

ADDIS ABABA UNIVERSITY
COLLEGE OF TECHNOLOGY AND BUILT ENVIRONMENT
SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING
(CONSTRUCTION TECHNOLOGY & MANAGEMENT STREAM)



**ASSESSMENT OF FACILITY MANAGEMENT PRACTICES IN ADDIS
ABABA'S CENTRAL BUSINESS DISTRICT HIGH RISE BUILDINGS:
CHALLENGES AND OPPORTUNITIES**

A Thesis submitted to the School of Graduate Studies of Addis Ababa University in
partial fulfillment of the requirements of the Degree of Master of Science in Civil
Engineering

(Construction Technology and Management)

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February 2025

Addis Ababa

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Approved by the Board of Examiner

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DECLARATION

I hereby declare that this thesis, titled “*Assessment of Facility Management Practices in Addis Ababa’s Central Business District High-Rise Buildings: Challenges and Opportunities*”, is the result of my original work. It has not been submitted, in whole or in part, to any other institution for any academic degree or qualification.

All sources of information and references used in this study have been duly acknowledged, and proper citations are provided throughout the document. Any assistance received during the research process has been explicitly mentioned in the acknowledgment section.

I take full responsibility for the content of this thesis and confirm that it complies with the academic and ethical standards of Addis Ababa University.

Henok Berhane Tesfagabier

February 2025

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ABSTRACT

High-rise buildings in Addis Ababa's central business district address urban density and land scarcity but face significant facility management challenges. These include limited adoption of advanced technologies, inadequate training, and the absence of standardized practices, leading to inefficiencies, safety risks, and reduced building lifespans. This study assesses current facility management practices, identifies key challenges, and explores opportunities for improvement to enhance efficiency and sustainability.

A mixed-method approach was employed, combining structured questionnaires and semi-structured interviews with facility managers and building occupants. Data analysis revealed a predominant reliance on corrective maintenance, with limited preventive strategies due to budget constraints. Energy efficiency initiatives, such as LED lighting and efficient HVAC systems, are in place but need expansion to incorporate renewable energy solutions. Technology adoption varies, with some buildings utilizing Building Management Systems while others struggle with financial limitations.

Key challenges include gaps in regulatory compliance, particularly in fire safety, environmental standards, and accessibility, necessitating investment and training. While tenant satisfaction is high for cleanliness and safety, parking and elevator services require improvement.

The study underscores the need for proactive maintenance strategies, increased technology adoption, and sustainability-focused initiatives. Strengthening facility management policies, investing in training programs, and encouraging government incentives for sustainable practices can enhance building performance. These findings provide a roadmap for aligning Addis Ababa's facility management practices with global standards, fostering long-term efficiency and resilience while informing future policies and research.

KEY WORDS: FACILITY MANAGEMENT, HIGH-RISE BUILDING, CENTRAL BUSINESS DISTRICT OPPORTUNITIES, CHALLENGES, ADDIS ABABA.

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LIST OF ABBREVIATIONS

| | |
|--------|---|
| AI | Artificial Intelligence |
| BAS | Building Automation Systems |
| BIM | Building Information Modeling |
| BMS | Building Management System |
| BREEAM | Building Research Establishment Environmental Assessment Method |
| CAFM | Computer-Aided Facility Management |
| CBD | Central Business Districts |
| CTBUH | Council on Tall Buildings and Urban Habitat |
| FM | Facility Management |
| HRBs | High-rise Buildings |
| HVAC | Heat, Ventilation, and Air-Conditioning |
| IFM | Integrated Facility Management |
| IFMA | International Facility Management Association |
| IoT | Internet of Things |
| IWMS | Integrated Workplace Management Systems |
| LED | Light Emitting Diodes |
| LEED | Leadership in Energy and Environmental Design |
| TQM | Total Quality Management |

CHAPTER ONE: INTRODUCTION

1.1 Background to the Research

In today's rapidly urbanizing and technologically advancing world, facility management has become a critical organizational function. It brings together people, places, and processes within the built environment to improve both quality of life and operational productivity. The importance of facility management has grown significantly in recent years, driven by the increasing complexity of modern buildings and heightened demands for sustainability and efficiency. This evolution reflects a broader recognition of the essential role that effective facility management plays in achieving organizational objectives and enhancing the well-being of occupants.

The rapid urbanization of Addis Ababa has led to significant changes in its skyline, with high-rise buildings emerging as a prominent feature of the central business district. These towering structures are often associated with urban development and modernity but demand specialized management to ensure safety, functionality, and sustainability.

Facility management encompasses a wide range of activities aimed at maintaining and optimizing buildings to ensure they operate efficiently and effectively. Key areas of focus include space management, systematic maintenance, and energy efficiency, all of which are essential for supporting daily operations. Among these, energy management has become a central pillar of facility management involving the reduction of energy consumption and the promotion of sustainability through monitoring systems, energy-saving initiatives, and environmentally friendly practices. The incorporation of technologies such as Building Information Modeling, Internet of Things devices, and advanced smart systems has transformed contemporary facility management, allowing managers to improve efficiency, reduce expenses, and achieve sustainability objectives (Shah, 2022). By creating safe, productive, and sustainable spaces, facility management aligns with organizational objectives and contributes to overall success.

High-rise buildings, defined by their numerous stories, are symbols of urban development and economic progress. Cities like New York, Dubai, and Hong Kong showcase skyscrapers that reflect modernity, technological advancement, and efficient urban space use (Jerzy & Hanna, 2019). Their size, structural complexity, and high occupancy demand

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specialized management practices. According to the Global Tall Buildings Database by the Council on Tall Buildings and Urban Habitat (2024), over 1,647 buildings exceeding 200 meters in height have been constructed worldwide, highlighting the growing trend of high-rise development and the need for advanced facility management strategies.

High-rise buildings offer benefits like increased density and energy efficiency but present unique challenges for facility managers. Unlike low-rise buildings, high-rise buildings require advanced systems for vertical transportation, energy management, and emergency response, often relying on sophisticated building management systems to oversee operations. In contrast, low-rise structures have simpler systems with lower maintenance needs, making their management less complex and costly. Managing high-rise buildings demands specialized knowledge of building systems, maintenance practices, and tenant relations for effective operation (Dahlan & Zainuddin, 2018).

In light of these considerations, this study seeks to bridge the knowledge gap in facility management practices for high-rise buildings in Addis Ababa's central business district. By assessing current practices, identifying challenges, and exploring opportunities for improvement, the research aims to provide actionable recommendations that enhance building efficiency, sustainability, and operational effectiveness. Through this evaluation, the study contributes to the broader discourse on urban development and facility management, offering insights that support informed decision-making and the advancement of best practices in high-rise building management.

1.2 Statement of the Problem

The rapid development of high-rise buildings in Addis Ababa's central business district has created significant challenges in facility management, particularly in ensuring efficiency, safety, and sustainability. While these buildings symbolize urban progress, their complex structures and high occupancy levels demand specialized management practices. However, current facility management strategies in Addis Ababa remain inadequate, leading to operational inefficiencies, safety concerns, and increased maintenance expenses.

A major issue lies in the lack of integration between hard and soft facility management. Hard facility management challenges include poor maintenance of essential systems such as elevators, HVAC, plumbing, and fire safety mechanisms, often resulting in frequent

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breakdowns and safety hazards. Additionally, many high-rise buildings suffer from inefficient energy management, leading to excessive utility costs and environmental concerns. On the other hand, soft facility management issues such as inadequate cleaning services, poor security management, and inefficient waste disposal negatively impact tenant satisfaction and building usability.

In Addis Ababa, facility management practices are hindered by skill shortages, insufficient data, and a lack of standardized systems, limiting informed decision-making and resource optimization. Facility managers face significant barriers, including budget constraints, a lack of qualified personnel, and the need for multidisciplinary expertise (Abera, 2017; Alebachew, 2022; Tsegaye, 2022). These challenges are compounded by the absence of systematic policies and inadequate integration of sustainability measures, leaving many high-rise buildings vulnerable to inefficiencies and risks. Without proper regulatory frameworks and systematic maintenance approaches, high-rise buildings in Addis Ababa risk becoming inefficient, costly, and unsustainable in the long run.

This study aims to assess existing facility management practices in Addis Ababa's high-rise buildings, identify key challenges related to both hard and soft facility management, and propose actionable improvements. By addressing these issues, the research seeks to enhance operational efficiency, promote sustainable urban development, and contribute to the long-term functionality of high-rise structures in the city.

1.3 Research Questions

- What are the current facility management practices in the central business district high-rise buildings?
- What are the major challenges faced by facility managers in the central business district high-rise buildings?
- What opportunities exist for improving facility management practices in high-rise buildings?
- What are the best practices in facility management that enhance the efficiency and sustainability of the central business district high-rise buildings?

1.4 Objective of the Study

1.4.1 General Objective

The general objective of this study is to comprehensively evaluate facility management practices in high-rise buildings within Addis Ababa's central business district. It aims to identify key challenges, assess opportunities for improvement, and propose strategic solutions that enhance operational efficiency, sustainability, and resilience. By integrating best practices, the study seeks to provide evidence-based recommendations that support policymakers, facility managers, and building owners in optimizing facility management systems, ensuring regulatory compliance, and fostering long-term sustainable urban development.

1.4.2 Specific Objectives

- To assess the current facility management practices in the central business district high-rise buildings.
- To identify challenges and opportunities in the existing facility management system.
- To suggest best practices and enhancements to facility management in high-rise buildings for sustainable urban development.

1.5 Significance of the Study

The study is expected to enrich the academic discourse on facility management in high-rise buildings, addressing existing knowledge gaps and creating a foundation for further research on facility management's role in sustainable urbanization. Practically, it provides actionable insights for facility managers, building owners, and policymakers, providing strategies to optimize facility management practices and strengthen urban planning initiatives. Additionally, the study aims to show ways to improve the living and working environments in high-rise buildings, contributing to greater occupant satisfaction, energy efficiency, and sustainability. Ultimately, the findings support the development of a resilient, well-managed urban infrastructure, benefiting a wide range of stakeholders.

1.6 Scope of the Study

This study focuses on assessing facility management practices, challenges, and opportunities in high-rise buildings within Addis Ababa's central business district. It examines key aspects such as maintenance strategies, technology adoption, energy efficiency, sustainability practices, regulatory compliance, and tenant satisfaction. The research is limited to high-rise buildings within the central business district and does not extend to other areas or building types in Addis Ababa. The findings aim to provide actionable insights and recommendations to improve facility management efficiency and sustainability, ultimately supporting informed decision-making and policy development.

1.7 Limitation of the Study

The study faces certain limitations, including restricted access to some buildings, limited availability of comprehensive documented data, and resource constraints, which may affect the depth and generalizability of the findings. Despite these challenges, the research strives to provide valuable insights that contribute to the advancement of facility management practices and sustainable urban development in Addis Ababa.

1.8 Organization of the Thesis

The study report is divided into seven chapters, each of which is summarized here:

Chapter One: Provides the background, problem statement, research questions, objectives, significance, scope, and limitations of the study.

Chapter Two: Reviews existing literature on facility management and high-rise buildings.

Chapter Three: Outlines the research design, data collection methods, and analysis procedures.

Chapter Four: Presents the results of the data analysis from the questionnaire survey and case studies, along with the corresponding discussion.

Chapter Five: Summarizes the key findings and provides conclusions, recommendations, and suggestions for future research.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Facility Management (FM) plays a crucial role in the efficient functioning and sustainability of High-rise Buildings (HRBs). As global urbanization accelerates, particularly in rapidly expanding cities, the need for effective FM becomes increasingly apparent. HRBs present unique challenges and opportunities that demand a comprehensive approach to managing these complex structures. Effective FM in HRBs is essential not only for operational efficiency but also for ensuring the safety, comfort, and functionality of the buildings for their occupants.

Facility management first gained prominence in the 1970s as a strategic approach to cost reduction and has since evolved into one of the fastest-growing fields worldwide. Facilities managers are responsible for managing the maintenance and operation of buildings and the services that support businesses and organizations (Moazzeni et al., 2023). As projected by global market analysis cited in (Chioma, 2023), the FM market is anticipated to grow to \$119.4 billion by 2030, having surpassed \$1 trillion in 2022 and potentially reaching \$2 trillion by 2027.

Just like people, buildings require maintenance, and the people who own them are in charge of doing so. The upkeep and administration of high-rise buildings with multiple owners are far more difficult than those of a single-owner home (Azian et al., 2020). High-rise buildings FM is a complex and specialized field that involves the planning, coordination, and control of all aspects of building operation and maintenance.

Facility management encompasses a wide range of services aimed at ensuring the efficient operation of buildings and infrastructure. As outlined by Opoku and Lee (2022), facility management includes maintaining building systems, managing spaces, ensuring safety and security, and overseeing cleaning and waste management. These services are essential for promoting operational efficiency and maintaining the structural integrity of buildings. Effective facility management practices are critical for enhancing both the sustainability and efficiency of buildings. Lui et al. (2022) point out facility management significantly contributes to resource optimization and energy savings through the implementation of energy-efficient systems and sustainable practices. In HRBs, which consume significantly

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more energy and resources than smaller structures, effective FM can have a profound environmental and economic impact. Safety and regulatory compliance are also key components of FM in HRBs. As noted by Opoku and Lee (2022), facility management ensures that buildings adhere to local regulations and safety standards, which is particularly vital given the increased risks of fires and other emergencies in tall structures. Effective FM involves routine inspections, proper maintenance of safety systems, and strict compliance with building codes to mitigate potential hazards.

The quality of FM directly affects occupant comfort and productivity. The Facility Management Association of Australia (2024) highlights that efficient facility management enhances user experience by ensuring a clean, safe, and comfortable environment. In HRBs housing residents, office workers, and businesses, effective FM is vital for maintaining high living and working standards and boosting satisfaction and productivity.

The administration of HRBs has been completely transformed by the incorporation of technology into FM. Building Management System (BMS) and Internet of Things (IoT) devices are examples of smart building technologies that enable real-time monitoring and control of building systems, improving efficiency and promoting preventative maintenance (Ahmad et al., 2023; Chung et al., 2018). By implementing these technologies, property managers improve security, optimize energy use, and provide residents with improved services. Facility management in high-rise buildings faces complex systems, high costs, and a need for expertise. As Tsegaye (2022) notes, Addis Ababa's facility management is developing, relying on basic services with minimal technology and manual operations. Addressing these issues requires skilled professionals, unified standards, training, technology adoption, and best practices.

FM is vital for HRBs, optimizing operations, ensuring safety and sustainability, and enhancing occupant satisfaction. As urbanization drives vertical growth, FM plays a critical role in shaping sustainable cityscapes. This chapter reviews existing FM practices in HRBs, offering a theoretical framework for the study. It explores the role of FM in operational efficiency, safety, and sustainability, covering maintenance protocols, tenant satisfaction, security, technology use, and waste management. The chapter also examines the unique challenges and opportunities of managing HRBs, drawing from prior research, journals, and industry reports. Identifying gaps and best practices lays the foundation for the empirical analysis and case studies focused on Addis Ababa's HRBs.

2.2 Definitions

2.2.1 Definition of Facility Management

Definitions and applications of FM and FM services vary significantly across different organizations and industries. The scope and meaning of FM can shift depending on an organization's specific needs and the sector in which it operates. Despite these variations, most scholars agree on the fundamental role of FM in ensuring organizational functionality. This function connects physical resources with human resources within a workplace, regardless of the range and diversity of services involved. Several scholars offer perspectives on FM, each highlighting different facets of its purpose and scope. Here are some of these definitions:

FM, as defined by the International Facility Management Association (IFMA), focuses on supporting individuals by ensuring the functionality, safety, comfort, efficiency, and sustainability of buildings and their surrounding infrastructure. This includes the spaces where people live and work. The definition emphasizes the interdisciplinary nature of FM and its goal of creating optimal environments through the integration of diverse elements (IFMA, 2024).

According to the British Standards Institute, FM is "the combination of processes within an organization to maintain and develop the agreed services that support and improve the effectiveness of its primary activities" (BSI, 2018). This definition emphasizes a process-oriented approach to FM and its primary purpose of supporting an organization's core operations.

According to the European Standard Norm (2006), facility management is defined as a coordinated process aimed at supporting and enhancing the efficiency of an organization's core activities through the management and provision of agreed-upon support services, ensuring a suitable environment to meet its evolving goals (IS EN 15221-1, 2006). This definition, similar to that of the British Standards Institute, underscores FM's role in fostering organizational effectiveness.

The ISO 41001:2018 standard, developed by the International Organization for Standardization, defines facility management as the organizational function that harmonizes people, processes, and the built environment to enhance the quality of life for individuals while boosting the output of the core business (ISO, 2018). This definition

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highlights FM's focus on a human-centered approach, prioritizing improved well-being and business efficiency.

This study defines FM as a multidisciplinary field integrating people, place, process, and technology to ensure functionality, comfort, safety, and efficiency of the built environment. FM includes building maintenance, space management, security, cleaning, and waste management. In HRBs of rapidly urbanizing areas like Addis Ababa, FM ensures operational efficiency and sustainability, supporting organizational goals, occupant well-being, and resilient urban infrastructures.

2.2.2 Definition of High-Rise Buildings

HRBs address land scarcity and growing urban populations, often serving as iconic projects showcasing advanced construction technologies. Defined by their height, complex infrastructure, and need for robust FM, HRBs highlight unique challenges in sustainability and urban development. Definitions vary, emphasizing scale, complexity, and functional demands, shaping FM practices to meet their specific requirements.

The CTBUH classifies high-rise buildings as those exceeding 14 stories or measuring between 50 m and 300 m in height. Structures taller than 300 m are referred to as "super-tall," while those surpassing 600 m are categorized as "mega-tall" (CTBUH, 2024).

The International Building Code characterizes high-rise buildings as any structure with an occupied floor situated over 23 meters above the lowest point accessible to fire department vehicles (IBC, 2018).

The Compulsory Ethiopian Standards define high-rise buildings as those with occupied floors exceeding 25 meters above the lowest level accessible to fire department vehicles. Exceptions include structures such as airport traffic control towers, open parking garages, buildings used for outdoor activities (e.g., amusement park structures, bleachers, grandstands, and stadiums), low-hazard special industrial occupancies, and buildings classified under hazardous occupancy groups (CES, 2015).

In the Addis Ababa master plan office building height regulation revised (2016), the report divides the city into four zones, each specifying the allowable building heights. In Zone I, located in the business district, buildings must have a minimum of 19 stories. Zone II permits buildings ranging from 9 to 19 stories. Zone III allows for buildings between 5

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and 9 stories. Zone IV, situated on the borders of Addis Ababa, is designated for residential buildings up to 5 stories, not exceeding 21 meters in height. The zones are elaborated as follows:

Table 2.1 The final 2016 building height regulation. (A.A Master Plan Office, 2016).

| Zone | Floor Area Ratio (FAR) | Building floor | Building Height (meters) | | Remark |
|------|--|----------------|--------------------------|-----------|-----------------------------|
| | | | Minimum | Maximum | |
| I | Minimum 10 [1:10] and free upper limit | Minimum G+19 | 70 | Unlimited | Main city center |
| II | 5-10 | Maximum G+19 | | 70 | Collect or street and above |
| III | 1.5-7 | Maximum G+9 | | 35 | Collect or street and above |
| IV | 0.5-3.0 | Maximum G+5 | | 21 | Collect or street and above |

Addis Ababa has recently experienced notable progress in the development of high-rise buildings, especially within its central business districts. The tallest structure to date is the Commercial Bank of Ethiopia headquarters, a 4B+G+46-story building, as depicted in Figure 2.1.

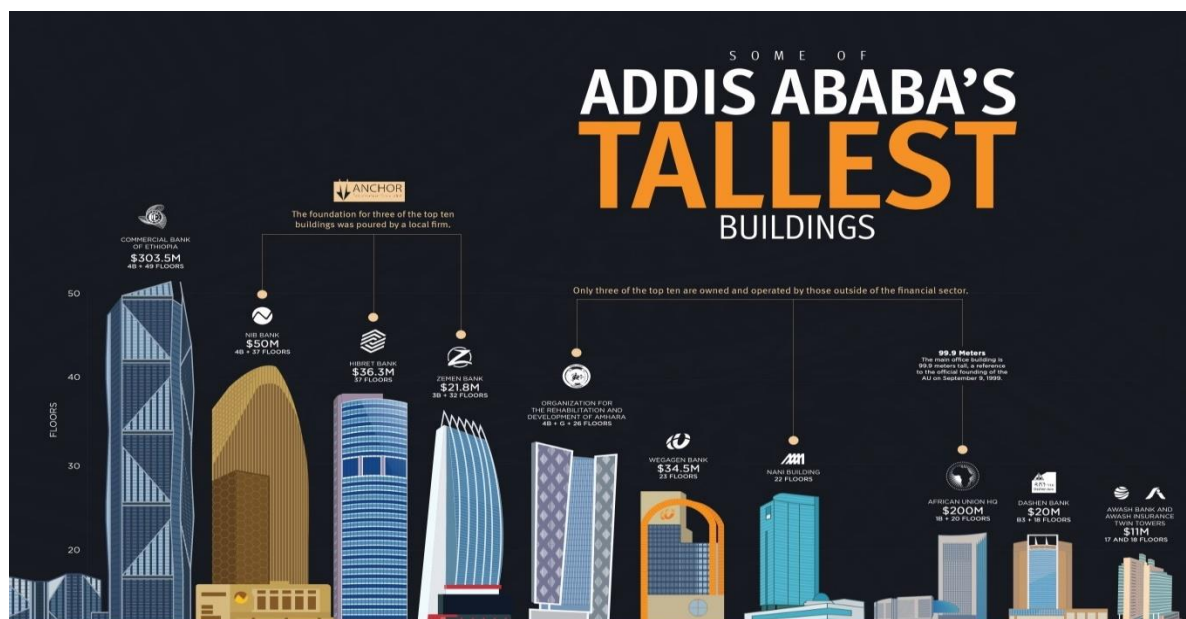


Figure 2.1 Some of the Addis Ababa tallest buildings. (Reqiq Insight ,2024)

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The definition of HRBs shows the absence of a universally accepted standard for classifying these structures, as height criteria vary across jurisdictions. Generally, a multi-story building qualifies as a high-rise if most occupants rely on elevators to access the upper floors. This dependence on vertical transportation distinguishes HRBs from shorter structures and introduces unique operational and maintenance challenges. The variability in defining HRBs highlights the need for adaptable FM practices tailored to each building's specific height, structural characteristics, and jurisdictional standards.

2.2.3 Definition of Central Business District

A Central Business District (CBD) is the main area within a city or town designated for business and commerce, functioning as the financial and commercial core.

Typically located in the downtown region, the central business district is characterized by iconic landmarks, high property values, and a bustling atmosphere, attracting a variety of establishments such as office buildings, banks, retail stores, and restaurants. The primary role of a central business district is to create a centralized space that facilitates business operations, encourages collaboration, and ensures accessibility. This concentration of businesses fosters economic growth and generates employment opportunities. Additionally, the Central Business District often serves as a cultural hub, hosting amenities like museums and theaters that enrich urban life (Nathan, 2024).

2.3 Historical Development of Facility Management

FM has evolved significantly over the decades, transitioning from a basic maintenance function to a strategic discipline essential for organizational efficiency, sustainability, and technological integration. Its development can be categorized into distinct phases influenced by business demands, technological advancements, and global standardization.

2.3.1 Early Origins: From Maintenance to Management

FM began as a maintenance-focused role in the 1970s in the United States, primarily dealing with building upkeep and operational efficiency. During this period, organizations viewed FM as a cost-control measure rather than a value-adding strategic function. The concept expanded globally in the 1980s, leading to the establishment of professional bodies such as the IFMA in 1980, the Facility Management Association of Australia

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(1988), and the British Institute of Facilities Management (1993) (Kazzam, 2024). These organizations laid the groundwork for FM by promoting standardized practices and professional development.

2.3.2 Formalization and Professionalization

As FM gained recognition, it evolved into a distinct profession in the late 20th century, emphasizing structured processes and professional standards. The IFMA and other global FM organizations played a crucial role in developing certification programs and knowledge-sharing platforms (Kazzem, 2024). Unlike its early focus on maintenance, FM in this era incorporated leasing, space planning, and workplace design, demonstrating a shift towards a broader business-oriented approach.

2.3.3 Integration of Technology: A turning Point in Facility Management

The 1990s and early 2000s marked a significant transformation in FM, driven by technological advancements. The introduction of Computer-Aided Facility Management (CAFM) systems and Building Automation Systems (BAS) enabled facility managers to remotely monitor and optimize building operations, improving efficiency and reducing costs (Araszkievicz, 2017). Compared to traditional manual FM practices, technology-driven systems offered predictive maintenance, real-time monitoring, and data-driven decision-making, making FM more proactive rather than reactive.

2.3.4 Strategic Facility Management: A Shift Towards Sustainability

By the early 2000s, FM had evolved from an operational function to a strategic organizational role, aligning with corporate goals such as cost optimization, sustainability, and employee well-being. The adoption of green building standards, such as Leadership in Energy and Environmental Design (LEED), reflected a growing emphasis on sustainability (Andi, 2024). Unlike previous decades, when FM was primarily concerned with building operations, this phase focused on long-term asset management, environmental responsibility, and integrated workplace strategies.

2.3.5 Modern Facility Management: A Multidisciplinary Approach

Today, FM encompasses strategic planning, sustainability initiatives, technological integration, and space optimization. The introduction of ISO 41001:2018, the international

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standard for FM systems, has further professionalized the industry, setting global benchmarks for FM practices (Alenka & Carmel, 2021). Unlike the early FM models that prioritized cost-cutting, modern FM emphasizes value creation, business continuity, and employee productivity through smart building technologies, energy management, and data analytics.

