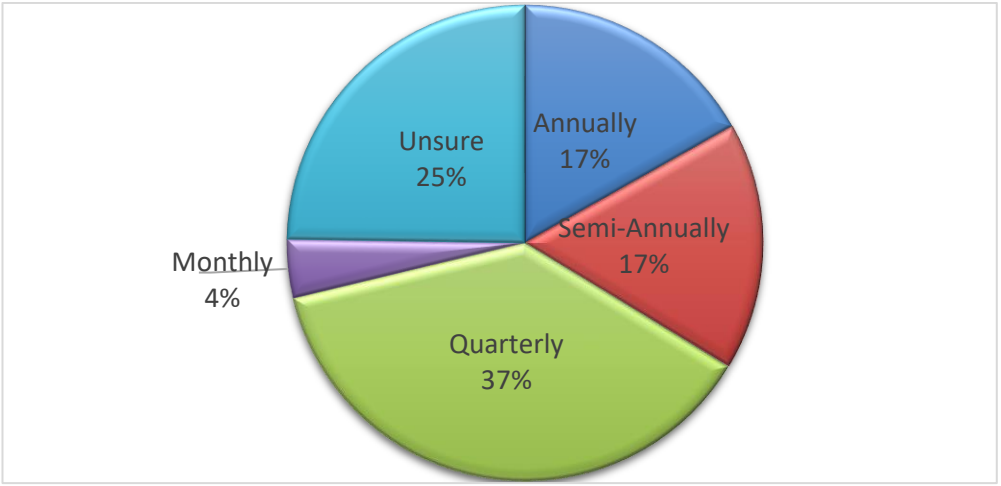

Figure 4.2: *Frequency on how often donors conduct maintenance surveys of infrastructure and equipment*.

Figure 4.3 provides results on the level of extent that the donors consult with personnel (users) on facility/equipment function. The other 71 percent of the respondents indicated that consultations were held all the time, while 21 percent indicated that they were rarely consulted, and eight percent were unsure.

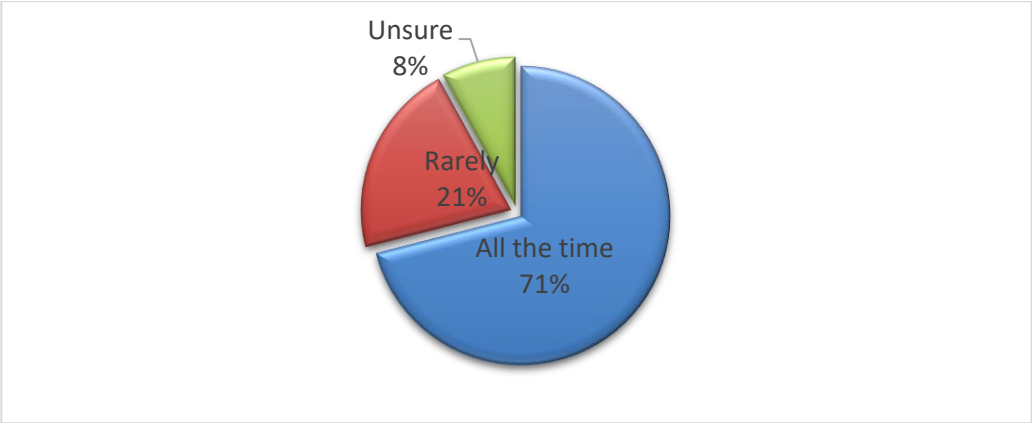

Figure 4.3: *Assessing frequency to what extent donors consult with personnel at the facility.*

For any damaged sections to a building or equipment that was not working properly at the facility and required maintenance, respondents were asked to indicate the turnaround time it took the donor to refurbish or fix the damages. Figure 4.4 indicates that 14 percent of the respondents indicated 2 months and 1 month respectively, while nine percent indicated two (2) weeks response time and 36 percent were unsure. Respondents that indicated other unspecified turnaround times were at 27 percent and their responses included;

- Majority did not specify the turnaround time as this was rarely documented.
- Some works were done in less a week after submitting the maintenance request.

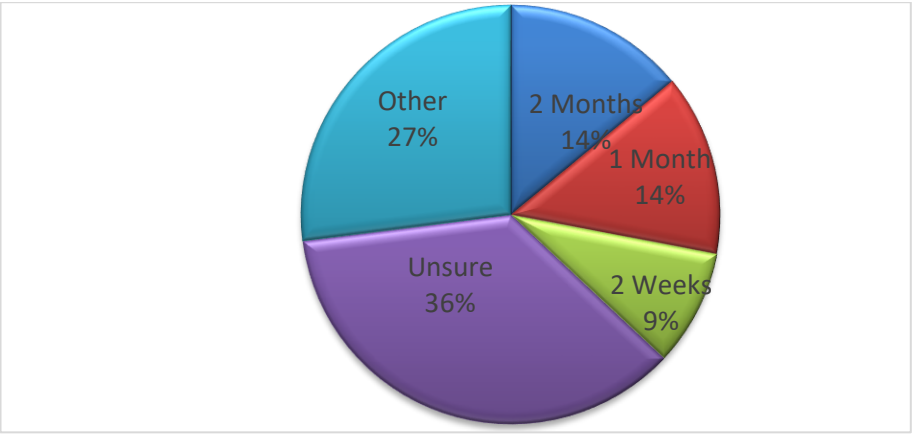

Figure 4.4: *Measuring turnaround time for donors to refurbish or fix damages*

Figure 4.5 presents results that were analyzed in response to the question that was enquiring on, while managing services at the facility, did donors at any point engage any facility personnel tasked to oversee maintenance activities to assist with the maintenance of infrastructure that was under their management.

Most of the respondents at 80 percent agreed while 17 percent responded no to this question.

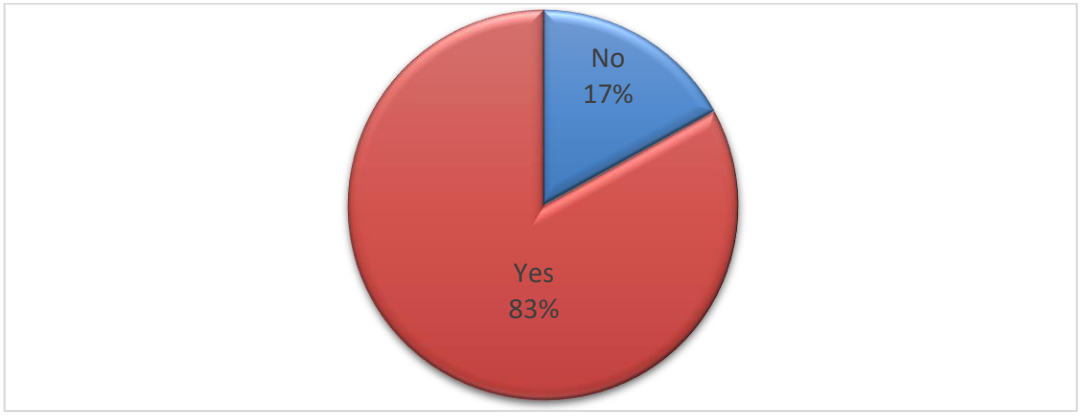

Figure 4.5: Establishing whether donors engage facility personnel when conducting maintenance activities.

To encourage local ownership and to monitor whether donors did mentor facility personnel on how to maintain the infrastructure that was set up and managed by the donors, Figure 4.6 indicates that 71 percent responded yes while 29 percent responded no to this question.

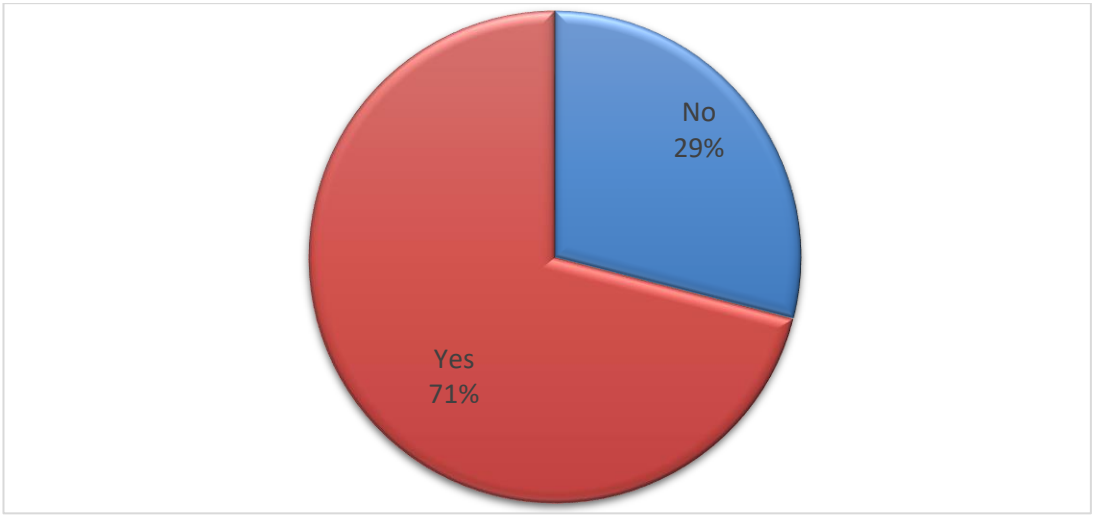

Figure 4.6: *Assessing whether facility personnel were mentored on maintenance activities.*

To establish the sustainability of maintenance of infrastructure prior to donors transitioning maintenance services to national management, in Figure 4.7 respondents were asked to indicate yes or no on whether donors requested for financial assistance

from the facility to assist with repair works to damaged infrastructure or equipment. Most of the respondents at 91 percent indicated no while 9 percent indicated yes.

