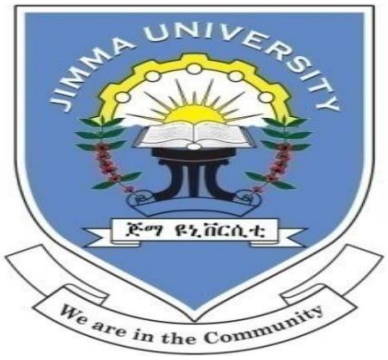

JIMMA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

JIMMA INSTITUTE OF TECHNOLOGY

FACULTY OF CIVIL AND ENVIRONMENTAL ENGINEERING

CONSTRUCTION ENGINEERING AND MANAGEMENT CHAIR

The Study of Building Facility Management Practice in Higher Education Institutes

A Thesis work submitted to the School of Graduate Studies of Jimma University in Partial Fulfillment of the Requirements for the Degree of Master of Science in Civil Engineering (Construction Engineering and Management)

By: Bontu Woyesa

February 2020

Jimma, Ethiopia

Jimma University

School of Graduate Studies

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By: Bontu Woyesa

Advisor: Engr. Alemu Mosisa (Assistant Professor)

Co-Advisor: Engr. Fitsum Alemayehu

February 2020

Jimma, Ethiopia

DECLARATION

I hereby declare that this research "**The Study of Building Facility Management Practice in Higher Education Institutes"** has not been proposed by any other student for MSc. program in this and other university.

Name	**Signature**	**Date**
Bontu Woyesa	_____	_____

The following construction engineering and management post graduate program member and advisor of this research with the title **"The Study of Building Facility Management Practice in Higher Education Institutes"** and I confirm that this research proposal is approved as degree of masters of construction engineering and management thesis for the student.

Advisor name	**Signature**	**Date**
Engr. Alemu Mosisa (Assistant Prof)	_____	_____

Co-advisor name		
Engr. Fitsum Alemayehu	_____	_____

ABSTRACT

Building facility management is a management system used to operate and maintain the buildings of an institution to create an environment that strongly supports the primary objectives of that institution. Due to the absence of building facility management practices and regular infrastructural maintenance plans, many buildings of public institutions are losing their economic value, leading to significant cost during maintenance and posing a great risk for the occupant.

The objectives of the research were to study facility management practice in higher education buildings and determining factors affecting the facility management practice. The questionnaire survey was performed on different purposively selected higher education building to observe their awareness and how they practice facility management. The research adopts a mixed type of research, both qualitative and quantitative. This research focuses on four selected universities located in the South-Western part of Ethiopia.

The research finding indicated that there is lack of building operation and maintenance policy that are used in the practices of building facility management, professional experts in building facility management, organized facility management, training for building maintenance staffs, regular building condition survey, technologies like computerized maintenance system to simplify building facility management practice and the result showed that corrective maintenance was found to be in use and was ineffective in ensuring prompt remedial works. 40 % - 50% of their response shows faults on buildings (physical problems) were mostly noticed by physical reporting and maintenance requisition forms. The main problems found in the university building maintenance were due to lack of trained staff, insufficient budget and too many calls for service. The plumbing Cleaning and lightening system in the studied university facilities were the major sources of complaints. Proper maintenance culture, Bureaucratic reporting process inadequate training is a major cause for maintenance problems.

Key words: Building, Facility Management, Maintenance

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LIST OF ABBREVIATIONS

BIFM	British Institute of Facilities Management
BU	Bonga University
BS	British Standard
CAD	Computer-Aided Design
CAFM	Computer-Aided Facilities Management
CDP	Campus Development and Planning
CMMS	Computerized Maintenance Management System
FIS	Facility Information Systems
FM	Facility Management
HEI	Higher Education Institute
IEM	International Electronic Manual
IFMA	International Facilities Management Association
IT	Information Technology
JU	Jimma University
MIT	Massachusetts Institute of Technology
MTU	Mizan Tepi University
MU	Maintenance and Utilities
O&M	Operation and Maintenance
PERT	Program Evaluation and Review Technique
PIMD	Property and Infrastructure Management Division
SAFMA	South African Facilities Management Association
UKFMA	United Kingdom Facilities Management Association
USA	United States of America
WKU	Wolkite University

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Facilities management is an integrated approach to operating, maintaining, improving and adapting the building and infrastructure of an organization to create an environment that strongly supports the ultimate objectives of that organization. The facilities management field has emerged from buildings maintenance management. Building maintenance and engineering services is a long-standing interest within the field (Barrett & Baldry , 2003).

Facility Management is essentially a key function in managing facility resources, support services, and working environment to support the core business of the organization in both long term and short-term (Chotipanich, 2004).

Facilities management is an emerging profession and the practice has advanced in many of the developed countries but still in its elementary stages in Africa and other developing countries. It is a field which includes several disciplines to ensure functionality of the built environment by incorporating people, place, process and technology (Ogebeifun, 2011).

Facility management practice in higher education buildings places focus on the management of the building portfolio, and the environment and further suggests some practical steps for effective facilities management operations in Texas A and M university in USA. In his words: ‘Business success is characterized not only by annual revenue and profit margins, but also by the way various aspects of the building portfolio and environment are maintained: monitoring daily maintenance, operations, and energy consumption; conducting assessments and benchmarking studies; adapting and aligning with policies; and assisting with the implementation of the organization‘s strategic and tactical planning (Lavy, 2008).

The study done in Botswana to evaluate the current practice of facilities management, particularly as it relates to building maintenance revealed that there was generally a lack of information on facilities management due to a number of factors, there was a lack of

knowledge on different types of maintenance and that the focus was mostly on emergency and day-to-day maintenance (Moseki, 2007).

Facilities maintenance is an important operation because the way it is conducted affects the effectiveness of user organizations and can enhance the productivity and well-being of employees (Wireman, 2004). The best way to attain excellent maintenance is to have a maintenance management that matches as closely as possible the expected requirements of the use (Zawawi, 2010).

However, there is no enough study to identify how well a building facility management practice has been performed in universities of Ethiopia. The focus of this research is to identify how those universities assess the contribution of the facilities management practice towards to achieving their objectives of teaching, learning and research program.

1.2 Statements of the Problem

Organizations and institutions often fail to recognize the importance of facility management to their business performance and success. Business success is characterized not only by annual revenue and profit margins, but also by the way various aspects of the building portfolio and environment are maintained (Lavy, 2008).Maintenance is a very important part of facilities management that requires planning because lack of planned maintenance leads to great economic loss. Erecting infrastructure without a functional maintenance plan or policy poses a great danger for the occupant and leads to serious economic loss. Also considering only new building construction cost leads to significance cost during maintenance stage (Ugwu, Okafor, & Nwoji, 2018). In Ethiopia, most of higher education institutions have not been studying the importance of facility management practice in higher education building and problem that affect the building facility management. Maintenance is carried out after a failure has occurred and intended to restore an item; this show the use of preventive and routine type of maintenance was very rare. Investigation made on many university shows that building elements were often inadequately maintained i.e. windows, doors, wall and other building elements and facilities frequently show evidence of lack of maintenance. Therefore, it is necessary to study and identify the importance of facility management practices with respect to

maintenance in higher education building for creating comfortable working environment and providing professional suggestions.

1.3 Research Questions

1 What is the current status of buildings facility management practice in higher education institutes?

2 What are the factors that affect building facility management practice in higher education institutes?

3 What are the factors affecting building maintenance practice in higher education institutes?

1.4 Objectives

1.4.1 General Objective

The general objective of the research is the study of facility management practices in higher education buildings.

1.4.2 Specific Objective

1. To identify the current status of building facility management practice in higher education institutes.
2. To identify factors affecting building facility management practice in higher education institutes.
3. To identify factors affecting building maintenance practice in higher education institutes.

1.5 Significance of the Study

This research would contribute to the knowledge and theory of building facility management practice. Because FM is essentially a key function in managing facility resources, manage facilities in a manner which reduces usage conflicts and overcrowding, increases the life time of building, minimize cost, reduce danger for the occupant, support services, and working environment to support the core business of the organization in both long term and short-term. Also particularly as it relates to building

maintenance contribute to good maintenance practice. This is because the study attempt to find out the factors affects facility management and maintenance practice is important for institution to prepare plan for the future. It also assists the concerned body of institution to become aware of the current state of their building and its effect on safety and health.

1.6 Scope and Limitation of the Study

Limiting the scope is necessary when studying on the certain issue thus, the scope of this thesis is to identify the current status of building facility management practice in higher education institutes, identify the problems about facility management practice in higher education buildings and identify factors affecting building maintenance problem in higher education institutes.

CHAPTER TWO

LITERATURE REVIEW

2.1 Definition of facility management

Different associations and authors discussed and variously analyzed Facilities management. The following selected definitions are based on a survey conducted via the internet to provide an overview of what facilities management is as perceived internationally by facility management associations:

a. International Facilities Management Association (IFMA): IFMA is a very comprehensive association, providing comprehensive input and educational opportunities in the discipline. The IFMA (2010) defines: Facility management is a profession that encompasses multiple disciplines to ensure the functionality of the built environment by integrating people, place, process, and technology (International Facilities Management Association, 2008).

Facilities provide essential support for human resources for the attainment of the organizational goals. For universities, one of the important goals is to attract the best students and retain quality staff. FM has been described as the profession that encompasses multiple disciplines to ensure functionality of the built environment by integrating people, place, process and technology (IFMA, 2016).

b. Facilities Management Association (UKFMA): The following definition is provided by FMA: Facilities Management is located in the support services sector of the UK economy and is the efficient integration of support activities within the business environment which is essential to the successful performance of any organization (Facilities Management association in the UK, 2010).

C. British Institute of Facilities Management (BIFM): BIFM defines facilities management as follows: Facilities management is the integration of processes within an organization to maintain and develop the agreed services which support and improve the effectiveness of its primary activities (British Institute of Facilities Management, 2010).

d. Facility Management Association of Australia (FMAA)

Best stated the FMAA definition of facility management as Facility Management is the practice of integrating the management of people and the business process of an organization with the physical infrastructure to enhance corporate performance (Best, 2003). According to Best, the broad categories of FMAA competencies are listed as follows:

- Use organizational understanding to manage facilities
- Develop a strategic facility response
- Manage risk
- Manage facility portfolio
- Improve facility performance
- Manage the delivery of services
- Manage projects
- Manage financial performance
- Arrange and implement procurement/sourcing
- Facilitate communication

e. South African Facilities Management Association (SAFMA): The SAFMA provides the following definition: Facilities management is an enabler of sustainable enterprise performance through the whole life management of productive workplaces and effective business support services (South African Facilities Management Association, 2010).

The above definitions suggest that facilities management obtains a supporting management function to the core business of an organization; focuses on the area of interface between physical workplace and people; and requires a multi-skill approach to integrate people, place, process, and technology in executing its support functions.

2.2 Building Facility Management

Building facility management is a management system used to operate and maintain the buildings of an institution to create an environment that strongly supports the primary objectives of that institution (Barrett & Baldry , 2003).

2.2.1 The Purpose of Building Facility Management

The general goal of building facility management is to ensure the provision of attractive buildings, with properly functioning components and systems, that are properly operated, maintained and that provide surroundings and conditions conducive to quality instruction and learning. To fulfill the general goal of facility management unit (Atkin & Brooks, 2009)

- Identify and correct facility deficiencies and needs through periodic review of existing systems and system components,
- Maintain buildings at a level that ensures facilities that are aesthetically pleasing, clean, sanitary, and safe and
- Manage facilities in a manner that minimizes usage conflicts, overcrowding, and retrofit costs.
- Ensure the availability of sufficient funding and other resources to support projected facility maintenance requirements

Atkin & Brooks argue that a holistic definition of FM should emphasize on the importance of integrative, interdependent disciplines whose overall purpose is to sustain an organization in the pursuit of its business or objectives. This means that the FM service should aim to accomplish; supporting people in their work and other activities, enhance individual well-being, enable the organization to deliver effective and responsive services, sweat the physical assets to make them highly cost-effective, allow for the future change in the use of space, provide the competitive advantage to the organization's core business and enhance the organizations culture and images (Atkin & Brooks, 2005).

2.2.2 Building Operation and Maintenance

Oxford Dictionary defines the verb 'maintain' as cause to continue. Therefore, maintenance is ensuring that physical assets continue to fulfill their intended functions (Lam, 2008). Generally, maintenance means to hold, keep, sustain or preserve the building or structure to an acceptable standard. The acceptable standard is defined as one which sustains the utility and value of the facility. The question of what is an acceptable standard? Is a matter of assumption and is generally subjective? Each owner or tenant

will have to establish his/her standards based on many factors, such as (Whole Building Design Guide, 2010).

- Usage of building
- Expected life
- Availability of capital, materials, and manpower
- Change in usage and personal

Historically, in both the public and the private sectors, maintenance is seen as an avoidable task that is perceived as adding little to the quality of the working environment and expending scarce resources which would be better utilized (Olajide & Afolarin, 2012).

2.2.2.1. Aims of Building Maintenance

The primary aim of maintaining a building is to ensure that the buildings continue to serve the purpose for which it was put up (Afranie & Osei Tutu, 1999). The purposes for which maintenances are undertaken include

a. To maintain the value of a building- a better-maintained building normally has greater value, however, the increased value may be marginal as location and size of a site all play an important role in the determination of value.

b. To ensure optimum use of buildings: - good maintenance should allow buildings to be used to their full potential.

c. To create or maintain a suitable appearance: - can make a positive contribution to the external environment and social conditions. Dilapidated buildings can contribute to social impoverishment and poorly maintained services and facilities, waste energy and resources and can affect the environment.

d. To maximize the life of the main components and materials: - maintenance can reduce the cost of subsequent maintenance by extending periods between repairs and replacements.

e. To ensure that buildings do not detract from surroundings and also maintain a suitable appearance.

2.2.2.2. Maintenance Type Classification

Maintenance is a collection of actions intended to retain an item in or restore it to, a state in which it can perform the function that is required for the item to provide a given service. This concept leads to a first classification of the maintenance actions in two main groups or types: actions oriented towards retaining certain operating conditions of an item (planned) and actions dedicated to restoring the item to said conditions (unplanned).