In conclusion, FM has undergone a remarkable transformation from a basic maintenance service to a strategic and technology-driven profession. The formalization of FM organizations, integration of technology, emphasis on sustainability, and adoption of global standards have all contributed to its growth. As high-rise buildings and urban infrastructure become increasingly complex, FM's role in ensuring operational efficiency, sustainability, and occupant well-being is more critical than ever. Future FM trends will likely focus on AI-driven smart buildings, digital twins, and enhanced sustainability practices, further shaping the profession for decades to come.

2.4 Overview of High-rise Buildings in Urban Context

HRBs have become defining features of modern urban landscapes, addressing land scarcity, population growth, and economic expansion. Their construction is driven by the need for efficient land use, economic activity, and architectural advancements. While HRBs optimize space and support economic growth, they also introduce infrastructure challenges, environmental concerns, and socio-economic disparities. This section explores their historical development, socio-economic significance, and environmental impact, comparing their benefits and challenges across different urban contexts.

2.4.1 Historical Development: From Early Skyscrapers to Modern High-rise Buildings

The origins of HRBs can be traced back to the Home Insurance Building in Chicago (1885), widely regarded as the world's first skyscraper. This building pioneered steel-frame construction, enabling greater heights and transforming urban skylines. By the mid-20th century, advancements in elevator technology, reinforced concrete, and structural engineering fueled high-rise development, particularly in cities like New York and Chicago (Britannica, 2024).

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In contrast, HRBs in developing nations gained prominence much later, primarily as a response to rapid urbanization and housing shortages. For example, in China, India, and Brazil, HRBs became critical for addressing population density and supporting economic growth. However, these developments often lacked the early regulatory frameworks that shaped HRBs in Western cities, leading to infrastructure challenges and informal high-rise settlements (Valery et al., 2018).

2.4.2 Socio-Economic Impacts: Growth vs. Inequality

HRBs play a vital role in economic expansion by providing commercial spaces, housing, and employment opportunities. In major financial hubs like Hong Kong, New York, and Dubai, HRBs attract global investments, increase land value, and symbolize national economic strength (Alenka & Carmel, 2021).

However, HRBs also contribute to socio-economic disparities. The high cost of constructing and maintaining HRBs often results in luxury apartments and office spaces, making them financially inaccessible to lower-income groups. This pattern is evident in cities like Mumbai and São Paulo, where high-rise developments have contributed to urban inequality, with slum dwellers living adjacent to skyscrapers (Zuo & Wenwu, 2023). Additionally, the concentration of commercial activities in HRBs can lead to traffic congestion and overstressed infrastructure, increasing the cost of urban services.

2.4.3 Environmental Considerations: Challenges and Sustainable Solutions

HRBs are associated with high energy consumption, increased carbon emissions, and urban heat islands. Tall buildings require significant energy for lighting, heating, cooling, and vertical transportation, making them major contributors to urban environmental degradation.

To mitigate these impacts, sustainable design principles are increasingly integrated into HRB construction. Modern skyscrapers incorporate green roofs, energy-efficient HVAC systems, and eco-friendly building materials to reduce their carbon footprint. Cities such as Singapore and Tokyo have implemented smart high-rise developments, using solar panels, rainwater harvesting, and automated climate control systems to enhance

sustainability (CTBUH, 2024). However, in many developing cities, the adoption of such technologies remains limited due to financial constraints and regulatory gaps.

In conclusion, HRBs are both a solution and a challenge in urban development. While they optimize land use, stimulate economic growth, and accommodate rising populations, they also exacerbate social inequalities, strain infrastructure, and contribute to environmental concerns. Their evolution reflects regional disparities, with developed cities focusing on high-tech, sustainable HRBs, while developing cities struggle with affordability and regulatory enforcement. Moving forward, urban planners must balance economic growth, environmental responsibility, and social inclusivity to ensure that HRBs contribute to sustainable and resilient urban landscapes.

2.5 Comprehensive Overview of Facility Management in High-Rise Buildings

FM in high-rise buildings is a complex discipline combining people, processes, and technology to maintain functionality, comfort, safety, and efficiency. HRBs, with their unique demands, require a strategic FM approach. This review examines FM practices for HRBs, focusing on organizational structure, staffing, methodologies, approach, and performance evaluation. It highlights how advanced FM strategies address the complexities of HRBs, supporting sustainable management and occupant satisfaction.

2.5.1 Organizational Structure of Facility Management

Effective facility management structures are key to operational efficiency. Larger buildings often benefit from a centralized approach, while mixed-use buildings might prefer decentralized structures. Organizational size, culture, and strategy dictate the best approach (Johannes et al., 2024). Barrett and Baldry (2003) identify four FM structure models.

- A. Office Manager Model:** FM is integrated into broader roles, with tasks handled by consultants or contractors as needed. It involves overseeing service contracts and leases, using a reactive approach to facility activities.
- B. Single-Site Model:** Used by large organizations with a dedicated facilities department at a single location. These organizations invest more in maintenance, using a mix of in-house and outsourced services.

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- C. Localized Site Model:** Applied to organizations with multiple locations. Routine decisions are made locally, with complex issues handled by headquarters. A mix of in-house staff and external consultants is used, with headquarters providing policies and support.
- D. Multiple-Site Model:** Used by large, dispersed organizations. Headquarters focuses on policy development, planning, and oversight, while regional offices manage operational issues.

2.5.2 Categories of Facility Management

FM is broadly categorized into hard FM and soft FM, both essential for ensuring the functionality, safety, and comfort of HRBs. Hard FM deals with maintaining the physical and structural aspects of a building, while soft FM focuses on services that enhance usability and occupant experience (Portobello, 2024; Service Channel, 2023).

A. Hard Facility Management

Hard FM encompasses the tangible, legally required services that ensure a building remains operational and compliant with safety regulations. These services are critical for structural integrity and long-term maintenance.

Key Hard FM Components in High-Rise Buildings

- **HVAC Systems:** Proper heating, ventilation, and air conditioning are essential for indoor comfort and air quality. Poor HVAC maintenance can lead to energy inefficiencies and health risks.
- **Fire Safety Systems:** HRBs require fire alarms, sprinkler systems, and marked exits to comply with safety standards and prevent fire hazards.
- **Plumbing and Water Supply:** Efficient water distribution and drainage systems are critical for HRBs, where pressure inconsistencies and water shortages are common.
- **Electrical and Lighting Systems:** Reliable electrical infrastructure and proper lighting are necessary for safety and functionality.

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- **Elevators and Vertical Transportation:** High-rise buildings depend on well-maintained elevators to ensure mobility and reduce energy consumption.
- **Building Maintenance:** Includes structural repairs, mechanical system upkeep, and regulatory compliance to ensure long-term operational efficiency (Portobello, 2024; Service Channel, 2023).

B. Soft Facility Management

Soft FM focuses on non-physical services that enhance security, cleanliness, and overall workplace satisfaction. Unlike hard FM, these services are not legally mandated but contribute to a well-functioning environment.

Key Soft FM Components in High-Rise Buildings

- **Cleaning and Janitorial Services:** Regular cleaning ensures hygiene and prevents the spread of diseases, especially in shared spaces.
- **Security and Access Control:** Surveillance, security personnel, and controlled entry points protect tenants and assets.
- **Waste Management:** Proper waste disposal and recycling systems prevent sanitation issues in densely occupied buildings.
- **Landscaping and Interior Decor:** Enhances the aesthetic appeal and contributes to a pleasant environment.
- **Pest Control:** Prevents infestations that can impact health and hygiene in large buildings.
- **Catering and Mail Management:** Support services that improve convenience and operational efficiency (Portobello, 2024; Service Channel, 2023).

Effective FM in HRBs requires a well-structured combination of Hard and Soft FM to ensure sustainable and efficient building operations. In Addis Ababa, challenges such as poor maintenance, inefficient energy use, weak waste management, and security gaps hinder optimal FM. Addressing these issues through technological adoption, policy frameworks, and professional development will enhance HRB operations, making them more functional, sustainable, and resilient in the face of urban expansion.

2.5.3 Staffing of Facility Management Unit

Effective facility management staffing in high-rise buildings requires a mix of technical and soft skills, like communication and problem-solving. It necessitates hiring qualified personnel and providing continuous training to keep up with evolving technologies. Multidisciplinary facility management teams should include experts in engineering, operations, safety, and sustainability (IFMA, 2024). The scarcity of qualified professionals makes ongoing development essential. Facility management units typically include senior and middle management, technicians, and craftspeople. While technical skills are important, strong management is needed to coordinate multidisciplinary teams. The facility management structure is shaped by the services provided (Khalid et al., 2019; Taye, 2016).

Some organizations hire facilities managers for operational services with minimal training. However, Abdulaziz and Fikri (2020) advocate for certified professionals with expertise in engineering, human resources, and contract management. Like project management, FM requires both technical and managerial skills. Skilled managers are vital for efficient operations and directly influence organizational outcomes, particularly in high-rises, which require diverse expertise for success.

2.5.4 In-House Versus Outsourced Facility Management Practice

FM ensures the efficiency and sustainability of built environments, with organizations choosing between in-house and outsourced approaches. In-house FM uses internal resources, offering control, customization, and alignment with organizational goals. It fosters accountability and flexibility but requires significant investment in staff, training, and technology, limiting scalability for large or complex facilities. Outsourced FM involves external service providers, offering cost-efficiency, specialized expertise, and scalability (Jensen, 2021). Astri (2018) highlights outsourcing's benefit for organizations focusing on core functions while delegating non-core activities. However, strong contract management is necessary to ensure service quality and minimize risks. Many organizations now adopt hybrid models to balance control and cost efficiency.

2.5.5 Methodologies of Facility Management

Technology and sustainability have driven facility management advancements, notably integrating Building Information Modeling (BIM) with Computer-Aided Facility Management for real-time data and efficient operations (Kyro & Lundgren, 2023). Predictive maintenance, a proactive approach, uses data to forecast equipment failures, reducing downtime. Sustainability is key to FM, especially in high-rise buildings including renewable energy, water conservation, and energy-efficient solutions, such as smart lighting and Heating, Ventilation, and Air Conditioning (HVAC), all contributing to improved financial and environmental results (Opoku & Lee, 2022; Lui et al., 2022). These FM advancements, driven by technology and sustainability, improve HRB operation, enhancing efficiency and environmental responsibility.

2.5.6 Assessment of Facilities Management Performance

Evaluating facility management in high-rise buildings is essential for functionality, safety, and sustainability, using key performance indicators such as operational efficiency, cost management, and occupant satisfaction. Operational efficiency is measured through energy usage, maintenance response times, and system reliability. Cost management tracks expenses for maintenance, utilities, and labor, and occupant satisfaction is measured using surveys (Daan, 2020). Regular audits and benchmarking against comparable buildings identify improvement areas and ensure compliance, enabling effective resource allocation. A comprehensive assessment framework using key performance indicators, audits, and benchmarking is crucial for enhancing the long-term functionality, safety, and sustainability of high-rise buildings (Daan, 2020; Justin et al., 2022). Continued facility management research is essential to address urban challenges, optimize resources, and advance management practices.

2.6 Overview of Central Business Districts

CBDs are the core areas of cities where economic, financial, and commercial activities are heavily concentrated. They are distinguished by their high-density land use, towering buildings, and a mix of retail, office, and service-oriented establishments. Acting as the economic hubs of cities, central business districts play a vital role in providing employment opportunities, facilitating business transactions, and driving urban growth.

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Their strategic location and accessibility make them highly dynamic and valuable urban spaces, attracting businesses, tourists, and residents while profoundly influencing the surrounding urban environment (Nathan, 2024).

2.6.1 Evolution of Central Business Districts

CBDs emerged during the Industrial Revolution as focal points for commerce and trade. The concept was formalized by E. W. Burgess in 1923 through his concentric zone model, which positioned the central business district as the city's central core. Today, central business districts serve as hubs for financial, business, cultural, and service activities, characterized by office buildings, hotels, and residential apartments. They are well-integrated with transportation networks, communication systems, and infrastructure, driving economic growth and commercial activities. Over time, central business districts have adapted to shifts in economic trends, urban planning strategies, and technological advancements. Modern central business districts now incorporate mixed-use developments, green spaces, and smart technologies to enhance competitiveness and sustainability. Additionally, decentralization and suburbanization have led to the emergence of multiple business districts in larger metropolitan areas (Nathan, 2024; Na et al., 2024).

2.6.2 Characteristics of Central Business Districts

CBDs are defined by their high land value, dense infrastructure, and excellent accessibility. They are characterized by HRBs and modern commercial and office facilities, supported by extensive public transportation and road networks. Many CBDs also incorporate mixed-use developments that blend residential, cultural, and recreational spaces, enhancing overall livability (Matt, 2019). As economic hubs, CBDs house premium office spaces, diverse services, and recreational facilities, often exerting regional influence. The tertiary sector dominates, replacing manufacturing activities, while retail operates at a high standard. These districts command the highest land prices in the city, with intensive land use and densely packed, vertical structures. They also experience significant population dynamics, with high densities of visitors and employees, drawing skilled professionals. However, CBDs often face peak traffic congestion, which is managed through efficient transportation systems (Na et al., 2024).

2.6.3 Challenges Facing Central Business Districts

CBDs are vital to urban economies but face significant challenges, including traffic congestion, overcrowding, and overburdened infrastructure. Their dense environments contribute to urban heat islands, pollution, and excessive resource consumption, increasing energy demand and straining public utilities. Aging infrastructure in many CBDs leads to frequent breakdowns in transportation, water, and waste management systems, further complicating urban operations.

Dependence on specific industries makes CBDs economically vulnerable, as downturns in key sectors can trigger widespread instability. Additionally, income disparity is intensified by the concentration of wealth, limiting access to affordable housing and essential services. Compact, vertical building designs hinder natural air circulation, reducing ventilation and trapping pollutants, which worsens air quality and increases the risk of respiratory illnesses.

Furthermore, tall structures block sunlight, creating shadowed urban canyons that decrease daylight penetration and affect human well-being. Wind-related issues, such as corner turbulence and wind tunnel effects, reduce pedestrian comfort and increase structural stress on buildings. The lack of green spaces and water features disrupts environmental balance, lowers humidity, and exacerbates mental health concerns by reducing natural recreational areas. Addressing these challenges requires sustainable urban planning, integrating eco-friendly building materials, resilient infrastructure, and innovative climate-responsive designs (Nathan, 2024; Na et al., 2024).

2.6.4 Opportunities for Improvement

To address the challenges faced by CBDs, various strategies focus on sustainable urban development. These include the adoption of green buildings, renewable energy, and efficient public transportation systems to minimize environmental impact. Green buildings incorporate energy-efficient designs, sustainable materials, and water-saving technologies to reduce carbon footprints, while renewable energy sources such as solar and wind power enhance sustainability.

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Smart city initiatives leverage technology and data analytics to optimize urban services, manage traffic flow, improve waste disposal, and enhance public safety. Intelligent transportation systems, including real-time traffic monitoring, smart parking, and automated public transit, help alleviate congestion and improve mobility (Na et al., 2024).

Decentralization efforts focus on developing secondary business districts to reduce the strain on primary CBDs. Establishing new commercial hubs distributes economic activity more evenly, reduces commuting pressures, and enhances regional economic resilience. Investment in mixed-use developments, where residential, commercial, and recreational spaces coexist, supports urban diversification and convenience.

Additionally, community integration initiatives promote inclusivity by ensuring affordable housing, accessible public spaces, and social infrastructure. Well-planned green spaces, pedestrian-friendly streets, and cultural hubs contribute to a more vibrant and livable urban environment (Matt, 2019). Strong government policies, private-sector collaboration, and technological advancements will be crucial in implementing these solutions effectively.

2.6.5 Central Business District in Addis Ababa

Addis Ababa's evolving skyline reflects the growth of financial institutions, marked by skyscrapers that blend traditional markets with modern businesses. This progress requires aligning internal systems with sustainable, inclusive, and community-focused practices. A study done by EiABC (2011) highlights the city's vision, symbolized by the 52-story height limit, exemplified by the new Commercial Bank of Ethiopia headquarters. The central business district encompasses the inner core, specialized areas like Piassa and Mercato, and connecting development corridors. Table 2.2 outlines updated building height regulations for the CBD, emphasizing open spaces, setbacks, and the preservation of historical sites. For example, Mercato features lower BAR and setbacks to accommodate narrow streets, while Piazza enforces height restrictions to protect cultural landmarks such as St. George Church. CBDs drive economic growth, innovation, and culture but face challenges like congestion, sustainability, and inequality. Solutions include green infrastructure, energy efficiency, smart technologies, and inclusive strategies to support small businesses and communities. These measures ensure CBDs remain equitable, adaptable, and vital for economic and social progress.

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Table 2.2 Building height regulation for the CBD. (Source: EiABC, 2012). Report on building height regulation updating study for Addis Abeba

| Central Business District (CBD) | | | | | | |
|---------------------------------|-------------------|--------------------------|-------------------------|-------------|-------------|--|
| No | Area (Location) | According to the old BHR | New BHR (Stories/Floor) | New BAR (%) | New Max FAR | Remark |
| 1 | Main center (CBD) | G+7- LDP | | 80 Max. | 1:5-1:7 | <ul style="list-style-type: none"> • The maximum height of buildings in the area requires that such buildings be located facing existing open spaces (Meskel Square, the Stadium, Ghion Hotel, etc.) • The total area coverage of the inner zone, intermediate and outer zone is 56.8 hectares, 158 hectares and 517 hectares res |
| | Inner zone | | 34-52 or E-52 | | | |
| | Intermediate ring | | 21-34 or E-34 | | | |
| | Outer ring | | 13-21 or E-21 | | | |
| 2 | Mercato | G+2- LDP | 1-5 | 85 Max. | 1:4 | <ul style="list-style-type: none"> • BAR is reduced from the previous 75- 100% to a maximum of 85% to allow for more open space. Minimum BAR is left • Due to the narrow size of the streets in Mercato, new buildings should be built according to the new setback requirements • Some road side development in Mercato is to be governed by a 1:1 enclosure 31 principle as indicated in the map. • In order to protect the working and living places of the poor in Mercato, the inner zones are to be redeveloped for low rise (the maximum being a walk-up building). |
| 3 | Piazza area | G+2-LDP | datum and 1-5 | 85 Max. | 1:4 | <ul style="list-style-type: none"> • Height in areas in close proximity to the Municipal and St George church is determined on the basis of a datum. The reference point is the dome of the church which rises about 8 meters from the ground level of 2478m above sea level. The use of the datum is to protect the view to these two historical buildings. With this design principle, Piazza falls in the same category with that of the “old city core” which is maximum of five stories (G+4) • Building height within the ‘historical area’ (as demarcated by the structure plan) will also be a maximum of five stories. • Exception along major streets within Piazza where the new height is 5-8 stories (see detail in the reg. for the “old city core” |

Note:

BAR: Built up Area Ratio in Relation to the Plot Size

BHR: Building Height Regulation

FAR: Floor Area Ratio in Relation to the Plot Size

LDP: Local Development Plan

2.7 Current Facility Management Practices in High-Rise Buildings: Global and Addis Ababa Perspectives

FM in high-rise buildings is a key factor in urban sustainability, operational efficiency, and tenant well-being. Globally, FM has evolved from a basic maintenance function to a strategic discipline incorporating technology, sustainability, and multi-stakeholder collaboration. While developed nations focus on smart building technologies, integrated systems, and sustainability standards, developing cities like Addis Ababa struggle with resource constraints, regulatory gaps, and limited adoption of modern FM practices (Astri, 2018; Azian et al., 2020). This section compares global FM approaches with the challenges and progress observed in Addis Ababa's high-rise building sector.

2.7.1 Global Perspectives on High-Rise Building Facility Management

A. Adoption of Technology: Enhancing Efficiency Through Digitalization

Technology has revolutionized FM in HRBs, streamlining operations, reducing costs, and enhancing predictive maintenance. Advanced tools such as BIM) and CAFM provide digital building models, improving asset tracking, space optimization, and lifecycle management (Kyro & Lundgren, 2023). Developed cities widely adopt Integrated Workplace Management Systems (IWMS), enabling real-time monitoring of space utilization, lease management, and energy efficiency (IBM, 2024).

In contrast, many developing cities lack access to these technologies due to high costs, limited technical expertise, and weak infrastructure. While some large commercial buildings in Ethiopia have begun integrating digital FM tools, adoption remains slow and inconsistent (Abera, 2017; Tsegaye, 2022).

B. Preventive vs. Predictive Maintenance: Moving Beyond Reactive Models

Globally, FM has transitioned from reactive maintenance (fixing issues after they occur) to preventive and predictive maintenance, reducing downtime and operational costs. Predictive FM uses IoT sensors, AI-driven analytics, and automated monitoring to detect potential failures before they happen (Moazzeni et al., 2023). Developed nations increasingly rely on data-driven FM models, whereas Ethiopian HRBs still depend on reactive maintenance due to financial constraints and lack of skilled personnel (Abera,

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2017). As a result, equipment failures, high repair costs, and operational inefficiencies remain common.

C. Sustainability and Energy Efficiency: Green FM practices

FM now aligns with global sustainability goals, integrating energy-efficient technologies, green building materials, and smart HVAC systems. Certifications like LEED (Leadership in Energy and Environmental Design) promote sustainability benchmarks for HRBs, reducing energy consumption and carbon emissions (Chioma, 2023; Lok et al., 2023).

However, while cities like London, Singapore, and Dubai incorporate solar energy, water-saving devices, and waste reduction strategies, Addis Ababa's HRBs lack widespread implementation of green building practices. This is primarily due to high initial investment costs, limited awareness, and weak enforcement of environmental regulations (Abera, 2017; Alebachew, 2022).

D. Collaborative Governance Model: Strengthening Multi-Stakeholder Engagement

Effective FM in HRBs requires coordination between government agencies, facility managers, property owners, and tenants. In developed nations, FM operates under clear regulatory frameworks, ensuring accountability, efficiency, and compliance (Jensen, 2021). In contrast, Addis Ababa faces governance challenges, including fragmented responsibilities, lack of standardized FM policies, and limited government support. Addressing these issues requires policy reforms, FM capacity-building programs, and enhanced collaboration between public and private sectors.

E. Integrated Facility Management: A Holistic Approach to Service Delivery

Integrated Facility Management (IFM) consolidates multiple FM services—hard and soft FM under a single system, improving efficiency, reducing operational costs, and enhancing tenant satisfaction (Wan, 2022). While IFM is widely adopted in corporate high-rises in developed cities, Ethiopia's FM sector remains largely fragmented, with outsourced contracts for cleaning, security, and maintenance often managed separately.

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Establishing centralized FM frameworks in Addis Ababa could streamline building operations, improve service quality, and reduce inefficiencies.

In conclusion, the evolution of global FM practices highlights the benefits of technology adoption, preventive maintenance, sustainability, strong governance, and integrated FM models. While developed nations have advanced FM systems, Addis Ababa's HRBs face multiple challenges, including limited technology use, outdated maintenance approaches, weak regulatory enforcement, and fragmented management structures. Bridging this gap requires investment in modern FM technologies, improved policies, capacity-building initiatives, and a shift toward integrated and sustainable facility management solutions.

2.7.2 Regional Variations in High-Rise Building Facility Management

FM practices in HRBs differ by region due to economic and regulatory factors. Developing economies emphasize cost-effective maintenance, while developed regions focus on sustainability, technology, and proactive strategies. Strict regulations enhance safety and environmental measures, and cultural priorities, like energy efficiency, promote green practices. Adaptable strategies blend global standards with local needs for effective HRB management.

A. Developed Regions

FM services began in the U.S. in the 1950s, fully developing by the 1970s, and spread to Europe in the 1980s, led by the UK, Germany, and France. Today, the UK, the U.S., Nordic countries, and the Netherlands lead global FM advancements (Jensen, 2021). In developed regions, high-rise building FM prioritizes regulatory compliance, advanced technology, and sustainability, with widespread adoption of green standards and energy management systems.

B. Developing Regions

FM in Asia and Africa is newer than in Europe and the U.S. Rapid development is seen in Japan, Hong Kong, and Singapore, while Malaysia and Thailand are still emerging (Anindya, 2018). Developing regions face challenges like limited resources, technology gaps, and weaker regulations but are increasingly adopting best practices from developed areas (Awosode et al., 2024).

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HRB FM practices vary by region. Developed areas widely use technologies like BIM and CAFM, while adoption in developing regions is growing with infrastructure improvements. Sustainability initiatives, such as LEED certification, are well-established in developed countries and gradually integrated in developing ones (Ali & Jaana, 2019). Globally, FM is shifting toward technological integration and sustainability. For cities like Addis Ababa, blending global practices with local adaptations is key to effective HRB management.

2.7.3 Facility Management Practices in Addis Ababa

Addis Ababa, established in the late 19th century, has transformed into a modern metropolis, with significant high-rise construction, including the 62-story Ethiopian Electric Power Headquarters (328 meters by 2027) and the 46-story CBE building (CTBUH, 2024).

FM in Addis Ababa is in its early stages, focused on basic property management like security, cleaning, and maintenance rather than comprehensive FM. IT support is minimal, and the sector is managed by a few specialists. Maintenance is reactive, increasing long-term costs, with defect identification relying on user complaints instead of systematic approaches. The lack of standardized services leads to inconsistencies, and gaps in process management and metrics hinder efficiency. Tenant services like safety and cleanliness are prioritized, but FM struggles to understand user needs or assess service effectiveness (Abera, 2017; Alebachew, 2022; Tsegaye, 2022).

