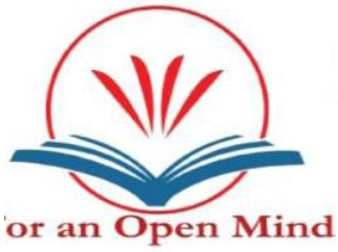

UGANDA TECHNOLOGY & MANAGEMENT UNIVERSITY

UTAMU

FACILITY MANAGEMENT AND PERFORMANCE OF SCIENCE LABORATORIES IN PUBLIC SECONDARY SCHOOLS IN TANZANIA: A STUDY OF BUKOBA MUNICIPALITY

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Table of Contents

Table of Contents ..... **i**

List of Figures ..... **iii**

List of Tables ..... **iv**

CHAPTER ONE **1**

1 INTRODUCTION **1**

1.1 Introduction 1

1.2 Background to the study 2

1.2.1 Historical Background 2

1.2.2 Theoretical Background 4

1.2.3 Conceptual Background 5

1.2.4 Contextual Background 7

1.3 Statement of the Problem 8

1.4 General objective 9

1.5 Specific objectives 9

1.6 Research questions 10

1.7 Hypotheses of the study 10

1.8 Conceptual framework 11

1.9 Significance of the study 12

1.10 Justification of the study 12

1.11 Scope of the study 13

1.11.1 Geographical scope 13

1.11.2 Content scope 13
1.11.3 Time scope 13
1.12 Operational Definitions of Key Terms and Concepts 14
2 LITERATURE REVIEW 15
2.1 Introduction 15
2.2 Theoretical Review 15
2.2.1 System Theory 15
2.3 Review of related literature 16
2.3.1 Design & construction on performance of science laboratories 16
2.3.2 Human factor on performance of science laboratories 18
2.4 Empirical Studies 22
2.5 Synthesis of the literature review 24
CHAPTER THREE 25
3 METHODOLOGY 25
3.1 Introduction 25
3.2 Research design 25
3.3 Study population 26
3.4 Sample Size and Selection 27
3.5 Sampling Techniques and Procedure 29
3.6 Data Collection Methods 30
3.6.1 Sources of Data 30

3.6.2 Questionnaire Survey 31
3.6.3 Interviews 31
3.6.4 Documentary Review 32
3.6.5 Observation 32
3.7 Data Collection Instruments 32
3.7.1 Interview Guide 33
3.7.2 Documentary Review Checklist 33
3.7.3 Information data sheet 33
3.8 Quality Control of Data Collected (Validity reliability) 33
3.9 Procedure for Data collection 34
3.10 Data Analysis Techniques 34
3.11 Measurement of the Study Variables 35
3.12 Ethical Considerations 35
4 REFFERENCES 37
5 Annex 41
5.1 The study protocol 41
5.2 Sample of Research Questionnaire 43
5.3 Sample of interview guide 46
5.4 Documentary review check list 46
5.5 Observation collection sheet 47

List of Figures

Figure 1: Conceptual frame work showing, facility management factors. 11

Figure 2*:* Protocol for Data Collection adapted from (Amaratunga & Baldry, 2002) 26

List of Tables

Table 1- Source: National Exam. Form IV- (2016) schools list. 28

Table 2: Showing the Population, Sample Size and Sampling Techniques for respondents.....28

CHAPTER ONE

1 INTRODUCTION

1.1 Introduction

This study will purposely examine the influence of facility management on performance of science laboratories in public secondary schools in Bukoba municipality in Tanzania. The independent variable is perceived as facility management conceived with design and construction, facility - utilization and human factor as conceptual constructs and the dependent variable is perceived as performance of science laboratories conceived with maintenance and operation and optimal usage as conceptual constructs.This study objectively intend to examine the influence of design and construction on performance of science laboratories in public secondary schools in Bukoba municipality; to examine the influence of human factor on performance of science laboratories in public secondary schools in Bukoba municipality and to assess the influence of facility utilization on performance of science laboratories in public secondary schools in Bukoba Municipality. It is significantly intend to examine way laboratories in Bukoba are mismanaged and to find a solution that will benefit in formulating blueprints for successful management and better performance of the facility.

This chapter presents background information, the problem statement, purpose of the study, objectives of the study, research questions, research hypotheses, conceptual framework, study scope, significance, justification and operational definition of terms and concepts.

1.2 Background to the study

1.2.1 Historical Background

Globally, education is one of the most powerful instruments in shaping the human race. Tilak, (2007) opined that it is one of the answers to all our socio-economic problems. The emphasis on secondary education was highlighted by UNICEF in 2007, as basic human right to citizens of all member states agreed on the world conference on Education for All held in Jomtien, Thailand in 1990. Notably, it was recommended that all participating countries including Tanzania have to commit themselves to providing every citizen the opportunity to achieve an acceptable level of education. This conference and the World Education Forum, 2015, held in Incheon Korea, were in synergy with the Tanzanian Government intention to revitalize the education sector.

In Tanzania today, just like in the colonial era, secondary education is looked at as the foundation for development and growth of all communities, and, it is the basis for reducing poverty, inequality, improving health, enabling the use of new technologies, creation and spreading knowledge.

Acording to America's Lab. Report, (2015) presented that Science education, of which laboratory experiences are a fundamental is a critical component of education for the 21st century. Science has been globally recognised as major instrument of economic development and social transformation. As a result, every nation has continued to pursue Science knowledge in order to remain relevant in a globalised world economy. Science infrastructures required for knowledge generation and support learning processes rely on facility management. The objective of science will not be attained if conditions of science laboratories in public secondary schools are below standard of performance. Mydin, Ramli, & Awang, (2012) describes that building performance as material, components or finishes which meet its accepted required criterion. Muhey, (2012) explained that condition of building performance get worth during the time where repair and maintenance is not carried out.

insisted that management of buildings to be more concerned with building maintenance once completed and when they are in use. The performance of laboratory is not a gifted thing, and will not happened in a vacuum but it should be influenced by the general body of build environment through design &construction, people and utilization of facility.

Government of Tanzania has been battling with various aspects of infrastructure development challenges especially in secondary schools of which its success is still in infant stage. The various government efforts to improve infrastructure in secondary schools included the Secondary School Development program- (SEDP II) introduced in the year 2010 aimed at the construction of three separate science laboratories (physics, Biology and chemistry) in every public school. To date most regions have not completed the construction of three laboratories as it was expected. A famous say by Vonnegut (1922-2007) that, "it is the human character to everybody wants to build but nobody wants to do maintenance". Looking to that say and the existing situation of mismanagement of laboratory facilities in Tanzania there is a danger to the national if no collective efforts done. Taale & Antwi, (2012) indicated that for the management of school to achieve school objectives there should therefore be a provision of resources to establish and maintain a good learning science environment, such as the laboratory facilities and must have better condition in physical and to abstract components. They have been a weakness in prioritizing and allocation of resources for school facilities, as SEDPII report indicates, the allocation of fund for improvement of school infrastructures from 2004-2009 were in a least per cent compared to others school budget items. Again there is a filling that Public schools in Tanzania are over utilized due to increase in enrolment and due to small amount of allocation of fund for improvement of school facilities. Still problem associated with improvement of school facility will not be attained when resource allocation is proportionally to number of students in school. Science laboratories are more expensive facilities in schools compared to others and consume more resource in

the construction, maintenance and procurement of equipment, management of schools in Tanzania must be aware on sustainability of these facilities.

There is also a reflection that laboratory facilities in rural schools are missused ,where by they are used for different purposes, as class room for nonscience students or store. Enoma, (2005) mentioned that management in schools should propose the best organization objective and requirements in a way that meet the organization needs by seeking to maximize performance of the facility.

Madritsch & Ebinger, (2011) described facility management to be more than cost centre but as an important function strategy to organization which actually focus on facility performance and it ensure that the building is constructed to meet the organization goal.

Mabula, (2012) reported that Science teaching in Tanzania is currently facing a serious problem which abstract science concepts. In fact he mentioned laboratory classroom for teaching to be discouraging due to lack of teaching science Materials and the quality of space of those facilities. Student need mental and physical experience of place and space in learning also teachers require space to exercise instructions thus it is important laboratory facilities in schools to be maintained.