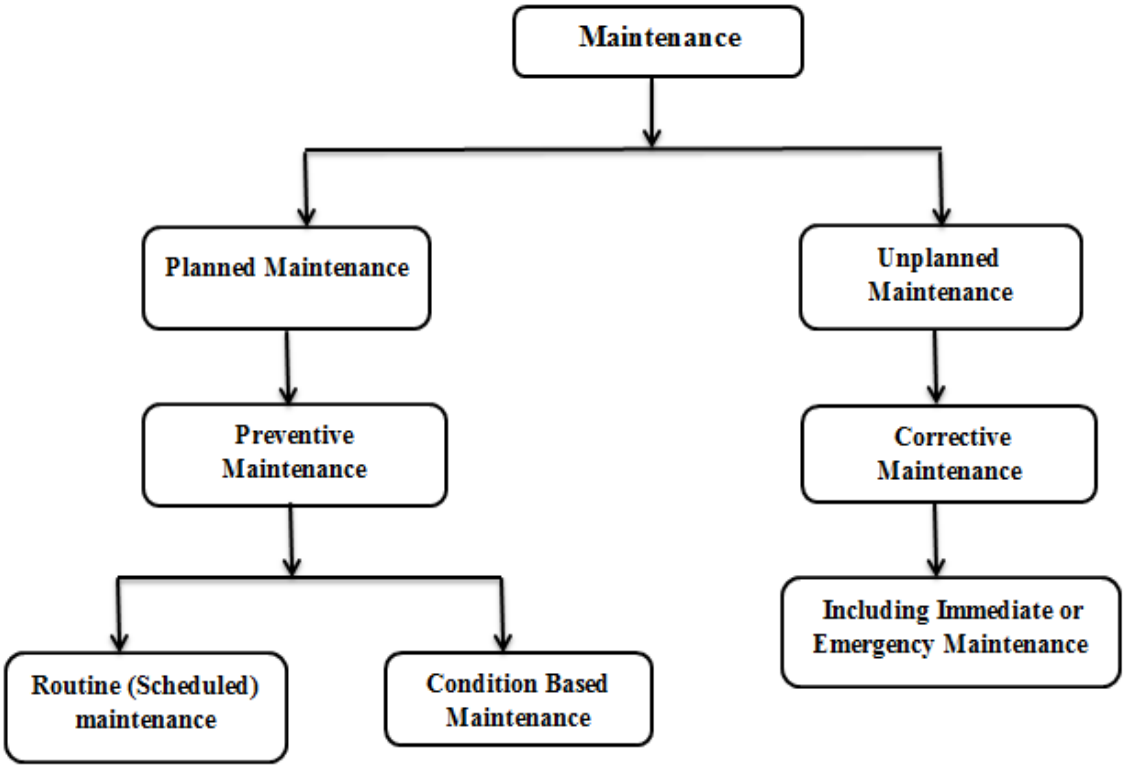


Figure 1 Classification of building maintenance type

Source: Chanter and Swallow, 2007

i. Planned maintenance: The maintenance organized and carried out with forethought, control and the use of records to a predetermined plan.

ii. Unplanned maintenance: The plan carried out to no predetermined plan. It refers to work necessitated by unforeseen breakdown or damages. For example, the ripping-off of a building, through the action of a storm, and its remedial action constitute unforeseen damages. It can also be termed unexpected and unavoidable maintenance.

iii. Preventive maintenance: The maintenance carried out at predetermined intervals or corresponding to prescribed criteria and intended to reduce the probability of failure or the performance degradation of an item.

iv. Condition-based maintenance: The preventive maintenance initiated as a result of knowledge of the condition of an item from routine or continuous monitoring.

v. Corrective maintenance: The maintenance carried out after a failure has occurred and intended to restore an item to a state in which it can perform its required function.

vi. **Immediate (Emergency) maintenance**: The maintenance which it is necessary to put in hand immediately to avoid serious consequences. This is referred to as day-to-day maintenance, resulting from such incidents as gas leaks and gale damage.

2.2.2.3. The Advantage of Preventive Maintenance

Well-Planned preventive maintenance is pleaded for its effects on improving equipment's operating efficiency, preventing premature replacement of components, and avoiding interruptions for building occupants. Preventive maintenance is extensively thought to reduce long-term costs by maximizing the operating capacities of equipment, minimizing downtime, and avoiding breakdowns that would otherwise lead to higher repair costs later. The preventive maintenance is justifiable for health, safety and environmentally significant components/items for both items whose condition can or cannot be monitored. According to (Seeley, 1987)successful preventive maintenance programs should achieve these goals:

1. Help buildings function as they were intended and operate at peak efficiency, including minimizing energy consumption. Because preventive maintenance keeps equipment functioning as designed, it minimizes inefficiencies in operations and usage of energy.

2. Prevent failures of building systems that would interrupt occupants' activities and the delivery of public services. Buildings that operate safely allow public employees to operate their jobs and serve the public. Because preventive maintenance includes regular

inspections and equipment replacement crucial to operating a building, maintenance staff reduces the problems that might otherwise lead to a breakdown in operations.

3. Sustain a safe and healthful environment by keeping buildings and their components in good repair and structurally sound. Protecting the physical integrity of building components through preventive maintenance preserves a healthy environment for employees and the public.

4. Provide maintenance in cost-effective ways. Preventive maintenance can protect minor problems from escalating into major systems and equipment failures that result in costly repairs. Preventive maintenance creates efficiencies when the costs of major repairs are avoided. Increasing preventive maintenance can minimize time spent reacting to crises, which is a more cost-effective way to operate buildings. Deferring preventive maintenance can result in higher costs over the long term.

2.3 Important Factors to Fulfill the Aim of Building Facility Management

To fulfill the goal of building facility management facility history, building operation and maintenance policy, operation and maintenance manual, training for building maintenance staff and information technology are important factors.

2.3.1 Facility History

A Facility's history includes detailed information in the form of drawing, manuals, repairs, renovations, and alterations, accumulated in the process of developing and operating the facility. In the life cycle of a typical facility, different personnel are involved in the design, construction and operation stages. The quality of documentation at each stage will affect the performance and management of the facility. Facilities documentation is a resource for planning repairs, shutdowns and other maintenance and operations activities. Facilities operation documentation serves as an in-house tool for the facilities manager to manage his day to day operations, planning, budgeting and objective management decisions (Clayton, 1998).

Higher education institutions in many developing countries grow from temporary to permanent sites; develop from makeshift to standard structures and through the process of acquisition and merger, each institution facilities of various ages with inadequate records

of as-built information. This situation is heightened due to poor archiving systems, documentation and information transfer during the transition from one administration or system to another. Developing an authentic facility's history is an exercise that should commence from the construction stage throughout the life of the facility. It is obligatory upon every operator in each phase of the facility to properly document the operations in the facility for the future. Commencing the documentation of facilities history through as-built drawings, the Chicago District Guideline describes as-built drawings as an official record of the project at the time of construction completion. The original 'as- designed' contract drawings and specifications are modified to show all additions, deletions and other changes made during construction. Accurate as-built drawings are crucial for project operation and maintenance, and future modifications, specifically for plumbing and electrical systems, which are hidden from view. (Chicago District Guideline, 2014)

Therefore, information about the intention to change or changes made should be communicated on time for necessary adjustments by all concerned and the revised drawing produced to guide the contractor accordingly. When these procedures are followed carefully, the final as-built documents made available at the commissioning will be authentic and helpful for the preparation of the "facilities operation documents" (Erdener & Gruenwald, 2001)

2.3.2 Building Operation and Maintenance Policy

A building maintenance policy is a written document and provides a management framework for the maintenance personnel to determine appropriate maintenance strategy and standard. Building maintenance policy and strategy are some of the main aspects of the management of building maintenance operation processes. The three essential elements for formulating the maintenance policy are the choice of maintenance strategies, defining maintenance standards and allocation of maintenance resources. Maintenance strategy, in general, contains preventive, corrective or condition-based maintenance. However, there are various views on choosing an appropriate maintenance strategy. Among different maintenance strategies, the effectiveness of planned preventive maintenance (PPM) is more challenged by the top management. Furthermore, the maintenance standard is difficult to agree with top management. Acceptable maintenance standard relies highly on available maintenance resources with consideration of common

factors such as characteristics related to building, tenant, technical, administrative and political factors. Maintenance activities could not be planned and implemented successfully without grasping of these elements (Chanter, 1996).

2.3.3 Training for Building Maintenance Staffs

Training is considered a vital element of operation & maintenance for new personnel; especially when new equipment is installed or emerging technology is being employed. Important to the overall facility management program, facilities personnel must be properly instructed and motivated. Training courses will familiarize personnel with the procedures necessary to operate and maintain complex systems and equipment, often using the system-level O&M manual as a framework of information. O&M manuals, likewise conducive for use in training, can be required as both papers and as an 'on-line' interactive electronic manual (IEM). Training should be ongoing to keep up with technology and equipment (Whole building design guide, 2010)

2.3.4 Information Technology

Computerized Maintenance Management System (CMMS) and Computer-Aided Facilities Management (CAFM) are common acronyms used to describe the numerous IT tools for Facilities Management. Though there is a wide variety of a system in the market, the choice of appropriate tool should be guided by the organization’s goals and aims of Facilities Management (Rycroft, 2006) that need to be carefully selected and operated with a dedication to achieving the desired results (Rycroft, 2007).

Computer-based information systems promote and enable; more efficient use of information at all managerial levels, improved decision making, improved managerial responsiveness, improved learning capacity, and capability. These benefits will ultimately enhance both the quality and cost-effectiveness of the services provided by the facilities management function (Whole Building Design Guide, 2011).

The purpose of a CAFM system includes:

To help the facility's manager ensure the organization's assets are fully utilized at the lowest possible cost while providing benefit to every phase of a building's life cycle, and

To support operational and strategic facility management, i.e. all of the activities related with administrative, technical, and infrastructural FM tasks when the facility or building is operational, as well as the strategic processes for facilities planning and management

CMMS is used by facilities maintenance organizations to record, manage, and communicate their day-to-day operations. The system can provide reports used in managing the organization's resources, preparing facilities key performance indicators (KPIs) to use in examining the effectiveness of the current operations, and making organizational and personnel decisions. In today's maintenance world, the CMMS is an important tool for recording work requirements, tracking the status of the work, and analyzing the recorded data to manage the work, produce reports, and help control costs. Facility professionals use tools to manage the planning and daily operations and maintenance activities required for a single facility or a large complex as well as provide all of the information required to manage the work, the workforce, and the costs necessary to generate management reports and historical data (Whole Building Design Guide, 2008).

2.3.5 Job Planning and Scheduling

Job planning is an essential element of effective maintenance management. Several tasks may have to be performed before the commencement of a maintenance job; for example, procurement of parts, tools, and materials, coordination and delivery of parts, tools, and materials, identification of methods and sequencing, coordination with other departments, and securing safety permits. Maintenance scheduling is as important as job planning. Schedule effectiveness is based on the reliability of the planning function. For large jobs, in particular, those requiring multi-craft coordination, serious consideration must be given to using methods such as Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM) to assure effective overall control.

2.4 Facilities Management Unit and Structure

There are various ways to organize the facilities department there is no one method that will guarantee success. Bearing that in mind, the following points should be taken into consideration when organizing the facilities department (Barrett & Baldry , 2003).

- The size of the organization is the starting point for deciding how any facilities department is to be structured. Different sized organizations will require different staffing levels. If an organization is quite small and located in just one building, for example, there is probably no need for a full-time facilities manager, as the number of facilities works undertaken will be minimal. At other ends of the scale, a large organization may need a correspondingly large facilities department.
- The location also is important. If a facility department is dealing with multiple sites it will undoubtedly require a different approach to one operating on a single site. With multiple site organizations, the facilities manager will have to decide whether services are to be provided on a centralized or decentralized basis.
- Another major consideration for the facility manager is what services should be provided by the facilities department. Again there is not a definitive guide as to what should be included. For example, vary considerably in their choice of functions, some concentrate primarily on maintenance. Whilst others include general office services, as a rough guide, any facilities department is likely to perform some of the activities listed in Table 1 however facilities managers should not just select items from the list at random, but provide only those services that are needed by their particular organizations. Once established, facilities departments do not have to limit themselves to their original activities and so the list can be extended as necessary. A further decision to be made relating to the choice of services is whether they are to be provided in house or contracted out.

Table 1 Typical Facilities Management Unit Functions

Facility planning	Building operations and maintenance	Building construction	General /office services
-Strategic space planning -Set corporate planning standards and guidelines -Identify user needs -Furniture layouts -Monitor space use -Select and control use of the furniture -Define performance measures -Computer aided facility management	-Run and maintain -Maintain building -Manage and undertake -Energy management -Security -Voice and data -Control operating budget -Monitor performance -Supervise cleaning and decoration -Waste management and recycling	-New building design and construction -Acquisition and disposal of sites and buildings -Negotiation and management of leases -Advise on property investment -Control on capital budgets	-Provide and manage support services -Office purchasing -Non building (catering, travel, etc.) -Reprographic services -Housekeeping standards -Relocation -Health and safety

Source: (Barrett and baldly, 2003)

2.4.1 Staffing Facilities Management Unit

There are four generic clusters or categories of personnel needed in a Facilities Management Unit, namely; senior management, middle-level management staff, and technicians. Opinions have been expressed in literature that Facilities Managers do not necessarily need to possess technical skills, but that modern management skills are essential since their main function is to coordinate and integrate the activities performed by a multi-disciplinary network (Barrett & Baldry , 2003).

Facilities manager could not be anybody with modern management skills but needs to be certified professional who demonstrates a high level of competence in their areas of expertise. To support this, professional requirements for practitioners as stipulated by the International Facilities Management Association (IFMA) and the Facilities Management

Association of Australia (FMAA) include a demonstration of knowledge, competence, and ability in a wide range of technical and management areas (Ogebeifun, 2011).

The sophistication level of infrastructure and technology supporting the core functions of the organization and huge investments in their development suggest strongly that Facility Managers should be professionals, competent and experts in the management of these support facilities. The quality of the support services has a direct effect on the output of the core functions of an organization. Therefore, Facilities Managers in the university setting, from the middle to the senior management level, should possess professional qualifications that could enable them to communicate and relate with academic and senior management staff of the university to be able to translate the strategic objectives of the university into the development, operation, and management of facilities for the pursuance of the core functions of teaching and research. In preference, they should come from the Engineering and built environment professions and possess hard and soft skills in project management and law, with well-developed interpersonal skills (Ogebeifun, 2011).

2.4.2 The Relation of Facility Manger with Other Organization Units

Generally, the facility manager is accountable for the effective and efficient provision of facilities and services to support a company organization in achieving its main objectives. This implies there are two facets of a facility manager task. The first one is operational and is the continuous provision of facilities and services here and now to support employees and the company as a whole. The second is strategic with an eye to the future, anticipating and meeting future needs (Anna, 2005).

Operational Facility Management focuses on:

- Preventing damage and maintaining buildings and installations in good condition and security
- Providing facilities and services to employees' internal customers
- Creating and maintaining a comfortable and efficient working environment**.**

2.4.3 Organizational Understanding of Facilities Management

According to Barret and Baldly facilities management as a profession is still relatively new; there is a certain amount of mistrust and misunderstanding of what it is about. Support of senior management is, therefore, an essential factor that can contribute to the influence that facilities management can have. Thus when facilities issues are properly understood by senior management, it is likely that facilities managers may become more involved in strategic planning. At present, upper-level managers often take a short term view of property issues, for instance, maintenance budgets may be one of the first to be cut in times of hardship. These executives fail to see those small savings in the short term may lead to greater expenditure later.

2.4.4 Facilities Managers Understanding of Organizations Objectives

In a similar vein, facilities managers do not always have a clear understanding of the core business and hence they are not active participants when important decisions are made. It is therefore essential that facilities managers take the time to learn what the core business is really about. Without this understanding, facilities departments can't be more proactive. If facilities managers are unable to take the initiative, senior managers may conclude that they are happy to remain in a reactive mode. Thus facilities managers should recognize the need to provide high quality, proactive and cost-effective services to maintain credibility with their client base (Barrett & Baldry , 2003).