Challenges to adopting global FM practices include infrastructure and resource limitations. Introducing technologies like BIM and CAFM through pilot projects and training can elevate local FM standards. Sustainable practices, such as green building certifications and preventive maintenance, can improve HRB efficiency. An integrated FM approach can streamline processes and enhance service delivery. Success requires investment in skill development, government support, public-private partnerships, and knowledge exchange to align local FM with international standards.

2.8 Challenges in High-Rise Buildings Facility Management

2.8.1 General Challenges in Facility Management

FM in high-rise buildings faces challenges in managing complex systems for maintenance, security, and cleaning. Efficient operations demand advanced technologies, such as Building Information Modeling (BIM) and Computer-Aided Facility Management (CAFM), and highly skilled personnel. High energy demands require strong energy management programs. Regulatory compliance, including local, national, and international codes, further adds complexity (Araszkiewicz, 2017).

2.8.2 Specific Challenges Facility Managers Facing in Addis Ababa

FM in Addis Ababa faces numerous challenges, including infrastructure limitations, resource constraints, and a lack of standardized FM practices and regulations. Rapid urbanization has outpaced infrastructure development, causing unreliable power, inadequate water systems, and limited public transportation, which complicates FM (MUDHC, 2015). Resource shortages also limit technological adoption and affect local materials, while inconsistent standards impact service delivery and compliance. Further, limited access to advanced training on technology and best practices creates a skills gap (Abera, 2017; Alebachew, 2022; Tsegaye, 2022). Addressing these issues requires establishing clear FM standards, improving infrastructure, investing in skill development, and providing the resources needed for advanced technologies and sustainable practices. Adapting global best practices and fostering professional development is also vital for effective FM in Addis Ababa's HRBs.

2.9 Opportunities for Improving Facility Management Practice

FM in high-rise buildings is essential for ensuring operational efficiency, sustainability, and occupant well-being. However, rapid urbanization, evolving building systems, and increasing environmental concerns necessitate continuous improvement in FM strategies (Orayinka & Cyril, 2020). To enhance FM practices, technological advancements, sustainability initiatives, professional development, and regulatory frameworks play a crucial role. While developed countries have made significant progress in integrating smart technologies, sustainable building standards, and FM certifications, cities like Addis Ababa still face gaps in technology adoption, policy enforcement, and capacity-building

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efforts. This section explores key opportunities for strengthening FM in HRBs by comparing global best practices with challenges and potential improvements in the Ethiopian context.

2.9.1 Technological Advancements: Enhancing Facility Management Efficiency

A. Building Information Modeling and Computer-Aided Facility Management

The adoption of BIM and CAFM has revolutionized FM by providing real-time data for decision-making, predictive maintenance, and asset tracking. BIM creates digital representations of buildings, facilitating lifecycle management, space utilization, and sustainability planning (Lucy et al., 2024). Similarly, CAFM centralizes maintenance, asset management, and space planning, improving operational efficiency (Emma, 2024).

In developed cities, BIM and CAFM are standard FM tools, enabling automated building monitoring and data-driven decision-making. In contrast, many HRBs in Addis Ababa lack digital FM systems, relying instead on manual processes that limit efficiency and long-term planning (Abera, 2017; Tsegaye, 2022). Addressing these gaps requires investment in digital infrastructure, skilled personnel, and policy support for widespread technology adoption.

B. Internet of Things and Smart Building Technologies

IoT-powered smart building technologies allow real-time monitoring and automation of key FM functions, including energy management, security systems, and environmental controls. These technologies optimize energy consumption, enhance occupant comfort, and improve security, ultimately reducing operational costs and environmental impact (Jose et al., 2023).

While developed countries integrate IoT into FM, Ethiopian HRBs struggle with outdated infrastructure, limited technical expertise, and high costs of implementing smart building technologies. To bridge this gap, government incentives, industry training, and cost-effective technology solutions are necessary to make smart FM accessible in emerging urban markets.

C. Artificial Intelligence in Facility Management Practice

Artificial Intelligence (AI) is revolutionizing FM by enhancing efficiency, reducing costs, and improving service delivery. AI-powered solutions like predictive maintenance, energy management, and automated operations streamline FM processes, aligning with global trends in smart building management (Farzaneh et al., 2021).

A key application is predictive maintenance, where machine learning analyzes sensor data to detect equipment failures before they occur. Pedral et al. (2022) note that this can reduce maintenance costs by 30% and extend asset lifespan. AI-driven analytics shift FM from reactive to proactive maintenance, minimizing downtime.

AI also improves energy management by analyzing consumption patterns, weather, and occupancy trends to optimize HVAC performance. In security and space management, AI-powered surveillance systems enhance building safety, while smart space utilization tools optimize layouts based on real-time occupancy (Abdelalim et al., 2025). These innovations boost cost savings, operational efficiency, and user experience. However, AI adoption in FM faces challenges like high initial costs, integration complexities, and the need for skilled personnel (Ucar et al., 2024). Additionally, data privacy and cybersecurity risks must be addressed for safe AI deployment.

In summary, AI is reshaping FM by enabling predictive maintenance, optimizing energy use, enhancing security, and improving space management. While challenges exist, ongoing advancements continue to drive AI integration, paving the way for smarter, more efficient facility management.

2.9.2 Sustainability Initiatives: Promoting Green Facility Management Practices

A. Green Building Certifications: Encouraging Sustainable Construction

Green building certifications like LEED (Leadership in Energy and Environmental Design) and BREEAM (Building Research Establishment Environmental Assessment Method) establish sustainability benchmarks for HRBs, focusing on energy efficiency, water conservation, and waste reduction (World Green Building Council, 2024). Cities

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like Singapore and London mandate sustainability certifications for HRBs, ensuring compliance with environmental policies.

However, green certifications are rarely enforced in Addis Ababa, and many HRBs lack sustainability-focused FM strategies. Adopting certification programs tailored to local climate conditions, economic constraints, and regulatory frameworks can help promote eco-friendly HRB development in Ethiopia.

B. Energy Management Systems: Reducing Operational Costs and Carbon Footprint

Advanced energy management systems enable FM teams to monitor energy usage, detect inefficiencies, and optimize building performance. These systems enhance HVAC efficiency, reduce energy waste, and lower carbon emissions through real-time analytics and automated controls (Hanzalah et al., 2023). In developed markets, energy management systems adoption is a standard practice, but in Ethiopia, high energy costs and unreliable power supply hinder widespread implementation. Introducing incentives for energy-efficient building upgrades and affordable energy management systems technologies can encourage sustainable FM practices in Addis Ababa's HRBs.

2.9.3 Professional Development

A. Training and Certification Programs: Building Facility Management Competency

Comprehensive training and certification programs enhance FM expertise by equipping professionals with knowledge of sustainability, technology integration, and strategic planning. Certifications offered by the International Facility Management Association (IFMA) improve HRB management practices, global knowledge exchange, and professional networking (IFMA, 2024). While FM professionals in developed cities undergo structured certification programs, many Ethiopian FM practitioners lack access to formal training and capacity-building initiatives (Tsegaye, 2022). Expanding local FM certification programs, university partnerships, and industry-led training workshops can address skill shortages and elevate FM standards in Addis Ababa.

B. Knowledge Sharing and Best Practices: Enhancing Industry Collaboration

FM efficiency improves when professionals engage in knowledge-sharing platforms, industry forums, and collaborative networks. Global FM leaders participate in conferences, workshops, and online forums to exchange insights and innovations (IFMA, 2024). In Ethiopia, limited industry collaboration and knowledge-sharing platforms hinder FM advancements. Establishing local FM associations, industry roundtables, and research collaborations can facilitate experience-sharing, capacity building, and standardization of best practices in HRB management.

2.9.4 Regulatory Frameworks: Strengthening Facility Management Governance

A. Standardized Regulations and Guidelines: Ensuring Compliance and Best Practice

Countries with strong FM policies enforce standardized regulations covering building safety, sustainability, and operational efficiency. Regulatory frameworks define benchmarks for quality assurance, tenant safety, environmental conservation, and maintenance standards (Lok et al., 2023). Ethiopia's FM sector lacks comprehensive regulations, leading to inconsistent service delivery, poor maintenance standards, and weak enforcement mechanisms. Establishing national FM policies, building codes, and industry guidelines can improve HRB safety, efficiency, and sustainability.

B. Government Support and Incentives: Encouraging Facility Management Advancements

Governments in developed countries offer subsidies, tax incentives, and policy support to promote energy-efficient buildings, smart FM technologies, and workforce development (Lok et al., 2023). Such initiatives drive FM innovation, attract investments, and encourage sustainable urban development. In Ethiopia, limited government involvement in FM regulation and support has resulted in fragmented FM practices and underutilization of modern building management systems. Introducing financial incentives, policy reforms, and FM industry collaborations can strengthen regulatory compliance and sector-wide improvements.

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In conclusion, the opportunities for improving FM in HRBs lie in technological integration, sustainability initiatives, professional development, and regulatory advancements. While developed nations lead in smart FM solutions, structured training programs, and robust governance frameworks, Ethiopian HRBs face challenges related to outdated systems, lack of skilled personnel, and weak regulations. Addressing these issues requires investments in digital FM tools, industry-driven training programs, stronger policy enforcement, and local adaptations of global best practices. By embracing technology, sustainability, and governance reforms, Addis Ababa can develop a resilient, efficient, and future-ready FM sector.

2.10 Future Trends and Directions in Facility Management

FM in high-rise buildings is evolving due to shifts in technology, demographics, and environmental factors. As urban areas grow, high-rise buildings increase, creating a need for adaptive FM strategies. FM is crucial for the efficiency, sustainability, and safety of these structures. Emerging trends, particularly technological innovations like smart building technologies, automation, and IoT, are reshaping how facilities are managed, enabling more efficient and responsive systems (Emma, 2024; Jose et al., 2023).

Sustainability initiatives are also becoming a central focus, with FM practices increasingly aligned with global environmental goals and sustainability standards. This shift not only helps reduce the environmental footprint of HRBs but also enhances their long-term viability. Moreover, professional development and knowledge sharing are crucial for equipping FM professionals with the skills and expertise needed to direct the difficulties of modern HRBs. Regulatory and policy support plays a vital part in determining FM practices, ensuring that they meet safety standards and contribute to broader urban planning objectives. Other key trends include a growing emphasis on occupant wellness, the use of data analytics to optimize building performance, and the development of disaster preparedness strategies to enhance the resilience of high-rise structures. Together, these factors define the future of FM in high-rise buildings, driving the field toward greater innovation, sustainability, and effectiveness (IFMA, 2024; Opoku & Lee, 2022; World Green Building Council, 2024).

2.11 Conceptual Framework

CBDs serve as hubs of economic activity, innovation, and urban development. In Addis Ababa, the rapid growth of HRBs presents unique FM challenges, particularly in areas such as vertical transportation, water supply, waste management, power management, and HVAC systems. Effective FM in these buildings requires tailored strategies that ensure operational efficiency, sustainability, and cost-effectiveness in dense urban environments.

HRBs face several facility management challenges, categorized into hard and soft FM, impacting efficiency, sustainability, and occupant satisfaction. Hard FM issues include vertical transportation problems such as frequent elevator malfunctions, long wait times, and inadequate maintenance, which disrupt mobility and increase energy consumption. Water supply inconsistencies arise due to pressure fluctuations, inefficient storage systems, and aging infrastructure, often leading to shortages that affect daily operations. Power management remains a major concern due to high energy demands, a lack of energy-efficient systems, and unreliable grid connections, resulting in increased operational costs. Inefficient HVAC systems further contribute to poor indoor air quality, excessive energy consumption, and occupant discomfort. On the other hand, Soft FM challenges include waste management issues, where limited collection space, improper segregation, and inefficient disposal methods create sanitation and environmental concerns. Additionally, poor cleaning and security services can negatively impact tenant satisfaction and overall building operations. Addressing both hard and soft FM challenges is essential for enhancing the long-term functionality, sustainability, and efficiency of HRBs in urban environments.

FM practices are supported by several theoretical models that enhance efficiency, sustainability, and cost-effectiveness. Life Cycle Costing evaluates the total cost of building ownership over its lifespan, helping facility managers implement cost-effective maintenance and operation strategies (State of Alaska, 2018). BIM improves FM efficiency by enabling better monitoring, predictive maintenance, and resource management, particularly in high-rise buildings (Kyro & Lundgren, 2023). Additionally, Total Quality Management (TQM) emphasizes continuous improvement, customer satisfaction, and employee involvement, fostering a proactive approach to FM practices (Dale et al., 2012). Grounded in TQM, the study focuses on customer satisfaction,

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continuous improvement, and employee involvement to improve FM practice and support urban development. Figure 2.2 presents the conceptual framework flowchart, illustrating how the study evaluates current FM practices, identifies specific challenges, and proposes best practices to enhance operational efficiency and sustainability. By addressing the technical and strategic gaps in FM, the study aims to develop a structured approach to improving facility management in HRBs, ensuring smoother operations, sustainability, and long-term urban development.

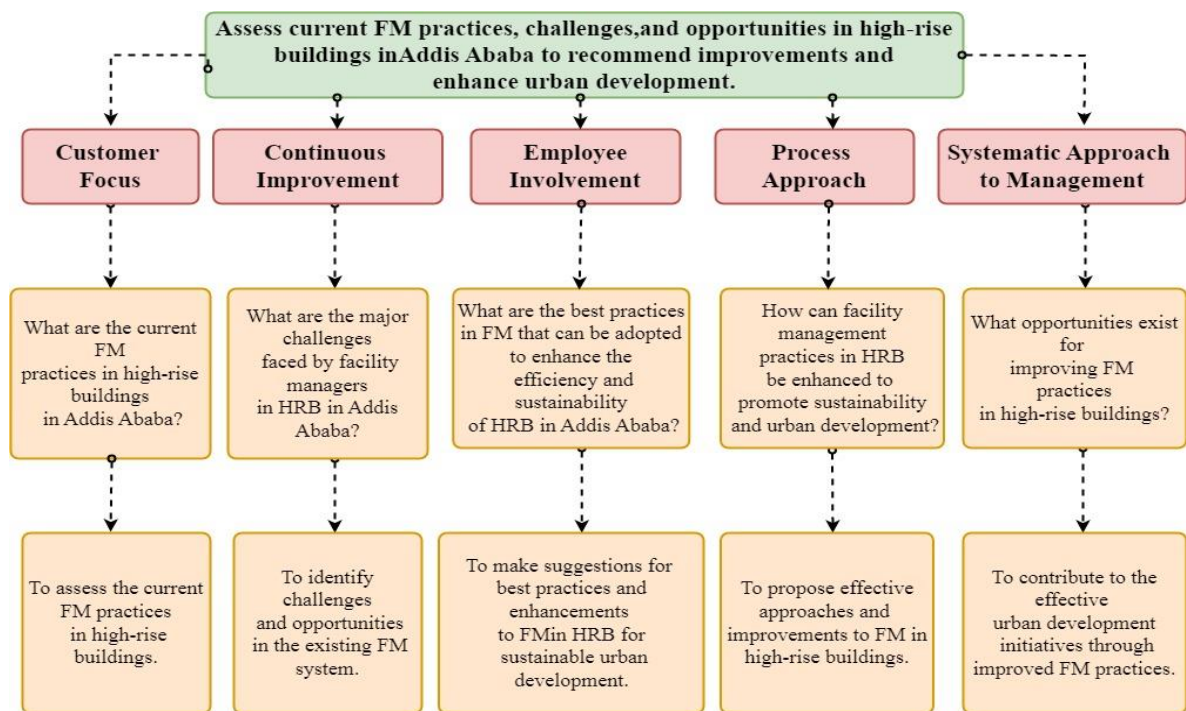


Figure 2.2 Conceptual frameworks flowchart

2.12 Summary of Literature

FM in high-rise buildings has gained global recognition, yet research remains limited, particularly in developing cities like Addis Ababa. While CBDs serve as economic and cultural hubs, most FM studies focus on practices developed in developed countries, overlooking the socio-economic, infrastructural, and regulatory challenges specific to Ethiopia. A critical gap in the literature is the lack of city-specific research on FM in Addis Ababa’s high-rise buildings, where international frameworks often fail to address local constraints such as limited financial resources, outdated infrastructure, and a lack of skilled professionals.

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Key technical barriers remain underexplored, including poor vertical transportation systems, water supply challenges, inefficient waste management, unstable power supply, and HVAC inefficiencies, all of which significantly impact building operations. The low adoption of modern FM technologies, such as BIM, the IoT, and data-driven predictive maintenance, further limits efficiency and sustainability. Regulatory inconsistencies and a lack of standardized FM policies also create operational uncertainties, making it difficult for facility managers to implement best practices effectively. Moreover, FM research in Addis Ababa lacks comprehensive empirical data, particularly studies that integrate both quantitative and qualitative methodologies. This gap hinders a holistic understanding of FM challenges and prevents the formulation of tailored solutions. While some studies highlight the benefits of TQM frameworks, they do not adequately address how TQM can be adapted to Addis Ababa's unique urban landscape.

Addressing these gaps is essential for developing FM strategies that enhance operational efficiency, sustainability, and resilience in high-rise buildings. The literature underscores the importance of context-specific FM approaches that integrate global best practices with localized solutions, ensuring that FM in Addis Ababa's CBD meets the demands of rapid urbanization while supporting long-term development goals.

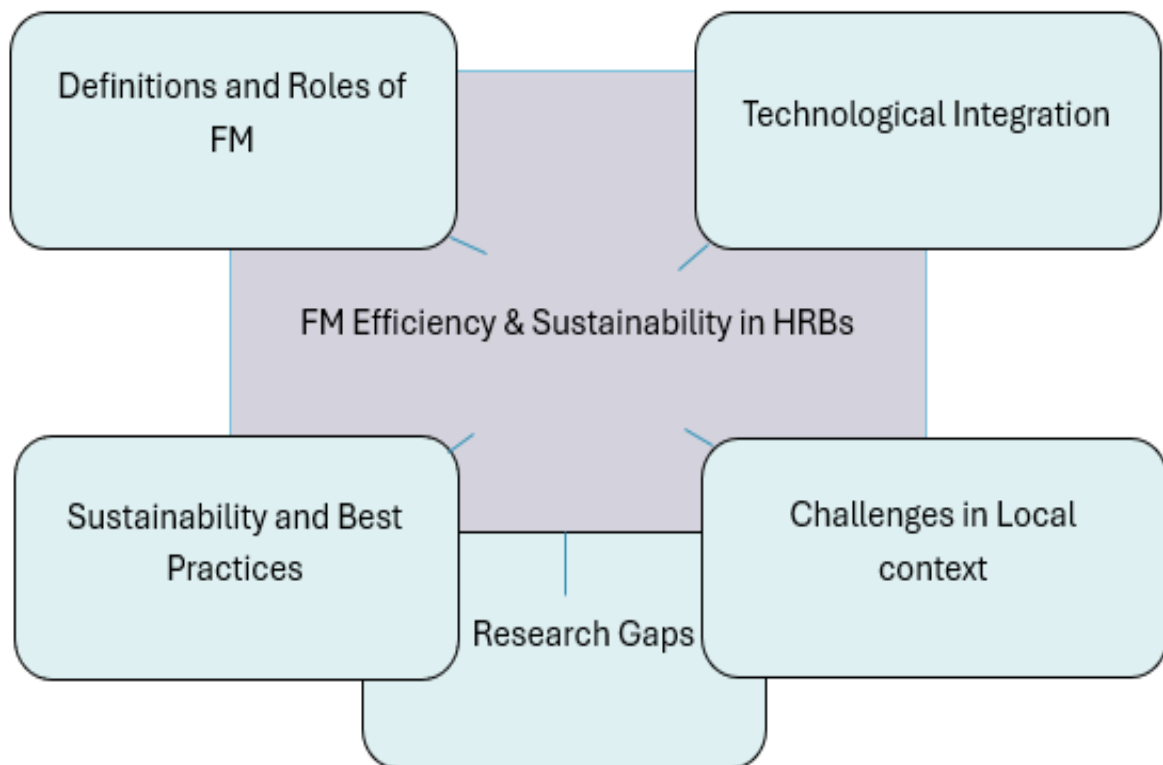


Figure 2.3 Summary of theme of the literature review

CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter outlines the research design and methodology for the study. The primary objective is to assess the current FM practices, identify challenges, and explore opportunities for improvement within high-rise buildings located in Addis Ababa's CBD. The chapter presents the rationale behind the chosen research approach, which combines both qualitative and quantitative methods to provide a comprehensive analysis.

The research design emphasizes the mixed-methods approach, leveraging the strengths of both qualitative insights and quantitative data to fully capture the complexities of FM practices. The chapter also outlines the study area, population, and sampling techniques, explaining how these elements ensure a representative sample that aligns with the study's objectives. Data collection methods, including surveys and interviews, are discussed in detail, followed by the tools and instruments selected to ensure reliability, validity, and ethical rigor. Finally, the chapter explains the data analysis techniques used to interpret both quantitative and qualitative data, ensuring that the research findings are accurate, credible, and actionable.

By providing a clear outline of the research methodology, this chapter sets the foundation for subsequent data collection and analysis, which inform the study's findings and recommendations for improving FM practices in Addis Ababa's CBD HRBs.

3.2 Research Design

The study employed a mixed-methods approach, integrating quantitative and qualitative methods along with case studies, to comprehensively examine FM practices in Addis Ababa's CBD HRBs. This approach was particularly effective for the following reasons:

1. Addressing the Complexity of FM Challenges and Opportunities

Quantitative methods, such as surveys with yes/no, rating scales, and Likert scale questions, provided measurable, statistical insights into FM practices, challenges, and stakeholder perceptions. These methods facilitated broad data collection, allowing the identification of patterns and trends across diverse FM contexts. In contrast, qualitative

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methods, including open-ended survey questions and interviews, captured nuanced, in-depth perspectives from key stakeholders, such as facility managers and building occupants. These insights revealed underlying issues, motivations, and contextual factors that were not apparent in the quantitative data alone, thus offering a comprehensive understanding of the FM challenges and opportunities.

2. Complementary Strengths of Mixed Methods

Quantitative data identified trends and general issues, while qualitative data provided context and explanations for these trends. For example, although a survey might have revealed low tenant satisfaction, interviews uncovered specific reasons, such as inadequate maintenance or poor communication. The combination of both methods enhanced data validity by triangulating findings from multiple sources, reducing potential biases associated with relying on a single method. This complementary approach strengthened the overall robustness and depth of the research findings.

3. Observations for Real-World Insights

To complement the survey and interview findings, direct on-site observations were conducted across multiple HRBs in Addis Ababa's CBD, capturing real-world FM challenges that were not fully disclosed by respondents. Several buildings exhibited poorly maintained HVAC systems, frequent elevator malfunctions, and water leakage issues, contradicting facility managers' claims of "regular maintenance schedules." Safety and compliance gaps were evident, with blocked emergency exits, malfunctioning fire alarms, and inadequate signage, indicating non-compliance with safety regulations despite reported adherence. Technology adoption disparities were also observed, as while some HRBs had modern security systems and digital monitoring tools, many still relied on manual record-keeping and outdated maintenance procedures, highlighting a gap between global best practices and local implementation. Additionally, waste management and energy efficiency issues were noted, with poor waste segregation, excessive energy consumption, and inefficient lighting systems, revealing discrepancies between reported sustainability efforts and actual practices. By integrating these direct observations, the study ensured that findings reflected real-world FM conditions, bridging the gap between perceived performance and practical implementation. The study's goals of assessing current FM practices, identifying challenges and opportunities, and proposing

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improvements required a multidimensional understanding. The mixed-methods design ensured that both the breadth and depth of FM practices were addressed. By integrating these methods, the study captured a holistic view of FM practices in Addis Ababa's HRBs, ensuring that the findings were robust, actionable, and contextually relevant. This approach was ideal for addressing the complexity of the research questions and providing practical recommendations for improvement.

3.3 Study Area

The study area for this research was Addis Ababa's CBD, particularly the area known as Senga Tera. This area had become a financial hub, resembling a local version of Wall Street with the rapid construction of HRBs by government and private financial institutions, as well as other major government institutes. This CBD hosted a concentration of some of Addis Ababa's most prominent HRBs. The choice of this area as the study focus allowed for a detailed exploration of facility management practices within a rapidly developing urban center, providing insights into the unique challenges and opportunities faced by facility managers in such an evolving context.



Figure 3.1 Aerial view of the central business district area. (Source: Google Earth)

3.4 Population and Sample

Due to time and budget constraints, the study employed a non-probability sampling technique, specifically purposive sampling, for both the study and the case studies. This approach specifically targeted HRBs within the CBDs of Addis Ababa. Purposive sampling, also referred to as judgmental sampling involved selecting buildings that were most relevant to the research questions and objectives, enabling the study to focus on structures that provided the most valuable insights into FM practices, challenges, and opportunities in HRBs. The study population encompassed all HRBs located in the CBD area around 'Senga Tera' in Addis Ababa. According to the CTBUH, HRBs are defined as buildings with 14 or more stories, and for this study, the sample included buildings exceeding 14 stories. These buildings served various purposes, including residential, commercial, and mixed-use functions.