It is through this reason that the researcher is interested to investigate on facility management and Performance of science laboratories in public secondary school in Bukoba and then come with advise on the best solution which will help in future on development of laboratory facilities in public schools in Tanzania and elsewhere in the world.

1.2.2 Theoretical Background

The study will be underpinned by Von Bertalanffy, (1967) Systems theory that will help to explain the key phenomenon of career choices.

1.2.2.1 System theory

Von Bertalanffy, (1967) explained that system theory is intended to elaborate properties, principle and law that are characteristics of "system'' irrespective of particular kind, the nature of the component elements, interaction, relations or "forces" between them. The writer further contended that a system is defined as a complex of element in interactions, and these interactions being in an ordered nature.

The systems theory when applied in the context of school that for learning to take place,management of the facilities and their performance should be guided in an appropriate control. This arises from the concept that a school itself is the system which has also sub system such as laboratories. When laboratory facilities are in use they are several interactions prevailing between, from external and internal which formulate a complex interaction, small change in one element can cause huge change.

The researcher notes that for laboratory facilities in school in order to benefit students there is need to observe the laboratory as single integrated system.

1.2.3 Conceptual Background

According to Zhang & Gao, (2010) One big challenge for both public and private building facilities owners is how to manage buildings efficiently and cost-effectively over a long-term planning using limited resources. Owoeye & Yara, (2011) have noted that as per inspector's reports many years in Nigeria secondary schools indicated abundant evidence on inadequacies in the provision and judicious use of school building facilities. Their findings showed many laboratory rooms have been held under unhygienic conditions while some other schools facilities have no ceiling, no doors and windows.

In Tanzania there was period of decades of nouse of laboratories,adequate, and negligences in maintenaces where by practicals were done theoretically.

Olubu, (2015) has founded that science laboratories are unique learning environment, with setting in which students can work cooperatively in small groups to investigate scientific phenomena and

present their Interactions between them and teachers. America's Lab. Report, (2015) has defined a laboratory as a place where practical works are taking place in a purposely assigned environment where students engage in planned learning experiences and interact with materials to observe and understanding phenomena. Again that report founded that due to enrolment and old laboratories facilities to improve laboratories performance a need for utilization in renovation and redesign is important over time

AL-hammad, (2015), explained that the performance of laboratory facilities points out to the way laboratory structures, equipment and supplies are oriented in terms of maintenance to support vision of science programsin schools over decades. Muhey, (2012)described facilities management(FM) as something which deals with integrated information handling devoting from business development to building, space, their associated environment and their business function. He recommended that Activities of facilities management should not only focus on the facility but through the whole life cycle.

Pathirage, Haigh, Amaratunga, & Baldry, (2008) they described Facility Management(FM) as an integrated approach during operating , maintaining , improving and adapting the building and infrastructure of an organization in order to create an environment that strong support the primary objective of the organization. Muhey, (2012) defined ''Operation'' as the effort required to supply the property with all required needs and usage and to maintain it on both the outside and inside of the building as to the proposed objectives. Also he mentioned that '**Maintenance''** is the work needed to preserve the function of the building, the technical and aesthetical standard and the value of the building itself.

According to AL-hammad, (2015), has described Facility Management into two groups, the first group he focused on describing of the physical work place which is directly link with design and construction and the second he focused on utilization and human influences in the use of premise.

1.2.4 Contextual Background

Bukoba municipal is the economic and an administrative centre of the other six districts in Kagera region. The district is located in the Northern-western part of the country about 1500Km from the business city of Dar es Salaam. Being in such a remote area, suggests for increased maintenance and renovation costs of both public and private facilities.

Bukoba town had only three wards in the 1960's while today has a total of 14 wards. According to National Census conducted by the National Bureau of Statistics (NBS) in 2012, shows that Bukoba has a population of 128,796 with the annual growth rate of 4%. The Municipal Council has a total of 30 secondary schools of which twenty (20) are government owned while the remaining ten (10) are privately owned. The over enrolment, is also said to limit the required laboratories standards. On the other hand subsequent changes in rural life and economic hardship has contributed to increased urban influx, a condition which emphasises a need for better management and utilization of the existing few laboratory facilities. Looking, on the physical environment of science laboratories it tells an interesting story that the city is growin fast, which leaves a crucial problem in the social facilities especially in the management of school facilities and in particular science laboratories. The four old schools constructed in the colonial era until recently in 2000 were still a hub for national education, which received students from all over the country but the learning infrastructures remained the same without any development.

The old laboratories infrastructure in Bukoba municipal are still poor in terms of maintenance and even 70% of the newly constructed science laboratories are incomplete. Government has tried to rescue the situation through construction of three science laboratories in every ward however several matters still exist as reported in (SEDPII), concerning laboratory experiences infrastructures and equipment.

The physical perception of science laboratories in Bukoba deteriorates although some of them were recently constructed; this reflects an existing lack of ownership and mismanagement. Apart from major problems facing schools in Tanzania today concerning management of facilities, the community involvement in school activities is questionable. According to the local newspaper the Daily news of Nov.2015 the Presidents' order faced resistance from teachers in Mwanza who did not agree the deduction of their salaries as a contribution for construction of laboratories. The academic records in schools in Bukoba show good performance where laboratories facilities were available in comparison to those schools which were unlucky. This situation is supported by several researchers around the world. Uko, (2015) indicated that in order to achieve this, there must be a continuous increase and adequate educational facilities, because the existing ones are often overstretched and are poorly maintained and cannot provide and foster desirable services. From the literature laboratories facilities all over the world do not cost too much initially rather much cost spent is needed for the operation and maintenance of the facilities and equipment.

The situation however is still a threat to Facility management and performance of science laboratories in public secondary schools in Tanzania. There is inconsistence in management of laboratories showing that many students may lack facilities to use in future because of misused of today and also there will be a burden to tax payers in future in order to make these facility sustainable.

1.3 Statement of the Problem

Science laboratories in public secondary schools in Tanzania present facility management challenges refered to (SEDPII) - program. They are in a state of derelict condition of structural ,aesthetic disrepair and indequate and if corrective measures are not properly carried out, it could results in a total breakdown of structural components. The physical impression of old science laboratories in public secondary schools in Bukoba are markably with lack of repair of affected building elements, corrosion

of surfaces; decay of structural members a situation which indicates that adequate management on operation, maintenance and optimization of usage is not provided. Despite the various strategies being adopted by the government on renovating and construction of three laboratories to every public secondary school and maintenance of existing laboratory facilities, still these infrastructures remain homes for defects that could have been avoided through proper facility management procedures.

A research conducted by Mabula, (2012) on how to promote science subject in secondary schools in Tanzania revealed poor quality of science classroom and laboratories teaching and a serious decline in interest of students in science subjects. Concluded that, teacher-students interaction and their relationship to laboratory facilities and learning environment of science needs improvement. Joshua & Modupe, (2012) both observed that quality assurance in a school is the systematic management, which ensure the learning environment and program meet the specified standards to achieve the set goals.

There is, therefore,the researcher sought to examine the influence facility management on performance of science laboratory in public secondary schools in Bukoba – Tanzania.

1.4 General objective

The general objective of the study is to examine the influence of facility management on performance of science laboratories in public secondary schools in Bukoba Tanzania. Furthermore is to advice the government on the best way in the management of science laboratory facilities in public secondary schools.

1.5 Specific objectives

The following are the specific objectives of the study:

i. To examine the influence of design and construction on performance of science laboratories in public secondary schools

ii. To examine the influence of human factor on performance of science laboratories in public secondary schools

iii. To assess the influence of facility utilization on performance of science laboratories in public secondary schools

1.6 Research questions

The study will attempt to answer the following research questions:-

i. How does design and construction influence performance of science laboratories in public secondary schools

ii. How does human factor influence performance of science laboratories in public secondary schools

iii. How does facility utilization influence performance of science laboratories in public secondary schools

1.7 Hypotheses of the study

The study will be premised on the following research hypotheses.