2.5 International Higher Education Building Facility Management Practice

2.5.1 Facility Management of Universities

Reviewing international practices are important to compare the studied university with some international universities including Texas A&M University in the USA, Massachusetts Institute of Technology (MIT) in the USA, Nigerian public universities and the Witwatersrand in South Africa Building facility management practices are investigated from literature as Summarized in Table 2. As discussed in Table 2, international building practices are evaluated based on the organization structure of

facility management, the practice of building maintenance type, training for staffs and the use of databases.

Ogebeifun evaluated facility management in a multi-campus setting adopting University of Witwatersrand as a case study. The study evaluated facility management system in use in the multi-campus university and how the university administration and academic staff perceive facility management contribution to the core objectives of the university. The scholar employed questionnaire and interview to gather data and the data were analyzed through descriptive statistics. Findings from the study revealed that two agencies were charged with the responsibility of facility management in the university. One of the agencies is charged with construction works and the other charged with maintenance. The first agency was assessed by administrative and academic staff on the following criteria; level of consultation, quality of internal management and reporting, quality of project delivery, delivering within budget and delivering within time. The academic and administration staff rated the agency high on quality of project delivery and delivering within budget and in time but low on level of consultation and reporting. The other agency was rated based on the following criteria; space management, consultation, functional services and response. The academic and administration staff rated the agency low in response and consultation but high in space management and functional services (Ogebeifun, 2011).

Odediran examined the facility management practices in the Nigerian public universities. The study was designed to achieve the following objectives; to examine the facility management practices in the study areas, to examine factors influencing facility management practices in the study areas, and strategies for improving facility management practices in the study areas. Data were collected through a well-structured questionnaires administered on both the managerial and technical officers charged with the responsibility of facility management. Data collected were subjected to descriptive and inferential statistical tool. Findings from the study revealed that facility management practices in the study areas are mostly reactive and reliability centered. Also, the following are factors influencing facility management practices in order of importance;

state of deterioration of facilities, level of technology for facility management and funding. The study suggested outsourcing, enhanced managerial goal, facility inspection and facility management plan as strategies for improving facility management practices. All the studies examined different aspects of facility management (Odediran et al 2015).

Table 2 International higher education facility management practices

Building facility management practice	**Texas A&M University in USA**	**Massachusetts Institute of Technology (MIT)**
Organizational structure	Facility management department is led by vice President Decentralized management structure where the day to day operational functions of facilities management are localized (Lavy, 2008)	Facility management department structured in three sections: campus Construction Services and maintenance and utilities (MIT Department of Facilities, 2009)
Building maintenance Type	No scheduled maintenance but Painting and patching of holes takes place regularly	Practice preventive maintenance on campus
Training for staffs'	Provide short courses to refresh staffs (Lavy, 2008)	Promotes capacity building.
Data bases	The data base stores dates of refresher courses that be taken online (Lavy, 2008)	

2.6 Local Facility Management Practice in Higher Education Building

The Ethiopian Government has aimed at a higher education expansion and reform program of impressive dimensions and has the vision of broadly enhancing the numbers of students within HEIs and increasing the university numbers in the country. Since 2000 GC Ethiopia's higher education sector has grown from two public universities to 32 and in light, these trends, and the federal government in 2015 GC green-lighted the construction of 11 new universities. Ethiopia is now having 43 operational of public universities (Education in Ethiopia, 2018).

Ethiopia plans to be a middle-income country by 2025. To be successful, higher education institution has its contribution by providing in-depth knowledge, seek academic development, educate students and coordinate national development (Ministry of Education, 2014).

To deliver their core teaching and learning mission, higher education institutions need to have a substantial facility. This often includes buildings. Inside the building, there are key elements like process, technology and people that are important and bear intricately linked relationships to each other in the organization so that higher education institutions require an efficient and effective facility management system in terms of giving better services to the users. Nevertheless, institutions often fail to be familiar with the importance of building facility management to their performance and success; this creates a challenge to keep up the building within the required lifetimes. There is no regular survey of building condition and routine university building maintenance or maintenance is practiced after problems have occurred and focus is only on new building construction. Therefore, research is needed on investigating building facility management practices in higher education universities in Ethiopia.

CHAPTER THREE

RESEARCH METHDOLOGY

3.1 Study Area

The study area of this research was conducted at four higher education institution Building, which is considered a very important type of projects that serve hundreds of people every day whilst costing millions to be built. These are Jimma, Mizan Tepi, Wolkite and Bonga Universities, Which are located at the south western part of Ethiopia.

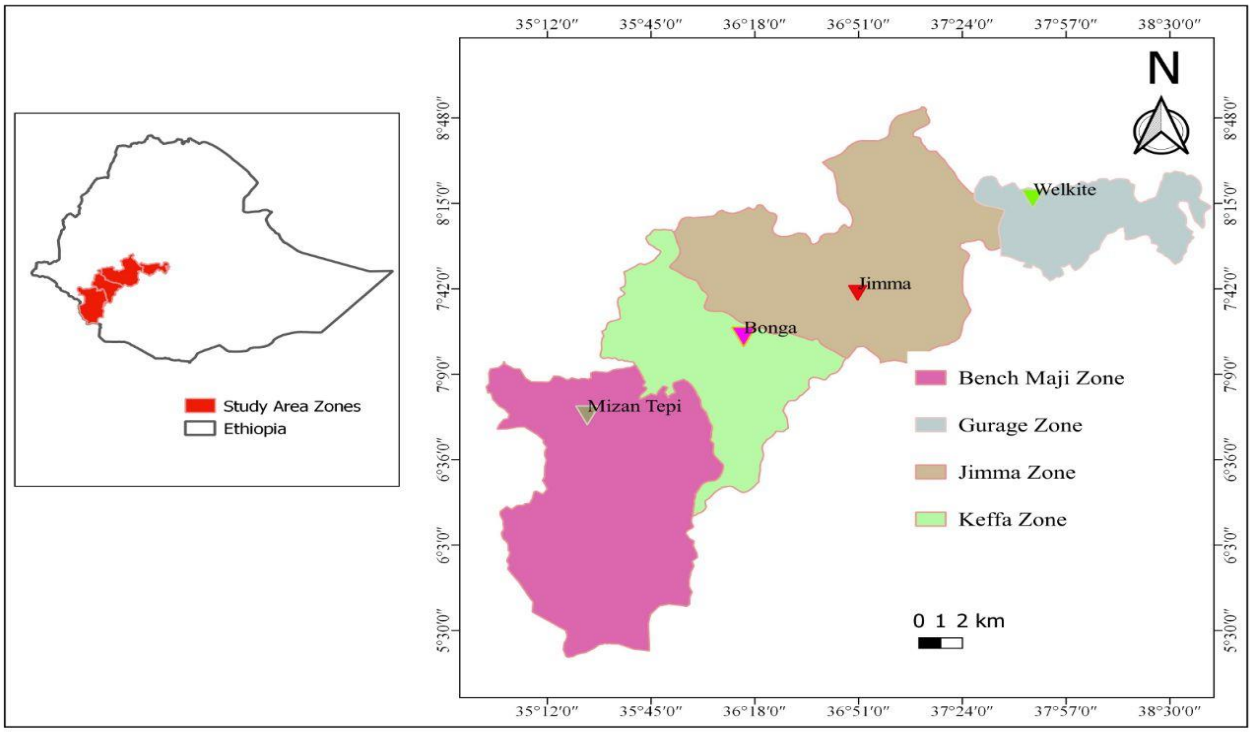


Figure 2 Study area

3.2 Study period

This research was carried out with a maximum of six months which starts in June and ends in January 2020 including from data collection to the final paper submission.

3.3 Research design

A research needs a design or a structure before data collection or analysis can commence. A study design/frame is the process that guides researchers on how to collect, analyze and interpret the data.

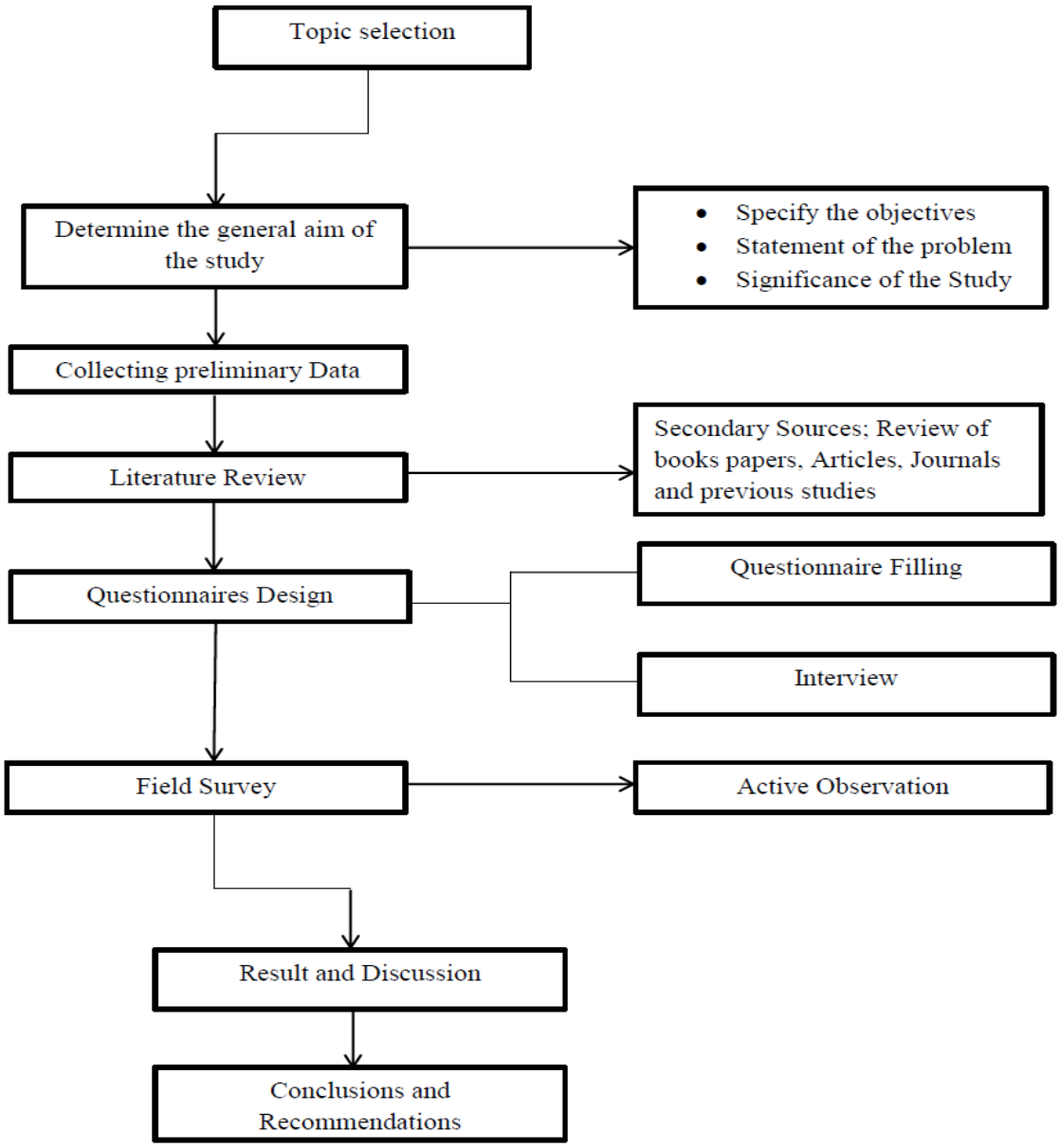


Figure 3 Research Design

3.4 Study variables

3.4.1 Dependent variable

The dependent variable of this research is the study of building facility management practices in higher education institutes.

3.4.2 Independent variables

- Facility History
- Availability of Trained staff
- Building elements
- Building Age
- Building Maintenance type

3.5 Research Population and Sample Size

The thesis focuses and considers four higher education institutes located in the southwestern part of Ethiopia namely: Jimma University, Wolkite University, Mizan Tepi University, and Bonga University. Cluster sampling was used to select representative samples to depend on their generation which university built recently and which university built long years ago (the selected universities were taken from different generations).

Table 3 Selected Universities Profiles

SN	Name of universities	Year of establishment(G.C)	Generation
1	Jimma University	1952	First
2	Mizan Tepi University	2006	Second
3	Wolkite University	2011	Third
4	Bonga University	2016	Fourth

Therefore, the first sample selected was Jimma University which is old and categorized as the first generation. The next was Mizan Tepi University that is categorized under the second generation. The third was Wolkite Universities that is younger and categorized

under the third generation. The last one was Bonga University that is a fourth-generation university and the youngest of all.

3.6 Data Collection

Data for the research was collected using both primary and secondary sources. The primary data was obtained through questionnaires, interviews and active observations (it involves observing the situation as it is without getting involved and changing things). The secondary data was obtained from the internet, thesis, journals, books and different articles in published documents. The secondary data was used to get an insight into the problem and was used as criteria for developing and analyzing the primary data (the reliable data for research). The research was both qualitative (descriptive) and quantitative (numeric) in nature.

Therefore Purposive sampling was used for top level management, middle level management, lower level management and Engineering department (Construction Project). Then depends on their responsibility, experiences and knowledge lower level management respondent was selected because of difficulties encountered in assessing the population size of the class.

Table 4 General profile of respondents (category)

Category	Number of Respondent
Top level management	6
Middle level management	7
Lower level management	45
Engineering Department (construction project)	15
Total	73

Purposive sampling on the other hand, is a useful sampling method consisting of getting information from a sample of the population that one thinks knows most about the subject matter (Walliman, 2005).

3.7 Field Survey

To accomplish this research, field observation was done. The observation was made to describe the physical features of the building by observing the building condition by age, building elements also assessing defects on a building. Recording of observations involved writing field notes and taking photographs.

3.8 Research Questionnaire Design

To find answers to the research questions and to achieve the objectives of the study, a questionnaire was designed based on a previous literature review based on the field observation from the checklists and the specific objectives. This enhanced proper usage of time during the data collection. The questionnaire designed includes; both closed and open-ended questions that were asked in the questionnaire. The close-ended questions had several choices of possible answers and the respondents selected whatever they feel was most appropriate. The closed-ended questions were selected because they are easier to assess and answer by considering how busy the respondents were.

Limited numbers of open-ended questions also include in the questionnaire because open-ended questions allow Respondents to include additional information including feelings, attitudes, and understanding of the subject and enable Respondents to raise new issues. Besides, interviews and observation were included in the primary data collection to make the data reliable. Therefore, the questions focus on building facility management practices in Higher Education Institute in depth by addressing questions focused on building facility management practice, facilities and services, building maintenance type, documentation and information technology applicable to facility management, delivering characteristics, means of detecting Faults, condition of building by age, general maintenance condition of building and factors in facility management practice.

3.9 Data processing and Analysis

Data analysis is a practice in which raw data is ordered and organized so that useful information can be extracted from it. The qualitative and quantitative data gathered from

the data collection process was analyzed by excel. The data were processed and analyzed in the form of a table and chart in the case of the quantitative technique, while descriptions and pictures were used in the case of the qualitative analysis. Analysis of the data provides a general overview of the results to make interpretations and discussions based on the results.