Table 3.1 List of investigated high-rise buildings

| No. | Building Name | Building Type | No. of Stories | Location |
|-----|---|---------------|----------------------|----------|
| 1 | CBE HQ's | Commercial | 4B + 46 Floors | CBD |
| 2 | Zemen Bank HQ's | Commercial | 3B + 32 Floors | CBD |
| 3 | Nib Bank HQ's | Commercial | 4B + 37 Floors | CBD |
| 4 | Hibret Bank HQ's | Commercial | 4B + 37 Floors | CBD |
| 5 | Abyssinia Bank HQ's | Commercial | 2B + 15 Floors | CBD |
| 6 | Wegagen Bank HQ's | Commercial | 3B + 23 Floors | CBD |
| 7 | Awash Bank HQ's | Commercial | Twins 17 & 18 Floors | CBD |
| 8 | Dashen Bank HQ's | Commercial | 3B + 21 Floors | CBD |
| 9 | Ethiopian Shipping & Logistic Service Enterprise HQ's | Commercial | 2B + 16 Floors | CBD |
| 10 | Nani Tower | Commercial | 2B + 22 Floors | CBD |
| 11 | Sengatera Trading S.C Building | Commercial | 2B + 23 Floors | CBD |
| 12 | Orda Ethiopian Buildings | Commercial | 4B + 26 Floors | CBD |
| 13 | Al-Sam Building | Mixed-Use | 2B + 21 Floors | CBD |
| 14 | Wastna Trade Center | Commercial | 4B + 20 floors | CBD |

3.5 Data Collection Methods

3.5.1 Data Collection Procedure

The data collection process involved the distribution of questionnaires to FM staff, followed by semi-structured interviews conducted with facility managers, maintenance staff, and tenants. Observations of HRBs were documented using checklists and notes to evaluate conditions for the case studies. The data collection adhered to a predefined timeline and followed ethical standards, including obtaining informed consent and ensuring confidentiality.

3.5.2 Primary Data Collection Methods

Questionnaires: questionnaires were utilized to gather quantitative data from FM staff and building occupants. These tools included a mix of yes/no questions, rating scales, Likert scale questions, and open-ended questions to capture a broad spectrum of insights and experiences (see Appendix A). The purpose of this method was to collect data on current FM practices, challenges, and perceptions from a wide range of respondents.

Interviews: Semi-structured interviews were conducted with key informants, including facility managers, maintenance staff, and tenants (see Appendix A: section E). This method allowed for an in-depth exploration of specific issues, providing rich qualitative data. The purpose of these interviews was to gain detailed insights into FM practices, challenges, and areas for improvement, and to understand the context and nuances that surveys might not capture.

Observations: Observations of HRBs were conducted to assess their physical condition, maintenance activities, and the use of technology in FM (see Appendix B & C). Data was systematically recorded using observation checklists and field notes to ensure accuracy. These observations provided firsthand insights into the actual state of FM practices and infrastructure within HRBs, focusing on operational efficiency, resource allocation, cost management, tenant satisfaction, energy management, regulatory compliance, communication, and scalability.

3.5.3 Secondary Data Collection Methods

Literature review: A comprehensive review of existing literature on FM practices, challenges, and solutions in HRBs was conducted, including academic journals, industry reports, and relevant case studies. The purpose of this review was to provide a theoretical framework for the study, identify gaps in existing research, and benchmark best practices. Tools and instruments for this method included access to academic databases, libraries, and online resources.

3.6 Data Analysis Methods

The study utilized a combination of quantitative and qualitative data analysis techniques to ensure a comprehensive understanding of FM practices in HRBs in the CBDs of Addis Ababa.

1. Quantitative Data Analysis:

- **Descriptive Statistics:** Quantitative data collected from questionnaires were analyzed using descriptive statistics to summarize the characteristics of the sample and the distribution of FM practices.
- **SPSS 23 Software:** This tool was employed to identify trends, patterns, and relationships within the data, enabling a deeper understanding of the issues and practices.
- **Rating Analysis:** The case study data were analyzed through rating analysis to compare FM practices in four HRBs. This method highlighted differences and similarities in the frequency and distribution of specific FM issues, providing a comparative perspective.

2. Qualitative Data Analysis:

- **Thematic Analysis:** Thematic analysis was used to code and categorize data from interviews, observations, and document analysis into themes, such as FM challenges, opportunities, and stakeholder perspectives. This systematic qualitative coding uncovered patterns and contextual nuances, providing deeper insights that complemented the quantitative findings.

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By integrating these methods, the study triangulated findings, ensuring validity and depth. The quantitative approach quantified trends and relationships, while the qualitative analysis provided rich, detailed insights, creating a holistic understanding of FM practices, challenges, and opportunities in Addis Ababa's HRBs.

3.7 Validity Test

Surveys are widely used in social science research for data collection, as they provide a structured approach to gathering relevant information reliably and accurately. The validity of a questionnaire is crucial in ensuring that the collected data accurately represents the area being studied (Hamed, 2016). In the context of this research, a systematic validation process was employed to confirm that the questionnaire effectively measured FM practices in high-rise buildings.

To establish content validity, the questionnaire was designed based on established FM frameworks, incorporating validated questions from previous studies. Facility management professionals reviewed the content to ensure alignment with the study's objectives, leading to refinements that improved clarity and eliminated irrelevant items. Face validity was assessed through a pilot test with a small sample of facility managers and building occupants. Their feedback helped reword ambiguous questions and restructure sections to enhance participant understanding.

Construct validity was ensured by designing the questionnaire to comprehensively cover key aspects of FM, including operational challenges, sustainability efforts, and improvement opportunities. The alignment of survey items with research objectives and insights from the literature review confirmed that the instrument effectively captured the intended variables. Finally, during data collection, the validated questionnaire was administered to facility managers, maintenance teams, and building occupants. The consistency in participant responses further demonstrated the reliability of the validation process, ensuring that the data accurately reflected real-world FM conditions.

3.8 Reliability Test

Reliability refers to the extent to which a measurement consistently produces stable and uniform results when assessing a particular phenomenon. It also includes the concept of repeatability, meaning a test is considered reliable if it yields the same results under

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identical conditions across multiple instances. One of the most widely used methods for evaluating internal consistency is Cronbach’s Alpha coefficient, particularly for Likert-scale-based assessments. While there are no absolute criteria for internal consistency, a minimum coefficient of 0.70 is generally accepted as an adequate standard (Hamed, 2016).

To ensure consistent and dependable results, a reliability test was conducted using Cronbach’s Alpha coefficient, calculated through SPSS version 23. The initial reliability assessment yielded a Cronbach’s alpha of 0.652, which was slightly below the acceptable threshold of 0.7. This indicated minor inconsistencies in the questionnaire responses, possibly due to the small sample size (14 HRBs) and variations in FM practices across different buildings. To improve reliability, several refinements were made to the questionnaire, including removing extreme responses, rewording unclear questions, and improving response categories. These adjustments enhanced consistency across participant responses and reduced variability in the data. After implementing these modifications, the final reliability outcome improved to 0.711, indicating an acceptable level of internal consistency. The results confirmed that the questionnaire provided stable and consistent responses, reinforcing the credibility of the study findings.

The reliability test results also ensured that statistical analyses, trend identification, and conclusions drawn from the data were robust and reproducible. This allowed for a more confident interpretation of FM challenges and opportunities in Addis Ababa’s HRBs, strengthening the study’s validity and reliability.

Table 3.2. Unadjusted Cronbach’s alpha coefficient

| Reliability Statistics | |
|-------------------------------|------------|
| Cronbach's Alpha | N of Items |
| .652 | 98 |

Table 3.3 Adjusted Cronbach’s alpha coefficient

| Reliability Statistics | |
|-------------------------------|------------|
| Cronbach's Alpha | N of Items |
| .711 | 95 |

3.9 Ethical Considerations

Ethical considerations for this study were carefully followed to ensure the integrity of the research process and protect the rights of participants. Informed consent was obtained from all participants, who were provided with clear and detailed information about the study's purpose, procedures, and potential risks and allowed to voluntarily consent to participate. Confidentiality and anonymity were maintained by securely storing personal data and excluding identifying details in any reports or publications. Participation was voluntary, and participants could withdraw at any time without consequence. Efforts were made to minimize harm by ensuring that the study did not cause distress or disruption to participants and that all participants were treated with respect. The study maintains transparency and integrity by clearly disclosing all methods, findings, and potential conflicts of interest.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the findings of the study, analyzing and interpreting them to address the research objectives. It provides insights into the current FM practices, identifies key challenges, and explores opportunities for improvement in HRBs within Addis Ababa's CBD. The discussion integrates these findings with existing literature to offer a comprehensive understanding of FM in this rapidly developing urban context.

4.2 Result and Discussion of Questionnaires

4.2.1 Section A: Demographic Information

The demographic analysis provides a comprehensive understanding of the profiles of facility managers and the buildings they manage within CBD high-rise buildings. This includes their educational qualifications, experience levels, staff sizes, and building features, which collectively influence FM practices. The findings highlight significant trends that shape FM challenges and opportunities in the field.

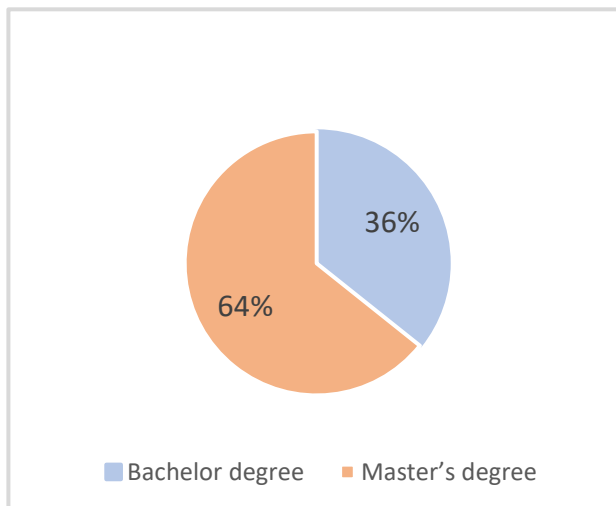


Figure 4.1 Education level of FM managers

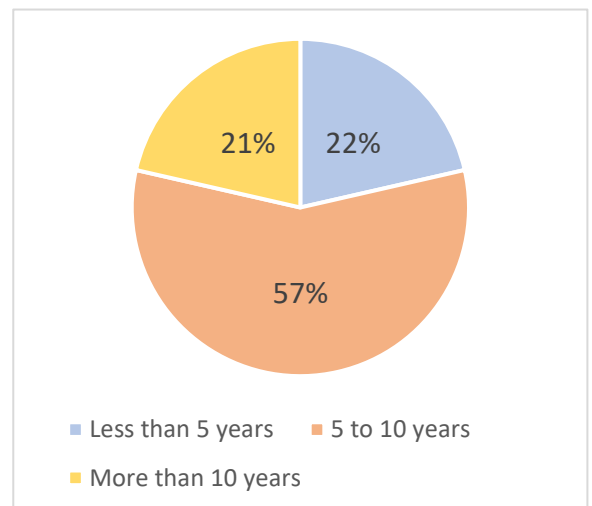


Figure 4.2 Years of experience

The data reveals that most facility managers in Addis Ababa's HRBs have substantial academic qualifications, with 64% holding master's degrees and 36% possessing bachelor's degrees, primarily from business and engineering backgrounds (see Figure 4.1). Notably, none of the facility managers have formal academic training in FM as a

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discipline, which may suggest a gap in specialized knowledge that could impact FM practices. In terms of experience, 57% of the respondents have worked in the field for 5 to 10 years, reflecting a solid grasp of FM challenges and opportunities. Meanwhile, 22% have less than 5 years of experience, indicating a need for further skill development among early-career professionals. Additionally, 21% of facility managers have more than 10 years of experience, contributing valuable expertise to the field (see Figure 4.1). These findings provide a basis for discussing the potential impact of educational and experiential diversity on the efficiency and effectiveness of FM practices in the area.

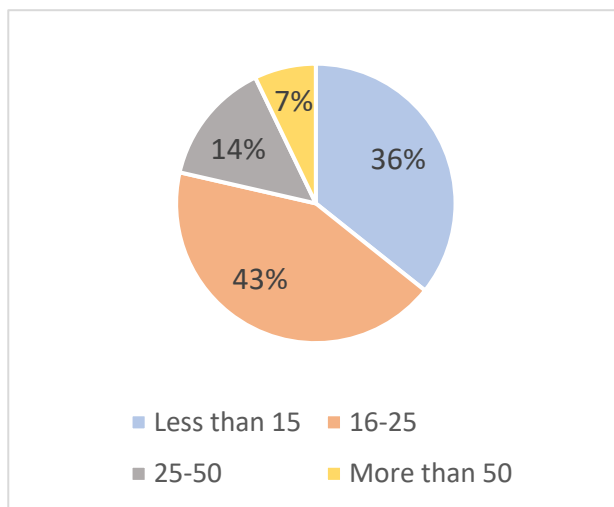


Figure 4.3 Number of personnels

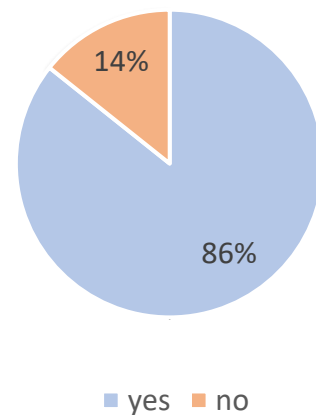


Figure 4.4 Dedicated FM team

Figures 4.3 and 4.4 indicate a structured approach to FM in high-rise buildings in CBD. A significant 86% of buildings have a dedicated FM team, demonstrating a strong emphasis on specialized personnel for building maintenance and operations (see Figure 4.4). Among these teams, 43% comprise 16-25 personnel, and 36% have fewer than 15, which suggests that many FM teams are relatively small, likely focusing on core operational tasks rather than large-scale maintenance. Only a minority 14% have teams of 25-50, and even fewer 7% exceed 50 members, highlighting potential resource limitations in larger-scale operations (see Figure 4.3). With most FM models focusing on a single-site approach, there is an opportunity to optimize operations by introducing more advanced or multi-site management practices. This dedicated yet limited FM staffing model suggests that while HRBs benefit

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from specialized FM teams, there may be room for enhanced resource allocation and training to meet growing urban facility demands.

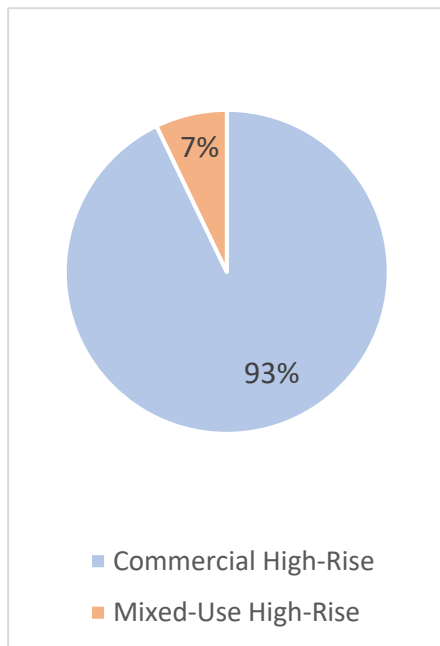


Figure 4.5 Types of buildings

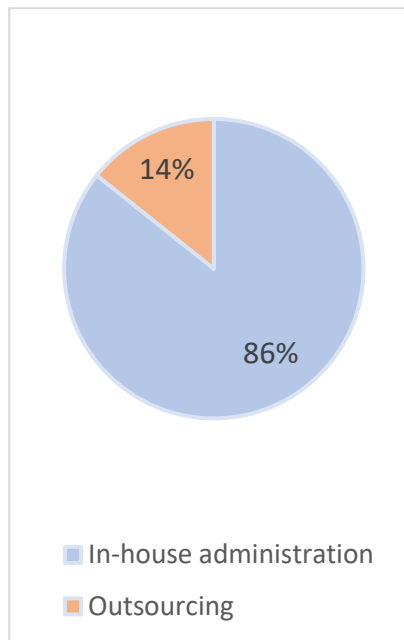


Figure 4.6 Method of FM administration

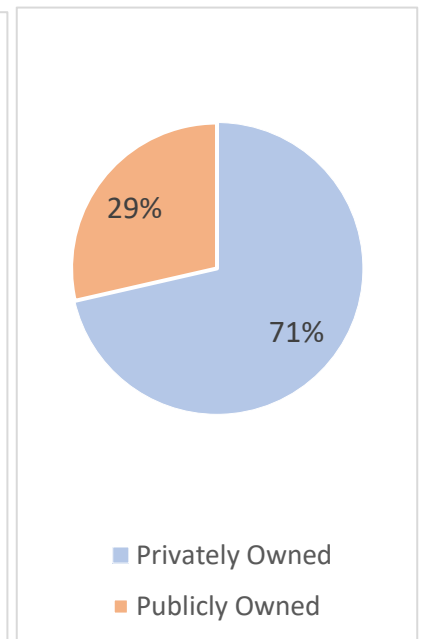


Figure 4.7 Ownership of the buildings

Figures 4.5, 4.6, 4.7, and 4.8 reveal CBD high-rise buildings; the data reveals patterns in building types, ownership, and floor numbers, all of which influence FM practices. According to the data, the majority 93% of buildings are commercial high-rises, while only a small portion 7% are mixed-use structures (see Figure 4.5). This commercial focus may streamline FM operations, as commercial buildings often have standardized needs compared to mixed-use facilities. Regarding ownership, 71% of buildings are privately owned, and 29% are publicly owned (see Figure 4.7). Private ownership might lead to more customized FM practices, as private owners often have specific goals for maintaining their properties. Publicly owned buildings, on the other hand, might face challenges related to budget restrictions and bureaucratic processes that could impact maintenance quality and frequency. Figure 4.6 indicates that 86% of the respondents use in-house administration for FM, while only 14% rely on outsourcing. This significant preference for in-house management suggests a tendency towards maintaining direct control over facility operations. However, the low adoption of outsourcing may point to limited trust in external

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providers or a lack of awareness about potential benefits such as cost efficiency and access to specialized expertise.

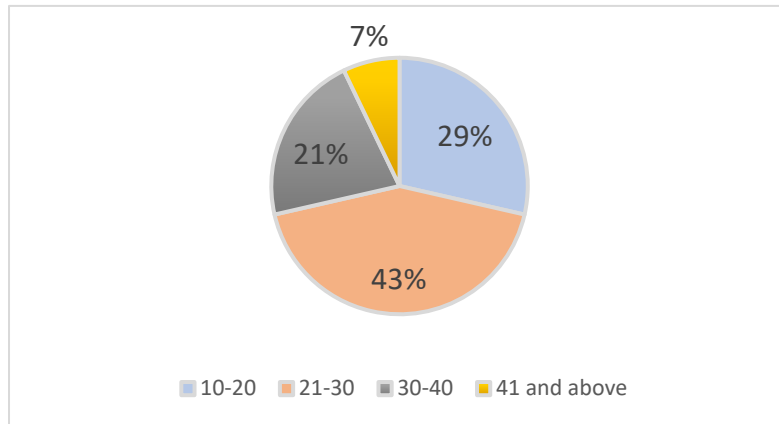


Figure 4.8 Number of floors

In terms of building height, the majority 43% of buildings have 21-30 floors, followed by 29% with 10-20 floors. Only one building (Commercial Bank of Ethiopia headquarters) exceeds 40 floors, indicating that most high-rises are mid-rises rather than extremely tall buildings.

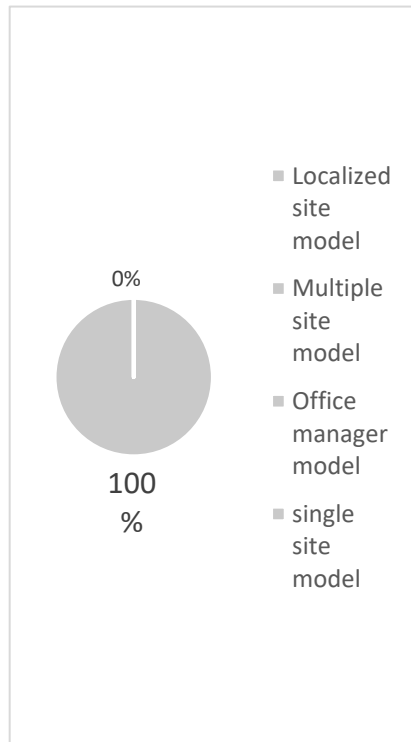


Figure 4.9 FM model

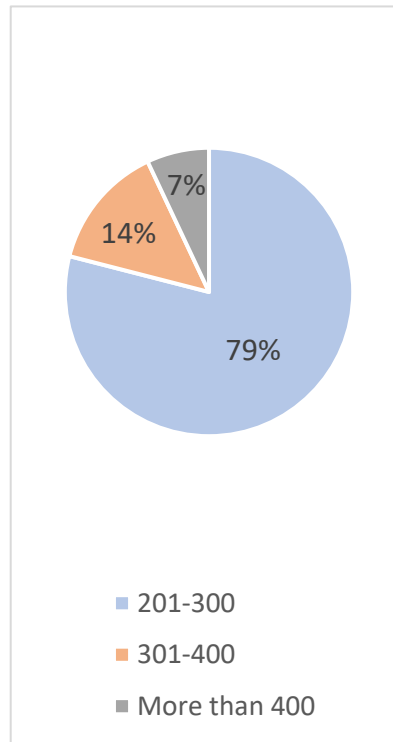


Figure 4.10 Numbers of occupants

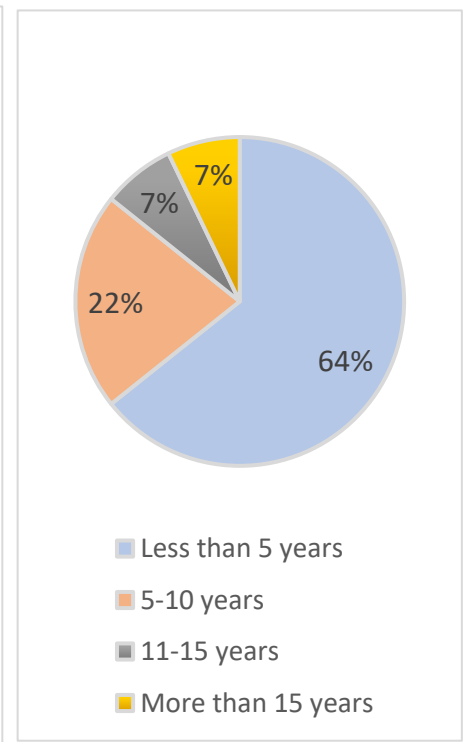


Figure 4.11 Building age

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Figures 4.9, 4.10, and 4.11 reveal key patterns in FM practices among HRBs in CBD. Notably, all respondents 100% use the single-site FM model, suggesting that FM operations are centralized within each building, likely allowing for tailored services specific to the unique needs of each structure (see Figure 4.9). This centralized model can streamline management but may limit opportunities for shared resources or efficiencies seen in multi-site models.

Regarding the approximate number of occupants, 79% of buildings house between 201 and 300 occupants, and 14% 301–400 occupants, while only a small proportion (7%) have more than 400 occupants (see Figure 4.10). This high occupancy level suggests that FM practices need to account for increased demands on resources, maintenance, and infrastructure to ensure safety and comfort for a large number of occupants. In terms of building age, 64% have been in operation for less than five years, indicating a relatively young building stock. Newer buildings typically have modern facilities and fewer immediate maintenance needs but may still require strategic FM planning to prevent premature wear and ensure long-term sustainability. Meanwhile, the remaining 36% have been in use for more than five years, and their age may necessitate more frequent maintenance and potential upgrades (see Figure 4.11). These patterns underscore a need for robust, adaptable FM practices in CBD high-rise buildings to accommodate high occupancy and evolving infrastructure needs.

The demographic profile of facility managers in the current study highlights significant trends that influence FM practices in HRBs in Addis Ababa. A majority of facility managers hold master's degrees, while the rest possess bachelor's degrees, predominantly in business and engineering. This trend aligns with the findings from Tsegaye (2022) study, which noted that the FM industry in Addis Ababa is primarily operated by professionals with backgrounds other than formal FM education. However, Tsegaye's emphasized the absence of local FM training programs, which limits the availability of specialized FM knowledge, supporting the current study's observation that none of the facility managers have formal academic training in FM.

In terms of experience, the current study found that a significant number of facility managers have 5–10 years of experience, followed by a smaller group with less than five years and a notable proportion with over 10 years. This is consistent with Alebachew's (2022) research, which emphasized the importance of experience in addressing FM challenges but noted that many managers lack adequate exposure to strategic FM practices.

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The findings also align with Taye's (2016) study, which identified low capacity in skilled operational personnel as a persistent challenge, particularly due to the absence of structured training and professional development in FM.

Regarding FM staffing, the current study reported that most HRBs have dedicated FM teams, with many teams being relatively small, focusing on core operational tasks. This aligns with Tsegaye (2022) findings, which highlighted resource limitations in FM operations, particularly for large-scale maintenance tasks. Similarly, Taye noted that inadequate staffing and lack of skilled personnel contribute to inefficiencies in managing university facilities, mirroring the challenges faced by HRBs in the CBD.

The study also revealed that most buildings are commercial, with only a small portion being mixed-use. This observation aligns with Abera's (2017) study, which found that commercial buildings often have standardized FM needs, simplifying management practices. However, Abera also highlighted inefficiencies in property management, particularly in generating income from underutilized assets, which may be an area of concern for privately owned HRBs in Addis Ababa.

Ownership patterns in the current study show that privately owned buildings dominate, with a smaller proportion being publicly owned. Private ownership was associated with more tailored FM practices, while public ownership faced budgetary and bureaucratic challenges. This is consistent with Abera's (2017) study, which noted that publicly owned properties often struggle with maintenance due to limited funding and inefficient processes. Similarly, Taye's (2016) findings highlighted the challenges of maintaining publicly owned university buildings, emphasizing the need for enhanced budget allocations and streamlined operations.

Finally, the preference for in-house FM over outsourcing reflects a tendency to retain direct control over operations. This contrasts with Tsegaye's (2022) recommendation to adopt IT-based solutions and external expertise to improve FM efficiency. The centralized single-site FM model, adopted by all respondents, aligns with Alebachew's (2017) emphasis on tailored management but contradicts his recommendation for multi-site strategies to optimize resource use.