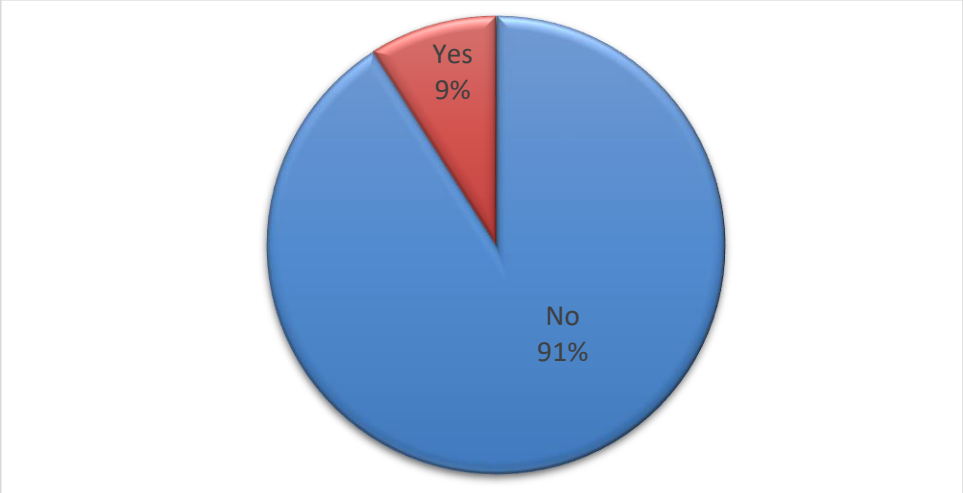

Figure 4.7: *To establish the financial sustainability of maintenance activities of infrastructure before transitioning to MoH.*

The respondents were further requested to indicate whether the facility received direct funding for maintenance activities. According to Figure 4.8, 78 percent of the respondents answered no to not receiving direct funding, while 22 percent responded agreed to receiving direct funding for maintenance activities or works.

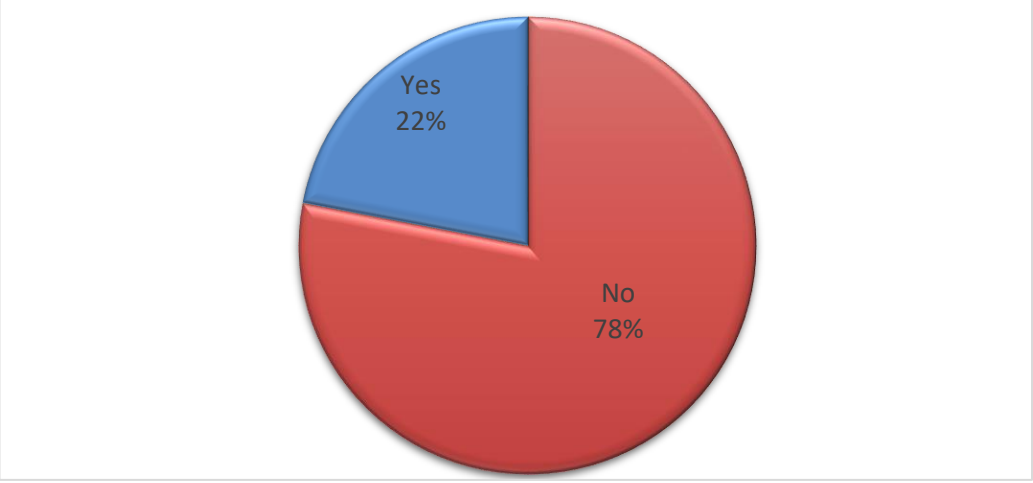

Figure 4.8: *Assessing whether the facility received direct funding for maintenance activities before transition.*

4.3. Part A.2: Univariate analysis

It was also prudent to investigate and gather general insights on how health centres where managing maintenance of infrastructure when donors were not supporting maintenance works before donors offered to provide support. To establish on whether facilities had maintenance technician permanently located at the facility, Figure 4.9 depicts 67 percent of the respondents had no maintenance technicians while 33 percent had reasons as to why the facilities did not have permanent maintenance technicians these included;

- Shortages of maintenance technicians.
- Zonal maintenance technicians assigned to cover several facilities.
- Some facilities were not allocated any maintenance technician.
- Reliance on district officers or provincial maintenance technicians to offer maintenance services.

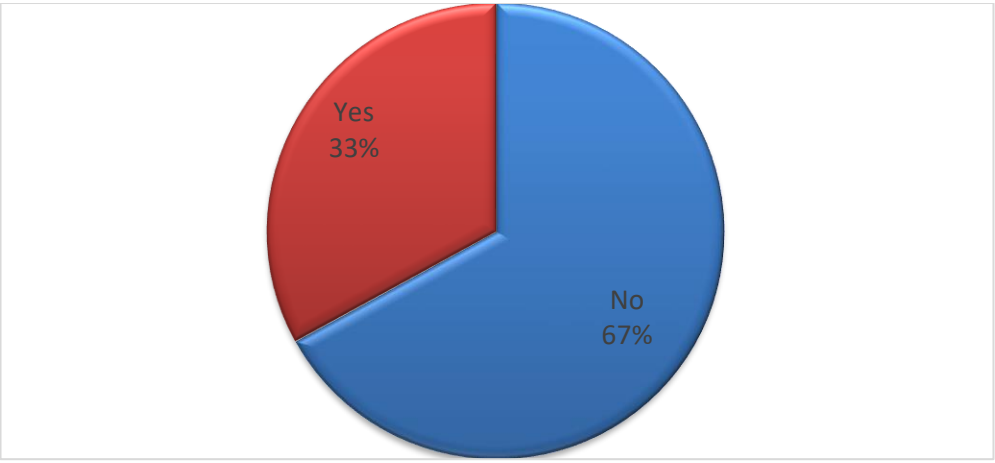

Figure 4.9: *Establishing whether the facility had a maintenance technician located at the facility.*

To investigate on maintenance plans availability in the facilities, Figure 4.10 shows that 92 percent of the respondents agreed to plans being available in the facility while eight percent had no plans in place. The reasons why the plans were not in place included;

- None receipt of the plans from the district health offices due to transport challenges.
- None availability of hard or soft copies of these plans at the district health offices.

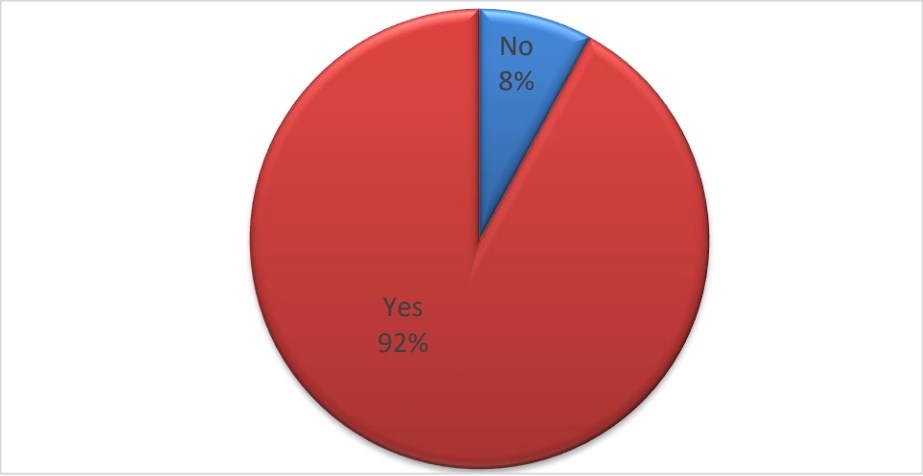

Figure 4.10: *Assessing whether the facilities have maintenance plans.*

To further ascertain to what extent the maintenance technicians from the DHO/MoH consulted with the personnel at the facilities on equipment functionality or physical infrastructure maintenance in Figure 4.11, 33 percent indicated that consultations where done all the time, while 58 percent indicated consultations were rarely done and at only eight percent none were done at all.

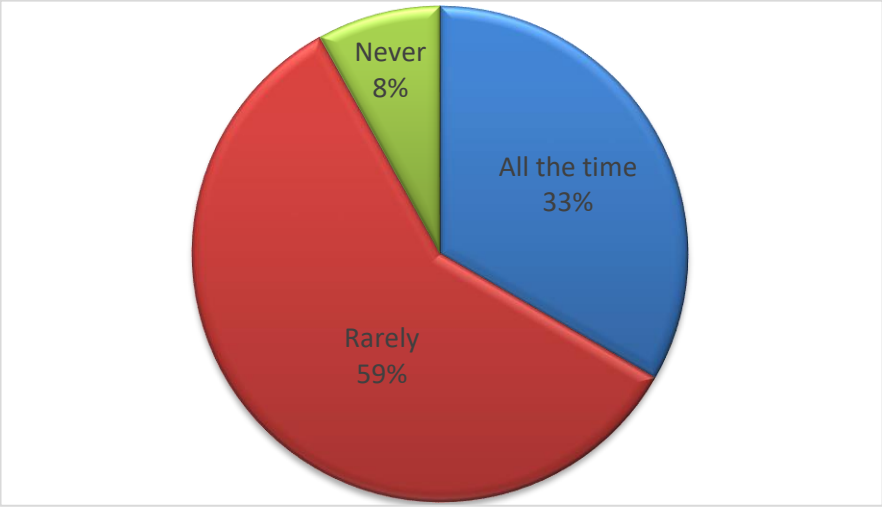

Figure 4.11: *Establishing to what extent the maintenance technicians from the district or MoH consulted with facility personnel on infrastructure functionality and maintenance.*

To establish the response time from the DHO/MoH on action to be taken on reports submitted by the facilities for any damaged sections to a building or equipment that was not working properly at the facility and required maintenance, Figure 4.12 shows that 33 percent indicated that it took 2 months for DHO/MoH to attend to the request, while five percent indicated that it took 1 month or 2 weeks respectively for the reports to be attended to. Most of the respondents at 57 percent indicated other responses which include;

- It was more than three months.
- Some facilities did not bother to document the turnaround time.