A rating scale is one of the most common formats for questioning respondents on their views or opinions of an event or attribute. In this regard, participants were asked to indicate the level of major causes of building maintenance problems by rating them on a on five point scale, (1 = very low, 2 = low, and 3 = medium, 4 = high, 5 = very high).Ranking of the factors have been done by Relative importance index (RII) as-per Equation 3.1

$$RII = \frac{\sum w}{AN} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{5N} \quad \textbf{(3.1)}$$

Where w is the weighting given to each factor by the respondent, ranging from 1 to 5, (n_1 = number of respondents for very low, n_2 = number of respondents for low, n_3 = number of respondents for medium, n_4 = number of respondents for high, n_5 = number of respondents for very high). A is the highest weight (i.e. 5 in the study) and N is the total number of samples. The relative importance index ranges from 0 to 1 (Tam & Le, 2006).

3.10 Ethical Consideration

The objective of the research was to study the practice of Building Facilities Management Practices at the University of the Jimma, Mizan Tepi, Wolkite, and Bonga. To avoid problems that will be occurred, the data was only being collected after ethical clearance is obtained from Jimma institute of technology (JIT) Research, Publication, and Graduate Studies & Consultancy Office of JIT. The purpose of the survey is entirely academic and it was clearly described to the Institution.

CHAPTER FOUR

RESULT AND DISCUSSION

4.1 Introduction

This chapter discusses the results, analysis, discussions, and findings of the data collected. Analysis of responses was done according to the specific objectives of the research. The main findings are summarized in this chapter based on the following research objective to get sufficient information and to reach a reasonable and substantiate conclusion, taking enough sample size is decisive. Therefore, four public universities are taken for the study depending on their generation as mentioned in chapter three. Accordingly, from selected universities 50% of questionnaires were distributed for Jimma University including all levels of management, 24% for Mizan Tepi University, 16% for Wolkite University, and 10% for Bonga University were distributed.

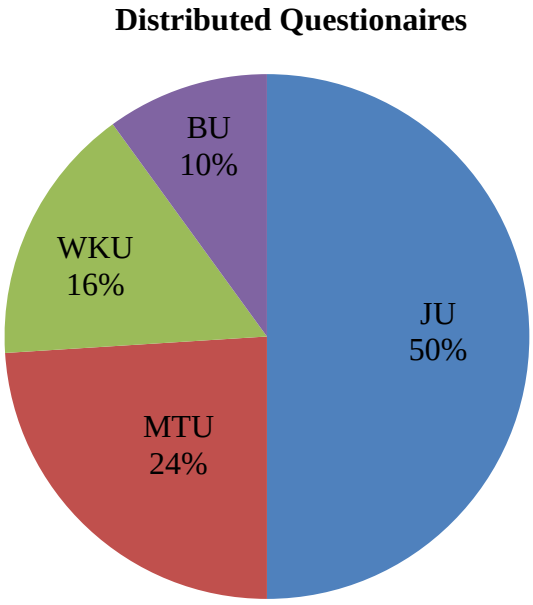


Figure 4 Percentage Distributed for each University

4.2 Respondents Position and Response Rate

During the survey, different peoples have participated to fulfill the objective of the paper. Three categories of questionnaires were designed for this study and were directed to top-level management, middle-level management, lower-level management and engineering

department (construction project). The questionnaires were developed in English. Hence, a total of 100 questionnaires were sent out to the four universities. The respondent position and number of distributed questionnaires are shown in Table 5.

Table 5 The respondent position and number of distributed questionnaires

Name of Universities	Position of the stakeholders				
	Top level management	Middle level management	Lower level management	Engineering dep't	Total
Jimma University	6	4	30	10	50
Mizan Tepi University	2	2	14	6	24
Wolkite University	1	1	10	4	16
Bonga University	1	1	5	3	10
Total	10	8	59	23	100

As shown in Table 5, the respondents were top-level management including Vice President and Managing Director, middle-level management includes Service Administration for Director of Directorate and facility management, and lower-level management and Engineering departments (Construction Project team) from four selected South-Western universities: Jimma, Mizan Tepi, Wolkite, and Bonga universities.

4.2.1 Respondents Response Rate

The questionnaires were developed in English and all interviews were conducted in a local language in Amharic and Afan Oromo. Hence, a total of 100 questionnaires were sent out to the four public universities, as shown in Table 6 of which a total of 73 or 73% of questionnaires were completed and used for the analysis. The questionnaires administered for top-level management, middle-level management and lower-level management which consists of Vice President, Service Administration Director of Directorate, Managing Director, Facility manager, maintenance staff and Engineering department (Construction Project). Whereas the structured interview was conducted for the facility manager, maintenance staff and Engineering department (Construction Project) to get reliable data and it was better to make them understand each question easily.

Table 6 Returned questionnaires

Name of Universities	Respondent position and Total of returned questionnaire				
	Top level management	Middle level management	Lower level management	Engineering dep't	Total
Jimma University	4	4	26	6	40
Mizan Tepi University	1	1	9	4	15
Wolkite University	-	1	6	3	10
Bonga University	1	1	4	2	8
Total	6	7	45	15	73
Total of returned questionnaire in %	60	87.5	76.3	65.2	73

4.3 Research Objectives and Results of the data Analysis

The research aims to study building facility management practices in selected universities. The main findings were summarized in this chapter based on the following research objectives:

1. The current status of building facility management practice in higher education institutes

2. Factors affect building facility management practice in higher education institutes

3. Factors affecting building maintenance practice in higher education institutes

The first objective: To identify the current status of building facility management practice in higher education institutes

4.4 Building Facility Management Practices in Universities

Building facility management practices in selected universities are assessed to answer research objective number one by considering the management system, domestic facilities, and services, building operation and maintenance practice concerning, building maintenance type, training for staff, databases and documentation that are used for facilitating the practice. As well as performance measurement on service delivery about

delivering characteristics means of detecting faults and condition of the building by age and general maintenance condition of buildings by assessing the present state/condition of building elements.

4.4.1 Facility Management Unit

All the survey participants think that facility management is implemented in their universities. But facility management is led by middle-level management in all studied university. There is a maintenance team in all studied university under the facility management.

According to Lavy facility management leads up to Vice President Level to influence and corporate decision making within a short period (Lavy, 2008). However, the facility management unit led by middle management level in the studied universities which makes the decision-making process complicated. To solve this challenge, it is better assigning Vice President for facility management with responsibility of facilities planning and management comprising the development and implementation of the university facilities and oversight for construction projects, responsible for planning, directing, and overseeing building operations, services and maintains the appearance of the building.

According to Best the facilities manager could not be anybody with modern management skills and an educated person but needs to be a certified professional who demonstrates their competence at a high level in their areas of expertise (Best, 2003). However, no expertise leads to the facility management department in the studied universities. To improve this thing, it is better to assign professional building construction and maintenance manager under the position of Vice president for facility management. The Building manager responsibilities include: coordinating the new building construction, building operation and maintenance.

4.4.2 Facility Management Structure

Facility Management Structure shows that each university uses a few different structures to manage the building. Facility management implementation is guided under Top-level management in all studied universities.

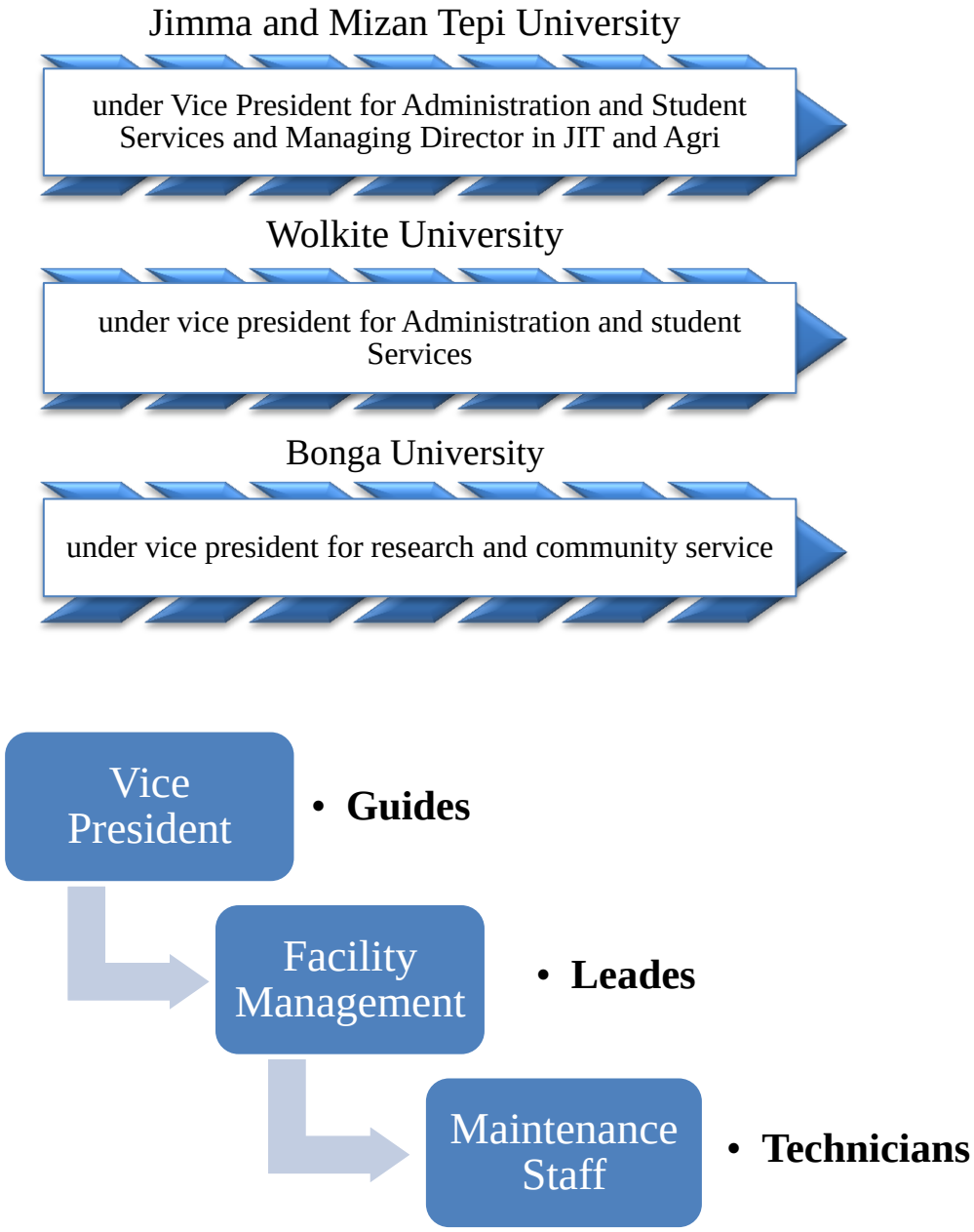
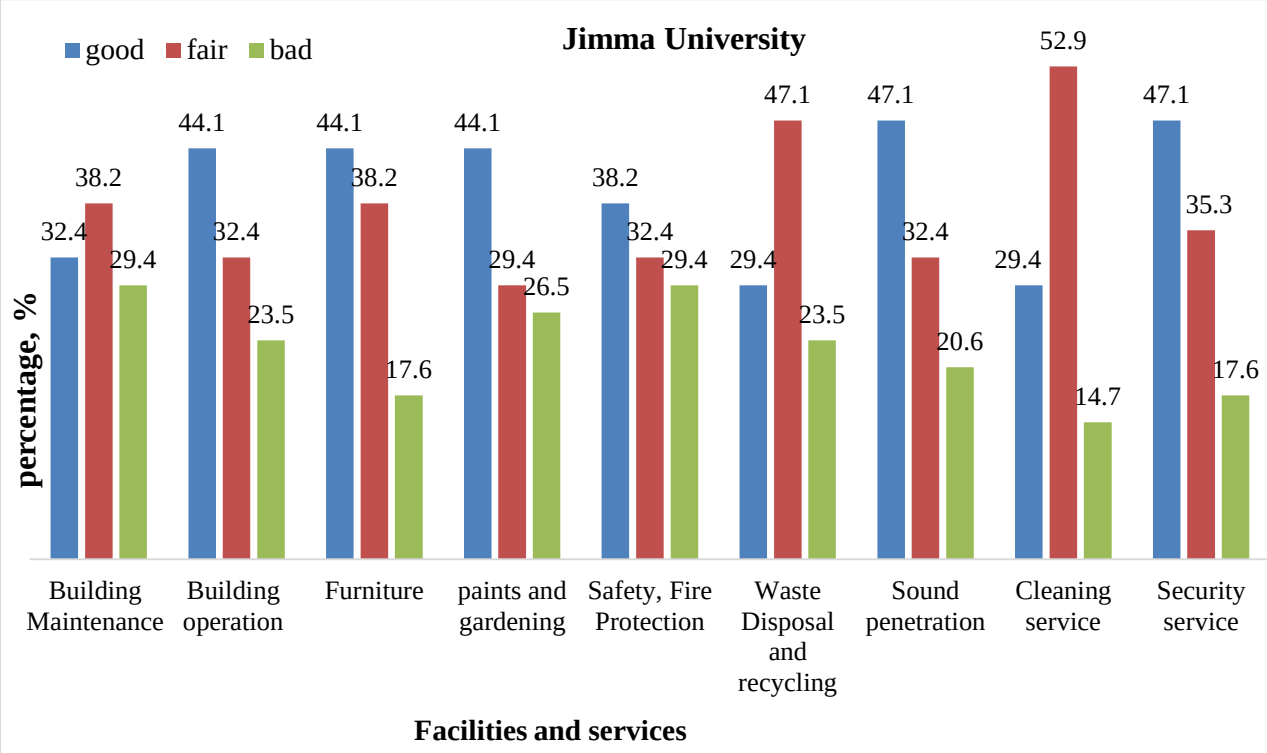