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In conclusion, the current study's findings are largely supported by other local studies, particularly regarding the lack of formal FM training, resource limitations, and challenges in public FM operations. However, the limited adoption of outsourcing and centralized single-site models highlights a contradiction with recommendations from previous studies advocating for multi-site management and integration of external expertise. This underscores the need for further exploration into how these practices could enhance FM efficiency in Addis Ababa's HRBs.

4.2.2 Section B: Current Facility Management Practice

This section examines the approaches and tools used in HRBs for maintenance and operations, focusing on strategies, maintenance frequency, technology integration, and energy efficiency. Respondents provided insights into their current practices, satisfaction levels, and the use of technologies, offering a comprehensive view of FM trends.

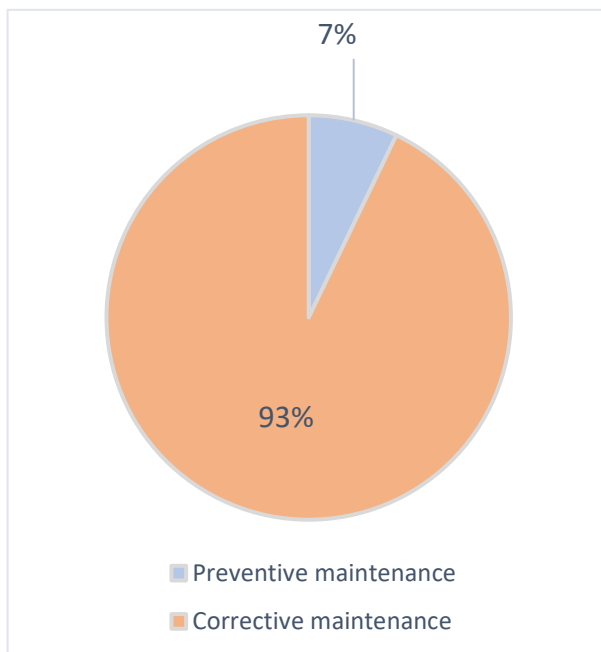


Figure 4.12 Current maintenance strategy

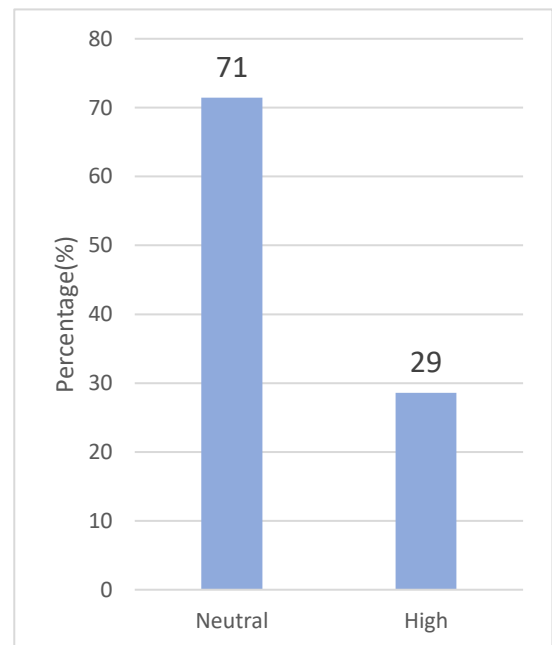


Figure 4.13 Satisfaction level

Figures 4.12 and 4.13 reveal critical findings about maintenance strategies. A majority of respondents 93% reported relying on a corrective maintenance approach, while only one 7% respondent, representing the CBE Headquarters, implemented preventive maintenance (see Figure 4.12). This highlights a reactive rather than proactive approach to managing HRBs, which could result in higher long-term costs and disruptions. The limited adoption

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of preventive maintenance suggests challenges such as budget constraints or resource limitations. Regarding satisfaction, 71% of respondents expressed neutral satisfaction with their chosen strategy, while only 29% reported high satisfaction (see Figure 4.13). This indicates that while the current strategies may be functional, they fail to fully meet expectations for efficiency and reliability. A transition towards preventive maintenance could improve overall satisfaction and reduce maintenance issues, contributing to more sustainable and effective FM practices in the long term.

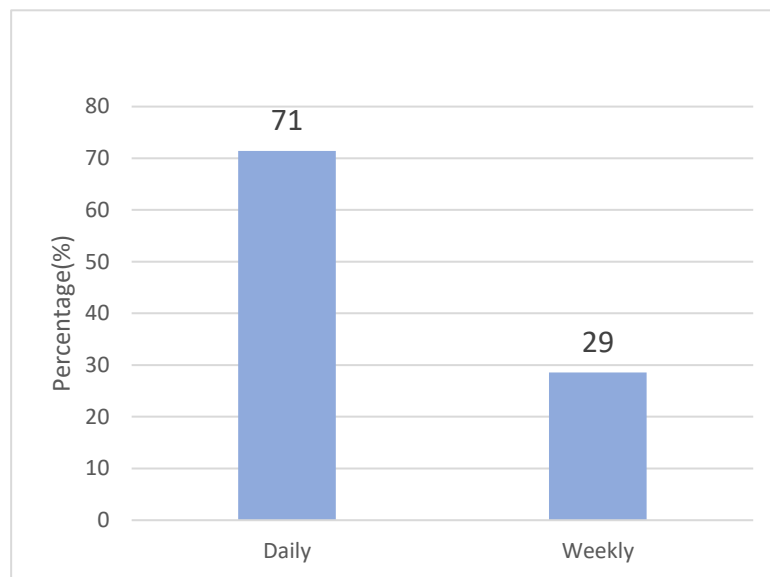


Figure 4.14 Routine maintenance activities

Figure 4.14 shows a majority 71% of respondents reported conducting maintenance activities daily, while 29% perform them weekly. The preference for daily maintenance activities suggests a strong focus on regularly addressing minor issues before they escalate, which can contribute to maintaining building functionality and safety. However, the 29% who conduct maintenance weekly may rely on less frequent schedules, potentially due to resource limitations or building occupancy requirements. This distribution highlights a trend toward daily maintenance but also indicates some variability based on facility needs and available resources.

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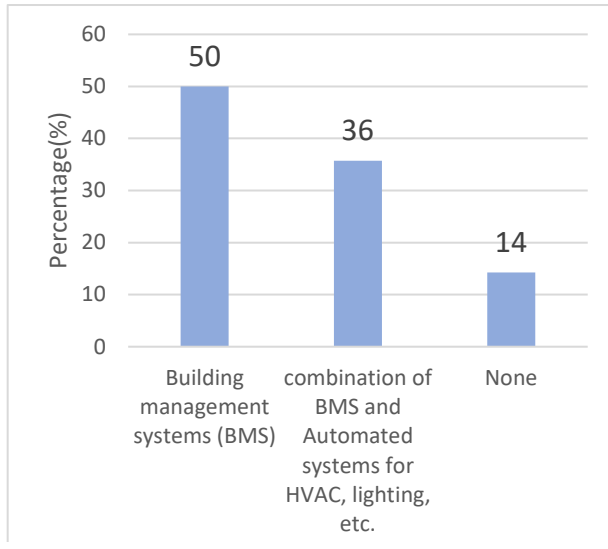


Figure 4.15 Current technology use in FM

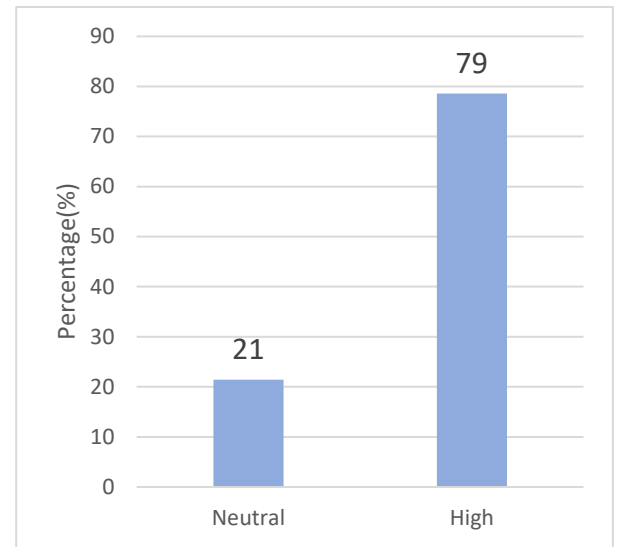


Figure 4.16 Integration of technology

Figures 4.15 and 4.16 show a growing preference for advanced technology in FM among respondents. Half 50% use BMS alone, while 36% combine BMS with automated systems for HVAC, lighting, and other functions, indicating a shift toward integrated solutions to enhance efficiency. However, 14% do not use any technology, likely due to budget constraints or limited technical resources (see Figure 4.15).

Most respondents 79% rated their technology integration as high, suggesting effective adoption, while 21% rated it as neutral, indicating ongoing efforts to fully incorporate these tools (see figure 4.16). This trend reflects a move toward increased technology use and improved operational control in FM practices.

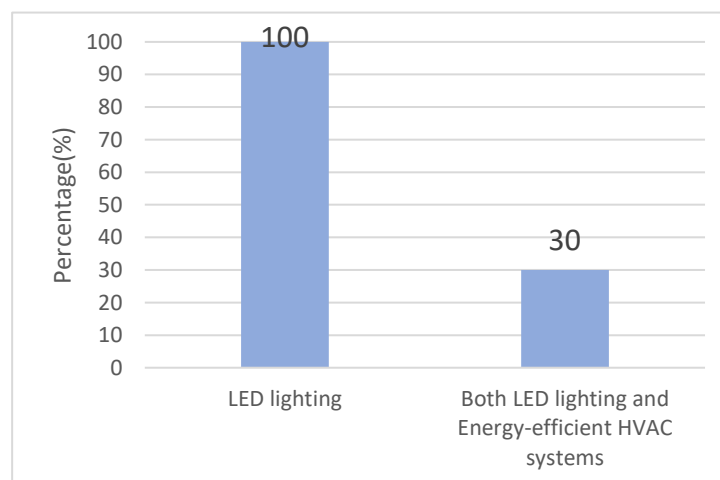


Figure 4.17 Implemented energy efficiency

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Figure 4.17 shows that all respondents 100% implemented LED lighting, highlighting its popularity for its low cost, ease of installation, and energy-saving benefits. Additionally, 30% combined LED lighting with energy-efficient HVAC systems, suggesting a more comprehensive energy management approach. Energy-efficient HVAC systems further optimize energy savings by improving heating, ventilation, and air conditioning efficiency. However, the limited adoption of combined measures reflects budget constraints, high costs, or technical challenges. The findings emphasize a reliance on LED lighting alone, indicating an opportunity to promote advanced systems like energy-efficient HVAC solutions for greater sustainability in HRBs.

The findings from this study reveal that FM practices in Addis Ababa's HRBs are predominantly reactive, with corrective maintenance being the most common approach. This aligns with previous local studies (Abera, 2017; Tsegaye, 2022), which noted that preventive maintenance remains underutilized due to financial constraints, lack of awareness, and weak enforcement mechanisms. Observational findings from site visits support these conclusions, as FM teams often responded to equipment failures rather than implementing systematic preventive maintenance plans.

Comparatively, international best practices emphasize preventive and predictive maintenance as cost-effective strategies to extend building lifespan and enhance operational efficiency. For instance, in the United States and Europe, FM models integrate CMMS to track asset conditions and schedule preventive maintenance, reducing downtime (Shohet & Lavy, 2021). Singapore mandates FM performance-based standards, requiring commercial buildings to implement predictive maintenance using IoT-enabled sensors to optimize energy and resource management (Building and Construction Authority [BCA], 2020). Similarly, the UAE and Qatar have strict FM regulations ensuring periodic maintenance in high-rise structures, minimizing unexpected failures and enhancing tenant satisfaction (Dubai Municipality, 2021).

The study also highlights the growing adoption of BMS in Addis Ababa's HRBs, particularly for energy efficiency, HVAC automation, and lighting control. However, observational data reveal that this adoption is fragmented, with many buildings lacking full-scale BMS implementation due to budget constraints and a lack of skilled professionals. In contrast, international FM practices prioritize smart building solutions, such as AI-powered energy management systems in Germany and the UK, robotic-assisted

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FM in Japan, and cloud-based FM platforms in Dubai (IFMA, 2022). These global trends indicate that while Addis Ababa's HRBs are beginning to integrate technology, the scale and efficiency remain limited, suggesting the need for greater investment in affordable FM technology. Additionally, energy efficiency practices in Addis Ababa's HRBs primarily involve LED lighting and energy-efficient HVAC systems, but comprehensive energy management systems remain scarce. This contrasts with global FM practices that promote net-zero energy buildings in Scandinavia, systematic energy audits in the U.S. Green Building Council's LEED-certified models, and carbon-neutral FM frameworks in China (USGBC, 2020).

The limited use of such advanced energy solutions in Addis Ababa indicates a reliance on cost-effective but incomplete measures, necessitating policy support, financial incentives, and awareness campaigns. Another critical finding from this study is the absence of standardized FM codes and regulations in Addis Ababa, which contrasts with structured legal frameworks in international cities. For instance, the UK's Royal Institution of Chartered Surveyors provides comprehensive FM guidelines to ensure compliance with building performance standards, Singapore's BCA enforces mandatory FM audits, and Dubai Municipality mandates FM service accreditation (RICS, 2019; BCA, 2020; Dubai Municipality, 2021).

The lack of such regulations in Addis Ababa results in inconsistencies in FM implementation, underscoring the need to develop a national FM code tailored to Ethiopia's urban landscape. In conclusion, FM in Addis Ababa's HRBs is evolving but remains reactive, with limited preventive maintenance, fragmented technology adoption, and an absence of standardized policies. To bridge the gap between local and international best practices, it is essential to develop a national FM code, encourage preventive maintenance, expand technology use, implement policy incentives, and enhance training programs. By integrating these strategies, FM in Addis Ababa's HRBs can transition from reactive to proactive management, aligning more closely with international best practices while addressing local challenges.

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4.2.3 Section C: Challenges in Facility Management Practice

This section examines operational issues in HRBs, including equipment performance, plumbing, electrical systems, HVAC stability, elevator reliability, and pest control. It evaluates financial sufficiency, tenant satisfaction, and regulatory compliance challenges, aiming to identify areas for improvement.

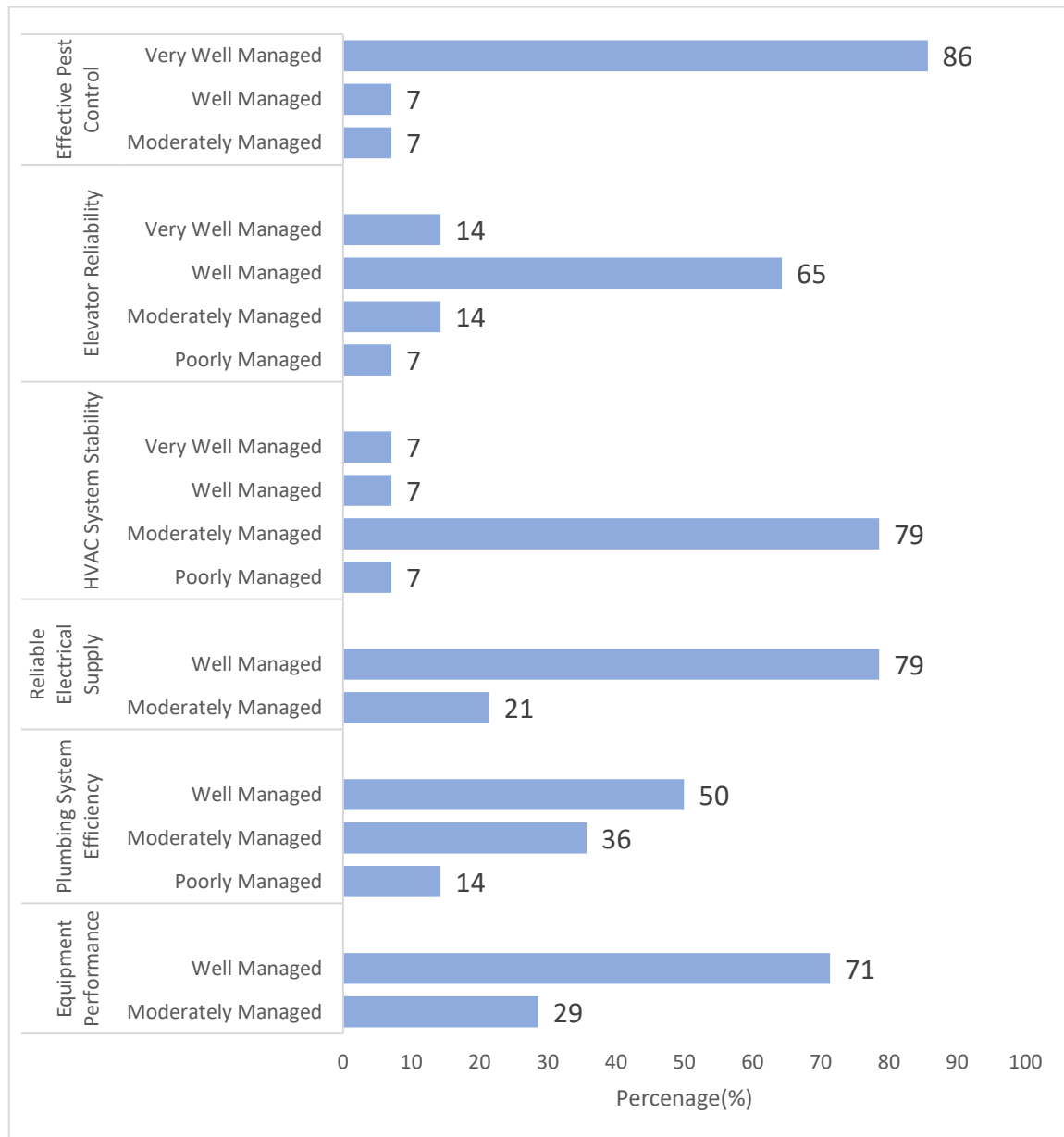


Figure 4.18 Addressed common problem in daily operation

Figure 4.18 highlights mixed operational efficiency levels. Equipment performance and reliable electrical supply are well-managed 71% and 79%, respectively. However, plumbing system efficiency shows challenges, with only 50% rated as well-managed.

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HVAC system stability is moderately managed 79%, indicating improvement needs. Elevator reliability is generally positive, though 7% is poorly managed. Effective pest control is rated very well-managed 86%, showing minimal issues. These findings reveal strengths and areas requiring attention in FM practices.

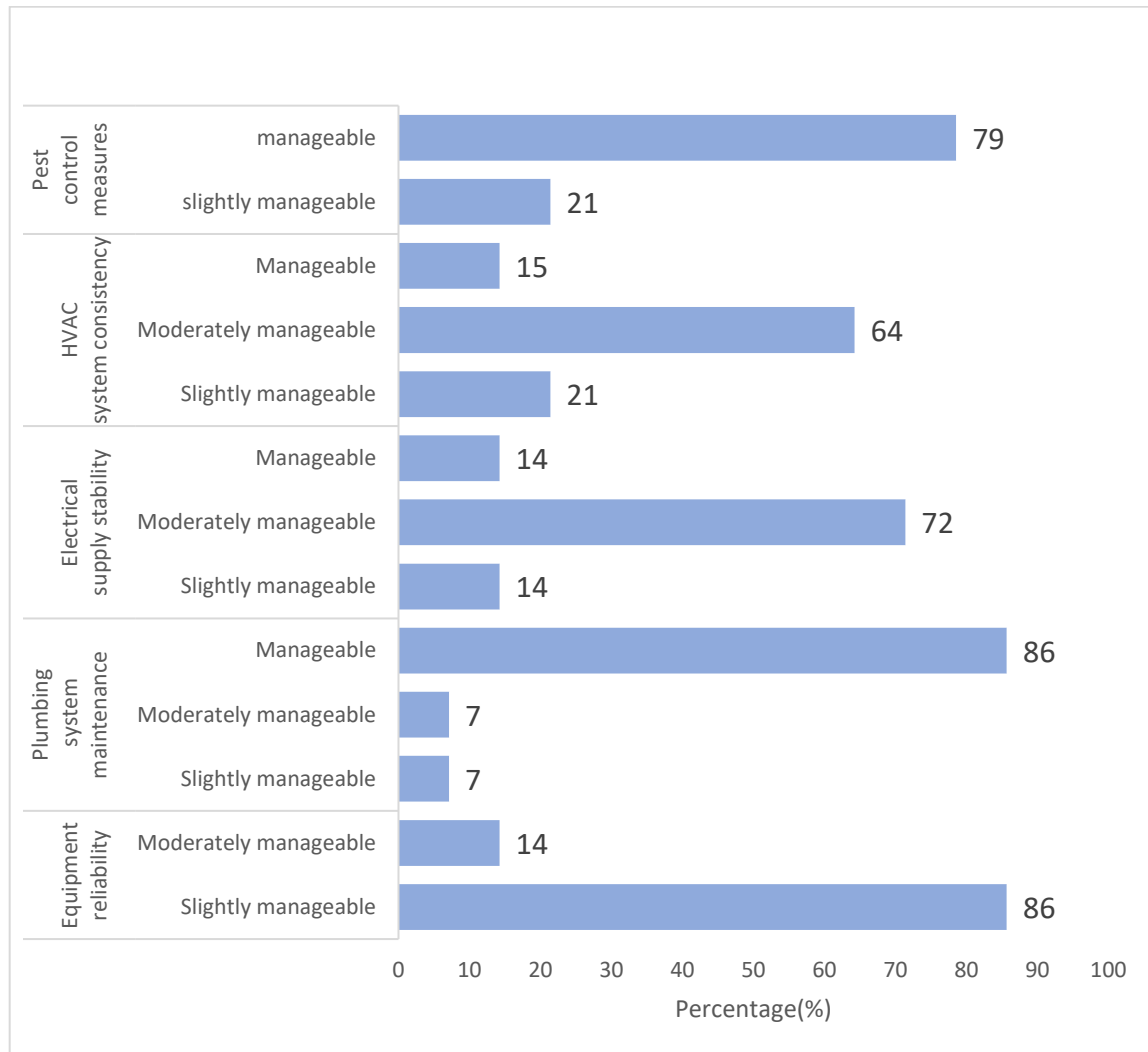


Figure 4.19 Manageable operation challenge

Figure 4.19 shows that equipment reliability and plumbing maintenance are largely manageable 86%, indicating strong performance in these areas. However, electrical supply stability and HVAC consistency pose moderate challenges, with 72% and 64% rated as moderately manageable, highlighting areas needing improvement. Pest control measures are well-managed 79%, showing minimal concerns. Overall, while equipment reliability and plumbing are strengths, enhancing electrical supply and HVAC consistency is necessary to improve operational efficiency.

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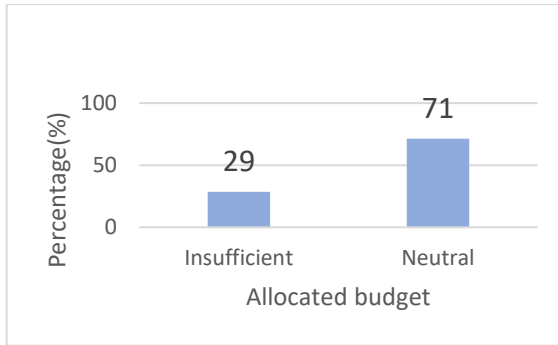


Figure 4.20 Budget sufficiency

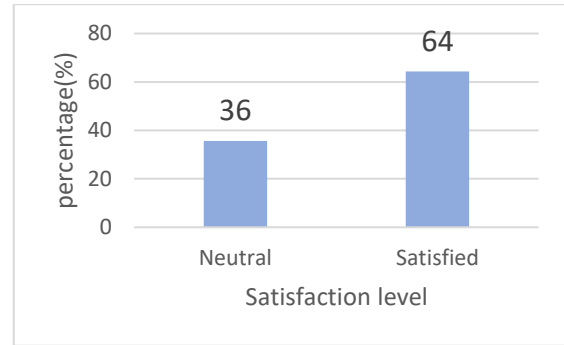


Figure 4.21 Tenant satisfaction

Figures 4.20 and 4.21 show financial sufficiency and tenant satisfaction in FM. Regarding budgets, 71% of respondents were neutral, and 29% found budgets insufficient, indicating potential gaps in funding that may impact service quality. Tenant satisfaction is mostly positive, with 64% satisfied and 36% neutral, suggesting general approval of FM services but room for improvement to enhance consistency and tenant experience.