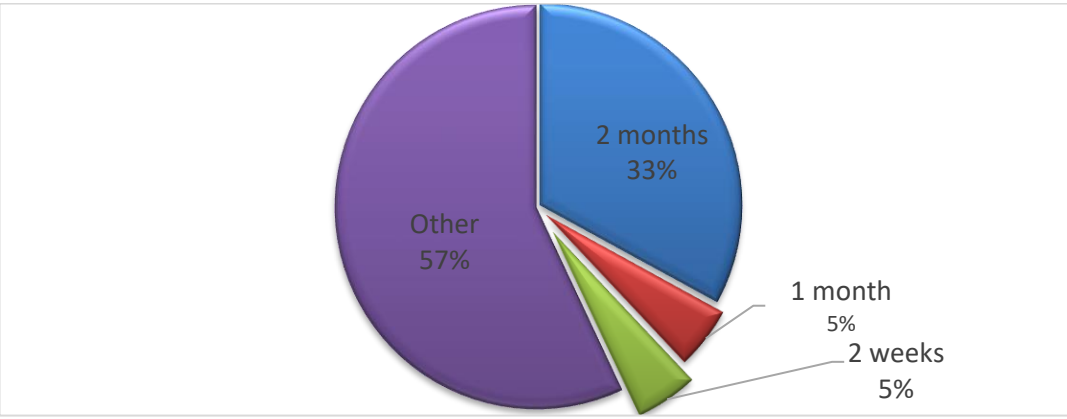

Figure 4.12: *Establishing turnaround time for resolving reported maintenance works.*

To investigate on whether the facilities conducted minor maintenance works such as replacement of door handles, broken windows, damaged taps, broken toilet flushers or linking toilets and many others, with their own financial resources, in Figure 4.13, 21 percent of the respondents were able to fix such maintenance works with their own financial resources while 79 percent could not manage to fix minor maintenance works with financial resources mobilised by the facilities due to limited funding and resource mobilization.

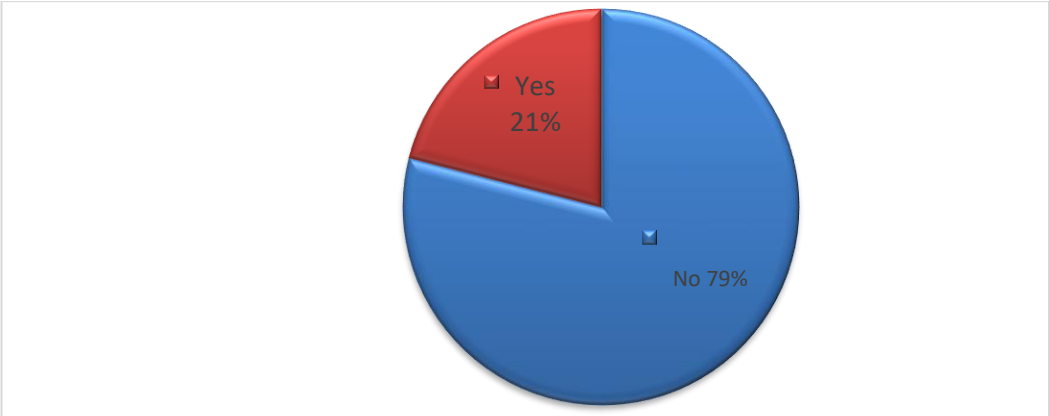

Figure 4.13: *Investigating whether the facility resolves minor maintenance works reported by the facility.*

To establish on whether the facilities had budget allocations for maintenance activities from the imprest received from MoH, in Figure 4.14, 87 percent had funds allocated for maintenance activities while 13 percent had no budget allocation for maintenance activities. It was further established that from the 87 percent that received funds for maintenance activities, the monies allocated for maintenance where diverted to other activities that need urgent attention thus suspending maintenance works.

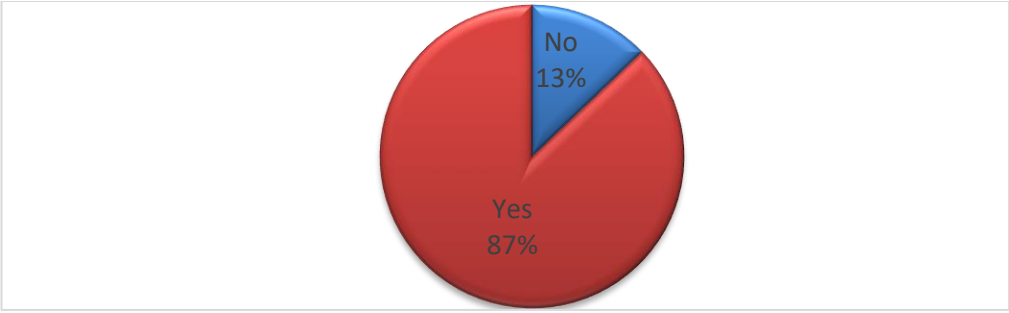

Figure 4.14: *Assessing whether the facilities have a budget allocation for maintenance activities.*

4.4 Part A.3 Univariate analysis

Table 4.3a: *Relationship between background characteristics and if the health facilities have a maintenance plan.*

Background characteristics	**Does the facility have a maintenance plan?**		
District setting	**Count**	**Per cent**	**P-value= 0.343**
Rural	15	68	
Urban	7	32	
Total	22	100	

Table 4.3b: *Relationship between background characteristics and if the health facilities have a maintenance plan - Provinces.*

Province	**Count**	**Per cent**	**P-value= 0.071**
Eastern	9	41	
Lusaka	5	23	
Western	8	36	
Total	22	100	

Table 4.3c: *Relationship between background characteristics and if the health facilities have a maintenance plan - Profession.*

Profession	**Count**	**Per cent**	**P-value= 0.898**
Sister in charge	2	9	
Nurse	10	46	
Clinician	4	18	
EHT	3	14	
Pharmacy Tech	1	5	
Other	2	9	
Total	22	100	

Table 4.4: *Relationship between background characteristics and if the health centre receives direct funding for maintenance activities – District Setting.*

Background characteristics	**Did the facility receive direct funding for maintenance activities?**		
District Setting	Count	Percent	P-value= 0.599
Rural	3	60	
Urban	2	40	
Total	5	100	

Table 4.4a: *Relationship between background characteristics and if the health centre receives direct funding for maintenance activities.*

Province	**Count**	**Percent**	**P-value=0.042**
Eastern	0	0	
Lusaka	1	20	
Western	4	80	
Total	5	100	

From Table 4.4 most health facilities from the rural areas reported that they receive most of direct funding for maintenance activities (60%) compared to those in urban (40%), it was also evident there is no relationship between the district setting and direct funding because the p-value was 0.599 which is greater than 0.05 therefore it is not statistical significant.

On the contrary, there was a relationship between the health infrastructures from a certain province with direct funding as it can be seen that the p-value is less than 0.05 which shows that there is a statistical significance between the variables.

4.5 Bivariate Analysis

In a bivariate distribution, we are interested in finding a relationship (if it exists) between the two variables under study. Bivariate is a statistical method designed to detect and describe the relationship between two variables (David, 2005).

To determine the relationship between background characteristics and those who responded that they had maintenance plan. The Table 4.3a results sought to determine the respondent's main reason for the health centre having a maintenance plan. Effects such as district setting, province and profession were captured as variables and they were subjected to a chi-square test as presented in Tables 4.3 and 4.3a. The chi-square value is a statistic that sum the contributions from each of the individual cells in a data table (Romijin, 2014). It provides a summary measure of the differences between what is observed and what is expected. The larger, the difference between what is observed and what is expected, the more likely the relationship between the variables is not due to chance (David, 2005). In this regard, all variables having a probability-value less than 0.05 show a positive relationship between the independent and dependent variables whereas, those variables with a probability -value greater than 0.05 show a negative relationship or rather no correlation.

Therefore, the results in Table 4.3a, show that most of the respondents from rural setting (68 percent) had a maintenance plan compared to those in urban settings represented at 32 percent. Furthermore, table 4.3b shows that 41 percent from eastern province responded that they had a maintenance plan this was followed by Lusaka province at 36 percent with Western province the least at 23 percent. If the probability-values on all cross tabulations (a technique for analyzing the relationship between two variables that have been organized in a table in form of row and column) were greater than the significance value (0.05), this showed that the results showed no significant relationship between the variables.

4.6 Analysis of Dependent Variables

This is used to find the degree of use attached to each of the observations. The standard deviation of the sample data is a description of the variation in measurements. The standard deviation of the sample is the degree to which individuals within the sample differ from the sample mean.

The standard deviation of the sampling distribution is called the standard error of the mean. Knowledge of the standard error helps in estimating how accurately a sample mean estimates a population mean. In other words, it is the measure of precision of sample estimates, it is the actual or estimated standard deviation of the sampling distribution of the sample statistic (Allen and Harrell, 1978).

4.6.1 Assessing the level of knowledge of maintenance workers at the health centre

To assess the level of knowledge on maintenance works by the workers at the health centres, respondents were asked to select on a Likert scale the following conditions; Not at all, Limited, Working knowledge and Very good knowledge.

Table 4.5: *Factors to assess the level of knowledge of maintenance workers at the health centres.*

Factors	Weighting	Mean	Std. Dev.	Rank
Are you able to perform minor electrical works such as replacing switches, sockets, wall plugs etc.?	24	2.125	1.035	1
Can you perform preventative maintenance on mechanical equipment such as greasing, oiling and replacing of worn or defective parts?	24	2.25	0.989	2
Can you conduct maintenance audits?	23	2.434783	0.896	3
Are you able to perform minor repairs to walls, ceilings, window frames and doors?	24	2.125	0.992	4
Are you able to assist skilled workers in more complex electrical, mechanical and plumbing works?	24	2	0.885	5
Are you able to conduct risk management process for maintenance (i.e. the act of identifying, analyzing and responding to potential risks)	24	2.666667	0.816	6