H_1: Design and construction significantly influence performance of science laboratories in publicsecondary schools

H_1: Human factor significantly influence performance of science laboratories in public secondary schools

H_1: Facility utilization significantly influence performance of science laboratories in public secondary schools

1.8 Conceptual framework

This sub section illustrates the conceptual framework of the study and provides a discussion of the main areas of focus in the conceptual review.

Independent variable (IV)	Dependent variable (DV)
Facility Management	Performance of science laboratories

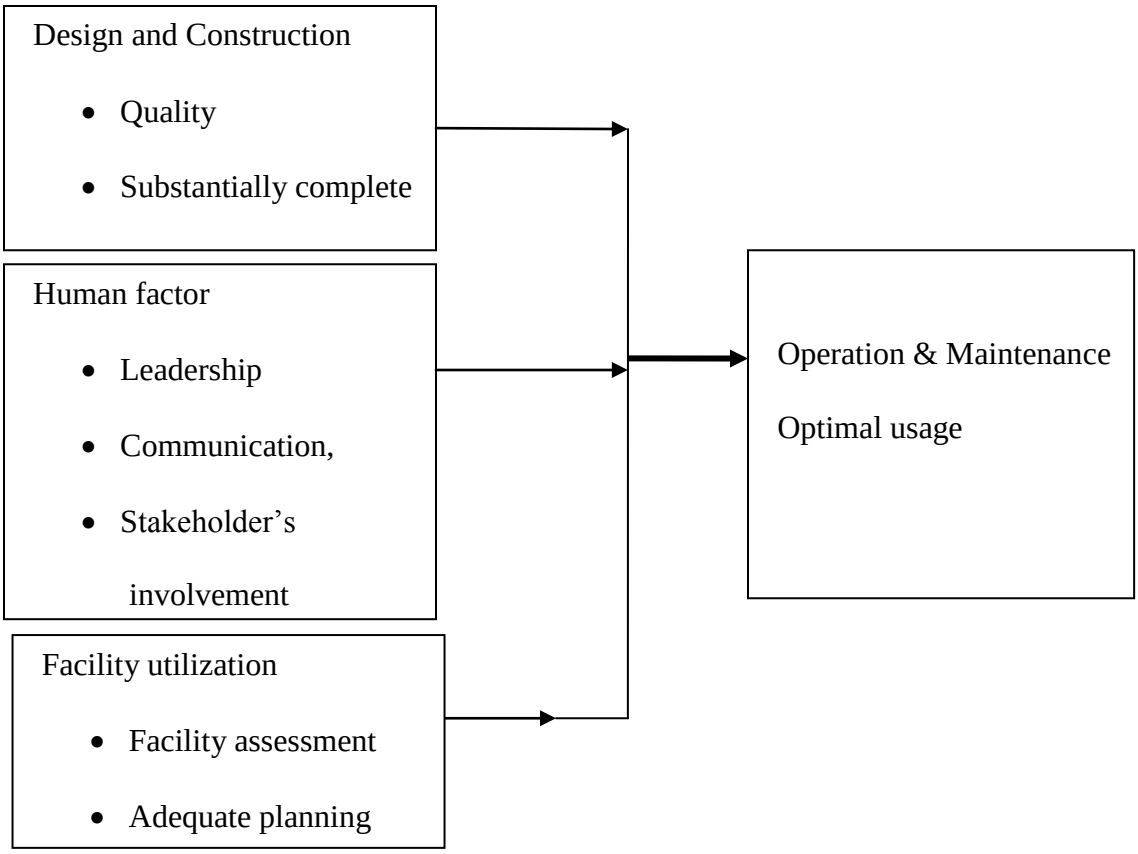

Figure 1: Conceptual frame work showing, facility management factors.

Source: Designed by the author from literature as per Amaratunga & Baldry, (2002);IFMA-forum 2005 and AL-hammad, (2015)

The conceptual frame work illustrates two sets of variables, the independent and dependent variables. The independent variable being facility management conceived with design & construction, facility

utilization, and human factor as constructs and the dependent variable is performance of science laboratories conceived with operation & maintenance and optimal usage as constructs.

Design and construction This part will deal with the quality of design and construction on aesthetics, dimension, usage, detailing, workmanship, and deterioration and also to the substantial completion which is the evaluation of extent of completion of design and construction of laboratory facilities in according to what was agreed. In another view substantial completion is considerably valued as value for money.

Human factor preferred to elements which contributes to effective and efficiency of performance which is the combination of communication, stakeholder's involvement, coordination, leadership and monitoring.

Facility utilization will be examined on the way facility management concept is operated in the area of facility assessment and adequate planning.

1.9 Significance of the study

This study will be beneficial to a number of persons and entities in the following ways: The study will be used by policy makers like Ministry of Education and vocational training in decision making. It will be useful to planners and architects in planning and designing various laboratories and others facilities. The study may add value to the body of existing knowledge and perhaps lead to ventures in further research.

Through the resultant interaction between the researcher and the respondents, the researcher's knowledge, skills and understanding of research will be improved.

1.10 Justification of the study

This study sought to examine the influence of facility management on performance of science laboratories in public secondary schools in Tanzania context and how likely affect the learning system.

It specifically intends to observe on those elements associated with success in facility management to reflect how these have influence on performance of science laboratories in public secondary school system in the County. It is also focused to suggest the best way such concept will be applied to improve management of facilities in public schools. Performance of science laboratories involve many factors such as instructions, furniture, interaction, policies, laboratory experiences and funding but these shall not be part of this study. This study intends to observe performance of the laboratories in terms of infrastructures/buildings.

1.11 Scope of the study

The scope is presented into three perspectives, the geographical, content and time cope:

1.11.1 Geographical scope

The study will be carried out in fourteen wards on 20 selected public science secondary secondary schools in Bukoba Municipality in Kagera region.

1.11.2 Content scope

The study will focus on examining the influence of facility management and performance of science laboratory in public secondary schools in Bukoba. The independent variable is a facility management constructed with design and construction, facility utilization and human factor and performance of science laboratories is the dependent variable constructed with operation, maintenance and optimal usage.

1.11.3 Time scope

The study will examine the case context of ten years period that is from 2005-2015. This is the time when the Ministry of Education and vocational training in Tanzania main land has got concerned about the education improvement in public secondary schools.

1.12 Operational Definitions of Key Terms and Concepts

America's lab. Report, (2015) has descried laboratory as a place where practical work take place in purposely assigned environment and where student engage in planned learning context and interact with materials to observe and understating phenomena and where equipment's are kept. Aladejana & Aderibigbe, (2007) presented that laboratory facility is associated with a range of important outcome for student and purposely designed for learning science activities. Hence, he mentioned laboratory facility environment as a subtle concept that can be better understood in terms of its components, which can either be physical or abstract. Atkin & Brooks, (2009) defined facility management as a technique which enables the organization to provide the right environment for conducting their core business on a cost-effective and in best value basis.

Femi, 2(014b) explained that deterioration of building is the condition which expected performance of a facility is not attained, and this performance is measured based on the cost of maintenance and the quality and standard of workmanship. Hence, contended that the maintenance cost of a building during its functional life could outweigh the initial cost of a new building if maintenance has not been incorporated during the planning stage of the project.

AL-hammad, (2015), explained that the performance of laboratory facilities points out to the way laboratory structures, equipment and supplies are oriented in terms of maintenance to support vision of science programs in schools over decades. For the purposes of this study, facility management factors which influence performance of laboratories on operation,maintenance and optimal usage will be referred to design and construction, facility utilization and human factor.

CHAPTER TWO

2 LITERATURE REVIEW

2.1 Introduction

This chapter provides a review on Facility Management and performance of science laboratories in public secondary schools. The presentation of this chapter begins with the theoretical review, review of related literature empirical study and a summary of the reviewed literature. The literature is presented in relation to the objectives that will guide the study. This further presents the identified research gap, which the study seeks to address. The literature reviewed is from journals, textbooks, working papers, dissertations and internet websites.