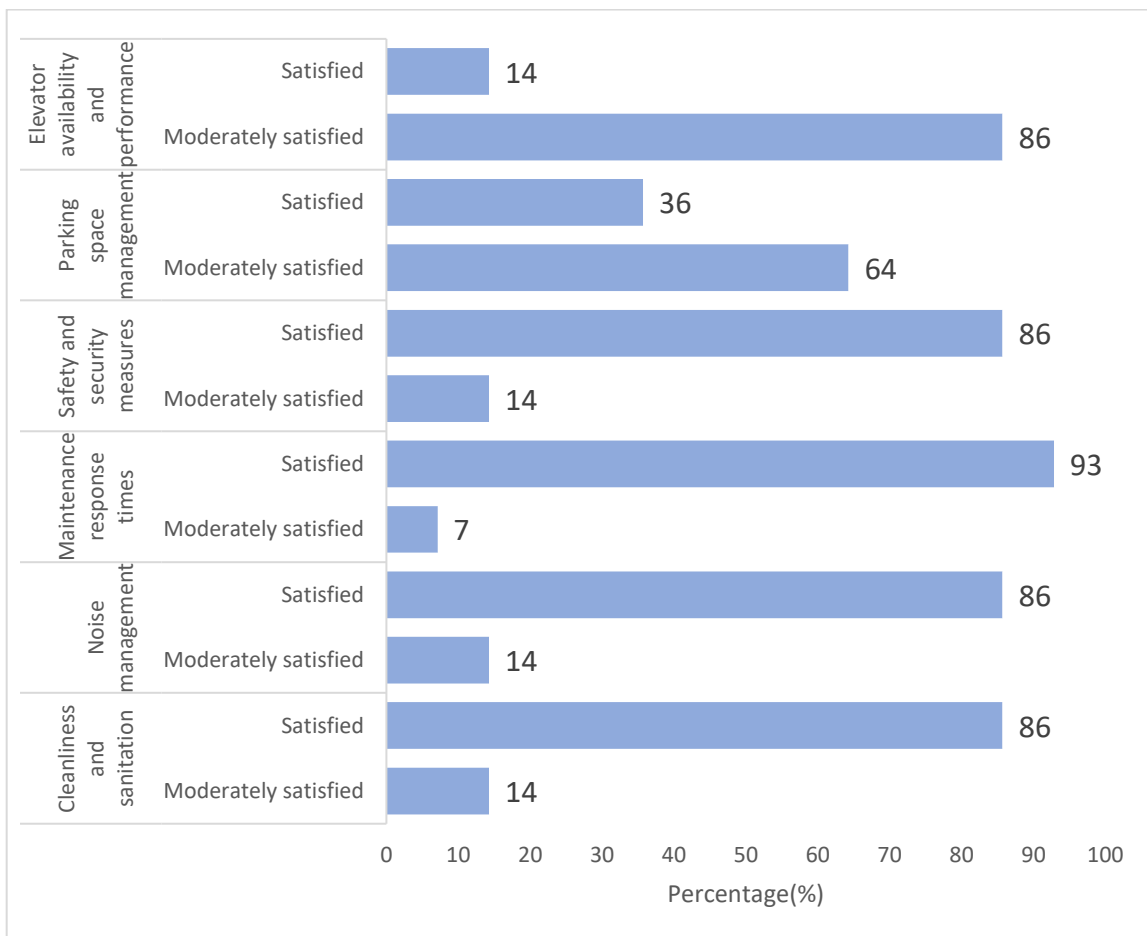


Figure 4.22 Tenant management improvement

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Figure 4.22 highlights high overall tenant satisfaction, with cleanliness, noise management, safety, and maintenance response rated as satisfied 86%–93%. However, parking space management (64% moderately satisfied) and elevator availability (86% moderately satisfied) show room for improvement. While essential FM services meet expectations, focusing on parking and elevator management could further enhance tenant experience and overall satisfaction.

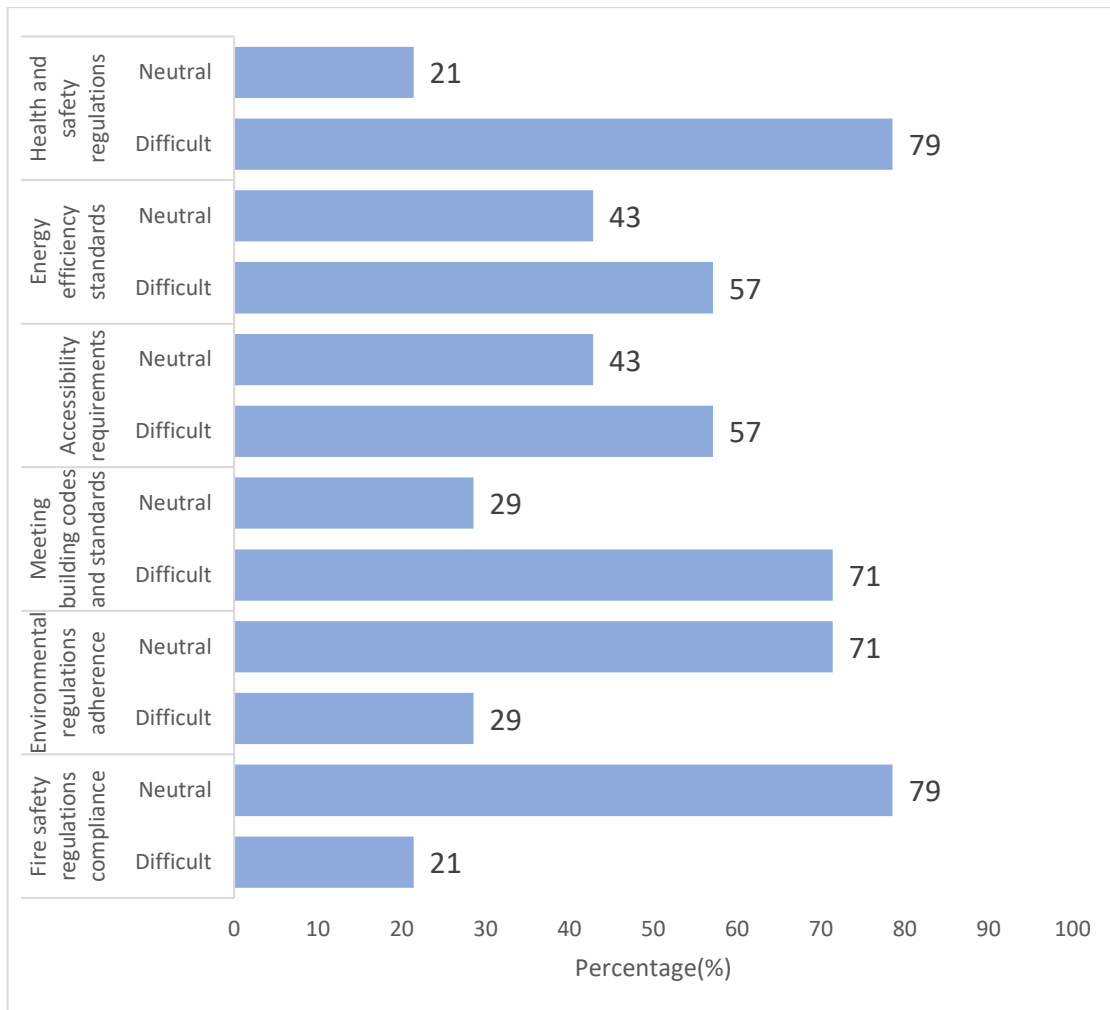


Figure 4.23 Easy of regulatory compliance

Figure 4.23 highlights notable challenges in regulatory compliance. Fire safety, environmental adherence, and building codes show moderate manageability, with 71%–79% rated neutral. However, accessibility requirements, energy efficiency standards, and health and safety regulations present significant difficulties, with 57%–79% of respondents finding compliance challenging. These findings emphasize the need for targeted resources and support to improve compliance in critical areas, enhancing FM’s effectiveness in meeting regulatory standards.

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The findings of this study indicate that FM in Addis Ababa's HRBs faces several operational challenges, particularly in maintaining key building services such as plumbing, HVAC, and fire protection systems. Observational and qualitative findings suggest that while electrical supply and equipment performance are relatively well-managed, plumbing systems frequently experience failures due to outdated infrastructure and a lack of preventive maintenance. This challenge is consistent with Abera (2017), who identified similar issues in public facilities, where aging systems and inadequate maintenance strategies resulted in frequent service disruptions.

Comparatively, international best practices emphasize proactive maintenance and advanced water management technologies to improve system reliability. For example, Singapore's FM standards mandate the use of real-time water monitoring systems to detect leaks and prevent water wastage (BCA, 2020). Similarly, in the United Arab Emirates high-rise buildings integrate automated water management systems to enhance efficiency and reduce operational costs (Dubai Municipality, 2021). The absence of such systems in Addis Ababa's HRBs highlights a critical gap in infrastructure investment and technological adoption.

HVAC system instability is another major challenge observed in this study, with qualitative responses indicating frequent malfunctions and inefficient climate control in HRBs. This aligns with Abera (2017), who found that HVAC inefficiencies in public buildings stemmed from poor maintenance and improper installation. Internationally, effective HVAC management relies on predictive maintenance and smart energy management solutions. For example, Germany and Japan implement AI-driven HVAC systems to optimize energy consumption and improve air quality (IFMA, 2022). The lack of such advanced HVAC solutions in Addis Ababa suggests an urgent need for improved maintenance strategies and investment in energy-efficient climate control systems. Fire protection measures also present significant challenges, as some buildings lack fully functional fire detection and suppression systems. This issue aligns with Taye (2016), who noted that poor adherence to fire safety regulations in university facilities contributed to increased fire risks. In contrast, international FM standards, such as those enforced in the UK, require high-rise buildings to undergo periodic fire safety audits and integrate IoT-based fire detection technologies to enhance occupant safety (RICS, 2019). The absence

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of strict enforcement of fire protection regulations in Addis Ababa underscores the need for policy interventions to strengthen compliance and improve emergency preparedness.

Vertical transportation, specifically elevator maintenance, also emerged as a challenge in some HRBs, with respondents reporting occasional service interruptions. Tsegaye (2022) similarly emphasized the importance of regular elevator maintenance, noting that resource constraints often hinder timely repairs. Globally, high-rise buildings in cities such as Dubai and New York employ predictive maintenance technologies for elevators, using sensors to detect performance anomalies and schedule preventive interventions (Dubai Municipality, 2021; IFMA, 2022). The reliance on reactive maintenance in Addis Ababa's HRBs contributes to elevator downtime, highlighting the need for modernization and predictive maintenance adoption.

Budget constraints remain one of the most significant barriers to effective FM, as many facility managers' report insufficient funding for maintenance and upgrades. This finding aligns with Abera (2017) and Taye (2016), who found that limited financial resources in public FM operations led to deferred maintenance and deteriorating infrastructure. In contrast, international FM models prioritize strategic financial planning to ensure long-term sustainability. For example, the United States Green Building Council promotes sustainable FM funding models that incorporate energy efficiency savings and public-private partnerships to offset maintenance costs (USGBC, 2020). Without similar strategic financial frameworks, Addis Ababa's HRBs will continue to struggle with maintaining high service standards.

Regulatory compliance presents another challenge, particularly in areas such as accessibility, energy efficiency, and health and safety standards. Observational data from this study indicate that many HRBs do not fully adhere to accessibility regulations, limiting ease of movement for individuals with disabilities. This finding aligns with Taye (2016), who highlighted poor compliance with building codes in university facilities. In contrast, international FM frameworks, such as those established by the UK's RICS and Singapore's BCA, enforce strict accessibility and sustainability requirements, ensuring that FM practices align with global best practices (BCA, 2020; RICS, 2019). Strengthening regulatory enforcement and increasing awareness of compliance standards in Addis Ababa's HRBs could significantly improve FM outcomes.

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In conclusion, the challenges in FM within Addis Ababa's HRBs include inefficiencies in plumbing and HVAC systems, insufficient fire protection measures, occasional elevator maintenance issues, budget constraints, and weak regulatory compliance. Comparatively, international best practices emphasize proactive maintenance, smart building technologies, predictive maintenance, and strong regulatory frameworks to address these issues. To bridge the gap, Addis Ababa must invest in advanced FM technologies, enhance regulatory enforcement, develop strategic financial models, and implement preventive maintenance strategies. By adopting these measures, the FM sector in Addis Ababa's HRBs can improve operational efficiency, occupant safety, and long-term sustainability.

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4.2.4 Section D: Opportunities for Improvement

This section explores ways to enhance FM practices in HRBs. Focus areas include improving maintenance response times, tenant communication, energy efficiency, security, and waste management. It also examines satisfaction with current practices, interest in new technologies like smart systems, willingness to adopt sustainability measures such as energy-efficient lighting and water-saving initiatives, and plans to prioritize key investments over the next five years.

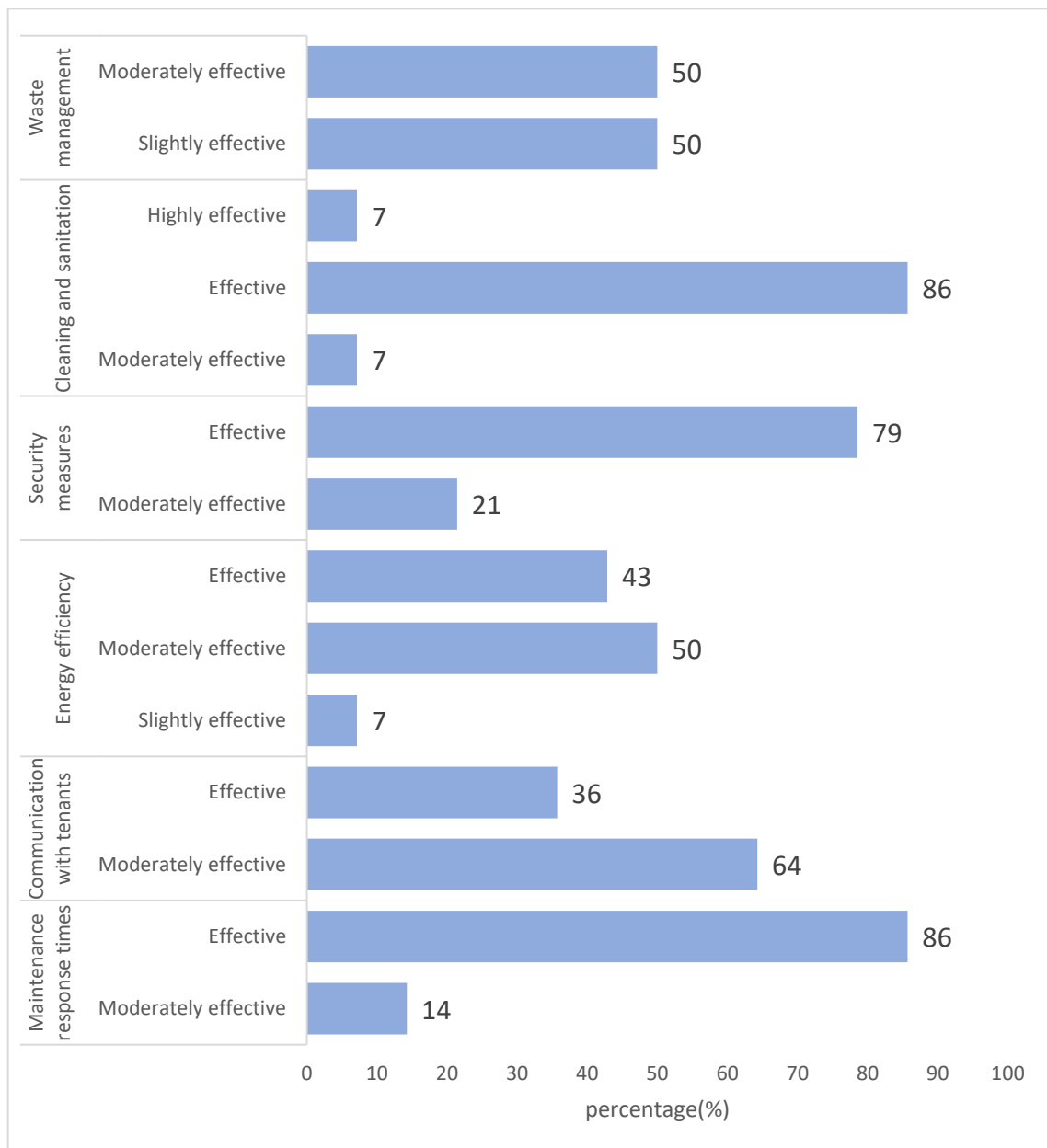


Figure 4.24 Priority areas for strengthening FM

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Figure 4.24 reveals maintenance response times are rated effective by 86% of respondents, with 14% rating them moderately effective. Tenant communication shows room for improvement, with 64% finding it moderately effective. Energy efficiency is seen as moderately effective by 50%, while 43% consider it effective. Security measures are effective for 79% of respondents. Cleaning and sanitation receive high ratings, with 86% finding them effective. However, waste management shows a significant need for improvement, with ratings split between slightly and moderately effective (50% each).

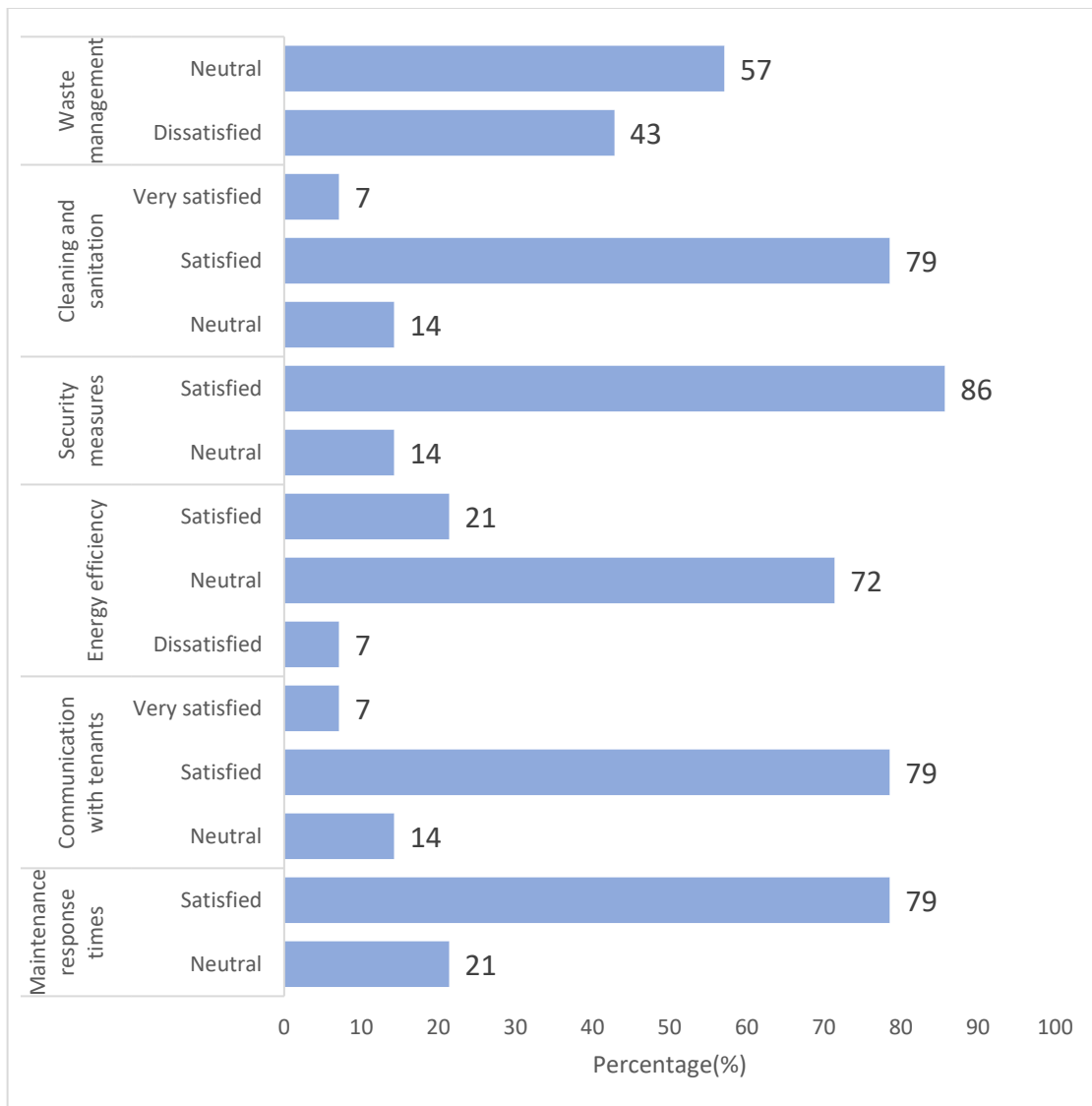


Figure 4.25 Satisfaction with current practices

Figure 4.25 shows varying satisfaction levels in FM practices. Maintenance response times and tenant communication scored 79% satisfaction each, with 21% neutral on maintenance. Energy efficiency had 72% neutral, 21% satisfied, and 7% dissatisfied,

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highlighting improvement needs. Security measures achieved 86% satisfaction, while cleaning and sanitation performed well with 79% satisfied and 7% very satisfied. Waste management was the lowest-rated, with 43% dissatisfied and 57% neutral, marking it as a key area for improvement.

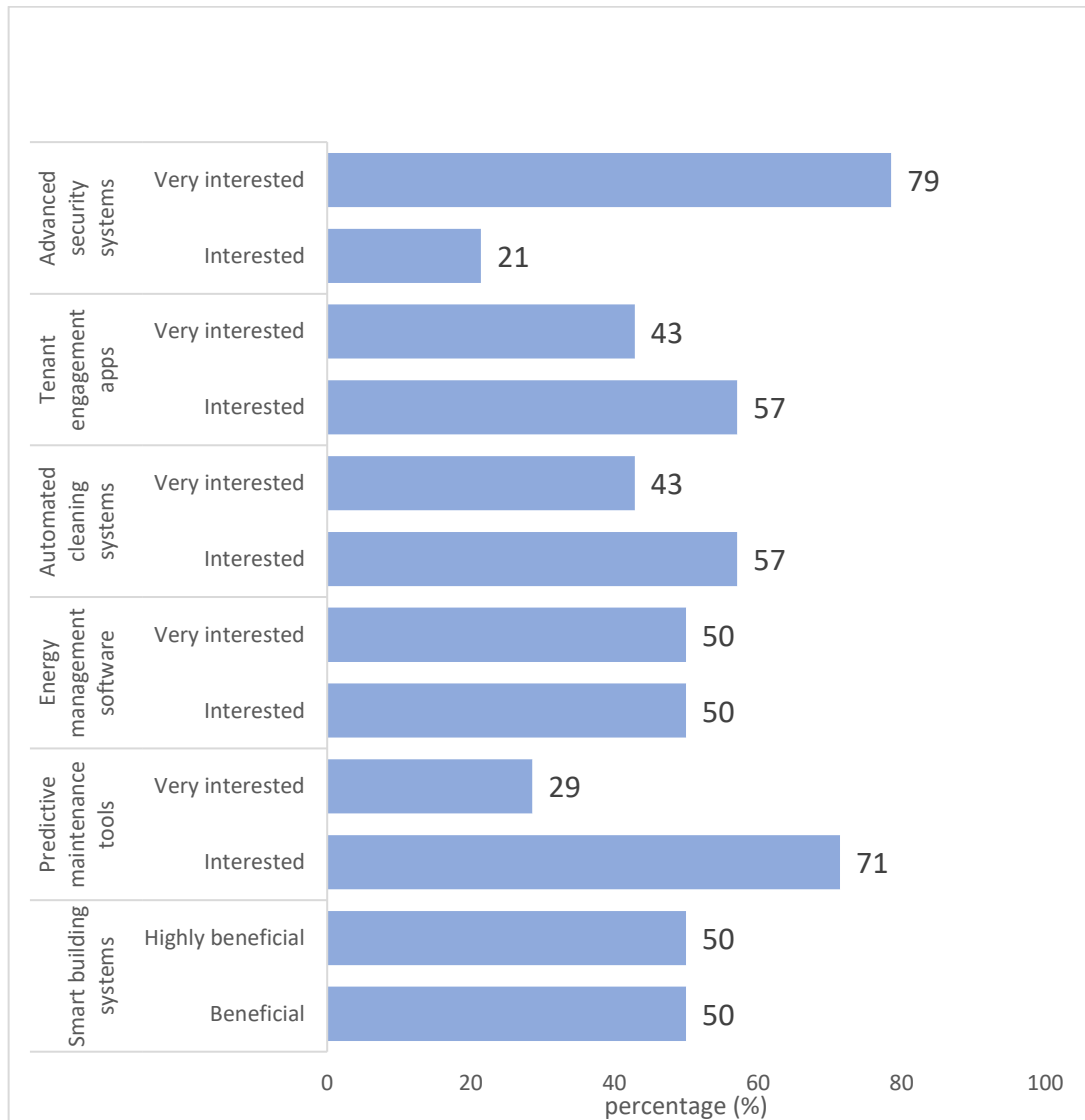


Figure 4.26 Interest in new technologies

Figure 4.26 highlights a strong interest in adopting new FM technologies. Smart building systems are seen as beneficial 50% or highly beneficial 50%. Predictive maintenance tools garner enthusiasm, with 71% interested and 29% very interested. Energy management software receives similar feedback, with 50% finding it beneficial and 50% very beneficial. Automated cleaning systems and tenant engagement apps show over 40% are very interested. Advanced security systems have the highest enthusiasm, with 79% very interested, indicating a clear priority for enhancing security technology.