Source: Own computations. Mean= 2.2669, Standard Deviation= 0.935418033

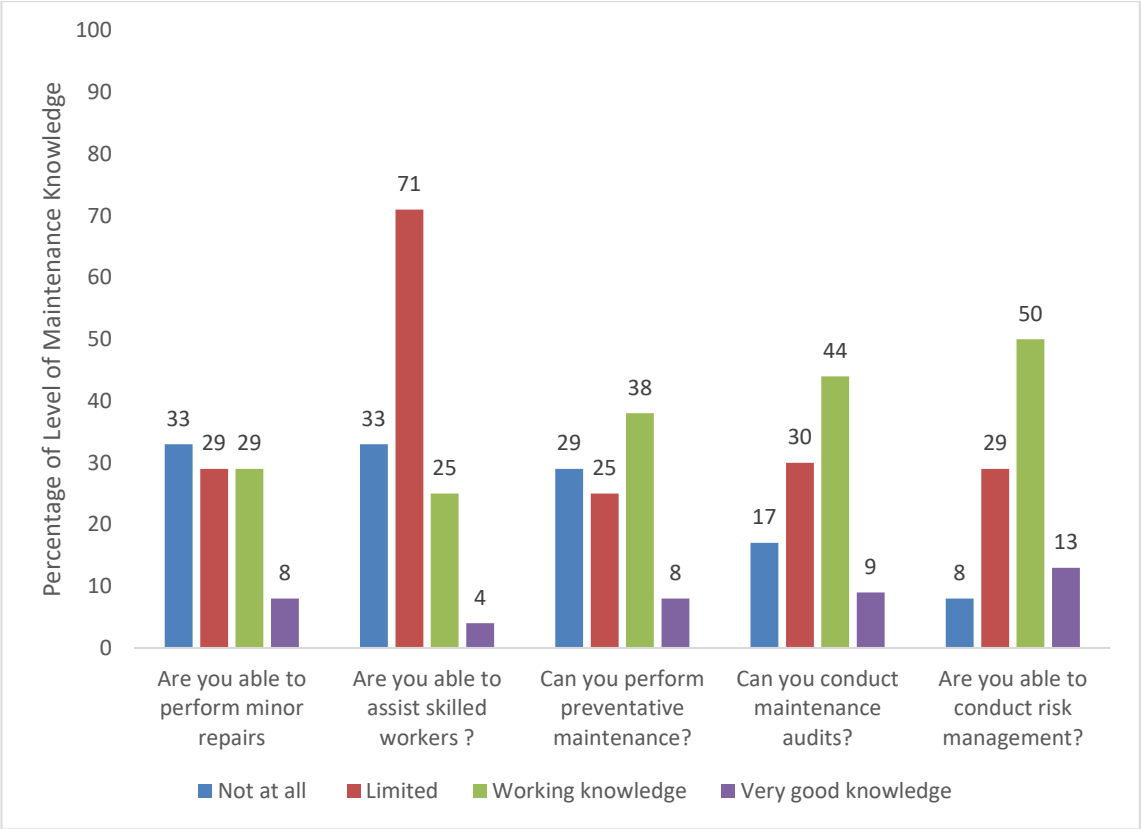

Figure 4.15: *The level of knowledge of maintenance workers at the health centres in percentages.*

As indicated in Table 4.5, respondents were asked to indicate on whether they could perform minor electrical works, and this was ranked first with SD of 1.035. The percentage distribution depicted in Figure 4.15 shows that; 33 percent of the respondents were not able to while 29 percent offered that they had limited knowledge on maintenance works at the health centre. While 29 percent had working knowledge and on the other eight (8) percent responded they had very good knowledge on performing minor electrical works.

Assessment on conducting preventative maintenance on mechanical equipment was ranked second with SD of 0.989 as shown in Table 4.5. According to Figure 4.15, it was evident that 29 percent of the respondents were unable to conduct preventative maintenance while 25 percent had limited knowledge. In addition, 38 percent had working knowledge while eight (8) percent had very good knowledge on preventative maintenance works.

As illustrated in Table 4.5, conducting maintenance audits was ranked in third with SD of 0.896. Figure 4.15 shows that 17 percent of the respondents were unable to conduct maintenance audit, while 30 percent had limited knowledge. Furthermore, nine (9) percent had very good knowledge on conducting maintenance audits while 44 percent had only working knowledge.

Table 4.5 shows that respondents were asked to rate their ability to perform minor repairs to walls, ceilings, window frames and doors. This assessment was ranked fourth with SD of 0.992. The results collected in Figure 4.15 indicate that 33 percent of the respondents were not able to perform minor construction maintenance works while 29 percent had limited knowledge. Only 29 percent had working knowledge with eight (8) percent having very good knowledge on performing minor construction maintenance works.

Assessment on the ability of the respondents to assist skilled workers in more complex electrical, mechanical and works was ranked fifth with SD of 0.885 as indicated in Table 4.5. with 71 percent of the respondents had limited knowledge on assisting skilled workers, while in Figure 4.15, 33 percent had no knowledge at all. Four (4) percent of the respondents had very good knowledge on assisting skilled workers with 25 percent only having working knowledge. Another key factor that was assessed and ranked sixth with SD of 0.816 was the ability of the respondents to conduct risk management processes as seen in Table 4.5. In Figure 4.15, eight (8) percent of the respondents were not able to conduct risk management process. Twenty-nine (29) percent had limited knowledge, while 13 percent had very good knowledge on risk management processes and 50 percent had working knowledge.

These results indicate that the level of knowledge of maintenance workers at the health centre are on the low for most health centres in Zambia. The level of the agreement on the lack of knowledge on maintenance is at least consistent as most of the variables had a standard deviation less than 1.

4.6.2 Assessing the level of usage of maintenance schedules and plans

Table 4.6 depicts the opinions of the respondents on the assessment of the level of usage of maintenance schedules and plans.

Table 4.6 shows that respondents were asked to indicate whether the health centres had maintenance schedules and plans. This assessment was ranked first with SD of 1.313. 33 percent of the respondents indicated that most of the time the maintenance schedules and plans were available while 13 percent of the respondents indicated no maintenance schedules and plans were available. Four percent of the respondents indicated the maintenance schedules and plans were rarely available and 21 percent mentioned theses could be seen sometimes.

Table 4.6: *Factors assessing the level of usage of maintenance schedules and plans.*

Factors	Weighting	Mean	Std. Dev.	Rank
Does the facility have a maintenance schedule or plan?	24	3.625	1.313	1
Do you understand the written sentences and paragraphs in the maintenance schedule or plan?	24	3.41667	1.213	2
Are you able to prepare budgets and reports for all anticipated maintenance works on time as indicated per schedule?	24	3.25	1.073	3
Do you conduct random tests and inspections of infrastructure to ensure they are in working order?	24	3.20833	1.179	4
Are you able to install, replace and maintain infrastructure as specified in the maintenance schedule?	24	2.375	0.924	5

Source: Own computations. Mean= 3.175, Standard Deviation= 1.14026024

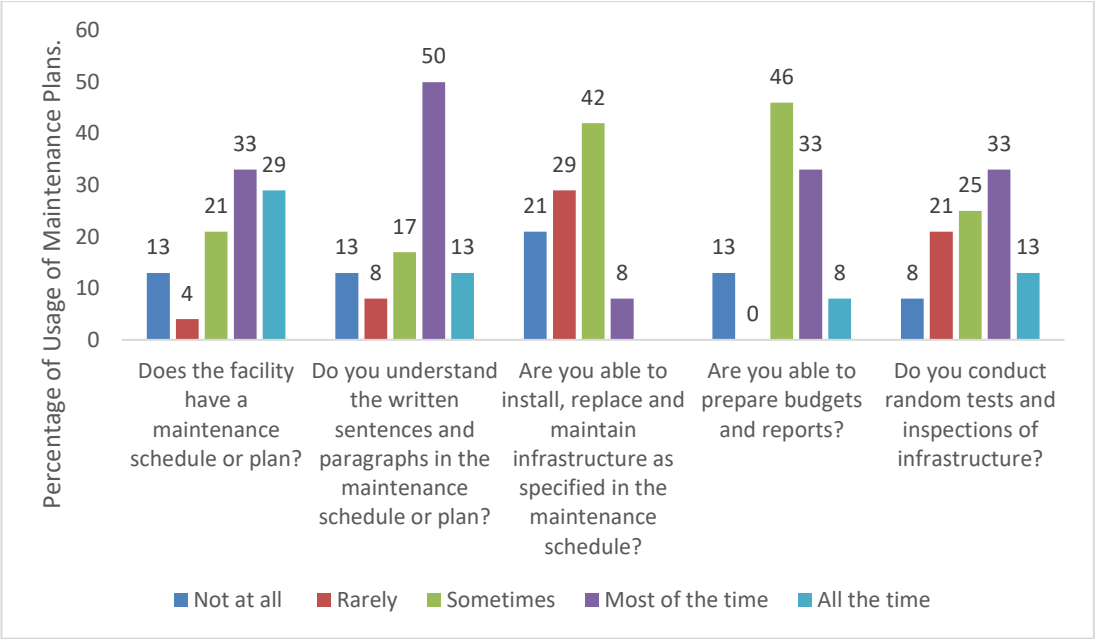

Figure 4.16: *Assessing the level of usage of maintenance schedules and plans in percentages.*

Assessment on whether the respondents understood the written sentences and paragraphs in the maintenance schedule or plan was ranked second with SD of 1.213 as indicated in Table 4.6. Most of the respondents at 50 percent understood the written sentences and paragraphs in the maintenance schedule or plan.

Eight percent of the respondent rarely understood the contents of the maintenance schedule and plans while 17 percent could sometimes understand the contents. The other 13 percent of the respondents did not understand the contents of the maintenance schedule and plans.

Another key factor that was assessed and ranked third with SD of 1.073 was the ability of the respondents to prepare budgets and reports for all anticipated maintenance works on time as indicated per schedule. Furthermore, 33 percent of the respondents indicated that most of the time they prepared budgets for maintenance works while 13 percent of the respondents did not prepare any maintenance budgets for the health centres. The other 46 percent indicated that they did prepare budgets sometimes.

Assessment on whether the respondents could conduct random tests and inspections of infrastructure to ensure they are in working order was ranked fourth with SD of 1.179. It was evident that; 33 percent of the respondents could conduct random tests and inspections of infrastructure to ensure they were in working order while eight (8) percent were unable to conduct random tests and inspections of the infrastructure.

Another 21 percent of the respondents rarely conducted random tests and inspections while 25 percent of the respondents sometimes did conduct random tests and inspections on infrastructure to assess whether they were in working order.

As shown in Table 4.6, the factor ranked fifth assessed whether the respondents could install, replace and maintain infrastructure as specified in the maintenance schedule with SD of 0.924. The results indicate that 8 percent of the time the respondents could install, replace and maintain infrastructure while 21 percent could not at all conduct this activity. With 29% of the respondents rarely installed, replaced and maintained infrastructure as per schedule with 42 percent of the respondents sometimes being able to undertake these maintenance tasks as specified in the maintenance schedule.