2.2 Theoretical Review

2.2.1 System Theory

Systems theory propounded by Von Bertalanffy, (1967), sheds light on this study. According to this theory, a system is made up of components that are interrelated and interdependent such that a small change in interaction or interplay of any part affects it whole. Laboratory in a school is also a sub system which has a complex interaction and interdependence of various elements. Its applicability on goal and motivation consists of individuals, groups and materials as components which brings the complex environment in their management. When laboratory facilities are in use there are several interactions prevailing between people, utilization and the physical environment in achieving learning goals. A small change on one element has a huge impact on the whole system. Hence laboratory (physical and space) conditions it's performance is influenced by components in the faculty of facility management which are associated with design and construction, utilization and human related factors. This study is anchored on this theory in a sense that the variables in the study presents a complex

phenomenon which require matching of various elements in Facility Management and performance of science laboratories in the context of the learning environment.

2.3 Review of related literature

This will present the overview of the facilities management on design, construction, utilization of facility and human factor constructs and performance of science laboratories on operation, maintenance and optimal usage constructs in public secondary schools.

2.3.1 Design & construction on performance of science laboratories

According to Ahmad, Nur Azfahani, & Nur Haniza, (2006), design plays a major role in determining the conditions of the building after completion; when defects and their maintenance are noted from the beginning and through construction control. The researchers further explains the indirect influence of design on the performance and physical characteristic of the building and its ability to withstand against environmental conditions and social interfaces such as graffiti and vandalism. Also Amin, (2005) sees effectiveness of the building performance is not only dependent on its aesthetic value but also on its ability to withstand maintenance works. That is to say, if a design of a building is constructed without any focus for maintenance it is hovering towards failure.

Other invistigates like Mydin et al., (2012) indicates deterioration will occur and cause poor performance in a building/facility when no remedial action are taken from the beginning of project planning, design or construction. It is further shown that problem associated with design during operation and maintenance stage are of mechanical nature such as underground movement, decaying of structure due to environmental effects from the radiation and moisture. They suggest that to overcome these problems a strategic planning is required.

Femi, (2014b) on the otherhand explains that no matter how good the design is, it is only good as to what the construction utilized it . Insisted that in construction and engineering projects the nature of

completion rate and type of defects vary drastically. Said, these happen due to lack of close supervision, inexperienced of the site manager or due to poor resource planning.

This was also earmarked in a report of Building Maintenance Committee (in the UK) shows about 20% of the average annual expenditure is spent on repairs of buildings with defects caused by fault design and construction. But Othman & Mydin (2012) went further reports more than 80% of the construction defects are caused by managerial problems. The report outlined some managerial problems as design error by the architect, the contractor mistakes, through defective materials, improper use or installation of materials or lack of adherence to the blueprint by the contractor.

Brief explaination on the influence of design and constrction on performance of science laboratories in school elaborated by Ezike, (2016) sees deterioration, wear and tear of educational facilities as a natural process which occurs due to factors such as design errors, premature construction, age, weather, usage, carelessness and poor plant maintenance of facilities by the management. But other researchers indicates that there are influences between design and construction on performance of laboratory facility during usage and how managements do to ensure sustainability.

However, poor management of school facility has negative impact on teacher's instractions and performance of students .According to Council of great city schools. Council, (2006) mentioned there is a relationship between well design and constructed laboratory facility and availability of science teachers in secondary school. The report further noted that due to poor performance of laboratory facilities in many schools.Managements of schools in America are waving to solve that problem by constructing new structures and renovating the old ones. The report recommends enough laboratory space to allow flexibility and functionality and should be innovated with combination of features of traditional laboratory and class room. The design and construction of laboratory should be future oriented supporting a vision of science programs over a decade.

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2.3.2 Human factor on performance of science laboratories

Laboratories activities and their management are done by people. Success and failure will depend on their experience, skill and knowledge on good leadership, communication, coordination and stakeholder's participation.Acording to Zhang & Gao, (2010) effective performance of laboratory during the operational and maintenance it success can be measured when they are influences of technical people.In this regard performance of science laboratory needs people with interest, skill ,commitment and experience in the management of equipment and the premises.

A study conducted by Ains & Sani, (2012) observes maintainability aspect at the design stage is often ignored and this contributed to future problems when implementing maintenance work. Therefore it was concluded that managers/leader's decision in design stage is the tool for critical analysis of project needs, problem solving and for holistic cost benefit. This was further elaborated by Wang & Ma, (2008) that importance of the experts in prediction of the cost and general environment on the performance of the facility is very important. This also indicates that judgement and decision made by people during commercement of activities help in the analysis of needs, and the process to be used.

Ability of technical part determined the quality of final product . Al-Hammad, (2005), contends that presence of inexperienced staff in the site is lack of commitment and such decision leads to poor performance of the facilities.

Enoma, (2005) argues that facilities managers are eyes and ears of client and his roles.Insists that their decision is shared by all different stakeholders at all stages of facility life cycle. This was supported by Ezike, (2016) explains that leadership is an important factor in maintaining aesthetically pleasing and healthy school environment. Again Ezike,(2016) describes that type of leadership required in maintaining school physical resources as dynamic and which requires aspect of the principal role.Further more, mentioned that principals who practice the transformational leadership style may increase school performance by maintaining educational facilities.

Other researchers went futher detailing some responsibilities of managers in school. In views of Ayeni & Adelabu, (2011) indicates that effective management of learning infrastructure is the prime responsibility of the school principal and other stakeholders. It is cited that the administrative responsibility for satisfactory physical environment is not limited to providing new facilities but the school head should direct the available resources to maintenance of those learning facilities. The article further suggests that teachers are responsible for making every item in their classes (the classroom building, furniture, audio-visual and other teaching aids, etc.) are in good conditions and prompt presenting report on any dilapidation or deterioration to the school head for necessary maintenance action.

When facility management concept is communicated to key players and when members works as a team performance of facility and maitenance also improve.According to Ezike, (2016) explains that teachers have the responsibility of supervising students when they perform their morning functions and laboratories activities. and then indicated that teachers report to the principal any damage, hence teachers act as the maintenance crew managers and supervisors nad also a link between principle and students.

Again management of facility depend on involvement of stakeholders.These are important people in the implementation they have power and interest. Emma, (2014) explains good maintenance culture and improved security of school properties should be imbedded by all educational institutions and management. In addition to that, proper management of laboratory facilities should be a collective responsibility and commitment of the educational institutions, the state government, parents, and private individuals and organizations

In order the work of facility management to be done properly coordination of activities is very important. Coordination helps manage scarce resources, time, people and uses of primise Martinez et al., (2007) shows that the Facility Management (FM) originates from the practitioner's experience and

practice in coordinating the physical workplace with the people and work organization. The study further highlights that facilities require assessment, inspection and monitoring in order to perform the intended goal. This presents evidence that this field integrates the principles of business management in architecture, behavioural and engineering sciences to ensure the effectiveness of the built environment.. Femi, (2014a) explained that perceived role of project coordination is to ensure quality of constructed projects, control of faulty defects and minimizing the cost in operation and maintenance. This revealed that majority of the responsibilities lies between the architects, builders and civil engineers. Further mentioned that their responsibilities are closely related that each one rely another to achieve expected results. Insisted that these responsibilities should not only be confined on the architects, builders and civil engineers but also from the client to the contractors, consultant and manufacturers of building materials, all must work together to avoid the issue of faulty construction and unnecessary expenditure on building maintenance. It is recommended that stages in facilities management are interconnected and need timely actions, therefore their efficiency will depend on coordination and team work.

Facility utilization on performance of science laboratories

Utilization in operation and maintenance is referred to as the management of various ways or processes which make the facility perform their respective function effectively, efficiently and in a sustainable manner. The processes has various stages or options in the assessment, planning, and implementation. In the management of building facilities, each option brings in an interaction and through that a chain of activities which need control is created. Utilization processes in management of laboratory facilities refers to the way the facility was developed, planned, designed, constructed, and monitored. Performance of laboratory facilities will depend on the way control was done on each stage during management of a facility. In addition to that Ezike, (2016) indicates that sustainability

and effective utilization of a school plant depends largely on its maintenance, as this is important to keep facilities functional or closest to its original state.