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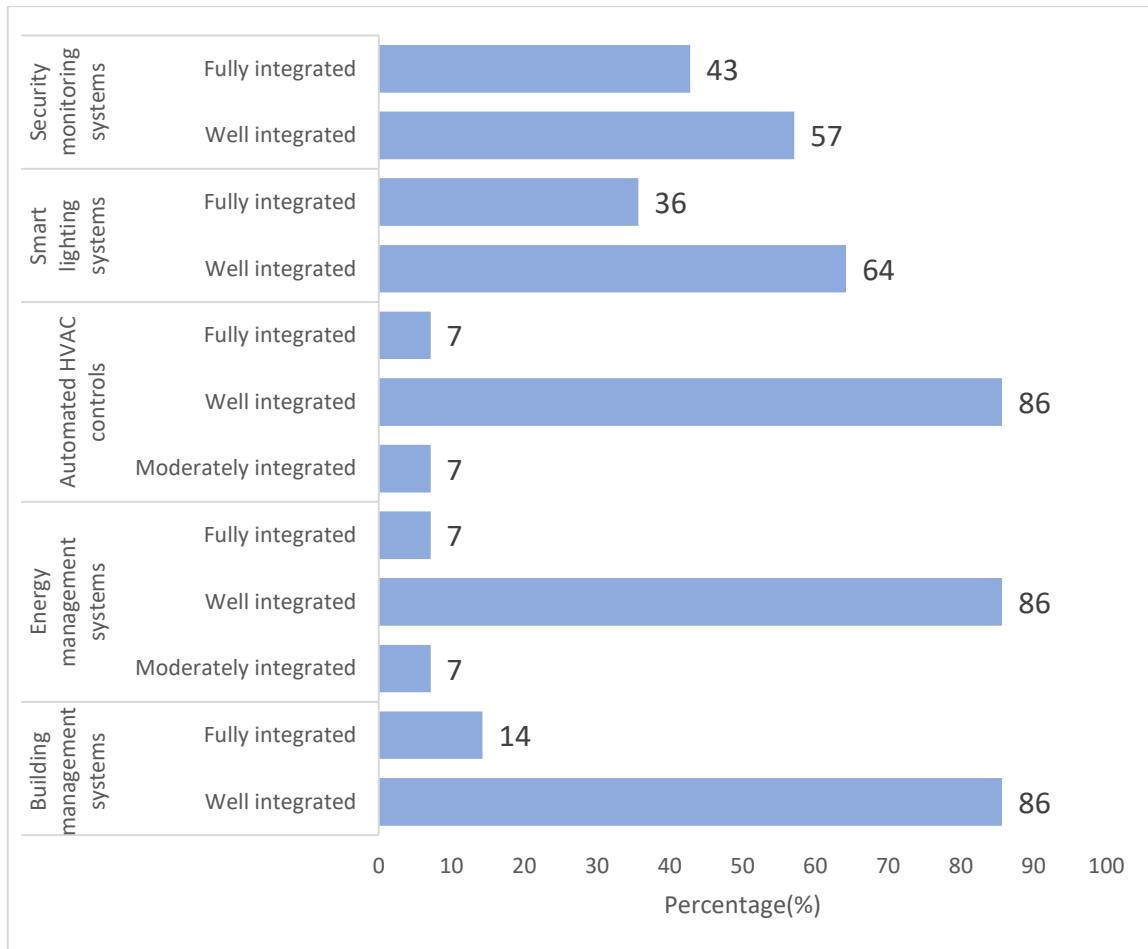


Figure 4.27 Current technology usage

Figure 4.27 highlights the integration of technologies in FM practices. Building management systems are well-integrated 86% and fully integrated 14%. Energy management systems and automated HVAC controls are also well-integrated 86% but fully integrated by only 7%, showing improvement potential. Smart lighting systems have higher integration, with 64% well-integrated and 36% fully integrated. Security monitoring systems are robustly implemented, with 57% well-integrated and 43% fully integrated, indicating a strong focus on security technologies in FM practices.

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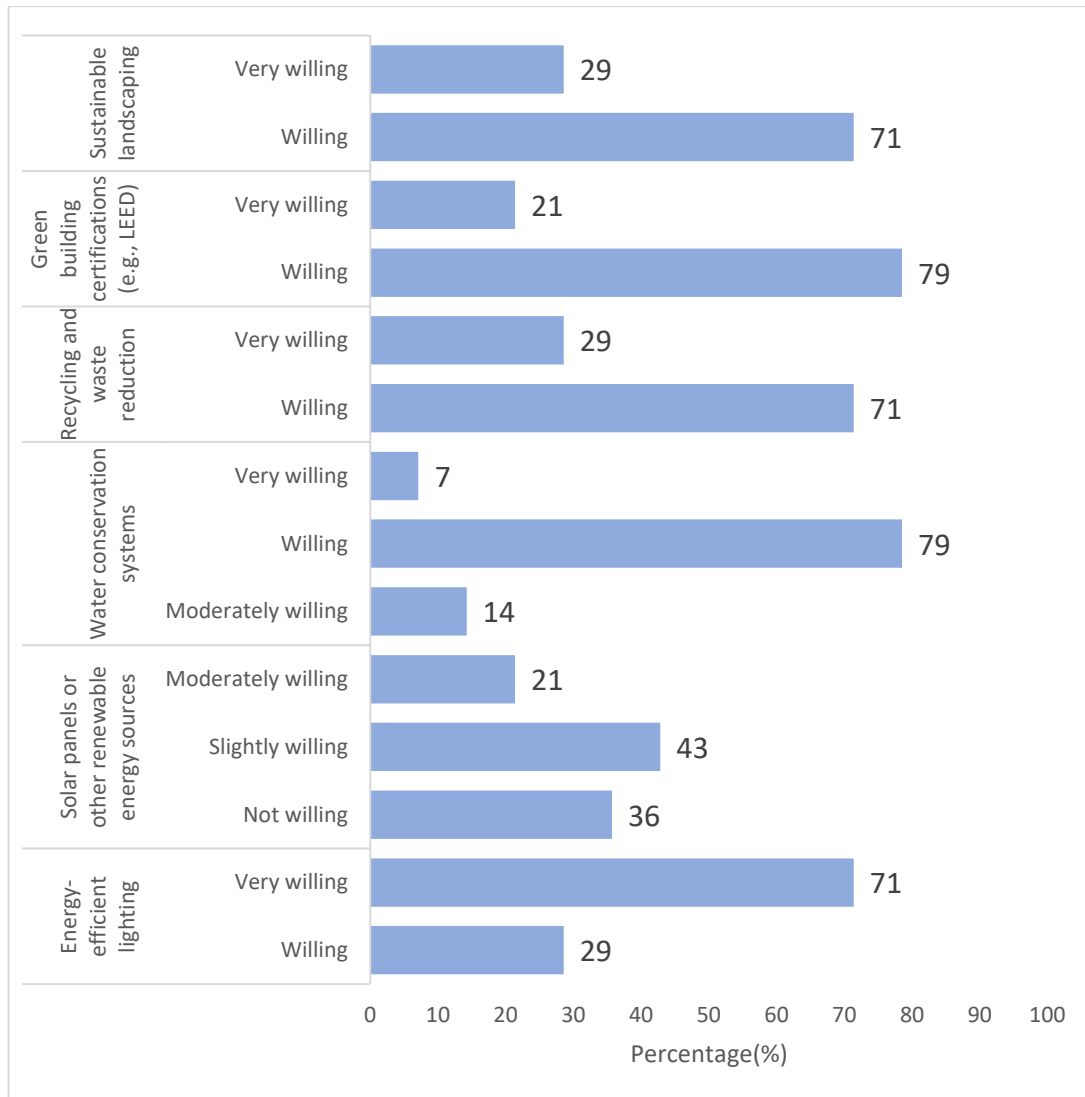


Figure 4.28 Willingness to invest in sustainability initiatives

Figure 4.28 reveals a willingness to invest in sustainability initiatives. The results indicate a strong willingness among respondents to invest in various sustainability initiatives, particularly in energy-efficient lighting, with 71% being very willing and 29% willing. Interest in solar panels or renewable energy sources is lower, with 36% not willing and 43% only slightly willing, reflecting potential cost concerns. Water conservation systems are a priority, with 79% willing and 7% very willing to invest. Recycling and waste reduction and sustainable landscaping both show high willingness levels, with the majority either willing or very willing, highlighting a growing commitment to eco-friendly FM practices.

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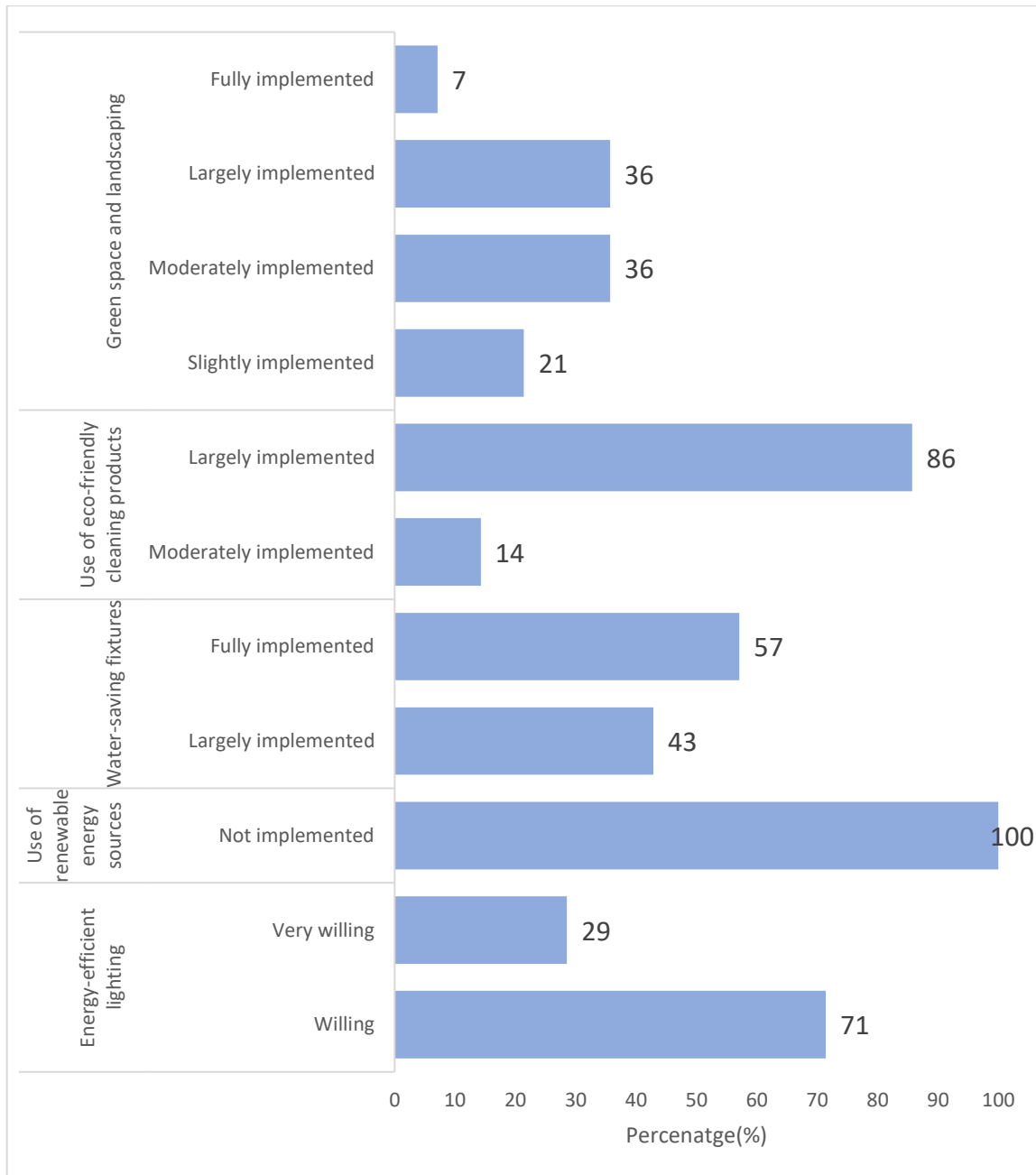


Figure 4.29 Current sustainability practices

Figure 4.29 shows there are varied levels of implementation for sustainability practices within buildings. Energy-efficient lighting is highly prioritized, with 71% willing and 29% very willing to implement it. However, renewable energy sources are not yet utilized, with 100% indicating no implementation, suggesting a gap in green energy adoption. Water-saving fixtures show strong adoption, with 57% fully implemented and 43% largely implemented. Eco-friendly cleaning products are largely adopted at 86%, while green space and landscaping have a more moderate presence, with 36% moderately and largely implemented, showing room for further improvement in sustainable landscaping.

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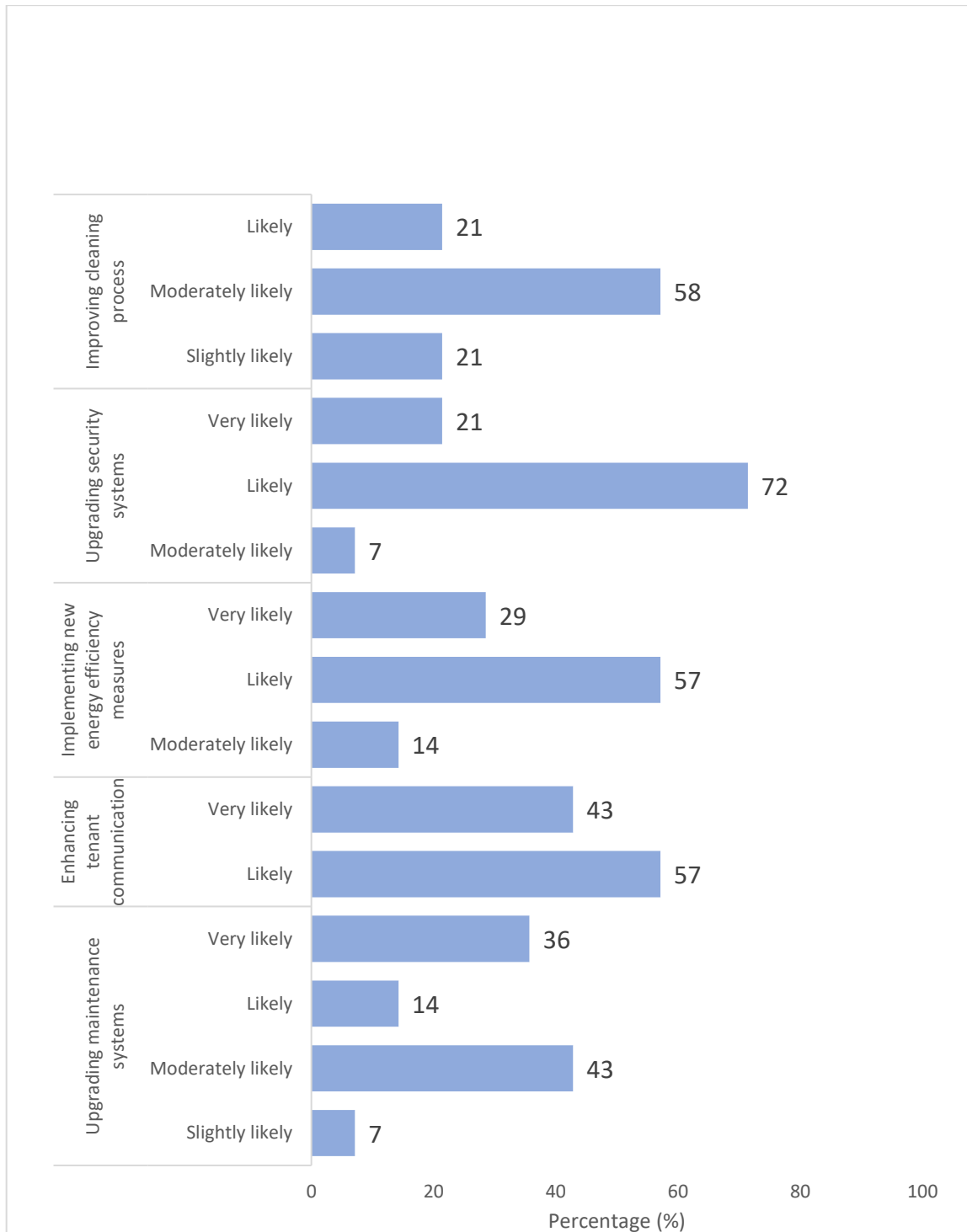


Figure 4.30 Future improvement plans

Figure 4.30 indicates that facility managers are committed to improving systems in the next five years, with a strong focus on tenant communication and security. Enhancing tenant communication has high intent, with 57% likely and 43% very likely to pursue improvements. Upgrading security systems is also a priority, as 71.4% are likely and 21% are very likely to make changes. Implementing new energy efficiency measures shows

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promise, with 57% likely and 29% very likely. However, upgrading maintenance systems is moderately prioritized, with only 36% very likely. Lastly, improving cleaning processes appears less urgent, with the majority 57% only moderately likely to proceed.

The findings of this study highlight several opportunities for improving FM practices in Addis Ababa's HRBs, particularly in areas such as maintenance response, energy efficiency, tenant communication, and technology adoption. Observational and qualitative findings indicate that while maintenance response times are generally effective, there is a need for improved communication between FM teams and tenants. These findings are consistent with Abera (2017), who emphasized the importance of timely maintenance to prevent service disruptions and enhance tenant satisfaction. Similarly, Tsegaye (2022) identified poor tenant communication as a persistent issue in HRBs, underscoring the need for structured engagement strategies. In contrast, international best practices emphasize the integration of digital platforms and mobile applications to streamline communication between FM teams and occupants. For example, Singapore's FM sector widely adopts tenant portals that facilitate real-time reporting of maintenance issues, improving service response times and tenant satisfaction (BCA, 2020). Implementing such solutions in Addis Ababa's HRBs could significantly enhance operational efficiency.

Energy efficiency remains an area with significant potential for improvement. While some energy management strategies are in place, many respondents in this study rated current efforts as only moderately effective. This aligns with Alebachew (2022), who recommended implementing advanced energy management solutions to reduce operational costs and enhance sustainability. In contrast, international FM models prioritize green building technologies such as automated lighting systems, energy-efficient HVAC controls, and solar panel installations. For instance, the LEED certification framework in the United States promotes the use of smart energy solutions, which have proven effective in reducing building energy consumption (USGBC, 2020). Similarly, Germany's energy-efficient building initiatives mandate the use of renewable energy integration, significantly lowering carbon footprints (IFMA, 2022). Adopting such international energy management strategies in Addis Ababa's HRBs could enhance cost savings and environmental sustainability.

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Waste management practices emerged as one of the weakest areas in the current study, with low satisfaction levels among respondents. This finding contradicts Tsegaye (2022), who reported moderate success in some commercial buildings' waste management efforts, indicating inconsistencies in FM performance across different facilities. Globally, cities such as Tokyo and Stockholm implement comprehensive waste segregation and recycling programs within high-rise buildings, ensuring sustainability and compliance with environmental regulations (RICS, 2019). A similar structured waste management system in Addis Ababa, incorporating recycling initiatives and waste-to-energy solutions, could improve efficiency and sustainability in FM operations.

Respondents in the current study also demonstrated a strong interest in adopting new FM technologies, including predictive maintenance tools, energy management systems, and advanced security solutions. This aligns with Tsegaye (2022) and Alebachew (2022), who emphasized the necessity of IT integration to modernize FM practices. Globally, predictive maintenance solutions using IoT sensors and artificial intelligence analytics have been successfully deployed in cities like Dubai and New York to enhance asset reliability and reduce maintenance costs (Dubai Municipality, 2021). Additionally, smart security systems, including biometric access controls and AI-driven surveillance, have been widely implemented in London's HRBs to improve building safety and risk management (IFMA, 2022). The enthusiasm for security technology upgrades in Addis Ababa reflects a growing recognition of the importance of safety in FM operations.

Sustainability initiatives, particularly energy-efficient lighting, water conservation systems, and recycling programs, were also identified as key opportunities for FM improvement. These findings align with Taye (2016), who advocated for eco-friendly FM practices in public and university facilities. However, the lack of renewable energy adoption remains a persistent challenge. This issue mirrors findings from Abera (2017) and Taye (2016), who attributed the slow implementation of green energy solutions to high costs and limited technical expertise. In contrast, international practices demonstrate the benefits of renewable energy adoption in FM. For example, high-rise buildings in Australia increasingly integrate rooftop solar panels and battery storage systems to reduce reliance on conventional power grids (BCA, 2020). Implementing similar solutions in Addis Ababa would require policy support, financial incentives, and training programs to bridge the existing knowledge gap.

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The study also indicates that future FM improvement plans prioritize enhancing tenant communication, upgrading security infrastructure, and implementing energy efficiency measures over the next five years. These priorities align with Alebachew's (2022) recommendations for strategic FM planning and proactive investment. However, the relatively moderate emphasis on maintenance system upgrades and cleaning process improvements suggests a potential underestimation of their long-term impact on FM efficiency. This contrasts with Tsegaye's (2022) argument that equal attention should be given to all FM aspects to ensure a balanced approach. Internationally, FM models such as the TQM approach in Japan emphasize continuous improvement in all FM areas, including routine maintenance and cleaning services, to achieve long-term efficiency and cost-effectiveness (IFMA, 2022). Adopting a more balanced FM strategy in Addis Ababa's HRBs could enhance service delivery and operational sustainability.

In conclusion, the study identifies several opportunities for improving FM practices in Addis Ababa's HRBs, particularly in tenant communication, energy efficiency, waste management, security upgrades, and sustainability initiatives. Comparatively, international best practices highlight the importance of digital transformation, proactive maintenance strategies, and integrated sustainability solutions. Addressing gaps in renewable energy adoption, regulatory enforcement, and structured waste management programs will be critical to realizing these opportunities. By investing in modern FM technologies, enhancing training programs, and strengthening regulatory frameworks, Addis Ababa's HRBs can achieve more efficient and sustainable FM operations.

4.2.5 Section E: Best Practices and Recommendations

This section evaluates the effectiveness of current FM strategies in HRBs. Key areas include preventive and corrective maintenance, energy management, tenant engagement, and staff training. It also explores practices like energy-efficient lighting, smart building technologies, and regulatory compliance improvements, emphasizing their impact on operational efficiency and sustainability. Future focus areas and best practices are recommended to enhance FM and support sustainable urban development.

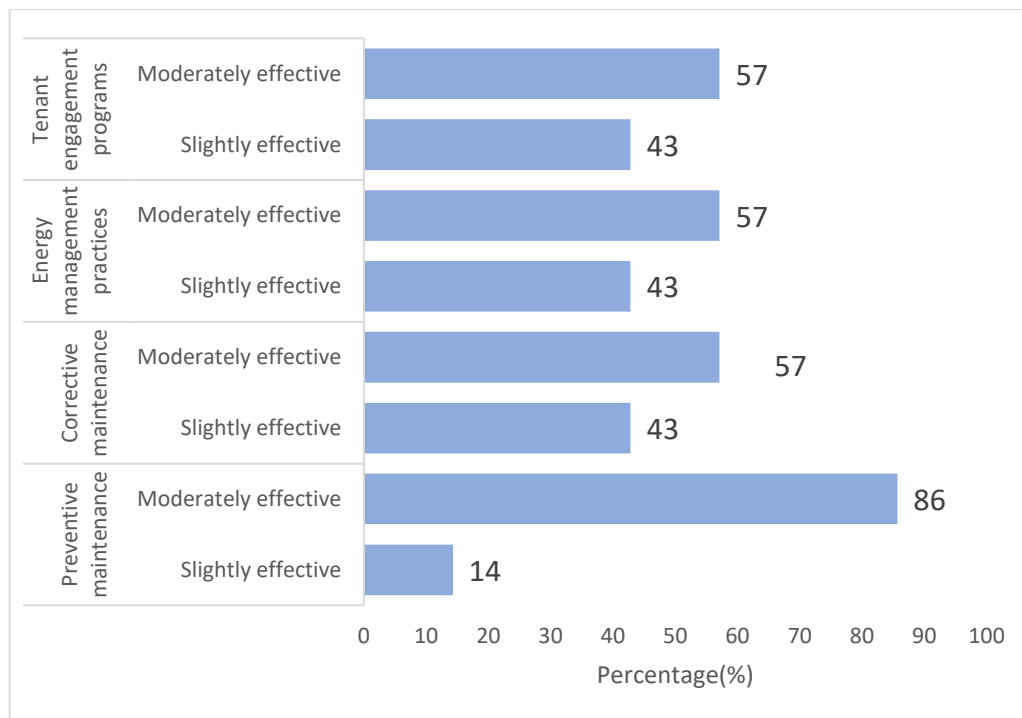


Figure 4.31 Effectiveness of current strategies

Figure 4.31 shows preventive maintenance is rated moderately effective by most respondents, underscoring its importance in proactive building management. Corrective maintenance, energy management, and tenant engagement programs also received moderate ratings, but some respondents viewed these as only slightly effective. This mixed feedback highlights opportunities for improvement, particularly in refining corrective actions and communication strategies. Overall, the analysis points to the need for improved FM practices to optimize outcomes, increase efficiency, and enhance tenant satisfaction in HRBs.

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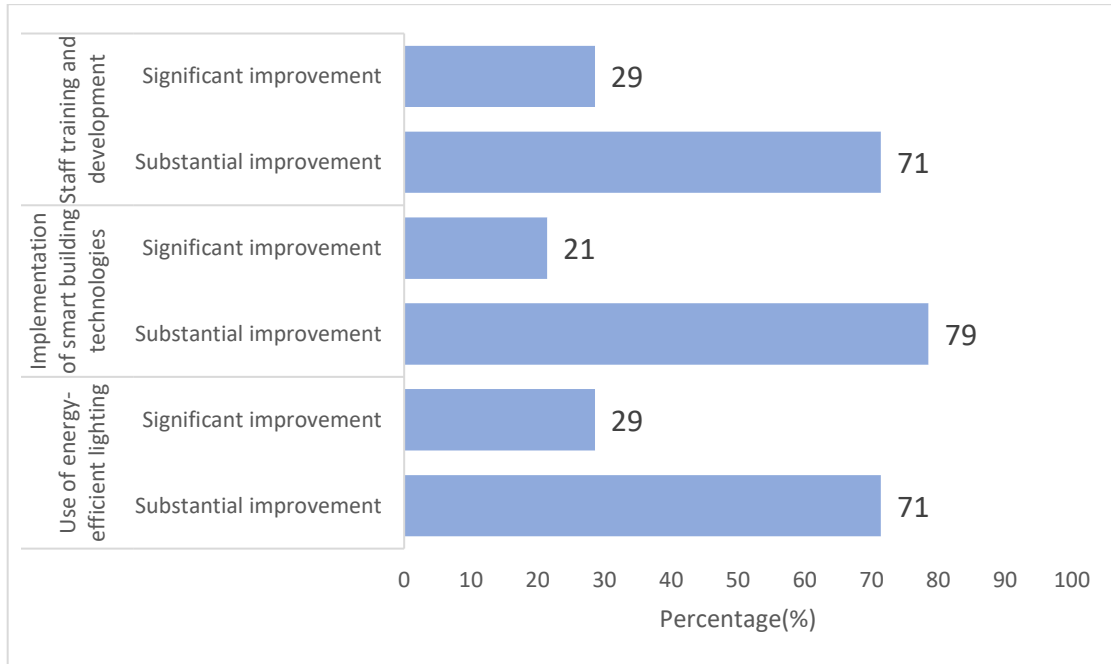


Figure 4.32 Practices on efficiency and sustainability

Figure 4.32 indicates that specific practices have positively impacted operational efficiency and sustainability in HRBs. The use of energy-efficient lighting and staff training and development are both seen as highly beneficial, with most respondents reporting substantial improvement and a notable percentage citing significant improvement. Similarly, the implementation of smart building technologies has shown strong results, with a majority indicating substantial improvement and some noting significant gains. These findings suggest that investments in energy-efficient solutions, technology upgrades, and continuous staff development are crucial strategies that enhance both efficiency and sustainability in FM practices.