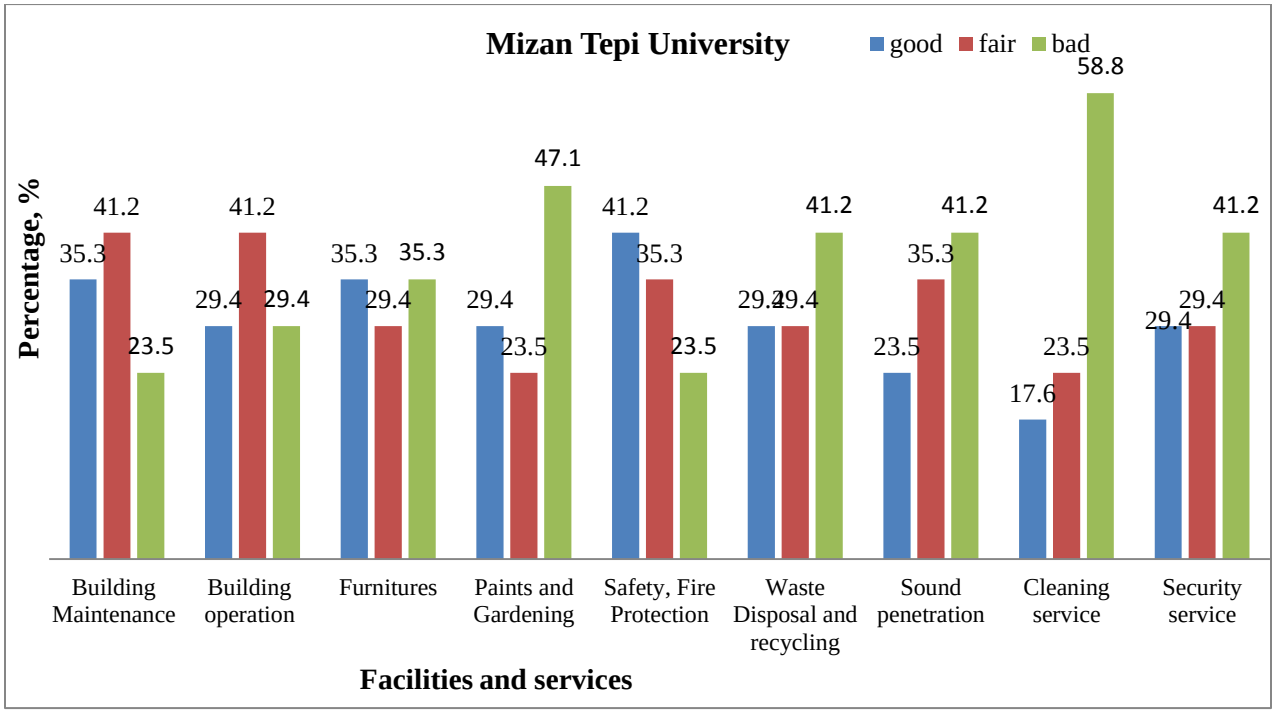
Figure 5 Facility management structures

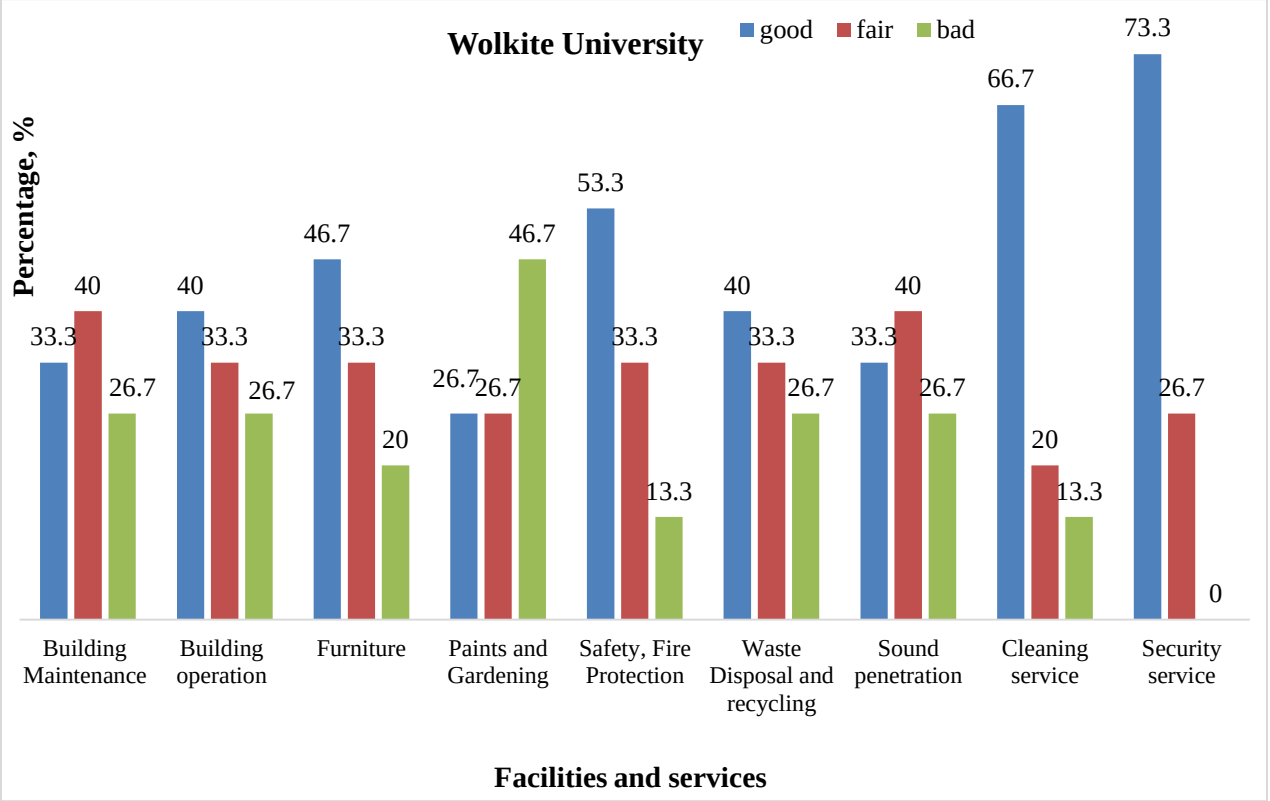
4.5 Condition of Facility Management Service in the Studied University

All the institutions surveyed had the full complement of the following domestic facilities services in their university. Middle-level management and lower-level management explained that building design and construction were not considered as one component of the facility management department. It's under engineering department (construction

project) which are responsible for design and supervision of new project by client-side as well as they are responsible for large maintenance that needs bidding and over the maintenance team capacity. However, these conditions affect the effectiveness and efficiency of the implementation of other components of facility management. Building design and construction and the implementation of facility management are investigated but including the engineering department in the facility management unit facilitates the communication between the staff who participated in new building construction and staff responsible for maintenance. The coordination between maintenance staff and new building construction staff has significance for maintenance staff to have a well-organized knowledge about the new building that makes it easy to keep the building as it is.




Mizan Tepi University
good
fair
bad
Percentage, %
35.3
41.2
23.5
29.4
41.2
29.4
35.3
29.4
35.3
29.4
23.5
47.1
41.2
35.3
23.5
29.4
29.4
41.2
23.5
35.3
41.2
17.6
23.5
58.8
29.4
29.4
41.2
Building Maintenance
Building operation
Furnitures
Paints and Gardening
Safety, Fire Protection
Waste Disposal and recycling
Sound penetration
Cleaning service
Security service
Facilities and services


Wolkite University
good
fair
bad
Percentage, %
33.3
40
26.7
40
33.3
26.7
46.7
33.3
20
26.7
26.7
46.7
53.3
33.3
13.3
40
33.3
26.7
33.3
40
26.7
66.7
20
13.3
73.3
26.7
0
Building Maintenance
Building operation
Furniture
Paints and Gardening
Safety, Fire Protection
Waste Disposal and recycling
Sound penetration
Cleaning service
Security service
Facilities and services

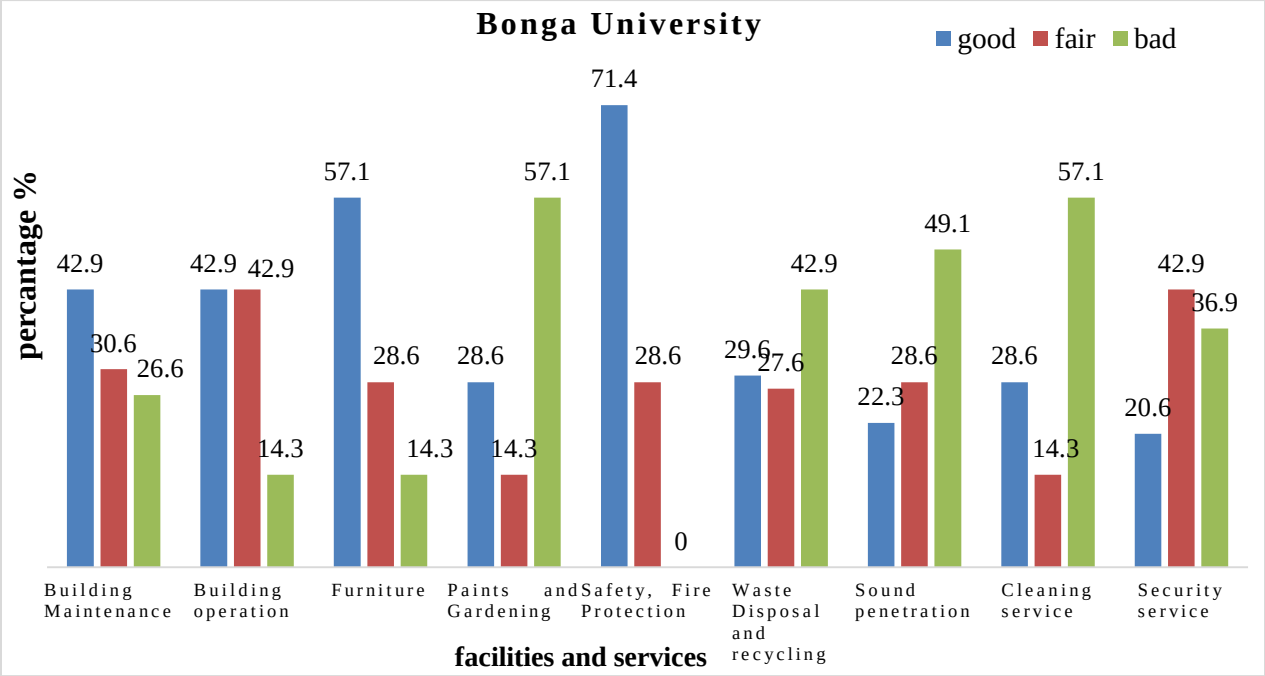


Figure 6 Facility Management Service in the Studied University

Figure 6 above shows details of the condition of these domestic facilities and services in the studied institutions. Based on the response of respondents and observation made, the percentage of domestic facilities and services of Jimma University were mostly in good and fair conditions. In Mizan Tepi University most of the percentage of domestic facilities and services were in fair and bad conditions. The percentage of domestic facilities and services for Wolkite University indicated a higher percentage were in good and fair conditions. In Bonga University a higher percentage of domestic facilities and services were indicated in good and bad conditions. The government aimed to expand coverage of the higher education institutes in all corners of our country by constructing low-cost buildings, especially for recent generations. Even though the aim was good, the facilities and services provided are not sufficient. Organizations should strive to achieve efficiency in service delivery; this will enhance customer satisfaction, develop staff knowledge and support gained and also improve process responsiveness and cycle time.

4.6 Building Operation and Maintenance

Assessment of building operation and maintenance was done based on the availability of detail records of university buildings, availability of training for facility management staffs, databases used for building facility management and the practice of building maintenance type.

4.6.1 Building Operation and Maintenance Policy

A building maintenance policy is a written document and provides a management framework for the maintenance personnel to determine appropriate maintenance strategy and standard. Top-level management in the studied universities was explained regarding the building operation and maintenance policy no policy guides how to operate and maintain the building in Higher Education instead the maintenance was held on the interest of universities. However, the policy of the building maintenance provides support to the maintenance personnel to determine proper maintenance strategy and standard.

4.6.2 Detail Records of University Building

Facility history includes detailed information in the form of drawings and manuals for operating the facility and a resource for planning repairs, shutdowns and other maintenance and operations activities. As the survey results indicated there were no detailed records of buildings, which are used to know the status of each building in all studied universities to use for maintenance purposes.

The original ‘as- designed’ contract drawings and specifications are modified to show all additions, deletions and other changes made during construction. Accurate as-built drawings are crucial for project operation and maintenance, and future modifications, specifically for plumbing and electrical systems, which are hidden from view (Chicago District Guideline, 2014).

However, lack of detailed record of buildings affects the performance and management of the facility as well as due to lack of proper documentation, information transfer is poor during the transition from one administration or system to another.

4.6.3 Availability of Trained Staff for Facility Management

The respondent in the studied universities explained that trained staffs are available in their universities but not enough trained staffs are available in all studied University.

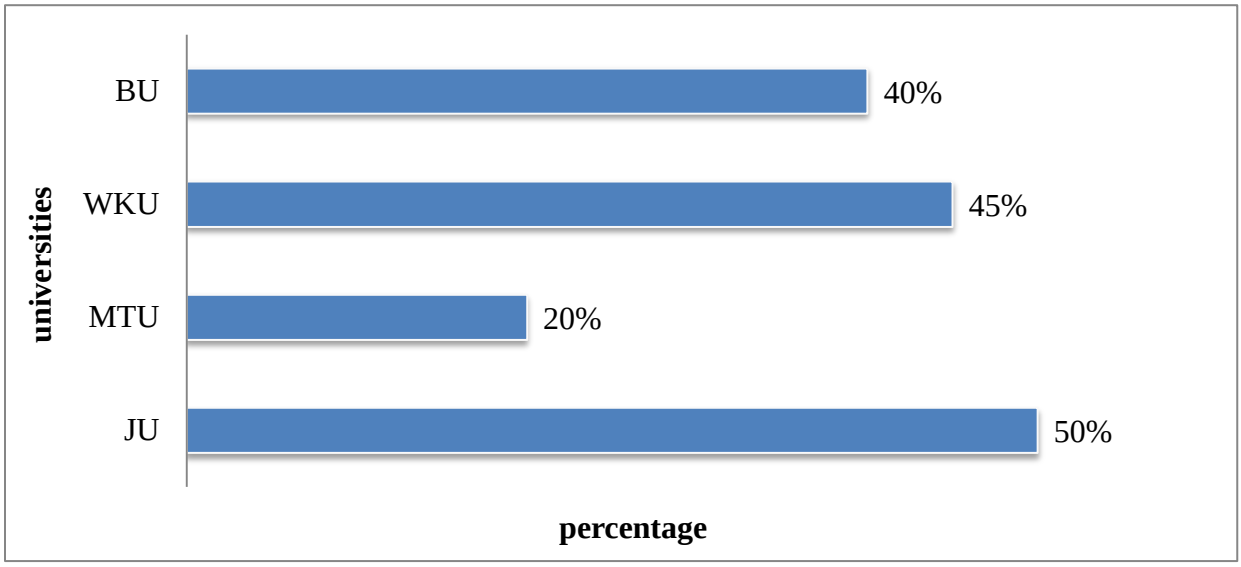


Figure 7 Availability of trained staff in facility management

Training is a vital element for building operation staff, as a majority of universities in the studied universities have trained staff but not enough in building maintenance so that facilities personnel must be properly instructed and motivated. As shown in figure 7, the availability of trained staff in facility management at Mizan Tepi University was very limited so that many duties of the facility management department were held by the construction project department which is not their responsibility. Even though there was a limited number of trained staff, the available staff does not work properly due to lack of policy implementation.

4.6.4 Data Bases Used for Building Facility Management

Different databases are used for building facility management practices like computerized maintenance management systems, building maintenance control systems and CAD for the documentation of drawings but no one respondent used these or other databases for facility management purposes in the studied universities. However, these databases will promote and enable more efficient use of information at all managerial levels, used by

facilities maintenance organizations to record, manage, and communicate their day-to-day operations, enhance both the quality and cost-effectiveness of the services provided by the facilities management.

4.6.5 Building Maintenance Type

As stated in the literature review maintenance types are categorized as: planned and unplanned maintenance. And they are further classified as preventive routine, corrective and breakdown maintenance.