Kcamete, Akinci, & Garrett, (2010) describes utilization in maintenance as the way of observing the significant expenses attributed to operations, maintenance and the ineffectiveness involved in practices/processes. . The article further recommendes to the owners and facility managers on the need to implement strategic planning and assessment and be able to decide on the use of computerized supports which would improve operation and maintenance of their facilities.

The concept of planning in utilization aims at organizing and stabling systematic approach to manage facility activities , resources ,control of space and reflection to other elements which support laboratory work. Uko, (2015) found that in managing facilities and for them to meet the intended objectives, caution must be taken in the planning of usage, that is to say facilities should neither be underutilized nor over-utilized. Maximum utilization occurs when facilities are put into effective use in line with their primary objectives and that the best way in facility utilization and optimum usage is aligned with principles, procedures and scheduling of facility needs, and complying with the code of standards.

America's Lab. Report, (2015) presents that ability of laboratory facility to address the pressing needs for laboratory teaching and learning is constrained by the way the facility is organized for routines activities in schedules, teacher's schedules, the allocation of space, supplies, and budgets. The report indicates further that for example, routines in class scheduling and space allocation will allow science teachers' ability or willingness to collaborate with other teachers in shared lesson planning, reflection, and improvement of laboratory activities. America's Lab Report, (2015) has shown that rigid schedules may discourage teachers from adopting new and more effective approaches to laboratory instruction when done in an extended classroom

In facility management assessement is important so that make the facility operate, maintained and being used as it was proposed.Laboratories are made of materials which are suspectable to age, wear and affected by weather.Also there is change of use of facility due to increase in demand and policies.

America's Lab Report, (2015)highlighted that facilities managers are responsible for conducting inventories and assessment in the use of space with time. That report cited that an assessment of the condition and adequacy of facilities must include an analysis of safety, adequacy, and equity of existing facilities and potential for expansion.

Adeyemi & Adu, (2010) found that enrolment affects class size. They indicated that class-size in Nigeria schools continues higher in trend in primary and junior secondary schools nevertheless; the approved class-size of 30 pupils per class. America's Lab Report, (2015) presented that capacity of teachers and schools to advance the learning goals of laboratories experiences is affected by laboratory facilities and supplies. It shows that adequate laboratory facilities, including space for a teacher; demonstrations, student activities, and safe storage space for supplies.

Many researchers indicated that multi-purpose science laboratories which supports different usage are important. They contended that Biology, chemistry, and physics are subjects which require different materials, facilities and teaching methods. Therefore the model for combining them should backup with view that a combination of those subjects require different needs..

2.4 Empirical Studies

Studies conducted by Femi, (2014b) & Femi, (2014a) sought to find out the defects caused by faulty design and construction on maintenance, a total of 115 structured questionnaire were randomly distributed to three groups of respondents builders, Architects and civil engineers, eighty (80) of them were completed and returned. The severity index (SI) was used to rank the most severe defects on maintenance. While, the kruskal Wallis test, shown that there were comparison and no significance

difference in the opinion between the respondents. The study concluded that ensuring quality during construction dependent on teamwork and the performance of contractor. The studies indicated the influence of facility management in construction and design on maintenance as a conclusion which implies further research is required

Uko, (2015) conducted a study which sought to assess and investigate how the proficiency and creativity of principals affect the management of school facilities in Cross River State, Nigeria. The study sample included 36 secondary schools, with two drawn from among the 18 Local Government Areas in the State. The primary data were collected from questionnaire and personal interview while the secondary data were collected from checklists, school records & documents, journals and internet. The data were given both qualitative and quantitative treatment. Pearson Product Moment Statistical Instrument was adopted in the analysis. The outcome of the study shows there is a significant relationship between the principal's proficiency, creativity and the overall educational objectives in the management of school facilities. This therefore shows that effective management of school facilities is necessary in creating the enabling conducive academic environment.

Based on the above, appropriate recommendations were made to which included matter related to human factor, policies and maintenacesl. This study relates to present study in a sense that aim at studying how facility in school are managed. However the aim,subject and methodology are different to the current study.

2.5 Synthesis of the literature review

Based on the reviewed literature it shows the effort of several scholars who studied the factors influencing facilities in the built environment and in public secondary schools specifically the laboratories. Through the reviewed literature the researchers found that a school is a system which its academic achievement depend on several factors which involves funding, economic factors, geographical, curriculum, instructions, social cultural of the area etc. Therefore dealing with school issues requires a state of care due that complexity.

The literature has also provided an in-depth knowledge about the nature and the genesis of the influence of facility management on performance of science laboratories in public secondary schools. First by providing a general (global) overview, second by drawing experience on case studies which mostly come from the developing countries and which provide a wide focusing on the respective situation of Africa, especially Tanzania and finally merging into the situation in Bukoba.

A number of gaps have been identified as per reviewed literature which this study will bridge some of them. Most of the studies on the subject are based on developed countries with a well-developed facility management and maintenance systems in education while the proposed one centred in Tanzania. Most studies focused on the influence of facilities on academic achievement with a general over view on the facility management and performance of the buildings and do not guide us on the relationship between the study variables. Femi, (2014) tried to observed few factors on the severity of effects of design and construction on maintenance but recommended further research to be done. Based on these therefore, the proposed study will focus on the effect of facility management on design & construction, utilization of facility and human factor and performance of science laboratories on operation, maintenance and optimal usage in public secondary schools in Bukoba Tanzania.

CHAPTER THREE

3 METHODOLOGY

3.1 Introduction

Research methodology is the science and philosophy behind all research. It helps us to understand different ways in which knowledge is created.

This Chapter presents and describe the approaches and techniques the researcher will use to collect data and investigate the research problem . It include the research design, study population, sample size and selection, sampling techniques and procedure, data collection methods, data collection instruments, data quality control (validity and reliability), procedure of data collection, and data analysis.

3.2 Research design

Research design is the blueprint for fulfilling research objectives and answering research questions. In other words, it is a master plan specifying the methods and procedures for collecting and analysing the needed information.

Due to the type of study proposal, variables and research questions the researcher prefers to apply case study (Combination of observation from field, questionnaires, interviews and literature survey). Yin, (1994) explained that the preference of the case study derive from the fact that the main research questions are in the form of “how” or “why” and it is suitable for studying social complex. It is used in operation management when you want to identify best practice, describe the really life context in which an intervention has occurred, It help to compare two phenomena, it examined particular approach in particular setting and it is applied with a mixed data collection method.

Since this study need to examine the influence of facility management on perfomance of laboratories, several interactions will happen when variables linked, a situation which creates a complex

environment in matching them.The researcher prefered case study design because of it modelity and simplicity in matching several data from multiple sources.

This study will also apply both quantitative and qualitative approaches because linking propostions requires explanations or descriptions again in the selection of samples and analysis emprical data are also needed.

. Yin, (1994) cited that case study involves various approaches therefore the demand of formulation of a protocol for data collection reduces the chances of missing important data and this facilitates subsequent analysis. In this research, the developed protocol for data collection will follow the structure illustrated bellow.

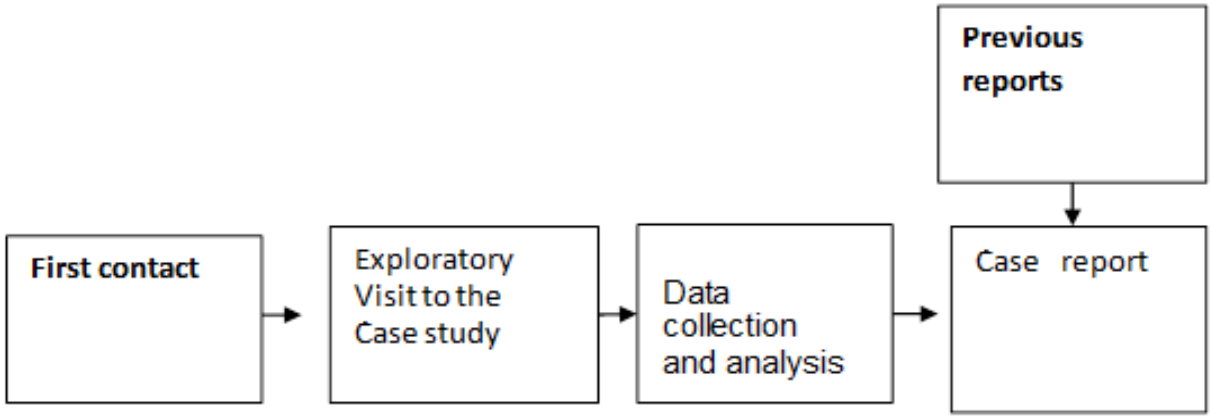

Figure 2*:* Protocol for Data Collection adapted from Amaratunga & Baldry, (2002)

The details of the protocol above is attached as *Annex 01*. It was adapted, modified and expanded to addresses the types of evidence that are available in the case organization and ways of gathering them.