Most of the factors had a mean more than 3.175 which indicates that usage of maintenance schedules and plans are on the high for most health centre in Zambia although implementation of actual maintenance works was hampered by lack of financial resources. The level of the agreement is relatively consistent as most of the variables had a standard deviation not more than 1 in absolute terms.

4.6.3 Improving maintenance of physical infrastructure at the health centre.

Respondents were asked to rank the key factors that would assist to improve maintenance of physical infrastructure in the health centres. All factors were ranked according to the standard deviation to adduce the most crucial factors that can help improve maintenance of physical infrastructure in the health centres.

As illustrated in Table 4.7, conducting regular inspections and audits on maintenance works was ranked first with SD of 0.487. This shows that the respondents saw this conduct of regular inspections and audits as a critical factor that assist in timely identification of maintenance works. This factor was also recognised by the O&M Best Practices guide (2010) which strongly recommends implementing reactive, preventative and corrective maintenance activities to prevent infrastructure from ruin and dilapidation.

Table 4.7 further shows that having clear policy guidelines on maintenance distributed and displayed in the health centre was ranked second with SD of 0.504. This result indicates that the respondents thought this was a very important factor to assist in conducting maintenance activities efficiently. These results agree with the parliamentary report on health (2014) that indicated that there is no policy on maintenance of infrastructure in the health sector and there in need to formulate a maintenance policy. Dhillion (2002) further asserts that having a maintenance policy is one of the most crucial elements of effective maintenance management.

From Table 4.7 it is shown that strict management practices by MoH to nurture maintenance activities was ranked third with SD of 0.659. This factor was also recognized by Florence (2011) who noted that maintenance culture is not universal in nature and is usually derived or learned through a person or organisation making maintenance a natural daily practice that can be followed and emulated by others.

Good communication and feedback by all stakeholders on maintenance works undertaken was ranked fourth with SD of 0.590 as can be seen in Table 4.7. This crucial factor agrees with Dhillion (2002) who identified eight elements of effective maintenance management. Under equipment records that is among the elements identified, he mentions that records or documents are useful when procuring latest items or equipment to determine operating performance trends, troubleshooting breakdowns, making replacements or modifications and identifying areas of concerns and investigating incidents.

As indicated in Table 4.7, provision of smart technologies to alert maintenance officers when to conduct scheduled maintenance activities was ranked fifth with SD of 1.021. These results agree with Dhillion (2002) who stressed that maintenance scheduling allocates appropriate time required to undertake maintenance works and suggested the use of methods time management schedule systems such as PERT and CPM.

Table 4.7: *Factors assessing improvement of maintenance of physical infrastructure in the health centres.*

Factors	**Weighting**	**Mean**	**Std. Dev.**	**Rank**
Conducting regular inspections and audits on maintenance works in all health centres by MoH.	23	1.348	0.487	1
Clear policy guidelines on maintenance distributed and displayed in the health centre	24	1.417	0.504	2
Strict management practices by MoH to nurture maintenance activities and schedules.	24	1.500	0.659	3
Good communication and feedback by all stakeholders on maintenance works undertaken.	24	1.500	0.590	4
Provision of smart technologies to alert maintenance officers when to conduct scheduled maintenance activities.	24	1.542	1.021	5
Assigning permanent maintenance officer at the health centre.	23	1.565	0.728	6
Continuously build capacity in maintenance officers	24	1.708	0.690	7
Award incentives to health centres adhering to maintenance schedules.	24	1.833	0.637	8
Removal of zonal maintenance officers	24	3.333	1.050	9

Source: Own computations. Mean= 1.749597333, Standard Deviation= 0.707211789

Assigning permanent maintenance officers at the health centres was ranked sixth with SD of 0.728 as seen in Table 4.7. This result agrees with findings from the prior investigation conducted by this researcher to gain preliminary insights on maintenance procedures in the health centres. The findings indicated that health centres do not have maintenance technicians on site.

As depicted in Table 4.7, continuously building capacity in maintenance officers was ranked seventh with SD of 0.690. This result agrees with Oswald and Ruedin (2012) article on the five principles that donors and NGOs must observe during transition to achieve sustainability of programs, implementing partners are urged to inclusively design project interventions that have self-sustaining systems as such as skills and knowledge transfer plans.

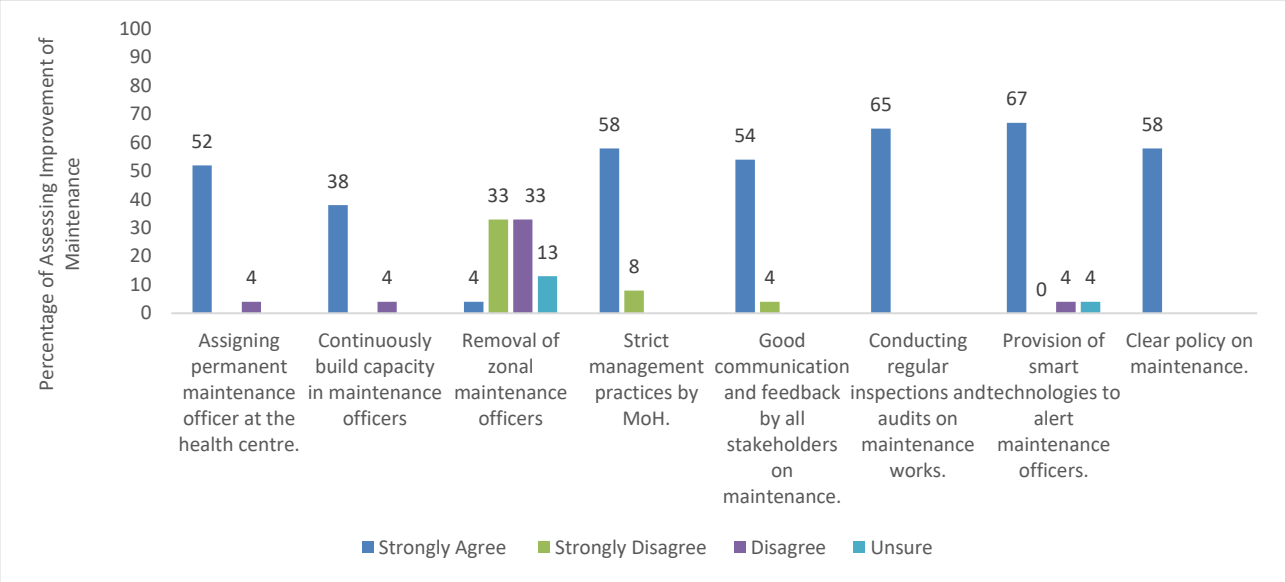

Figure 4.17: *Assessing improvement of maintenance of physical infrastructure in the health centres.*

Awarding incentives to health centres adhering to maintenance schedules was ranked eighth with SD of 0.637 as can be seen in Table 4.7. This factor to improve maintenance agrees with Lekan (2010) who emphasises that funds budgeted for maintenance must not be allocated to other areas when expenditure needs outstrip the budget.

As illustrated in Table 4.7, ranked in ninth position is the factor to remove zonal maintenance officers with SD of 1.050. This shows that this factor if removed will effectively enhance maintenance of physical infrastructure in the health centres if only health centres can have permanent maintenance technicians on site.

4.6.4 Recommendations from donors to MoH before transition.

Respondents were asked to rank the recommendations from donors to MoH before transition to assist in improving maintenance of physical infrastructure in the health centres.

Table 4.8: *Recommendations donors need to consider before transitioning.*

Factors	**Weighting**	**Mean**	**Std. Dev.**	**Rank**
Implement continuous training and talent development for maintenance personnel.	24	1.167	0.381	1
Engage MoH fully during the project lifecycle while it is managed by donors to foster sustainability	24	1.333	0.482	2
Invest in preventative and predictive maintenance activities.	24	1.542	0.509	3
Provision of smart technologies to refine maintenance schedules and plans	24	1.542	0.884	4
Improve cooperation with relevant stakeholders and ministries on timely conditional and corrective maintenance works	24	1.750	0.897	5
Consider private sector participation in carrying out maintenance works.	24	1.958	0.751	6
Implement inclusive user charges for maintenance revenue collection	24	2.750	1.422	7

Source: Own computations. Mean=1.72, Standard Deviation= 0.760596929,

The section explored the recommendation need to be considered before donors transitioned health centres to MoH management with seven (7) factors that might have a bearing on improving maintenance of physical infrastructure at the health centre using a Likert scale (1- strongly disagree, 2-disagree, 3-neurtal/unsure 4-agree, 5-strongly agree). It is interesting to note the survey results show that most recommended that health centres should implement continuous training and talent development for maintenance personnel.

In this analysis being able to implement continuous training and talent development for maintenance personnel was ranked first and then followed by engaging MoH fully during the project lifecycle while it is managed by donors to foster sustainability in second. The question to know if there is need to implement inclusive user charges for maintenance revenue collection was ranked last.

4.7 Statistical and regression tests

Statistics is concerned with scientific methods for collecting, organising, summarising, presenting and analyzing data as well as deriving valid conclusions and making reasonable decisions on the basis of this analysis. Statistics is concerned with the systematic collection of numerical data and its interpretation.

The word ‘statistic’ is used to refer to a number that describes a sample.

1. Numerical facts, such as the number of people living in particular area.
2. The study of ways of collecting, analyzing and interpreting the facts.

Statistical tests, provides a mechanism for making quantitative decisions about a process or processes. The intent is to determine the presence, quality or truth of the statistics (Romijin, 2014). The statistics are used to estimate the probability that the sample statistic (or observed relationship) provides an accurate estimate for the population.

One of the most widely used statistics is the coefficient which measures the degree of association between the two values of related variables given in the data set. It takes values from + positive to – negative. If two sets or data have positive coefficient, they are said to be perfectly correlated positively and if it is positive they are said to be perfectly correlated negatively (Barzun, et.al, 1970).

Regression analysis is a set of statistical processes for estimating the relationships among variables. Its focus is on the relationship between a dependent variable and or more independent variables. More specifically, regression analysis helps one to understand how typical value of the dependent variable changes when any one of the independent variables is varied, while the other independent variables are held fixed (David, 2005).