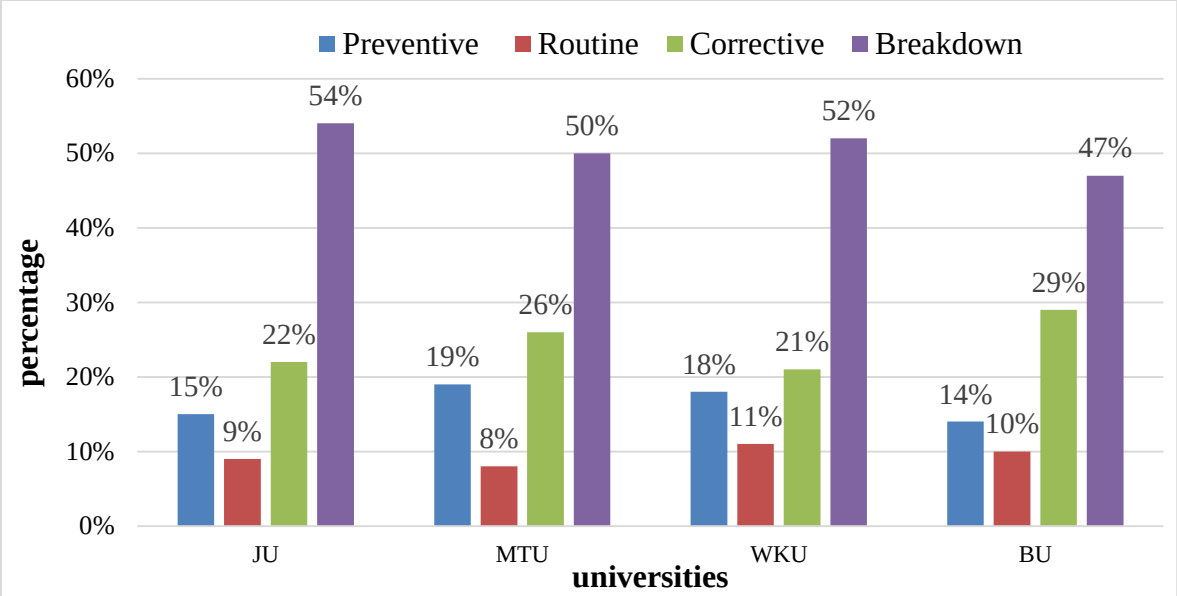


Figure 8 Building maintenance type practiced by studied universities

As shown in figure 8, a result of the respondent of facility management and maintenance staff indicated the majority of universities have practiced break down maintenance type with the comparison of routine and preventive maintenance. Due to the lack of preventive maintenance tasks include inspections, equipment checks, adjustments and overhaul at specified intervals hadn't been done.

So it is advisable to implement planned maintenance because it can extend the life of building components, prevent minor problems from escalating into the major system and equipment failures that result in costly repairs, preserves a safe environment for employees and the public, keeps equipment functioning as designed and it reduces

inefficiencies in operations and energy usage. In contrast, unplanned maintenance refers to a work necessitated by unforeseen breakdowns or damages.

The respondents reply that 40% - 55% of the maintenance activity is broken down maintenance and only 10% is routine maintenance.

4.6.6 Delivering Characteristics

As shown in Figure 9, the studied university's building maintenance conditions were improved from year to year. Most of the respondents replied 'yes' indicating the building condition was improved from time to time but there was no regular or scheduled maintenance, as most of the maintenance was reactive, and conducted upon the request or need.

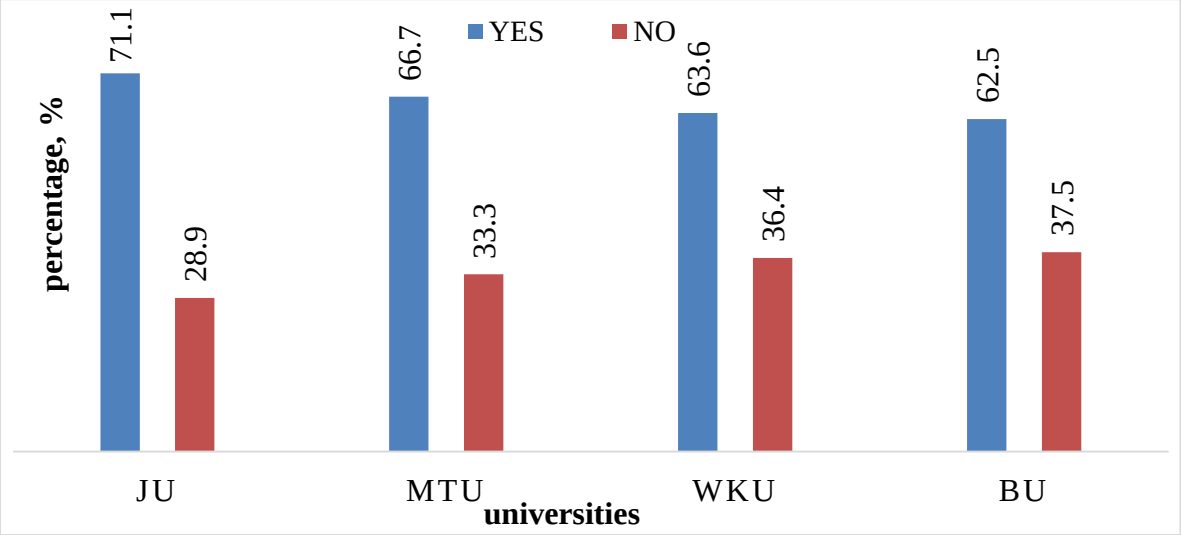


Figure 9 Delivering characteristics

Mostly the buildings are maintained during break time and summer season. However, the condition of the building's major systems: plumbing, electrical, structural systems, roof, door, and windows are necessary to asses to eliminate hazardous conditions (like repairing bad electrical connections or faulty fixtures, or replacing broken door and windows) and which their repairs can be postponed.

4.6.7 Means of detecting faults

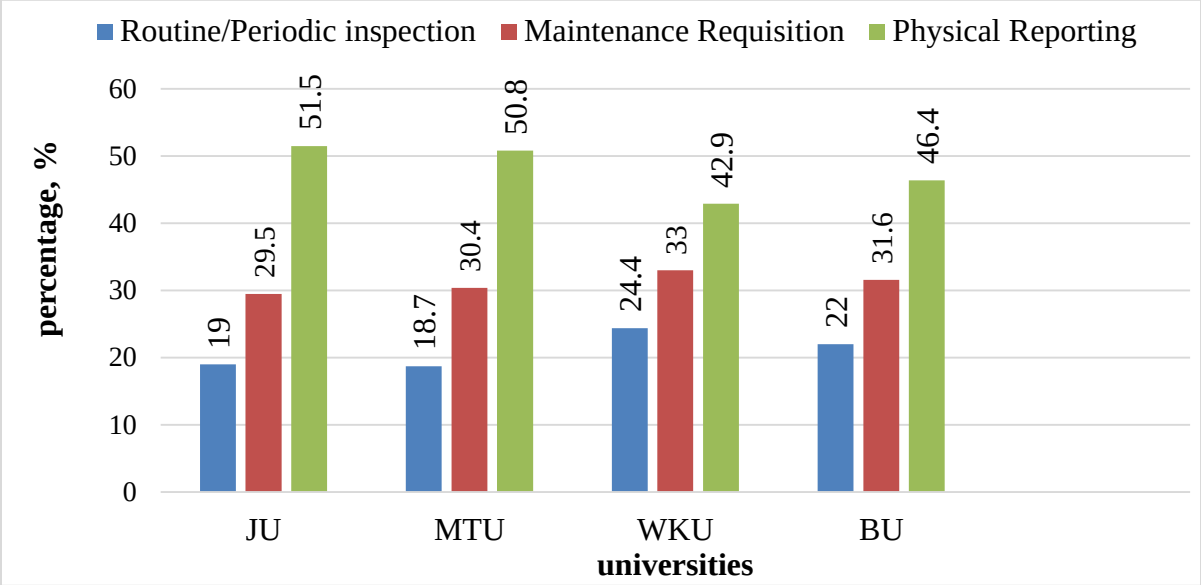


Figure 10 Means of detecting faults

According to the response of the studied university buildings, 40 % - 50% of their response shows faults on buildings (physical problems) were mostly noticed by physical reporting Figure 10 illustrates maintenance requisition forms is the second way of detecting faults; routine/ periodic inspections are rarely applicable in the studied universities because of the inadequate number of maintenance staff.

4.6.8 Condition of Building by Age

A total of 100 questionnaires were distributed. From 100 questionnaires 90 questionnaires were distributed for facility management; maintenance staff and engineering department for each studied university depending on their generation and availability of building age from a total of 90 questionnaires 67 responded and used for analysis. 36 questionnaires were responded from Jimma University because Jimma University is the first generation university and contains building age from less than five years to greater than thirty years are available. 14 questionnaires were from Mizan Tepi University in which buildings from less than five years to 20 years are available, 10 questionnaires were from Wolkite University in which buildings less than five years to ten years are available and 7 questionnaires were from Bonga University because

building less than five years are only available. The condition of the buildings managed by respondents is shown in figure 11.

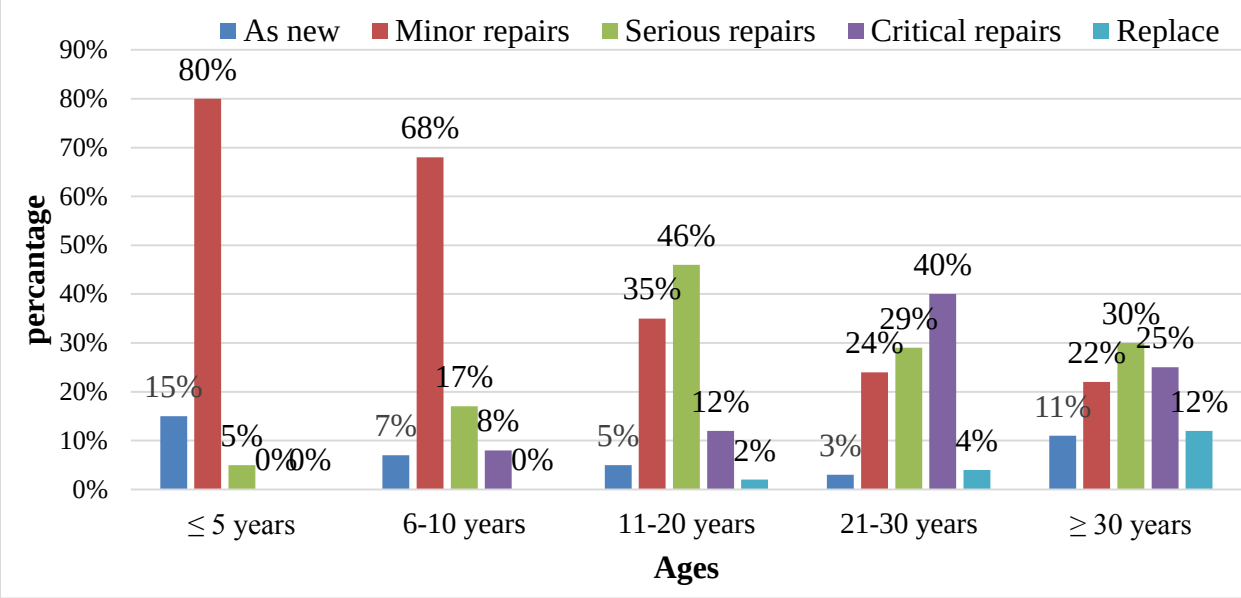


Figure 11 Condition of Building by Age

The responses confirm that the majority of the buildings that are less than five years old require minor maintenance since they are still relatively new and only five percent require series repairs due to low quality of building materials. The results for buildings that are between six and ten years old would suggest that their maintenance condition is good. For older buildings (more than ten years old), the results suggested that the buildings were deteriorated and need critical repairs and replace over a period of time due to lack of proper maintenance. 11 percent of respondents indicated that buildings over 30 years were as good as new because they were well designed and constructed using good material quality.

4.7 General Maintenance Condition of Buildings

Having assessed the maintenance condition of some facilities in the buildings as well as individual elements, a general assessment of the buildings surveyed was carried out to establish an overall picture of the maintenance conditions of higher education institutions. A building is made of different elements with each performing specific functions. The effective functioning of these elements determines the condition of a building. All the

elements have well defined and specific functions irrespective of the design of the building, its specifications, and construction. The maintenance condition of the buildings was done by assessing the following elements: the roof, any building roof cover forms an important component of that building and a building roof must be in place before it can be habitable. The floor of any building is an area that experiences a lot of activity due to the movement of occupants and as such undergoes both imposed and natural stress. The wall element is used for enclosing space and it is one of the most replaceable elements of the building and it is basic to all buildings. Painting on a building adds esthetic to any built environment and it also helps as a qualitative measure of the building. And Windows and doors are purposely put a place for aeration and sunlight penetration into a building, it also ensures that properties of occupants are safe and secure. Therefore depending on the observations; questionnaires and interview the survey results of the general maintenance condition of buildings by institutions are presented.

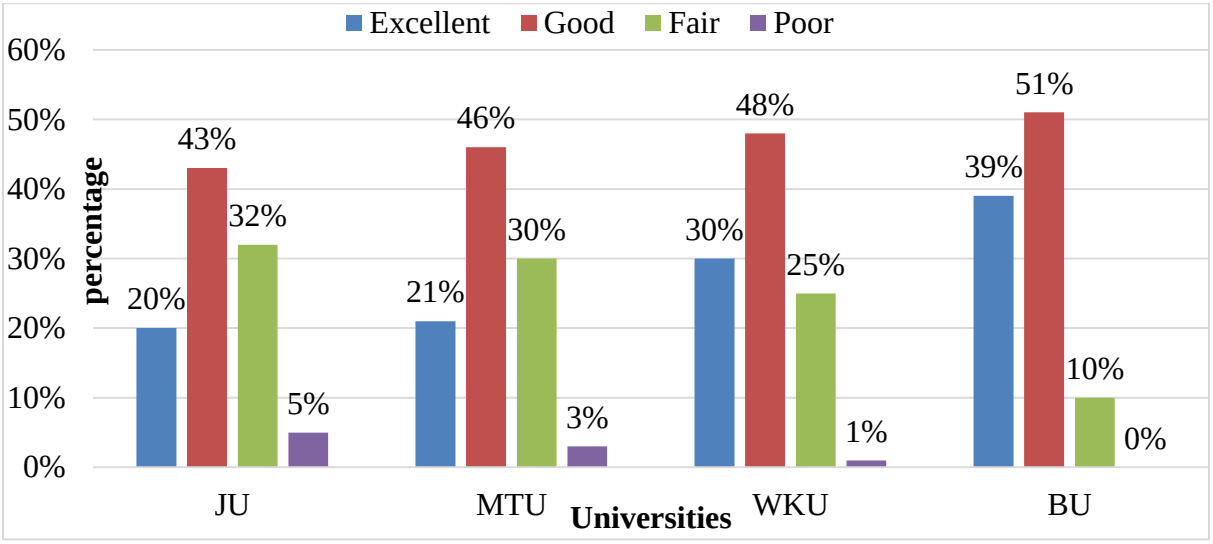


Figure 12 General Maintenance Condition of Buildings

The buildings were categorized into excellent, good, fair and poor. The building was categorized as being in excellent condition if components are brand new and no issues to report and structurally sound with no defect and no need for maintenance. Those in good condition if components are structurally sound with no defects (no cracks, peel-off, tilted, broken down, leakages, faded, etc.); no immediate issues or concerns and require only

general maintenance and slight repair; little or no deferred maintenance exists. Few building systems fail, and they allow uninterrupted daily use of the facilities.