3.3 Study population

Population in this context refers to an entire group of individuals, events or objects having common observable characteristics. Ngau & Kumssa, (2004) presented that a population is the aggregate of all

that conforms to a given specification. The population under this study will include twenty public science secondary schools from 14 wards in Bukoba Municipal Council –Tanzania.

3.4 Sample Size and Selection

The study is based on a sample size of 3 which will be drawn from a population of twenty science public secondary schools. The sample size of 3 is sufficient and this is supported by Hamel, Dufour, & Fortin, (1993) mentioned that for case study the relative size of the sample whether (2,10 or 100) cases are applied , does not transform a multiple case into a macroscopic study. Stake, (1995) mentioned that sample size depend on the level of certainty that is wanted about the results and it is conditioned by the scarcity of time and available resources. Table 1: Showing the Population Sample.

No.	Category of sample	Location Ward	Sample techniques
1	Bakoba. Sec. School	Bakoba	judgemental
2	Bilele.Sec .School	Bilele	judgemental
3	Bukoba. Sec. School	Miembeni	judgemental
4	Buhembe Sec. School	Buhembe	judgemental
5	Hamugembe Sec. School	Hamugembe	judgemental
6	Ijuganyondo Sec. School	Ijuganyondo	judgemental
7	Kagemu Sec. School	Kitendaguro	judgemental
8	Kagondo Sec. School	Kagondo	judgemental
9	Kashai Sec. School	Kashai	judgemental
10	Kahororo Sec. School	Kahororo	judgemental
12	Kibeta Sec. School	Kibeta	judgemental

13	Mugeza Sec. School	Mugeza	judgemental
14	Nshambya Sec. School	Nshambya	judgemental
15	Nyanga Sec. School	Nyanga	judgemental
16	Omumwani Sec. School	Nshambya	judgemental
17	Rumuli Sec. School	Miembeni	judgemental
18	Rwamishenye Sec. School	Rwamishenye	judgemental
19	Rugambwa Sec. School	Rugambwa	judgemental
20	Rutunga Sec. School	Kahororo	judgemental

Table 1- Source: National Exam. Form IV- (2016) schools list.

The sample size for respondents will be 51 respondents comprised of 18-form (iv) science students where six respondents will be selected (each two in respect to subjects, physics Biology and chemistry) from each school, 3-head teachers one from each school, 3-laboratory technicians one from each school, 9 science teachers three from each school 3-procurement officers either from schools or from municipal head office, 6 committee members two from each school, 2- Auditors, and 7-Engineers. A total of 51 respondents will be selected basing on fact that they have enough information due to their in routine laboratories activities either in operation or during the construction.

Category of sample	Population	Sampling Size	Sampling Techniques
Respondents	51	51	Purposive

Table 2: Showing the Population, Sample Size and Sampling Techniques for respondents

Source: Tongco, (2007)

3.5 Sampling Techniques and Procedure

This study is intending to apply judgemental sampling technique in the selection of samples. Stake, (1995) contended that in case study the selection of sample "small sample size" will be enough but must be typical to represent others. He suggested criteria in the selection must base on maximizing on what we can learn and which leads us to understanding. Yin, (1994) contended that investigator skill and experience has much influence on selection of sample and on sample techniques. Hamel et al., (1993) indicated that in case study sample techniques for cases and for theoretical replication are discretionary and judgemental. The researcher is intending also to apply purposive technique in sampling of respondents. According to Tongco, (2007) purposive sampling enables a researcher to choose participants of his own interest based on education and experience. In this regard three schools will be selected as case sample basing on their historical background. The selection will include two old science schools most constructed in the colonial era and one new school recently constructed under SEDPII -program. Other conditions for selection of school sample will focus on the management structure and composition, availability of resources, understanding of the school management to assist us on data collection regarding the concept facility management and performance of laboratories, renovation/maintenance culture, gender and trend of school in education reform.

Bukoba secondary school and Rugambwa girl's school are oldest schools constructed during colonial era located in the centre of Bukoba urban setup. These schools went through different reforms under different authorities. Bukoba is a mixed school it was owned by Indians and Rugambwa is a girl school was under missionary before 1950s. Today both schools are under local government. The third school will be Nshambya this is ward school it is located in remote area, and was constructed in the recent years under the Secondary education development program SEDPII-2010/2015.The above inventory presenting features which the investigator fill confidently that method used in sampling of

three school is reliable and it will help in the collection of enough required data. Respondents will be selected from those schools, judgemental and purposive techniques will be applied based on seniority for officers and students will be sampled based on performance in science subjects.

3.6 Data Collection Methods

According to Yin, (1994) data collection in case study depend on triangulation of information from multisource. Yin, (1994) has elaborated that triangulation increases the reliability of the data and the process of gathering it. He mentioned that, in the context of data collection, triangulation serves to corroborate the data gathered from other sources. The data that will be collected during this phase will be organized and documented. Therefore the method for data collection will be triangulation by searching converging findings from different sources and those data collected will be put into practice in organized form on the basis of following the chain of the protocol in the tabulation form. Both primary and secondary data that is qualitative and quantitative will be obtained.

3.6.1 Sources of Data

Yin, (1994) indicated that source of data for case study is of six types, grouped into two primary and secondary data:-

The primary data will be collected through questionnaire and personal interview of (typically open-ended, but also focused, structured &surveys are possible) from respondents and through observation by (assuming a role in the situation & getting an inside view of the events) from the field. The secondary data will be collected from checklists, school records, and review of literature, documents (organizational charts, progress reports budgets etc.), books, magazines, journals and internet**,**

3.6.2 Questionnaire Survey

The researcher will use the questionnaire survey because it is practical, large amounts of information can be collected from a large number of people in a short period of time and in a relatively cost effective way. The results of the questionnaires can usually be quickly and easily quantified by either a researcher or through the use of a software package and can be analysed more 'scientifically' and objectively than other forms of research. The questionnaire will consist of both closed and open-ended questions. The researcher will develop appropriate tools for the collection and analysis of necessary data. The questionnaire will be divided into two sections (A&B). Section A will contained information on personal and demographic data of the respondents while Section B will contained data on Facility Management and performance of science laboratories in public of secondary schools. The respondents scoring of the instrument will be on Likert scale with options presented as follows: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). The questionnaire will be self-administered and in this case will be given to respondents who are knowledgeable. Questionnaires will be distributed to 18-form (iv) science students where six respondents will be selected (each two in respect to the subjects, physics Biology and chemistry) from each school, 3-head teachers one from each school, 3-education officers , 9 science teachers three from each school 3-procurement officers either from schools or from municipal head office, 6 committee members two from each school, 2-Auditors, and 7- Engineers. A total of 51 respondents will be given questionnaires selection will base on seniority and for students will be only for those who are performing better in science subjects. Example of Questionnaire is attached as *Annex 02*.

3.6.3 Interviews

Interviews will be person to person verbal communication in which one person will be interviewed at a time. Interviews will be used because they have the advantage of ensuring probing for more

information, clarification and capturing verbal expression of the interviewees Litchie & Lewis, (2014) Interviews will be personal interviews and will be conducted with a selected few of the total number of respondents indicated in the list for questionnaire.