The t-test (*t)* shows the overall comparison of two means and determines within a specified degree of certainty whether the two means really are different, or whether the difference might have occurred by chance.

The confidence level is the frequency of possible confidence intervals that contain the true value of their corresponding parameter. The confidence level indicates the probability that the confidence interval captures the true population mean. This measures the association between two variables.

Correlation (r) is used to measure the strength of association between two variables and ranges between -1 (perfect negative correlation) to 1 (perfect positive correlation).

Cohen (1992) has the following interpretation of the absolute value of the correlation.

Table 4.9: *Coefficient and confidence levels.*

q24f	**Coef.**	**Std. Err.**	**T**	**P>t**	**[95% Conf.**	**Interval]**
q23	.3809524	.5088376	0.75	0.462	-.6743122	1.436217
_cons	1.952381	.9687979	2.02	0.056	-.0567829	3.961545

Table 4.9 shows q24f is a question that was assessing if the facility can conduct risk management process for maintenance while q23 is a question assessing whether the facility does have a budget allocation for maintenance. Figure 4.14 shows that a budget allocation for maintenance has a positive effect on the ability of the facility to conduct risk management process for maintenance, because the coefficient is positive. The positive coefficient of .3809524 increases the predicted probability of this test. However, the effect of having a budget allocation for maintenance there is no significant effect on conducting a risk management process as the probability-value (P>|t|) 0.462 is greater than 0.05 therefore a budget allocation does not have a significant effect and that the relationship not statistically significant.

A standard error is the standard deviation of the sampling distribution of a statistic. Standard error is a statistical term that measures the accuracy with which a sample represents a population. In statistics, a sample mean deviates from the actual mean of a population; this deviation is the standard error. Therefore, the standard of error of 0.462 shows that there is a moderate true relationship between Q24f is a question that was assessing if the facility can conduct risk management process for maintenance while q23 is a question assessing whether the facility does have a budget allocation for maintenance, because the value (0.462) is greater than zero. Furthermore, the t-test shows that it is highly likely that the mean age is not less than estimated one. The confidence interval at 95% shows that the possible confidence level of 1.4 shows that the probability that the confidence interval captures the true population mean.

Table 4.10*:* Coefficient and confidence levels

Q24e	**Coef.**	**Std. Err.**	**P>t**	**[95% Conf.**	**Interval]**
q23	-0.2667	0.56466	0.642	-1.4409	0.9076
_cons	2.93333	1.07265	0.012	0.70263	5.16404

Table 4.10 is showing the *Coefficient and confidence levels Q24e is a question that was assessing if the facility can conduct maintenance audits while q23 is a question assessing whether the facility does have a budget allocation for maintenance*. Figure 4.16 shows that a budget allocation for maintenance has a negative effect on the ability of the facility to conduct maintenance audits, because the coefficient is negative. The negative coefficient of -0.266667 reduces the predicted probability of this test. Furthermore, the effect of having a budget allocation for maintenance shows that there is no significant effect on conducting maintenance audits as the probability-value 0.642 is greater than 0.05, therefore a budget allocation does not have a significant effect on the facility can conduct maintenance audits and that the relationship between the variables is not statistically significant. The t-test compares two means and determines within a specified degree of certainty whether the two means really are different or whether the difference might have occurred by chance.

A standard error is the standard deviation of the sampling distribution of a statistic. Standard error is a statistical term that measures the accuracy with which a sample represents a population. In statistics, a sample mean deviates from the actual mean of a population; this deviation is the standard error. Therefore, the standard of error of 0.564 shows that there is a moderate true relationship between showing the question Q24e on assessing if the facility can conduct maintenance audits while q23 is a question assessing whether the facility does have a budget allocation for, because the value (0.642) is greater than zero. Furthermore, the t-test shows that it is highly likely that the mean age is not less than estimated one. The confidence interval at 95% shows that the possible confidence level of 0.907599 shows that the probability that the confidence interval captures the true population mean.

4.8 Analyzing Research Questions Results and Findings

4.8.1 Why do most health centres lack the services of structural maintenance workers?

One of the respondent said that; there is need to identify skilled labour and which can be taken further on services for structural maintenance. In this statement, it is evident the respondent was trying to say there was lack of skilled workers to provide the maintenance services. Furthermore; another respondent said; *there should be on-going mentorship and trainings on infrastructure maintenance.* Given these responses it can be concluded that most health centres lack services of structural maintenance workers due to the reasons given.

4.8.2 Why is there inadequate funding or no funding at all for maintenance works in health centres?

To respond to this; one responded that funding is not easily accessible for the infrastructure maintenance. Another respondent said, the donors should continue overseeing the maintenance of physical infrastructure because they would be more effective implementation of programs and services.

4.8.3 Why is there lack of ownership and care for the infrastructure from members of staff and the community?

One of the respondents said that it is because there is lack of inclusion of the community in maintenance activities in the imprest and having a maintenance technician in the health centres. On the contrary another respondent said that, there is lack of lobbying for funding from the companies in the district and there must be continuous provision of technical and financial support.

4.8.5 Why is vandalism contributing to the dilapidation of structural infrastructure in the health centres

There reason for this can be evidenced by the responded that said: MOH should be monitoring the infrastructure and assign technical support and reintroduction of user fees.

4.9 Interview data analysis

Structured interviews were conducted to get more insight on maintenance processes with the various stakeholders in the health sector. Two (2) structured interview guides were designed for the government stakeholders i.e. MoH, MWS and DHO while the latter one was designed for the donors implementing and supporting services in the health sector. The structured interviews targeted five (5) professionals, three (3) from government's MoH, MWS and DHO while the 2 were from the donors namely CIDRZ and University of Maryland. The interview guides had some questions which were not included in the questionnaires to obtain more information on maintenance processes that could not be obtained using the questionnaires and literature review. The interviewees were sampled using purposive sampling in order to obtain data from selected stakeholders that were seen as the best to provide the needed information.

The selection of an individual was based on the experience in the maintenance and public infrastructure management. The purpose of the interviews was to obtain in depth understanding and background information of maintenance processes in the public sector in relation to infrastructure in the health centres.

4.9.1 Interview information government stakeholders.

Out of the targeted three respondents only two participated in the interviews. DHO took long to attend to the request to conduct interviews and while pushing for the approval, the request letter went missing and could not be traced.

The overall response rate was at 67 percent, two were interviewed out of the three targeted. All the respondents selected to participate in the interviews had substantial experience in the public and health infrastructure management sector.The interviewees were asked to state which ministry they worked with and their job title. The respondents were all in senior management positions.

4.9.1.1 Availability of maintenance policy

All the interviewees acknowledged that both MoH and MWS had no maintenance policy. However, MoH some years back had started the process of developing a maintenance policy which as far as production of a draft maintenance policy. This unfortunately was not approved by higher authorities but instead the draft policy was changed to maintenance guidelines for MoH for use in all health centres and hospitals. The maintenance guidelines have been used by MoH when conducting maintenance and rehabilitation works.

The MWS began the process of drafting the overall maintenance policy in 2016 and currently the draft copy has been completed and circulated to all ministries and other major government stakeholders such as spending agencies and the provinces for comments before the final adoption and approval of the maintenance policy. The interviewee affirmed that once the maintenance policy is approved, this will be the only maintenance policy to be used by all ministries and other government stakeholders. It is anticipated the maintenance policy will be ready in 2018.

4.9.2 Understanding of maintenance of physical infrastructure.

The interviewees both acknowledge there has been no attention given to most maintenance requests in the past years and to date since both ministries' focus has always been on construction of new infrastructure.

Requests for maintenance works would only be attended to only when a piece of equipment had completely broken down or damages to a roof.

The interviews further asserted that preventative and corrective maintenance has been in non-existence in most public infrastructure including the health centres. Hospitals have been an exception as these have maintenance departments that oversee the maintenance requirements for these institutions and are funding by MoH. The interviewee from MWS mentioned with the creation of the new ministry of housing and infrastructure, this ministry's mandate is to spearhead and monitor all construction of new objects in the country while the mandate for MWS will be on maintenance and rehabilitation of all public infrastructure including the health centres.

4.9.3 Assessment of knowledge and skills required to conduct maintenance works

The interviewee from both ministries confirmed that the ministries have all the skilled artisans and engineers to conduct maintenance works. It was however acknowledged that more human resources would be needed and recruited to cover all government offices and stake holders and provinces.

4.9.4 Conducting random maintenance inspections

The interviewee from MWS advised the ministry has set up a task force that will be going around the provinces to assess maintenance needs for all public infrastructure. Currently the task force is working in Lusaka and will eventually proceed to other provinces. The interviewee from MoH advised health centre personnel have been encouraged to use the 5 S policy alongside the maintenance guidelines to maintain physical infrastructure. The 5S is a system for organising spaces so work can be performed efficiently, effectively and safely. 5S stands for Sort, Set in order, Shine, Standardize and Sustain.

4.9.5 Conducting sensitisation on the importance of maintenance of physical Infrastructure

Both interviewees from MoH and MWS acknowledge there hasn't been much sensitisation on maintenance of physical infrastructure in the health centres and generally in the public sector.

The MoH does conduct periodic maintenance sensitization in health centres and encourages the use of the 5S system lamented the MoH interviewee. Upon implementation of the maintenance policy in 2018 as advised, the all ministries will work in collaboration with ministry of information and broadcasting services in sensitizing the public and other government agencies on maintenance activities.

4.9.6 Monitoring of minor maintenance works

The interviewee from MoH mentioned it was difficult to measure how long it took for the department to resolve minor maintenance work which largely depended on funding which in most cases was inadequate to cover and address all maintenance requests submitted by the health centres. The interviewee from MWS highlighted the non-availability of petty cash to assist in resolving minor maintenance works, in most cases minor maintenance works were not budgeted for.

4.9.7 Financing for maintenance works

The interview from MWS mentioned due to limitations and budget sealings received from the Ministry of Finance and National Planning (MFNP) currently budgeting for maintenance works is dependent on each ministry's requirement. However, the interviewee mentioned that with the maintenance policy that will be implemented in 2018, a non-defined percentage from each budget allocation for each ministry will be channeled for maintenance and rehabilitation works and these monies will be kept by MFNP and will only be released upon request and approval by the relevant ministry in collaboration with MWS.