Buildings those in fair condition had the following characteristics as components show signs of minor deterioration and require some corrective maintenance and major repairs; some deferred maintenance exists. Building systems fail occasionally, causing some interruptions in day to day use of the facilities. Those in poor condition had the following characteristics: components show signs of severe deterioration and require corrective maintenance and emergency repairs; deferred maintenance is extensive. Building systems fail frequently, causing continuous interruptions in daily use of facilities. For example completely broken down, dirty paint.

As indicated in figure 12, the general maintenance condition of buildings in all studied universities is almost in good condition. Among the studied universities, Wolkite and Bonga universities were in excellent and fair maintenance conditions than the others.

4.8 Factors Affecting Facility Management Practice in Higher Education Buildings.

Questionnaires were distributed only for facility management and maintenance staff for each university as respondents of all studied universities replied yes there were factors in their universities of building facility management practice. The factors are ranked by the respondent response by using the rating scale for each studied university.

Table 7 Factors affecting Building Facility Management practices in JU

Factors	**Mean**	***RII***	***Rank***
Inadequate FM personnel skill level	4.54	0.907	1
Financial Challenges	4.46	0.893	2
Lack of organized facility management department	4.09	0.819	3
Lack of Professional associations	4.02	0.804	4
Problem of policy implementation	3.63	0.726	5
Inadequate facilities usage information	3.59	0.719	6

Table 8 Factors affecting Building Facility Management in MTU

Factors	**Mean**	***RII***	***Rank***
Inadequate FM personnel skill level	4.50	0.900	1
Problem of policy implementation	4.46	0.893	2
Financial Challenges	4.26	0.852	3
Lack of organized facility management department	3.94	0.789	4
Inadequate facilities usage information	3.85	0.770	5
Lack of Professional associations	3.61	0.722	6

Table 9 Factors affecting Building Facility Management in WKU

Factors	**Mean**	***RII***	***Rank***
Problem of policy implementation	4.54	0.907	1
Lack of organized facility management department	4.31	0.863	2
Inadequate FM personnel skill	4.26	0.852	3
level Inadequate facilities usage information	4.17	0.833	4
Financial Challenges	3.91	0.781	5
Lack of Professional associations	3.72	0.744	6

Table 10 Factors affecting Building Facility Management in BU

Factors	**Mean**	***RII***	***Rank***
Lack of organized facility management department	4.61	0.922	1
Inadequate FM personnel skill level	4.41	0.881	2
Problem of policy implementation	4.39	0.878	3
Lack of Professional associations	4.15	0.830	4
Financial Challenges	3.87	0.774	6
Inadequate facilities usage information	3.70	0.741	5

The study shows that the respondents' rate on different factors as the cause in building facility management, inadequate FM personnel skill level, financial challenges, and lack of organized facility management department were the major factors affecting BFM

practice in JU. In MTU, inadequate FM personnel skill level, problem of policy implementation and financial challenges were taken as the main factors that affect BFM practice. The problem of policy implementation, lack of Professional associations and lack of organized facility management department were the main factors that affect BFM practice in WKU and BU. However, to minimize the above explained factors it needs reducing the root causes of problems. To improve the problem simplifying the bureaucracy of the office, classifying job and adapting the use of documents and to get competent professionals in facility management the universities should have structured facility management department with well trained and skilled manpower and share experience from other countries professionals or associations how to develop their competency.

4.9 Factors Affecting Building Maintenance Practice in Higher Education Institutes

4.9.1 Problems Faced with Building Maintenance

Maintenance is one of the major characteristics of a developed nation. That is why in many developed nations there is a huge presence of various well-maintained infrastructures like skyscrapers, tall buildings, etc. Infrastructural development and maintenance have a great impact on the socio-economic growth of a nation. Most developed nations invest in infrastructure and depend on it as a source of revenue for their economy. Hence they take maintenance of these infrastructures seriously. Countries like Dubai use infrastructure to attract tourists to their nation and this in turn yield revenue for the country (Cobbinah, 2010).

Table 11 Building Maintenance Problems

No	Common Problems	Percentage to their significance
1	Not enough staff	100%
2	Not enough budget	100%
3	Too many calls for service	84%
4	Poor construction quality	80%
5	Service administration inefficiencies	77%
6	Building design inefficiencies	75%

Six most common problems in the studied university building maintenance and the response to their significance are shown in table 11. According to the responses, the main problems found in the university building maintenance were not enough staff, insufficient budget and too many calls for service.

4.9.2 Major Causes of Building Maintenance Practice

From the study, major causes of building maintenance practice in the studied universities were ranked by the respondents as shown on table 12.

Table 12 Cause of Building Maintenance practice

Factors	Mean	*RII*	Rank
Lack of maintenance culture	4.69	0.938	1
Bureaucratic reporting process	4.22	0.844	2
Inadequate funds	4.16	0.831	3
Pressure on facility/building due to number of occupants	3.96	0.791	4
Poor work done on building	3.78	0.756	5
Non response to maintenance request	3.64	0.729	6

Documentation problem	3.51	0.702	7
Too many call for service	3.36	0.671	8
Building ages	3.27	0.653	9
Non-availability of spare materials	3.20	0.640	10

The main causes were lack of maintenance culture, next is the Bureaucratic reporting process and inadequate budget takes the third place and non-availability of spare material take the last place.

According to (Cobbinah, 2010) some of the factors responsible for the poor maintenance of public buildings are the age of the buildings, lack of maintenance culture, inadequate budget and high maintenance cost, pressure on building facilities and poor construction work.

4.9.3 Causes of Delays in Maintenance Works

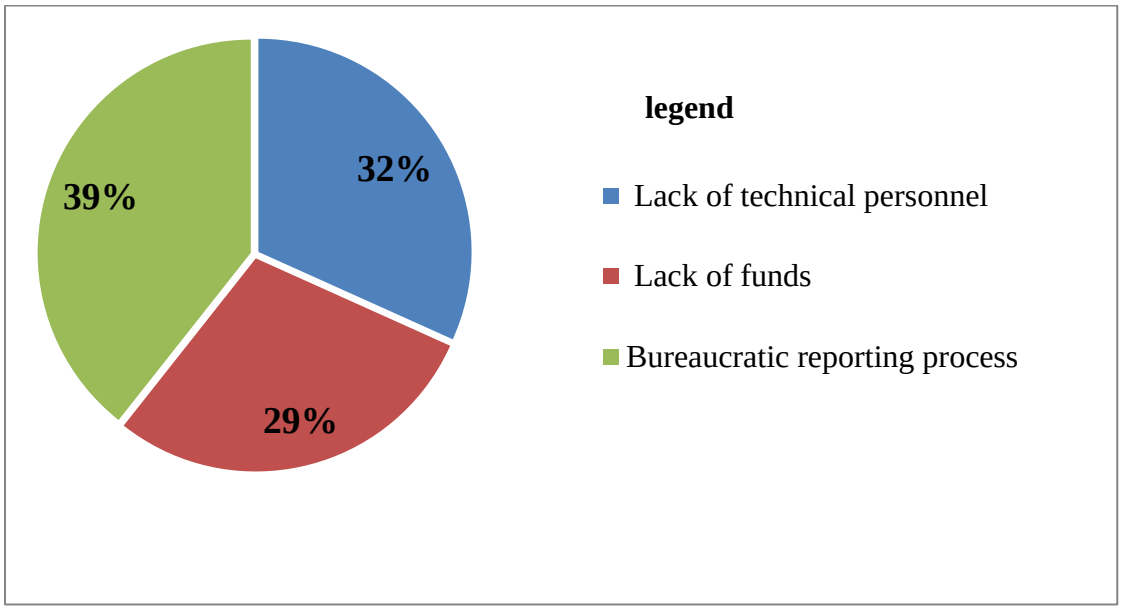


Figure 13 Causes of Delays in Maintenance Works

As shown in figure 13, all the studied universities respond that lack of qualified technical personnel which was the major cause of delay in maintenance works. Next to that, the

bureaucratic reporting process and fund were contributing to the delay of the maintenance work.

4.9.4 Major Sources of Maintenance Related Complaints.

Major maintenance related complaints in the studied university and the response on their significance are shown below

Table 13 Major Sources of Maintenance Related Complaints

No	Complaints	Percentage to their significance
1	Plumbing	100%
2	Paints	100%
3	Cleaning	97%
4	Lighting	90%
5	Choices of Materials	89.5%
6	Water Supply	88.7%
7	Waste Disposal	77.6%
8	Furniture	58%
9	Sound Penetration	54.5%
10	Fire protection	20%

The plumbing, paints and cleaning system in the studied university facilities were the major source of maintenance related complaints. And fire protection is the least maintenance related complaints. This problem can be solved by incorporating early important inputs from the maintenance department at the design stage of the buildings.

The research examined the process of building maintenance and management in Malaysia shows that the major source of maintenance related complaints that need the most attention are lighting, HVAC, telecommunications and sanitation (Zawawi, 2010).

4.10 Comparisons on the Practices of Building Facility Management

As shown in Table 14, based on structure of facility department, building condition survey, building maintenance type, responsibility of FM and, present of specific leading body or separate unit to support facility management, documentation of facility history and training for building maintenance staffs.

Table 14 Building facility management practices in the studied universities with respect to Africa and international universities

Key words	The studied universities	Africa Universities	International universities
Facility management department	Led by middle level	Led by middle level	Led up to Vice President level
The responsibility of facility management	Building operation and maintenance	planning, development, maintenance, operations and record-keeping	Building operation and maintenance including new building design & construction
Present of specific leading body	Not available	Not available	Available
Documentation of facility history	There is no as built drawing , maintenance manual	There is no	There is as built drawing, maintenance manual
Building condition survey	Assess the condition of the building rarely	Assess but not daily	Assess daily /always the condition of the building
Building maintenance type	Practice break down maintenance (after building parts are break)	Practice corrective maintenance reactive only: as items break	Practice preventive maintenance
Training for building maintenance	They do not provide	They do not provide	They provide
Technology or data bases availability for building maintenance	They do not use	They do not use	They use
Means of detecting faults	Physical reporting	Physical reporting	Routine / periodic inspection
Responsiveness and Timeliness	Take Days and depend on the degree of problem	Take Days	From 1-6 hours
major causes of building maintenance problems	Lack of maintenance culture, bureaucratic reporting process and budget	acute growth in population, lack of funds lack of maintenance culture and The age of buildings	the age of the buildings, lack of maintenance culture, inadequate budget
major maintenance related complaints	Plumping, cleaning and painting	Plumbing and Drainage	Lighting, HVAC, telecomm….. And sanitation.
Painting of the building	There is no regular painting		Planned painting

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Conclusions

Conclusions are drawn from the study by combining the findings, discussions, and recommendations as to what should be done to solve problems. The following conclusions are drawn from the investigation undertaken in the research.

Lack of building operation and maintenance policy, detail record of the building, regular training for building management staff and facility management experts affect building facility management. The most frequently practiced maintenance type in the studied universities was breakdown building maintenance.

The main factors encountered during building facility management were: Lack of Professional associations, lack of organized facility management department and Financial Challenges. Delays in carrying out maintenance works were mainly due to lack of qualified technical personnel, not having enough staff and enough budgets are the main problems found in the university building maintenance departments.

The plumbing system in the studied universities facilities was the major source of complaints, cleaning and lightening are also other maintenance related complaints and lack of maintenance culture was ranked as the first place that are causes for lack of building maintenance in the studied universities.

5.2 Recommendations

This study has dealt with the facility management practices in higher education buildings in Ethiopia a case study on Jimma, Mizan Tepi, Wolkite, and Bonga universities. Based on the study the following recommendations were suggested.

Some higher educational institutes shall start to open the facility management department under the degree and master level to get facility management professionals.

Rearrangement of the organization structure of facility management by upgrading the position of facility management up to Vice President Level, assigning building construction and maintenance manager under the position of Vice president

Prepare training, conference, etc. to share experiences from other international universities, providing training and short courses for the employee of facility management.

All the studied universities need to prepare a detailed record of the condition of the building and prepare the maintenance manual.

Maintenance is an important function in Ethiopia because of the fast development of building constructions. To get optimum economic life out of these assets it is necessary that they are systematically and properly maintained. The government has to acknowledge this fact and have all along realized the importance of sound maintenance practices. As it is impossible to construct any kind of building without following the Ethiopian building code standards (EBCS) also national standard guidelines should be available for maintenance works.

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APPENDIX A

Questionnaire for Top Level Management

Dear /Sir

I kindly request your participation and support on **study of building facility management practices in higher education institutes** in south western part of Ethiopia 'by responding questionnaire. Any information you can provide would be greatly appreciated.

General information

The main objective of this research is to investigate facility management practice in higher education institutions which are located in south western part of Ethiopia then find the possible way to improve the situation.

The purpose of the study is to:

- To study the current status of facility management practice in higher education building
- To identify factors affecting the facility management practice in higher education building
- To identify factors affecting maintenance practice in higher education building

The identity of the respondents shall be kept confidential. The information provided by you will be analyzed as whole, and we ensure you that this information will be held in strict confidence and used for the scientific research purpose only.

Thank you for your anticipated cooperation.

Best regards.

Advisor: Alemu Mosisa (Assistant Prof)

Researcher: Bontu Woyesa

Email: bonnyakesa2017@gmail.com

Phone no: 0917794214

Jimma, Ethiopia

Section1. Personal information

Please put a (X) mark of your choice against each question.

1.1. Educational stutas: College Diploma ☐ 1st Degree ☐ 2nd Degree ☐ Above ☐

1.2. What is your position in this University

☐ Vice president
☐ Service Administration Director of Directorate
☐ Managing Director
☐ Engineering Department
☐ Facility Management
☐ Other

Section2.Questions about building facility management system and practice

2.1 Is there specific leading body or association of Facility management in your university who provides guidelines and control on the quality level as well as to assess the performance of Facility management practice to your university?

☐ Yes ☐ No

2.2 Is there Facility management unit or department in your university?

☐ Yes ☐ No

2.3 In what level of management does facility management unit is headed?

☐ Top level of management (vice president, dean of colleges….)

☐ Middle level of management (directors, Facility manger….)

☐ Lower level of management

2.4 Is there facility management expert who leads a facility management unit?

☐ Yes ☐ No

2.5 If your answer for 2.4 is yes, is there archiving team for archiving campus building documents?

☐ Yes ☐ No

2.6 Is There Maintenance Team or Department in Your University

☐ Yes ☐ No

2.7. If your answer for 2.7 is yes, is it ☐ Preventive ☐ Reactive

2.8. How Defects are detected on buildings

☐ Periodic inspection/planned ☐ Maintenance Requisition/ UN planned

If other_____

_____

2.9. Is there Planning and Scheduling team for building maintenance?

☐ Yes ☐ No

If yes please could you write some responsibility of the team

_____

_____

2.10.Is there detail records of all university buildings?