3.6.4 Documentary Review

Secondary data will be obtained through use of published and unpublished documents. Various publications, books magazines, thesis, internet, and newspapers, reports, historical documents and other sources of published information will be reviewed by the researcher. According to Ragin, (2014), secondary data can be helpful in the research design of subsequent primary research and can provide a baseline with which the collected primary data results will be compared to other methods.

3.6.5 Observation

Obervation data will be obtained through researcher's detachment to the organizational setting, and the latter by the personal involvement in the research process. The researcher intend to visit three school sites for physically knowledge gain.and secondly obtain all information through photos, notice, sketches and even recording. Most of the data will be obtained from existing laboratories structures,on ongoing activities if any,archives and from the environment.The information obtained will be usefull as part of data collection but also as reducive or inducive data in matching data and theoricall propositions.

3.7 Data Collection Instruments

The key data collection instruments to be used will be the questionnaires, interview guide and documentary review checklist and data sheet for collection of observation data, and camera.

3.7.1 Interview Guide

The interview guide will be used to collect the data. The interviews will be person to person interviews and will be conducted with key informants. The interview will be in a structured and non structured form. The interview conducted to respondents at school management, committee members and other senior staff in Bukoba municipal council.

3.7.2 Documentary Review Checklist

The documentary review as Johansson, (2003) presented that checklist is used for purposes of reviewing documentary data. Documentary data will be obtained through the use of published and unpublished documents such as laboratory time table, cleanness time table, maintenance records contract document, as built drawing and reports.

3.7.3 Information data sheet

Information data sheets will be used to capture information during observation in the field. Some of information to be captured through datasheet may include, type, activities, sub-variables, location, date, informers etc.

3.8 Quality Control of Data Collected (Validity reliability)

As noted from many readings the researcher prefers to use triangulation techniques for the data quality control, this choice will ensure that data collected are valid and reliable. Referring to Feagin, Orum, & Sjoberg, (1991) mentioned that case study is known as a triangulated research strategy where by reliability is interpreted as ability to replicate the original study using the same research instruments and get the same results. Feagin et al., (1991) asserted that triangulation can occur using the data, investigators, theories, and even methodologies. Again, Stake, (1995)stated that the protocols that are used to ensure accuracy and alternative explanations are called triangulation. He contended that the

need for triangulation arises from the ethical need to confirm the validity of the processes. Yin, (1994) indicated that triangulation in case study done using multiple sources of data. He asserted that the development of the rules and procedures contained in the protocol enhance the reliability of case study. Again he mentioned that the discipline imposed on the investigator by the protocol is important to the overall progress and reliability of the study. *Johansson, (2003)* has mentioned that the essence of case study methodology is triangulation; he indicated that triangulation is the combination of different levels of techniques, methods, strategies, or theories. *Johansson, (2003)*believed that case study developed through the mastery of such combinations provides an important way of ensuring the validity and liability. Both researchers have indicated that the ability and experience of the investigator on checking the matter by repeating asking same question to several people and checking with alternative and independent source is to increase reliability and validity it through this that triangulation seems to me, the best method for the quality control. Cross check of validity and reliability will be done through data analysis from different source on the same case.

3.9 Procedure for Data collection

Once the proposal is officially accepted and allowed to go to field for data collection. Authorization will be got from Bukoba municipal Council which is an introduction .The second stage will be design of the abbreviations list for the purposedof confidentially of respondents. The next step will be review of research protocol. The entry briefing to head of the organization on what research is about will be held before starting of collecting any information.

3.10 Data Analysis Techniques

The procedure for data analysis will rely on the views presented by Yin, (1994), Trochim, (1989) & Campbell (1975). Yin, (1994) considered the data analysis in the case study to be the last and most complex stage. He mentioned that data analysis in case study involves all strategies through

observation, examination categorization and tabulation or combination of the research data to ensure they are matching to propositions and they relate to the variables and constructs.

Yin, (1994) suggested that when case study is done basing on statistics, their findings under that analysis are more reliable but this process it bring complication which can lead the investigator away of the research target. Further mentioned that for case study analysis the most reliable strategies is to use a pattern matching. Trochim, (1989) considered pattern-matching as one of the most desirable strategy for case study analysis.Also cited that this technique it compare an empirically based pattern with a predicted one. The findings presented by Yin, (1994) and Trochim, (1989) were summarized by Campbell, (1975)explains that pattern-matching is linked as matching of theoretical statement with findings of case and comparing result with alternative method or information .It is through this that researcher is convinced to observe pattern matching as a best technique of the choice for data analysis.

3.11 Measurement of the Study Variables

The independent variable will be measured and the dependent variable will be measured using a five-likert scale. Different variables will be measured at different levels, that is, variables will be measured using amount, per cent, ranking, and ratio scales. The five-likert scale ranged from 5 to 1, where 5 indicate ‘strongly agree’, and, 1, ‘strongly disagree’ will be applied. Different research instruments which will proved reliable and valid will be also used.

3.12 Ethical Considerations

According to DiCicco-Bloom & Crabtree, (2006) indicated that there are several reasons why it is important to adhere to ethical norms in research. First, they explained that norms promote the aims of research, such as knowledge, truth, and avoidance of error. Second, they cited that since research often involves a great deal of cooperation and coordination among many different people in different disciplines and institutions, ethical standards promote the values that are essential to collaborative

work, such as trust, accountability, mutual respect, and fairness. In order to promote ethics in the proposed study, respondent's names will be withheld to ensure anonymity and confidentiality in terms of any future prospects. In order to avoid bias, the researcher will interview the respondents one after the other and will ensure and inform them about the nature and extent of his study and on the other hand he will give them reasons as to why is interviewing them.

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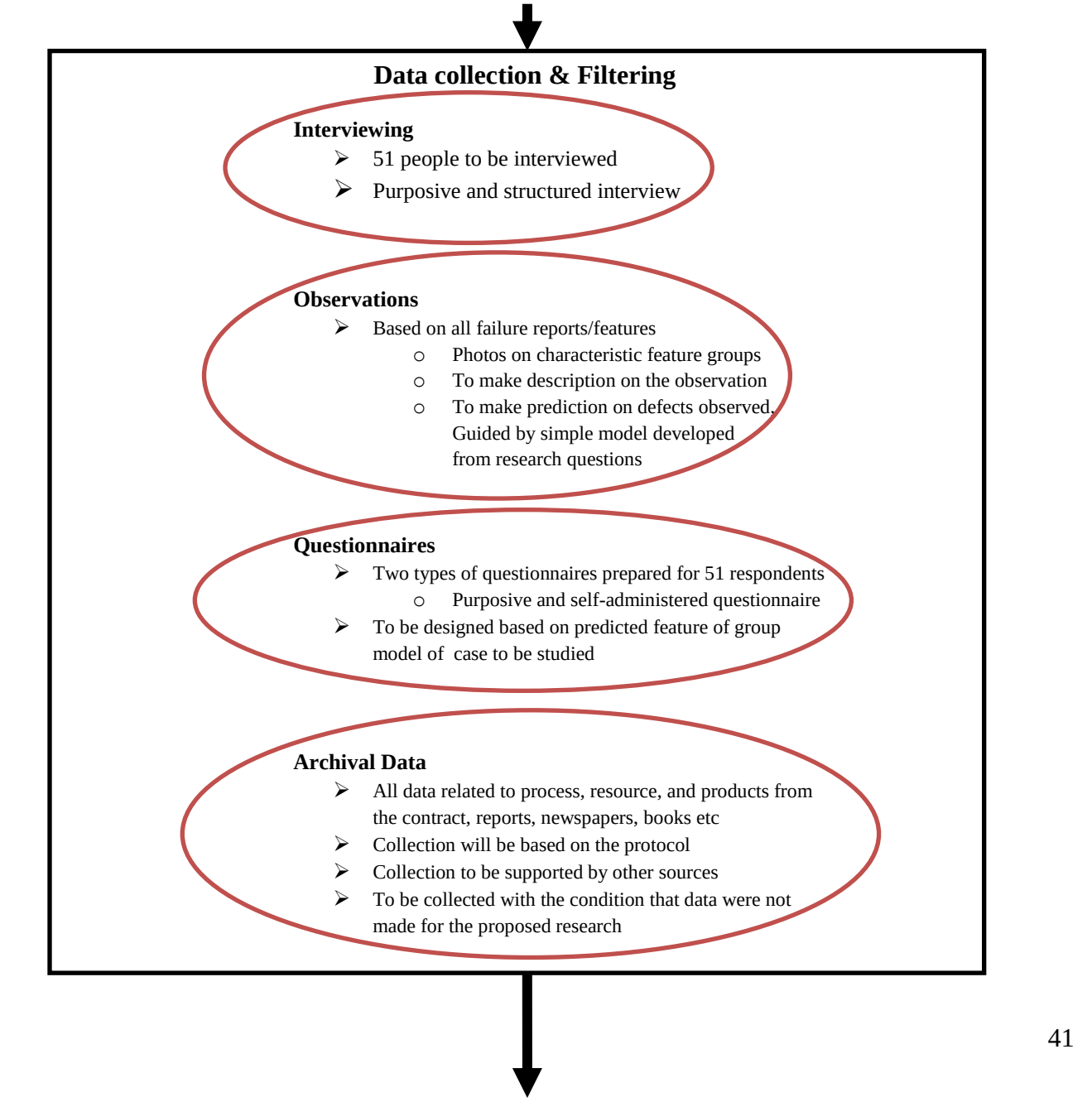
5 Annex