4.9.8 Factors affecting delays and extended timelines for major maintenance works

Both interviewees acknowledged that it takes very long and years for certain maintenance works due to;

- Funding constraints, the budgets rarely cover all costs for maintenance.
- The focus by government has been more on constructing new structures and less on rehabilitation of physical infrastructure.
- However, both interviewees were quick to mention that there is a shift moving towards preventative and corrective maintenance awareness.

4.9.9 Mentoring personnel on managing physical infrastructure before transition from donor to national management

Both interviewees did advise donors conduct mentorship trainings to capacity build the public service employees before they transition services. Personnel transfers to other health centres has led to knowledge gaps overtime.

4.9.10 Criteria used to identify maintenance works to be conducted by MoH/MWS

The interviewee from MoH mentioned that the district and provincial technical personnel identify all maintenance works that require attention and refer all requests to MoH for implementation. The MoH prioritize the requests and five (5) percent is allocated towards maintenance activities from the overall budget infrastructure budget. MoH allocates funds for maintenance activities to facility based on prioritization.

4.9.11 General attitudes of staff members managing public infrastructure

The interviewees acknowledge there is a bad lazeafe attitude towards maintaining and take care of public infrastructure and equipment by the public service workers and the citizens. The country has no maintenance culture and there is a serious need to sensitize the public on maintenance culture.

4.9.12 Interview Information from the donors

Out of the two (2) targeted donors only one responded to the interview request. The donor that responded to the request was the CIDRZ who currently are the major implementing partner assisting MoH in implementing health services in Lusaka, Western, Eastern and Southern provinces of Zambia.

4.9.12.1. Availability of maintenance schedules

The interviewee mentioned that the organisation has a maintenance schedule that is used for tracking all maintenance requirements and requests received from all supported health centres and this is managed by the senior maintenance officer.

4.9.12.2 General attitudes of staff members managing public infrastructure

The interviewee cited that there is very bad attitude from the public services workers in taking care of equipment constructed and installed by the donors. The culture has been, things must breakdown before any maintenance can be conducted.

4.9.12.3 Donor collaboration with MoH/DHO when conducting maintenance works.

The interviewee pointed out that there is no linkage between the donor, DHO and MoH when the donor is conducting maintenance works due to other work commitments by DHO/MoH. The interviewee also affirmed that the health centres have no onsite maintenance technicians to oversee maintenance works. All the maintenance works are reported to the district for action.

4.9.12.4 Financing for maintenance works

The interviewee indicated they had no funding challenges for maintenance works. For small works, petty cash was readily available for use. While major works such as breaking down a wall or construction these require procurement processes which do not take for approval and implementation.

4.9.12.5 Transition of services from donor to national management

The interviewee pointed out that the donor submits a memorandum of understanding which details what needs to be done on wards as DHO and MoH continues with managing the services. All infrastructure and equipment are handed over to DHO and MoH for continuation of services to the community.

4.9.12.6 Factors causing lack of maintenance when donors transition to national management

The interviewer cited the reasons below as the major factors causing the lack of evidence after transition;

- Inadequate funding from MoH
- MoH has competing demands and manages too many facilities.
- Lack of direct funding to the facilities to address maintenance requirements.

Summary

This chapter discussed the collected and analyzed results of the study. The data presented was gathered using a questionnaire and Semi-structured interviews. The presentation of the results was done using pie charts, bar graphs and tables. The analysis of the data elaborated that most health centres do not have maintenance technicians permanently on site to attend to maintenance requests. The major factors noted and causing the lack of maintenance of physical infrastructure after transition include, inadequate funding for maintenance activities from MoH. MoH has competing demands and manages too many health centres, no maintenance policy is in place to guide maintenance implementation and management and facilities do not receive direct funding for maintenance activities. The top recommendations that can improve the maintenance of physical infrastructure include; introduction of health insurance scheme with a defined percentage of money collected channeled to maintenance of physical infrastructure. The next chapter outlines the conclusion and recommendations of the study.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The previous chapter presented the analysis and discussion of the results of the study. It presented the data obtained from the questionnaire survey and structured interviews. The major factors affecting the lack of physical infrastructure maintenance in health centres transitioned from donor to national management were deduced. Suggestions were also provided on how the maintenance of physical infrastructure can be improved upon.

This chapter presents the conclusion of the study drawn from the analysis of results from the questionnaire survey and the structured interviews. The chapter also includes a summary of the discussion of the research findings that are presented in chapter four and makes recommendations to health authorities (the government), health practitioners and the general populace in Zambia on sustainable physical infrastructure maintenance.

5.2 Conclusion

All objectives of this study were achieved. The conclusions are discussed according to the findings and achievements of the objectives.

5.2.1 Assessing the level of knowledge of maintenance workers in the health centres on maintenance works and schedules.

The first objective was to assess the level of knowledge of maintenance workers in the health centres. Five (5) factors were assessed and it was established that the level of knowledge of maintenance workers in the health centres are on the low for most health centres. It was established that most of the respondents at 33 percent were unable to perform any minor maintenance repairs within their health centres.

It was also evident that 29 percent of the respondents were unable to conduct preventative maintenance while 25 percent had limited knowledge. Maintenance audits to ascertain infrastructure maintenance requirements were rarely conducted due to limited knowledge on conducting maintenance audits from the maintenance workers.

The lack of knowledge of maintenance workers in the health centres can be attributed to the lack of continuous capacity building of maintenance workers in the health centres.

5.2.2 Assessing the level of usage of maintenance schedules or plans by maintenance workers in the health centres.

The second objective was to establish the level of usage of maintenance schedules and plans. Most of the factors had a mean more than 3,175 which reveals that the usage of maintenance schedules and plans are on the high for most health centres. It was established that the health centres do have maintenance schedules and plans and these were easily understood by maintenance workers tasked to conduct maintenance activities. At 33 percent, most of the respondents were able to prepare budgets for conducting maintenance works while only 13 percent of the respondents did not prepare any maintenance budgets in their health centres and this was attributed to lack of financial resources allocated to maintenance works.

5.2.3 Improving maintenance of physical infrastructure in the health centres transitioned from donor support to national management.

The last objective was to suggest viable options that can assist to improve the maintenance of physical infrastructure in the health centres. Nine (9) measures were identified and it was established that the most important measures were for the Ministry of Health to conduct regular inspections and audits on maintenance works in health centres, implementation of a maintenance policy that can be distributed and displayed in the health centres and strict management practices by MoH to nurture maintenance activities and schedules. The findings from the study showed that among all the measures, 67 percent of the respondents strongly agreed to the provision of smart technologies to alert maintenance officers on when to conduct scheduled maintenance activities.

5.3 Recommendations

An aspect of health management that is generally overlooked is infrastructure maintenance. Arising from the conclusions documented, the following are the main recommendations from the study;

1. Implement continuous capacity building activities for maintenance workers assigned in health centres that have transitioned from donor to national management in order to foster continuity and sustainability. This will greatly assist to improve the knowledge levels for maintenance officers.
2. Implementation of a maintenance policy. Currently only maintenance plans and schedules are used as maintenance guidelines in the health centres.
3. Ministry of Health to proactively take the lead and nurture maintenance activities at all levels to improve the maintenance of physical infrastructure in the health sector.

Direction for future research, the research recommends;

1. Future studies should focus on the adequacy of the maintenance policy in the health sector.
2. Investigate the overall maintenance culture as a factor to implementing maintenance of physical infrastructure.

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APPENDICES

Appendix A: Sample of research instrument – questionnaire for health centres

The University of Zambia

School of Engineering

Department of Civil & Environmental Engineering

P.O. Box 32379, Lusaka.

Cell: +260977619877, Email:cjicax@yahoo.com

Dear Sir/Madam,

REF: AN INVESTIGATION INTO THE LACK OF MAINTENANCE OF PHYSICAL INFRASTRUCTURE IN HEALTH CENTRES TRANSITIONED FROM DONOR TO NATIONAL MANAGEMENT.

My names are Bwalya Helena Mutale a Master of Engineering student in Project Management at the University of Zambia. As part of my research towards my master's dissertation, I am gathering data on maintenance and sustainability of physical infrastructure in health centres transitioned from donor to national management. The study is aimed at improving the maintenance of infrastructure by determining the factors affecting the maintenance and identifying sustainable solutions that can help improve maintenance in the health centres.

Find attached a questionnaire, and based on your experience as a professional, kindly answer all questions provided. It is important that you do not write your name or personal information on this copy. The research is purely for academic purposes and all information gathered will be kept strictly confidential.

If you have any queries or would like to know the findings of this research, please do not hesitate to get in touch using the contact details provided below.

Yours faithfully,

Bwalya H. Mutale (MEng Student)

Email: bwalyahelena.mutale@gmail.com
Cell: 0977 661165

Supervised by
Dr.E.M.Mwanaumo
(Erastus.Mwanaumo@unza.zm)

PARTA. GENERAL INFORMATION

This section asks some basic questions about you. Place a mark "x" next to the appropriate item. Choose only one answer for each statement.

PART A.1: PERSONAL INFORMATION

1. What is your gender?

   Male ☐ Female ☐

2. Provide your age group (***Please tick one***)?

   <20 21 -29 30-39 40-49 50-59 60+

   ☐ ☐ ☐ ☐ ☐ ☐

3. Which of the following categories best describes your profession (***Please tick one)***?

   Sister In Charge Nurse Clinician EHT Pharmacy Tech Other

   ☐ ☐ ☐ ☐ ☐ ☐

4. What is your highest level of education (***Please tick one)?***

   Secondary Certificate Diploma Degree Masters Doctorate

   ☐ ☐ ☐ ☐ ☐ ☐

PART A.2: This section covers questions that will assist the research understand how donors manage the facilities to remain in a working state when they are managing the services.

Tick in the relevant tick box for your answers.

1. In your opinion, how would you describe the way donors manage the infrastructure facility and equipment when they are still supporting the services?