☐ Yes ☐ No

2.11 What are the duty and Responsibility of Facility Management?

_____

_____

Please provide any other thoughts, information or contacts concerning building facility management practice in Ethiopian Universities

_____

_____

_____

Thank you!

APPENDIX B

Questionnaire for Middle Level Management

Dear /Sir

I kindly request your participation and support on **study of building facility management practices in higher education institutes** at south western part of Ethiopia 'by responding questionnaire. Any information you can provide would be greatly appreciated.

General information

The main objective of this research is to investigate facility management practice in higher education institutions which are located in south western part of Ethiopia then find the possible way to improve the situation.

The purpose of the study is to:

- To study the current status of facility management practice in higher education building
- To identify factors affecting the facility management practice in higher education building
- To identify factors affecting maintenance practice in higher education building

The identity of the respondents shall be kept confidential. The information provided by you will be analyzed as whole, and we ensure you that this information will be held in strict confidence and used for the scientific research purpose only.

Thank you for your anticipated cooperation.

Best regards.

Advisor: Alemu Mosisa

Researcher: Bontu Woyesa

Email: bonnyakesa2017@gmail.com

Phone no: 0917794214

Jimma, Ethiopia

Section1. Personal information

Please put a (X) mark of your choice against each question.

1.1. Educational stutas: College Diploma ☐ 1st Degree ☐ 2nd Degree ☐ ☐ Above

1.2. What is your position in this University

☐ Vice president for Business and Development ☐ Engineering Department

☐ Service Administration Director of Directorate ☐ Facility Manager

☐ Managing Director ☐ Other

Section2. Questions about building facility management system and practice

2.1 Is there Facility management unit or department in your university?

☐ Yes ☐ No

2.2 How do you rate the availability of facility management [FM] services in your university?

Services	Good	fair	bad
Building Maintenance			
Building operation			
Furniture			
Paints and Gardening			
Safety, Fire Protection			
Waste Disposal and recycling			
Sound penetration			
Cleaning service			
Security service			

2.3 Is there documentation of facilities in your universities?

☐ Yes ☐ No

2.4 Who is responsible for the supervision of maintenance works?

☐ Maintenance officer ☐ Engineer ☐ External Personnel

If other please mention_____

2.5 Is there maintenance unit in facility management department?

☐ Yes ☐ No

2.6 If your answer for question 2.4 is yes. Are well trained staffs available for maintenance unit?

☐ Yes ☐ No

2.7 How faults are detected on buildings?

☐ Routine/Periodic inspection ☐ Maintenance Requisition

☐ Physical reporting

2.8 How will you classify the general condition of your school building?

Excellent: No Need for Maintenance

Good: Need Minor Maintenance

Fair: Need Major Maintenance

Bad need immediate maintenance

☐ Excellent ☐ good ☐ fairly ☐ bad

2.9 How will you classify State of repair of building per Age?

☐ Condemn/replace ☐ Critical repairs ☐ as new

☐ Serious repairs ☐ Minor repairs

Section 3 Questions about problems and challenges in Facility Management practice

3.1 Are there any problems and challenges in Facility Management practice in your university?

☐ Yes ☐ No

3.2 If your answer for question 3.1 is yes Please rate the following causes to problems happen in your university?

Factors	Level of causing				
	Very low/1	Low/2	Medium/3	High/4	Very high/5
Lack of organized facility management					
Lack of Professional association					
Financial challenge					
Problem of policy Implementation					
Inadequate FM Personnel skill level					
Inadequate Facilities Usage Information					

☐ If other please mention……..

……

Thank you!

APPENDIX C

Questionnaire for Building Maintenance Staffs and Engineering Department

Dear /Sir

I kindly request your participation and support on **study of building facility management practices in higher education institutes** which are located in south western part of Ethiopia 'by responding questionnaire. Any information you can provide would be greatly appreciated.

General information

The main objective of this research is to investigate facility management practice in higher education institutions which are located in south western part of Ethiopia then find the possible way to improve the situation.

The purpose of the study is to:

- To study the current status of facility management practice in higher education building
- To identify factors affecting the facility management practice in higher education building
- To identify factors affecting maintenance practice in higher education building

The identity of the respondents shall be kept confidential. The information provided by you will be analyzed as whole, and we ensure you that this information will be held in strict confidence and used for the scientific research purpose only.

Thank you for your anticipated cooperation.

Best regards.

Advisor: Alemu Mosisa (Assistant Prof)

Researcher: Bontu Woyesa

Email: bonnyakesa2017@gmail.com

Phone no: 0917794214

Jimma Ethiopia

Section1. Personal information

Please put a (X) mark of your choice against each question.

1.1. Educational stutas: College Diploma ☐ 1st Degree ☐ 2nd Degree ☐ Above ☐

1.2. What is your position in this University

☐ Vice president for Business and Development ☐ Engineering Department
☐ Service Administration Director of Directorate ☐ Facility Manager
☐ Managing Director ☐ Other

Section 2 Questions about Building operation and maintenance

2.1 Is there maintenance unit in facility management department?

☐ Yes ☐ No

2.2 If your answer for question 2.1 is yes. Are well trained staffs available for maintenance unit?

☐ Yes ☐ No

2.3 If your answer for question 2.1 is yes. What type of building maintenance is practiced in your university?

☐ Preventive maintenance ☐ Corrective maintenance

☐ Break down maintenance ☐ Routine maintenance

2.4 How many time does the conditions of the building is assessed in your university?

☐ Always ☐ Rarely ☐ not assessed

2.5 If your answer for question 2.4 is not assessed. Due to what reason the condition of the Building is not assessed?

_____
_____

2.6 How long does it take to respond to maintenance request/needs of personnel?

☐ From 1- 6 hr. ☐ 1day ☐ week

☐ Month ☐ more than 1 month

2.7 Does the building conditions in the university improved or stayed at acceptable levels from year to year?

☐ Yes ☐ No

2.8 How will you classify State of repair of building per Age?

☐ Condemn/replace ☐ Critical repairs ☐ as new

☐ Serious repairs ☐ Minor repairs

2.9 How will you classify the general condition of your school building?

Excellent: No Need for Maintenance

Good: Need Minor Maintenance

Fair: Need Major Maintenance

Bad need immediate maintenance

☐ Excellent ☐ good ☐ fairly ☐ bad

Section 3 Questions about Facility Management practice

3.1 Does your university use data bases for facility management purpose?

☐ Yes ☐ No

3.2 If your answer for question 3.1 is yes. What databases used in your university?

☐ Computerized Maintenance Management system ☐ Building maintenance control system

☐ CAD for the documentation of drawings

Please list any other databases used by your university;

……..…….

3.3 is there documentation of facilities in your universities?

☐ Yes ☐ No

3.4 If your answer for question 3.3 is yes. What documents are available in your university?

☐ As built drawings ☐ maintenance and operation manual

☐ Both ☐ None

3.5How do you rate the availability of facility management [FM] services in your university?

Services	Good	fair	Bad
Building Maintenance			
Building operation			
Furniture			
Paints and Gardening			
Safety, Fire Protection			
Waste Disposal and recycling			
Sound penetration			
Cleaning service			
Security service			

3.6 If your answer for question 3.1 is yes Please rate the following causes to problems happen in your university?

Factors	Level of causing				
	Very low/1	Low/2	Medium/3	High/4	Very high/5
Lack of organized facility management					
Lack of Professional association					
Financial challenge					
Problem of policy Implementation					
Inadequate FM Personnel skill level					
Inadequate Facilities Usage Information					

☐ If other please mention……..

……

Section 4 Questions about problems and challenges in maintenance practice

4.1 Are there any problems and challenges in Maintenance practice in your university?

☐ Yes ☐ No

4.2 What do you believe are the problems that your university faces in terms of building maintenance? (Please tick as many as appropriate)

☐ Not enough staff ☐ Building design inefficiencies

☐ Too many calls for service ☐ Service administration inefficiencies

☐ Not enough money ☐ Poor construction quality

☐ Other, please state

4.3 How will you rate the following as the major cause of maintenance of building if it is so? Please rank with very high being the major reason and very low being the least factor.

Factors	Level of causing maintenance problem				
	Very low/1	Low/2	Medium/3	High/4	Very high/5
Lack of maintenance culture					
Inadequate funds					
Bureaucratic reporting process					
Pressure on facility/building due to number of occupants					
Poor work done on building					
Non response to maintenance request					
Too many call for service					
Documentation problem					
Building ages					
Non availability of spare materials					

4.4. Causes of delays in maintenance works

☐ Lack of technical personnel ☐ Lack of funds

☐ Non availability of materials ☐ Bureaucratic reporting process

☐ Others

4.5 What are the major sources of maintenance related complaints? Please tick as many as apply

☐ Cleaning ☐ Indoor Air Quality ☐ Plumbing

☐ Choice of Materials ☐ Repair/Replace ☐ Furniture

☐ Waste Disposal ☐ paints ☐ Design

☐ Fire Protection ☐ Sound Penetration ☐ Water Supply

☐ Lighting

☐ If other, please state_____

Thank you!

APPENDIX D

Photographs of Maintenance Problems of Universities Buildings

Picture1: Moisture in ceiling due to a leakage from the roof in Jimma and Mizan Tepi University

Picture 2: Moisture in floor due to a leakage from outside in Jimma Universities

Picture 3: Class room shows lack of wall cleaning and needs painting in Mizan Tepi and Bonga Universities.

Picture 4 Broken doors which is not good for safety and appearance

APPENDIX E

Factors affecting building facility management practice in JU

Calculating Cronbach's coefficient alpha for a 6 Question questionnaire with Likert score between 1 and 5 based on the 30 person sample

No	Q1	Q2	Q3	Q4	Q5	Q6	Total
1	4	4	5	4	3	5	25
2	5	3	5	3	4	5	25
3	5	4	5	4	2	5	25
4	5	4	5	5	5	5	29
5	5	4	5	4	3	4	25
6	3	3	5	4	2	3	20
7	5	2	5	4	5	5	26
8	5	4	5	5	4	5	28
9	5	3	5	4	2	5	24
10	5	5	5	5	4	4	28
11	4	5	5	2	5	5	26
12	5	5	4	4	4	5	27
13	4	4	5	4	3	5	25
14	5	5	5	5	2	5	27
15	4	5	5	4	4	5	27
16	5	5	4	5	5	5	29
17	4	3	5	1	4	4	21
18	5	5	5	4	4	5	28
19	5	5	5	5	5	5	30
20	3	5	4	4	1	4	21
21	5	5	5	5	4	5	29
22	4	3	4	3	5	4	23
23	5	5	5	3	4	5	27
24	5	4	5	2	2	4	22
25	5	5	5	5	4	5	29
26	4	3	4	5	5	5	26
27	5	5	5	5	1	4	25
28	5	3	5	2	1	5	21
29	5	5	5	5	5	4	29
30	3	5	5	3	2	5	23
Total	137	126	145	118	104	140	770
Var	0.445556	0.82667	0.1389	1.1956	1.78222	0.288889	4.677778

k	6
$\frac{\sum Var}{Var}$	4.67778 / 7.62222
α	0.66356

Factors affecting facility management practice in MTU

Calculating Cronbach's coefficient alpha for a 6 Question questionnaire with Likert score between 1 and 5 based on the 10 person sample

	Q1	Q2	Q3	Q4	Q5	Q6	Total
1	5	2	4	5	5	5	26
2	5	3	5	5	5	5	28
3	3	5	4	4	5	4	25
4	5	3	4	5	5	4	26
5	3	1	3	3	5	2	17
6	5	3	2	5	4	3	22
7	4	3	3	5	5	2	22
8	5	1	2	4	5	2	19
9	4	5	1	5	4	3	22
10	3	2	5	5	5	2	22
Total	42	28	33	46	48	32	229
Var	0.760000	1.760000	1.610000	0.440000	0.160000	1.360000	3.57000

k	6
$\sum Var$	3.570000
Var	10.29
α	0.7837

Causes of Building Maintenance

Calculating Cronbach's coefficient alpha for a 10 Question questionnaire with Likert score between 1 and 5 based on the 45 person sample

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Total
1	5	5	5	5	5	5	5	5	5	5	50
2	5	5	5	5	5	5	5	5	5	5	50
3	5	5	5	5	5	5	5	5	5	5	50
4	5	5	5	5	5	5	5	5	5	5	50
5	5	5	5	5	5	5	5	5	5	5	50
6	5	5	5	5	5	5	5	5	5	5	50
7	5	5	5	5	5	5	5	5	5	5	50
8	5	5	5	5	5	5	5	5	5	5	50
9	5	5	5	5	5	5	5	5	5	5	50
10	5	5	5	5	5	5	5	5	5	5	50
11	5	5	5	5	5	5	5	5	5	5	50
12	5	5	5	5	5	5	5	5	5	4	49
13	5	5	5	5	5	5	5	5	5	4	49
14	5	5	5	5	5	5	5	5	5	4	49
15	5	5	5	5	5	5	5	5	5	4	37
16	5	5	5	5	5	5	4	5	4	4	40
17	5	5	5	5	5	5	4	5	4	4	32
18	5	5	5	5	5	5	4	5	4	4	41
19	5	5	5	5	5	5	4	4	4	4	36
20	5	5	5	5	5	5	4	4	4	3	37
21	5	5	5	5	4	4	4	4	3	3	36
22	5	5	5	5	4	4	4	4	3	3	38
23	5	5	5	5	4	4	3	4	3	3	36
24	5	5	5	5	4	4	3	4	3	3	37
25	5	5	5	5	4	4	3	4	3	3	28
26	5	5	5	5	4	4	3	4	3	3	40
27	5	5	5	4	4	3	3	3	3	3	37
28	5	5	5	4	4	3	3	3	3	3	26
29	5	5	5	4	4	3	3	3	2	3	29
30	5	4	5	4	4	3	3	3	2	3	20
31	5	4	5	4	4	3	2	3	2	3	35

32	5	4	5	3	3	3	2	2	2	2	31
33	5	4	4	3	3	3	2	2	2	2	30
34	5	4	4	3	3	3	2	2	2	2	30
35	5	3	4	3	3	2	2	2	2	2	28
36	5	3	4	3	3	2	2	2	2	2	28
37	4	2	4	3	2	2	2	2	2	2	25
38	4	2	4	3	2	2	2	2	2	2	25
39	4	2	3	2	2	2	2	2	2	1	22
40	4	2	3	2	1	2	1	1	1	1	18
41	3	2	3	2	1	2	1	1	1	1	17
42	3	1	2	1	1	2	1	1	1	1	14
43	3	1	2	1	1	2	1	1	1	1	14
44	3	1	2	1	1	1	1	1	1	1	13
45	3	1	2	1	1	1	1	1	1	1	13
Total	211	185	201	181	171	168	151	159	147	144	1590
Var	0.436543	1.920988	0.915556	1.799506	1.982222	1.751111	2.095802	2.204444	2.151111	1.893333	17.150617

K	10
$\sum Var$	17.150617
Var	145.956
A	0.98055