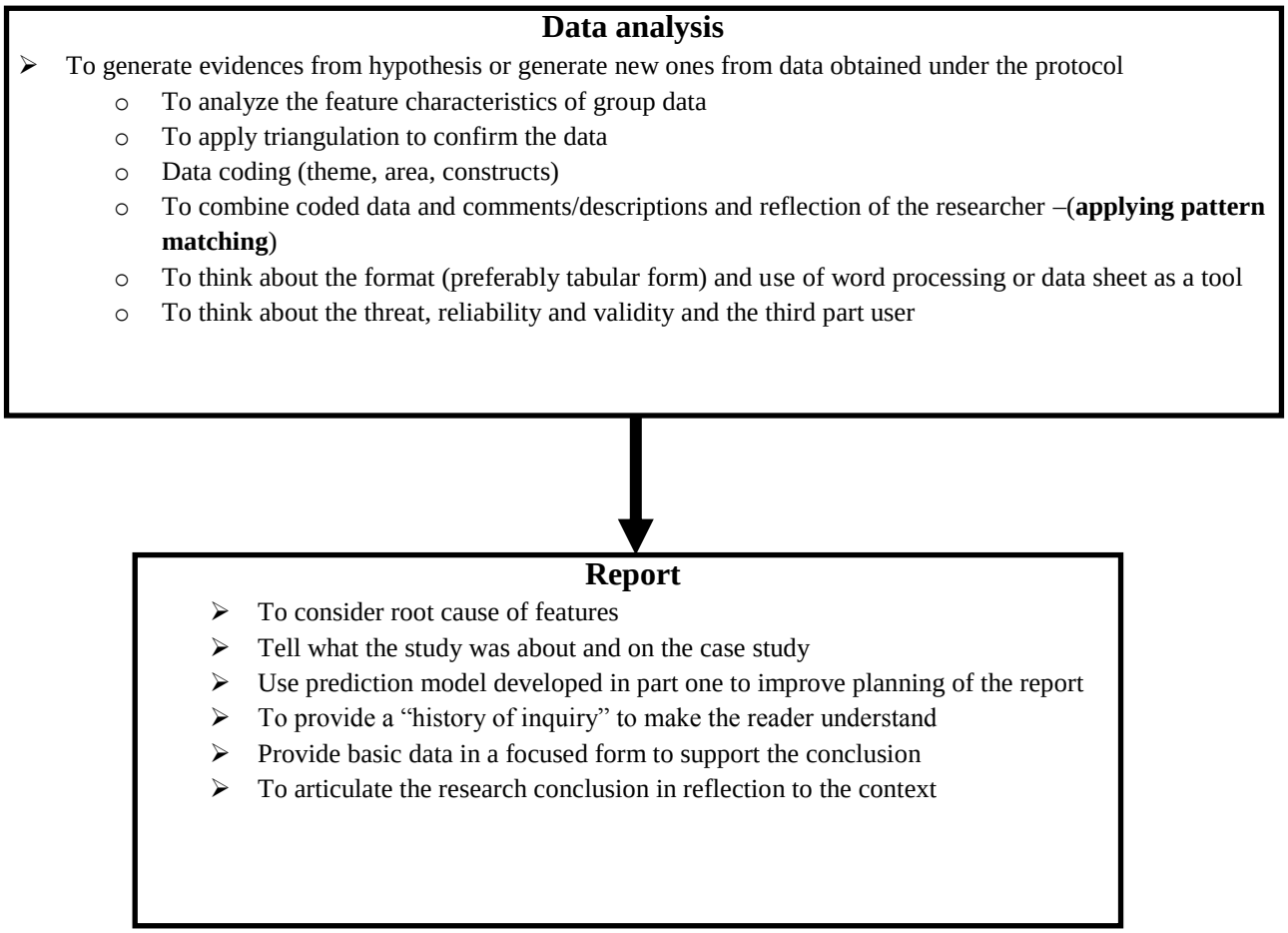
5.1 The study protocol

First contact & exploratory visit to the site

Think about what will be studied

- To establish data from what is known from experience, literature etc. On goal, scope, methodology and constructs
- To group features (qualitative data) through explanatory predictions based on research questions
  - How do design and construction related factors affect operation and maintenance of science laboratories
  - How do design and construction related factors affect optimal usage of science laboratories
- To establish relation from research question with a thinking (on constructs) the inputs and outputs either positive or negative impression and formulate a study guide model





A case study protocol adapted and modified by researcher from (Amaratunga & Baldry, 2002)

5.2 Sample of Research Questionnaire

Answer: - mark "√" where required.

Please try as much to rate your level of satisfaction on the following.

1. Human factor

No.	Questionnaire	Strong agree (SA)	Agree (A)	Dis agree (D)	Strong dis agree (SD)
i	Source of Construction of laboratories was community idea.				
ii	Top-down approach was successful method in the laboratories implementation.				
iii	Top management/leaders involvement help in project success.				
iii	Construction of laboratories was well supervised by technical staff				
iv	Lack of maintenance culture of the management affect sustainability of laboratories.				
v	No planned laboratories maintenance in schools				

2. Design &construction (A)

No	Questionnaire	Strong agree (SA)	Agree (A)	Dis agree (D)	Strong dis agree (SD)
i	"Typical standard drawing" was best design for construction& maintenance of laboratories.				
ii	Drawings used in construction of laboratories were fully dimensioned & detailed.				
iii	Appraisal was done before implementation of laboratory project.				
iv	Your own view, constructed laboratories were well completed and it certify your perception.				

3. Facility utilization

No.	Questionnaire	Strong agree (SA)	Agree (A)	Dis agree (D)	Strong dis agree (SD)
i	There are regular facility assessment of laboratories and technical staff are available				
ii	Laboratories are fully utilized and no problem with enrolment.				
ii	There is a clear plan on operation and maintenance of laboratories in schools				
iii	Design & construction envisaged usage and sustainability of laboratories				
	There is reliable Facility Management (FM) systems in place in all schools				

Additional comments

- Would you like to be interviewed?
- Contact -Mobile number……

5.3 Sample of interview guide

No	Question	Yes	No
i	If there was feasibilty study before commercement of Design and construction of laboratories .		
ii	If planningand assessment weredone during implementation of laboratories activities		
iii	If there was stakeholders parcticipation during implementation of laboratories activities.		

5.4 Documentary review check list

Item	ID -code	Reference	Preferred proposition	Contact Person/location
01	Item -type			
	Available at			
	Addition record			
	Key words			
	Author			
	Issued			
	publisher			
	Copy right			
	Edition			
Additional records:				

5.5 Observation collection sheet

Site		Location		Visiting Date		Type of information
Observer		School	Ward	Start time	End time	
Name:						
Observed events						
01						
02						