   Excellent ☐ Good ☐ Fair ☐ Poor ☐

   Unsure ☐

2. How often were donors conducting maintenance surveys of the facility or equipment under their support?

   Annually ☐ Semi-annually ☐ Quarterly ☐ Monthly ☐

   Unsure ☐

3. Did the donor have a maintenance plan?

   NO ☐ YES ☐

   If YES, was the maintenance plan kept at the facility?.....

4. To what extent did the donors consult with personnel (users) on facility/equipment function?

   All the time ☐ Rarely ☐ Never ☐ Unsure ☐

5. For any damaged sections to a building or equipment that was not working properly at the facility and required maintenance, what was the turnaround time for the donor to refurbish or fix the damages?

   2 months ☐ 1 month ☐ 2 weeks ☐ 1 week ☐

   Unsure ☐ Other (Specify)…….

6. While managing services at the facility, did donors at any point engage any facility personnel tasked to oversee maintenance activities to assist with the maintenance of infrastructure that was under their management?

   NO ☐ YES ☐

7. Were any facility personnel mentored on how to maintain the infrastructure that was set up and managed by the donors?

   NO ☐ YES ☐

8. To foster sustainability, at any point during their management of services, did the donors request for financial assistance from the facility to assist with repair works to damaged infrastructure or equipment?

   NO ☐ YES ☐

9. Did the facility receive direct funding for maintenance activities?

   NO ☐ YES ☐

PART A.3: This section covers questions that will assist the research understand how health centres manage to maintain the infrastructure when donors are not supporting any services at the centre.

Tick in the relevant tick box for your answers.

1. Does the facility have a maintenance technician permanently located at the facility?

   NO ☐ YES ☐

   if NO, who provides the skilled labour to conduct the maintenance to work on the infrastructure/equipment?.....
   .....

2. Who oversees maintenance activities at the facility?

   Environmental Health Technician ☐

   District Maintenance Technician ☐

   Ministry of Health Maintenance Technician ☐

   Ministry of Works and Supplies Technician ☐

   Other (Specify)……
   ...

3. How often did the facility conduct maintenance surveys of the facility or equipment?

   Annually ☐ Semi-annually ☐ Quarterly ☐ Monthly ☐

   Unsure ☐

4. Does the facility have a maintenance plan?

   NO ☐ YES ☐

   If NO, what are the reasons for not having a maintenance plans?.....
   .....
   ……
   …….

5. To what extent did the maintenance technicians from the district/MoH consult with personnel (users) on facility/equipment function?

All the time ☐ Rarely ☐ Never ☐

Unsure ☐

6. For any damaged sections to a building or equipment that was not working properly at the facility and required maintenance, how long did it take to refurbish or fix the damages?

   2 months ☐ 1 month ☐ 2 weeks ☐ 1 week ☐

   Other, (Specify)……

7. For minor maintenance works such as replacement of door handles, broken windows, damaged taps, broken toilet flushers or linking toilets etc, does the facility fix these damages from their own funding?

   NO ☐ YES ☐

   if NO, who provides funding for such repair works and any other maintenance works? ☐ MoH ☐ District

   Other (Specify)…….

8. Does the facility have a budget allocation for maintenance activities from the imprest that is received at the facility?

   NO ☐ YES ☐

   if NO, who provides funding for maintenance works? MoH ☐ ☐ District

   Other (Specify)……

PART B: Level of knowledge of maintenance workers at the health centre

Please express your level of knowledge about maintenance activities at the health centre. Kindly, mark your answer with an *"x"* in the appropriate box.

No.	Kindly indicate your level of knowledge on maintenance	Not at all	Limited	Working knowledge	Very good knowledge
1.	Are you able to perform minor repairs to walls, ceilings, window frames and doors?				
2.	Are you able to perform minor electrical works such as replacing switches, sockets, wall plugs etc.?				
3.	Are you able to assist skilled workers in more complex electrical, mechanical and plumbing works?				
4.	Can you perform preventative maintenance on mechanical equipment such as greasing, oiling and replacing of worn or defective parts?				
5.	Can you conduct maintenance audits?				

6.	Are you able to conduct risk management process for maintenance (i.e. the act of identifying, analysing and responding to potential risks)				

PART C: Level of usage of maintenance schedules and plans

Kindly indicate your level of usage of maintenance schedules and plans. Kindly, mark your answer with an *"x"* in the appropriate box.

No.	Kindly indicate your level of usage of maintenance schedules and plans	Not at all	Rarely	Sometimes	Most of the time	All the time
1.	Does the facility have a maintenance schedule or plan?					
2.	Do you understand the written sentences and paragraphs in the maintenance schedule or plan?					
3.	Are you able to install, replace and maintain infrastructure as specified in the maintenance schedule?					
4.	Do you conduct random tests and inspections of infrastructure to ensure they are in working order?					
5.	Are you able to prepare budgets and reports for all anticipated maintenance works on time as indicated per schedule?					

PART D: Improving maintenance of physical infrastructure at the health center.

Please do indicate what measures you would suggest to improve maintenance of physical infrastructure. Kindly, mark your answer with an *"x"* in the appropriate box.

No.	Indicate what measures you would suggest to improve maintenance of physical infrastructure.	Strongly Agree	Agree	Strongly Disagree	Disagree	Unsure
1.	Assigning permanent maintenance officer at the health centre.					
2.	Continuously build capacity in maintenance officers					
3.	Removal of zonal maintenance officers					
4.	Strict management practices by MoH to nurture maintenance activities and schedules.					
5.	Good communication and feedback by all stakeholders on maintenance works undertaken.					
6.	Conducting regular inspections and audits on maintenance works in all health centres by MoH.					
7.	Clear policy on maintenance distributed and displayed in the health centre.					
8.	Provision of smart technologies to alert maintenance officers when to conduct scheduled maintenance activities.					
9.	Award incentives to health centres adhering to maintenance schedules.					

Any other recommendations on how maintenance of physical infrastructure can be improved upon in health centres transitioned from donor management to MoH

……
……
……

PART E: Maintenance framework for transitioned health centers

Kindly provide your input on what can be done to make the most of already existing physical infrastructure and prevent future dilapidation. Kindly, mark your answer with an *"x"* in the appropriate box.

No.	Indicate what measures you would suggest assist to prevent dilapidation of the physical infrastructure.	Strongly Agree	Agree	Disagree	Strongly Disagree	Unsure
1.	Invest in preventative and predictive maintenance activities.					
2.	Provision of smart technologies to refine maintenance schedules and plans					
3.	Improve cooperation with relevant stakeholders and ministries on timely conditional and corrective maintenance works					
4.	Engage MoH fully during the project lifecycle while it is managed by donors to foster sustainability					
5.	Implement inclusive user charges for maintenance revenue collection.					
6.	Consider private sector participation in carrying out maintenance works.					
7.	Implement continuous training and talent development for maintenance personnel.					

END!

Thank you

Appendix B: Sample of research instrument – Structured interview guide for donors

STRUCTURED INTERVIEW GUIDE
PROVINCE:
DONOR
NAME:……..

1. What is your role in the maintenance department?

2. What do you understand by the term maintenance?

3. What is your understanding of the term maintenance policy?

4. Do you have maintenance schedules for tracking all maintenance works done, pending or deferred?

5. How are maintenance activities scheduled to ensure timely response to requests and service delivery?

6. What are the general attitudes of facility staff members when managing equipment that is in their care?

7. Do you work in collaboration with the facility/District/Ministry personnel when conducting maintenance works?

8. How is the financing for maintenance works? Does it take long to access funds requested for maintenance works?

9. Upon transition of services from donor management to the District/MoH, do you continue with technical support of maintaining physical infrastructure?

10. During handover, is there documentation that is submitted to the district/MoH on maintenance schedules?

11. What are the major causes of lack of maintenance to equipment and physical infrastructure when donors transition services to MoH/District?

12. In what ways, can the donors assist the District/MoH to ensure that the District/MoH continue with maintain the physical infrastructure handed over by the donors?

Appendix C: Sample of research instrument – Structured interview guide for Ministry of Health(MoH)

STRUCTURED INTERVIEW GUIDE

PROVINCE:
DISTRICT:
District Health Office Personnel ☐

Ministry of Health Personnel ☐

Ministry of Works and Supply Personnel ☐

1. What is your position in this department?
2. What is the structure of this department?
3. What do you understand is the meaning of the term, maintenance of physical infrastructure?
4. What is your knowledge on maintenance policy?
5. Do you have a copy of the maintenance policy? Is this distributed in all health centres in your district?
6. How are maintenance works classified and handled?
7. Are your members of staff in this department skilled and able to perform routine mechanical, electrical and renovation works?
8. At what point is the maintenance of physical infrastructure referred to District office/MoH/Ministry of Works and Supplies for management?
9. Do you conduct random inspections in health centres to ensure equipment and other physical infrastructure are in good working condition?
10. Do you conduct sensitization talks on the importance of maintain physical infrastructure to health centre facility staff to encourage local ownership?
11. What is the turnaround time for resolving simple maintenance works i.e. plumbing works, replacing of damaged taps, door handles, broken toilet flushers?
12. What is the turnaround time for resolving maintenance works that require construction works i.e. renovations/refurbishments?
13. How is the financing for maintenance works? What is the process for collecting funds for maintenance activities?

14. Why does it take long for instance months or years for certain maintenance works such as repairs to crack in a wall, damaged sections of a ceiling or replacement of damaged equipment to be worked on?

15. When donors are managing/supporting services at a health centre, does the District/MoH/Ministry of Works and Supplies engage their personnel to be mentored when donors are maintaining the physical infrastructure or equipment?

16. What criteria is used to identify maintenance works that can be conducted by the district/MoH/Ministry of Works and supplies?

17. How are maintenance activities scheduled to ensure there is timely response to requests submitted by health centres?

18. How long have you been handling maintenance activities in the health centres?

19. What are the general attitudes of staff members when managing equipment that is in their care?

20. Why has the District/MoH neglected the maintenance of infrastructure and equipment in the health centres?

21. Does the District/MoH have challenges in employing skilled maintenance engineers or technicians?

22. What are your suggestions on the best strategies that can assist to improve the almost non-existence of maintenance of infrastructure in facilities that have transitioned from donor to MoH management?