Figure 4.33 reveals a high perceived effectiveness of various regulatory improvements in enhancing FM. Respondents view enhanced environmental regulations as particularly beneficial, with most finding them effective. Similarly, more stringent safety standards and improved compliance monitoring are rated as effective by a majority, indicating strong support for these measures. Simplified permitting processes for upgrades received mixed feedback, with a notable portion finding them moderately effective, suggesting some room for improvement in streamlining regulatory requirements. Standardized training requirements for FM are also well regarded, with a high percentage finding them effective, highlighting the importance of consistent staff development.

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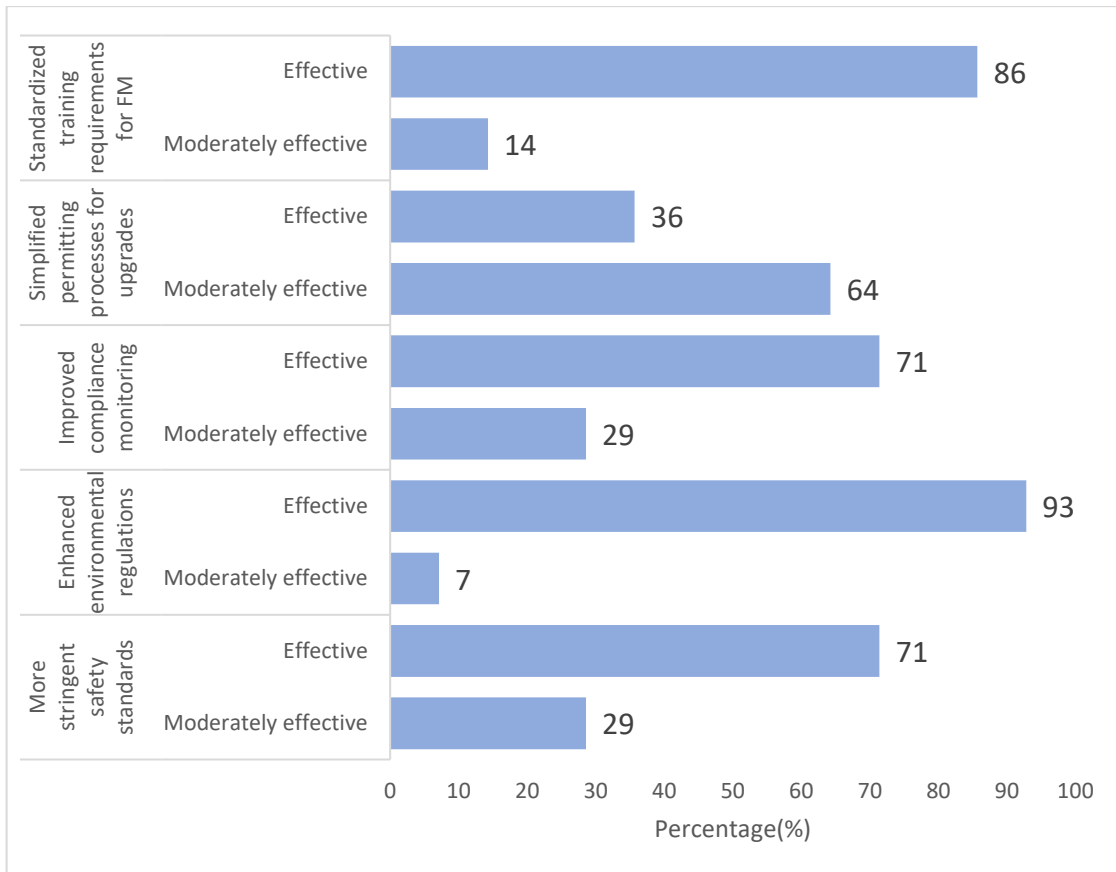


Figure 4.33 Effectiveness of regulatory improvements

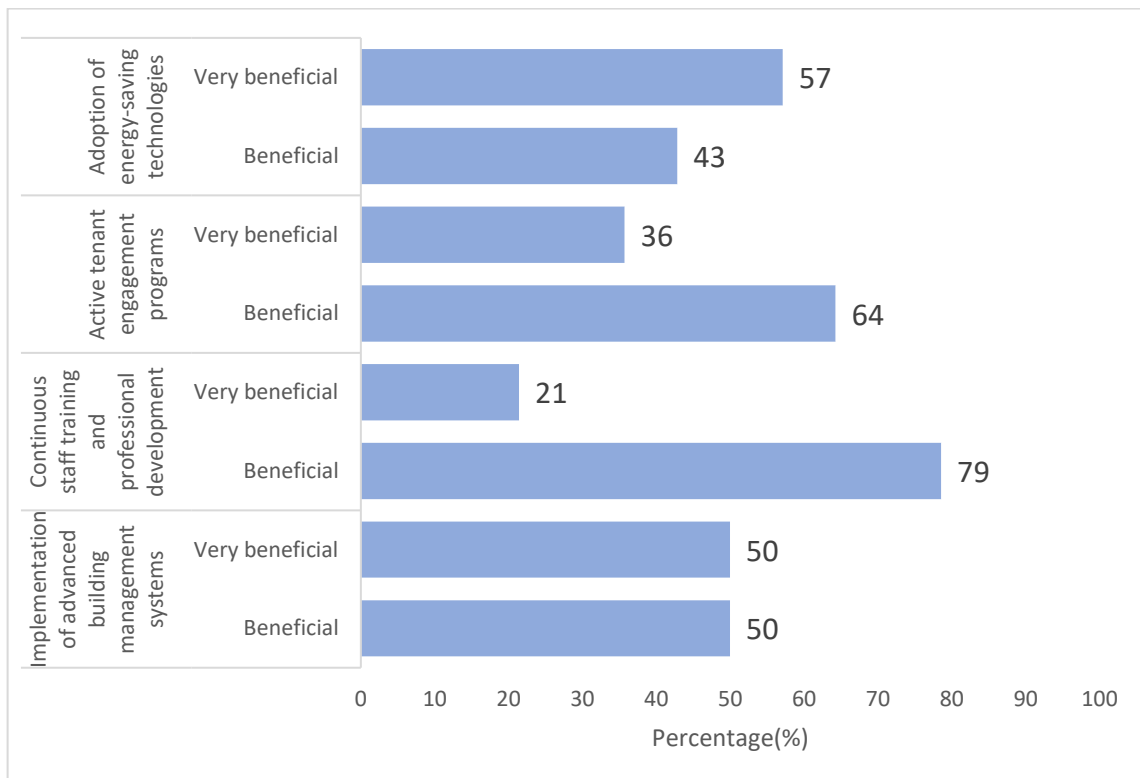


Figure 4.34 Recommendations for best practices

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Figure 4.34 reveals responses suggest strong support for recommended best practices in high-rise building FM. The implementation of advanced building management systems is highly regarded, with all respondents finding it either beneficial or very beneficial, highlighting its potential to streamline operations. Continuous staff training and professional development also receive positive feedback, emphasizing the role of skilled personnel in effective facility management. Active tenant engagement programs are similarly valued, underscoring the importance of communication in tenant satisfaction. Lastly, adopting energy-saving technologies is seen as highly advantageous, with a majority rating it very beneficial, reflecting a commitment to sustainability and cost efficiency in FM.

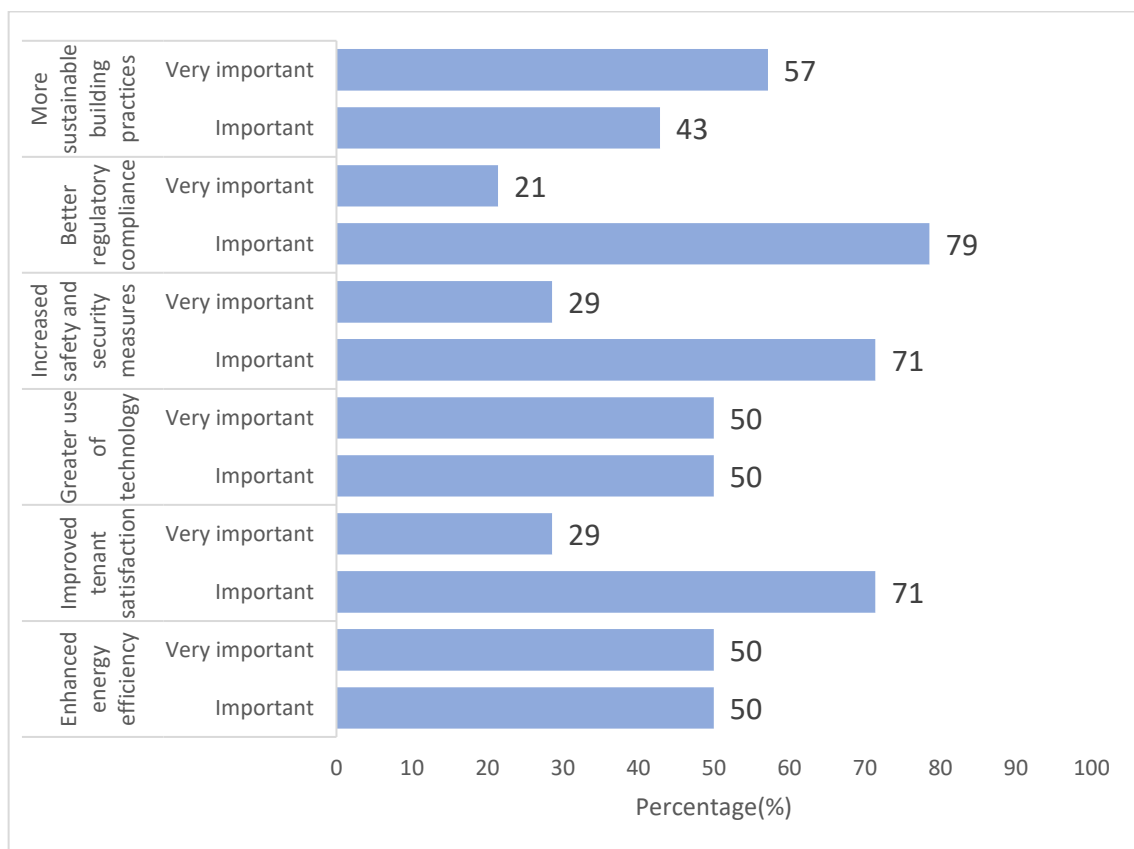


Figure 4.35 Future focus areas for improvement

Figure 4.35 results highlight several priority areas for future improvements in FM for HRBs. Enhanced energy efficiency and greater use of technology are rated equally as important or very important by all respondents, indicating a strong focus on innovation and sustainability. Improved tenant satisfaction and increased safety and security measures are also prioritized, reflecting a commitment to tenant well-being. Better regulatory compliance is another key focus, with the majority rating it as important, ensuring adherence to standards. Finally,

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sustainable building practices are viewed as essential, with a significant emphasis on their importance for long-term environmental responsibility.

The current study highlights the importance of preventive maintenance in ensuring effective FM operations. Preventive maintenance plays a critical role in reducing operational disruptions and minimizing long-term costs, aligning with Alebachew's (2022) findings that emphasized the need for proactive maintenance strategies. However, challenges such as resource constraints and limited technical expertise hinder the effective implementation of preventive maintenance in Addis Ababa's HRBs. Abera (2017) similarly found that many FM teams struggle with timely preventive interventions due to financial and logistical limitations. International best practices, such as those observed in Singapore and Dubai, demonstrate the value of structured maintenance frameworks that integrate predictive analytics and automated scheduling to enhance maintenance efficiency (BCA, 2020). Implementing such strategies in Addis Ababa could optimize resource use and improve service reliability.

Energy-efficient solutions, staff training, and smart building technologies have been identified as essential components for enhancing FM performance. The current study's findings support Taye's (2016) research, which emphasized the significance of energy-efficient lighting systems and professional development programs in university facilities. Similarly, Tsegaye (2022) advocated for the adoption of IT-driven technologies and continuous staff training as a means to modernize FM practices. Internationally, countries such as Germany and the United States have successfully integrated smart energy management systems, such as automated lighting controls and real-time monitoring tools, to optimize energy use in commercial buildings (IFMA, 2022). The gradual adoption of similar technologies in Addis Ababa's HRBs represents a positive step toward aligning with global FM best practices.

Regulatory compliance remains a key area for improvement. The current study found that environmental and safety regulations are increasingly being enforced, leading to perceived improvements in FM standards. This aligns with Abera's (2017) findings, which suggested that regulatory compliance plays a vital role in enhancing building operations when properly implemented. However, the ongoing bureaucratic hurdles associated with permitting processes remain a major challenge, as also reported by Taye (2016) in

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university facilities. International FM models, such as those used in Japan and Sweden, emphasize streamlined regulatory frameworks that facilitate efficient building management while maintaining strict safety and environmental standards (RICS, 2019). Simplifying the permitting process in Addis Ababa could significantly reduce operational delays and improve regulatory adherence in HRBs.

The study also recommends the implementation of advanced BMS, continuous staff training, active tenant engagement programs, and energy-saving technologies as best practices. These recommendations align with Alebachew's (2022) emphasis on leveraging technology and professional development to enhance FM efficiency. The focus on tenant engagement is consistent with Tsegaye's (2022) findings, which underscored the importance of communication in improving tenant satisfaction. Internationally, cities such as London and New York have established tenant-focused FM models that incorporate mobile applications and digital reporting platforms to streamline communication between building occupants and FM teams (IFMA, 2022). Adopting similar digital tools in Addis Ababa's HRBs could enhance tenant satisfaction and operational transparency.

Despite the growing interest in energy-saving technologies, financial and technical barriers remain significant obstacles to widespread adoption. The strong support for sustainability initiatives in the current study contrasts with Abera's (2017) findings, which reported limited implementation of green energy solutions due to high upfront costs and a lack of expertise in public facilities. International examples, such as Australia's commitment to net-zero energy buildings and Denmark's investment in district heating systems, demonstrate the potential for renewable energy integration in FM (BCA, 2020). To overcome local challenges, Addis Ababa's HRBs could benefit from financial incentives, policy support, and specialized training programs to facilitate the transition to sustainable FM practices.

Future priorities for FM improvement in Addis Ababa's HRBs should focus on energy efficiency, technological innovation, tenant satisfaction, safety, and regulatory compliance. These priorities align with the recommendations of other local studies, such as those by Tsegaye (2022) and Alebachew (2022), which emphasized sustainability, innovation, and adherence to standards as critical components of modern FM. The current study's emphasis on sustainable building practices supports Taye's (2016) findings, which

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advocated for eco-friendly solutions to address resource management challenges. Internationally, green building certifications such as LEED and BREEAM have been widely adopted to promote sustainability in FM (USGBC, 2020). Introducing similar certification programs in Addis Ababa could enhance environmental accountability and encourage the adoption of best practices.

In conclusion, the findings of the current study are largely supported by existing local research, particularly regarding the importance of preventive maintenance, energy efficiency, technology adoption, and regulatory compliance. However, challenges such as bureaucratic inefficiencies in permitting, financial constraints in energy-saving technology adoption, and inconsistencies in tenant engagement highlight areas where further improvements are needed. A comprehensive FM strategy that integrates global best practices with localized solutions such as targeted investments, strategic planning, and capacity-building initiatives will be essential to advancing FM in Addis Ababa's HRBs. By adopting an adaptive and forward-thinking approach, the city can create more sustainable, efficient, and tenant-friendly high-rise environments.

4.3 Case Study one: Comparative Evaluation of Facility Management Practices in LEED-Certified and Non-Certified High-Rise Buildings.

4.3.1 Introduction

Introduced in 1998 by the U.S. Green Building Council, Leadership in Energy and Environmental Design has become a global standard for promoting sustainable building practices. It provides detailed guidelines for sustainable design, focusing on five core areas: site development, water efficiency, energy conservation, material usage, and indoor environmental quality. By addressing environmental, economic, and social aspects of sustainability, LEED enhances living conditions, preserves ecological balance, and drives transformative changes in the construction industry (Ji-Myong et al., 2020).

LEED certification has significantly improved FM practices worldwide. For instance, a study in Singapore demonstrated that LEED-certified high-rise buildings reduced energy and water consumption by 30% compared to non-certified buildings through advanced HVAC systems and rainwater harvesting technologies. Similarly, in retrofitted federal buildings in the US, a LEED Gold-certified structure reduced operational costs by 25% through efficient energy monitoring and waste management practices. These examples highlight how LEED certification enhances operational efficiency and sustainability. (Karen et al., 2023; Vidushini et al., 2017). Providing a framework for regions like Addis Ababa to adopt.

Currently, in Addis Ababa, 10 buildings are registered for LEED certification, and only three have achieved certification. The Commercial Bank of Ethiopia headquarters earned LEED Silver certification, featuring smart lighting, energy-efficient HVAC systems, and solar-powered lighting solutions. Additionally, the Horn of Africa Regional Environment Centre and Network Headquarters (HoA-REC&N HQs) became Ethiopia's first LEED Gold-certified building in March 2017. It exemplifies sustainability by achieving 53% energy savings and a 45% reduction in water use through advanced plumbing fixtures. The building also incorporates environmentally friendly materials, with 20% sourced locally, and provides 95% of its occupied spaces with access to natural light, highlighting its commitment to sustainable practices. Furthermore, the NEC Addis Ababa building received a Green Certificate in 2012 (cscec.org; gbig.org; hoarec.org).

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Despite these achievements, Addis Ababa faces significant challenges in adopting green building practices. As Ethiopia's rapidly urbanizing capital, the city has experienced a surge in high-rise construction, straining its infrastructure and resources. Water scarcity remains a critical issue, with inconsistent access to clean water, while frequent energy shortages underline the importance of efficient energy management. Additionally, limited public awareness of sustainable building practices, including LEED certification, has slowed the widespread adoption of green FM practices.

Africa lags behind other regions, such as the Middle East, in adopting LEED certifications, with South Africa leading the continent at over 200 certified projects as of 2023, followed by Kenya and Ghana with progress in cities like Nairobi and Accra. Ethiopia, however, has only three LEED-certified buildings, highlighting the need for policy support, incentives, and awareness campaigns to promote green FM practices in Addis Ababa. Historically, Egypt dominated LEED certifications in Africa between 2000 and 2010, accounting for nearly 50% of certified projects, with South Africa at 10%. In the following decade, South Africa took the lead, with Egypt close behind and Kenya in a distant third (Itd in-depth.org).

High-rise buildings have distinct operational requirements, making sophisticated FM practices essential, particularly in densely populated urban areas. LEED certification addresses these needs by providing standards tailored to vertical infrastructure. Measures such as energy-efficient HVAC systems, streamlined water management practices, and waste recycling programs not only enhance sustainability but also improve operational efficiency and occupant satisfaction. For instance, LEED-certified buildings in developed countries integrate advanced energy tracking systems that significantly reduce resource wastage (Liu et al., 2022).

LEED certification itself has evolved since its inception. Initially introduced as version 1.0, the framework expanded over time to assess sustainability across diverse building types and operations. LEED NC V2.0, launched in 2001, was followed by V2.2 in 2005 and a major update in 2009 that included design, construction, and operational aspects. LEED V4, introduced in 2013, remains the current standard. Buildings are certified as Certified, Silver, Gold, or Platinum based on points across six categories: Sustainable Sites, Energy, Water Efficiency, Indoor Quality, Materials, and Innovation (Ali et al., 2019).

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The CBE headquarters in Addis Ababa, spanning 160,000 square meters and rising 46 stories as East Africa's tallest building, is a prominent example of LEED Silver certification. Its diamond-inspired design incorporates advanced features such as solar lighting, sensors, an air-source heat pump, and the precision offered by BIM (cscec.org; Kassa, 2015). This building serves as a critical sample for this study, offering valuable insights into the application and impact of LEED certification on FM practices in Addis Ababa.

By examining the comparative performance of LEED-certified and non-certified HRBs, this study aims to showcase the tangible benefits of sustainable FM practices in Addis Ababa's unique context and explore pathways for broader adoption of green building strategies.

4.3.2 Objectives and Scope of the Study

The study compares LEED-certified and non-certified HRBs in Addis Ababa across six FM categories: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Regional Priority, and Overall FM. It evaluates sustainability, operational efficiency, and adherence to local challenges. Highlighting HRBs' environmental impact through energy use, water consumption, and waste, the research emphasizes sustainability. By analyzing LEED-certified buildings, designed to meet global standards, alongside non-certified ones, it assesses the tangible benefits of green building practices in Addis Ababa's urban context.

4.3.3 Methodology

This case study utilized structured rating questionnaires detailed in Appendix B, covering six categories: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Regional Priority, and Overall FM. A five-point scale assessed quality and effectiveness:

The five-point scale was chosen for its ability to provide nuanced yet straightforward evaluations of FM performance. This scale allows for clear differentiation between varying levels of quality and effectiveness, ranging from "Poor" to "Excellent." It facilitates detailed comparisons across categories, enabling the identification of specific strengths

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and weaknesses in FM practices. The scale's simplicity ensures consistency in responses while offering sufficient granularity for meaningful analysis.

1. **Poor:** Rarely performed or of very low quality.
2. **Fair:** Inconsistently performed with limited effort.
3. **Satisfactory:** Meets basic expectations but needs improvement.
4. **Good:** Consistently well-executed with minor issues.
5. **Excellent:** Performed exceptionally, exceeding standards.

Two HRBs in Addis Ababa were chosen as representative examples for this study: one LEED Silver-certified building (the Commercial Bank of Ethiopia headquarters) and one non-certified building. The LEED-certified building was selected to demonstrate how global green building standards can enhance FM practices, featuring advanced systems such as smart lighting, energy-efficient HVAC systems, and renewable energy integration. The non-certified building, with comparable structural and operational characteristics but lacking a formal certification, was selected to highlight gaps in FM practices and explore opportunities for improvement. These buildings represent a cross-section of Addis Ababa's HRBs, reflecting varying levels of adoption of sustainable and structured FM practices.

4.3.4 Result and Findings

The study compares FM practices in two high-rise buildings in Addis Ababa: the LEED Silver-certified Commercial Bank of Ethiopia headquarters building (4B+46) and a non-certified building (4B+20). Results indicate that the LEED-certified building outperformed the non-certified one in all categories, reflecting superior sustainability and operational efficiency.

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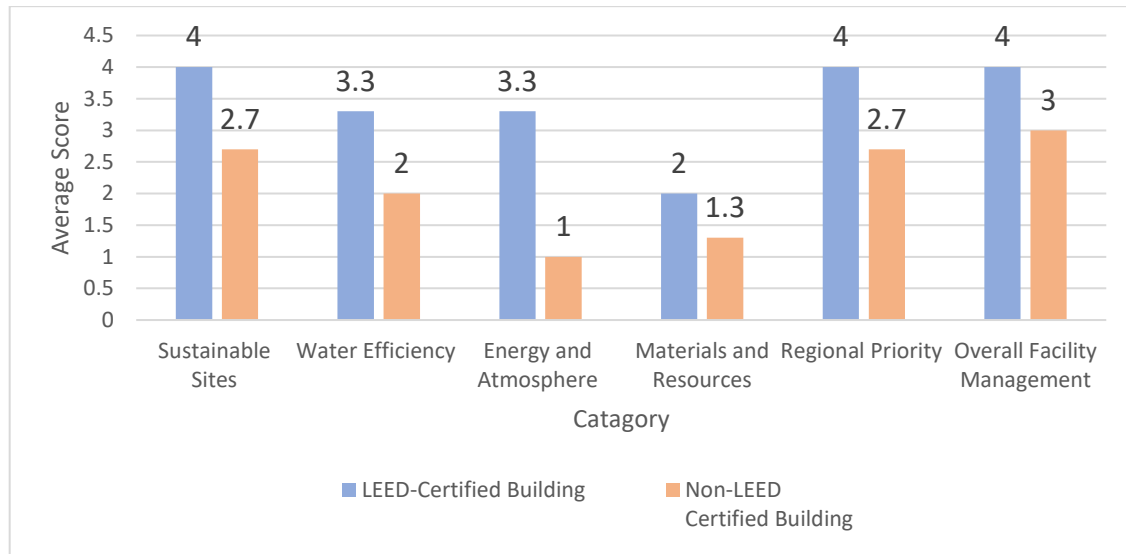


Figure 4.36 Comparison of facility management practice by category

Key Findings and Analysis

- 1. Energy and Water Efficiency:** The LEED-certified building scored significantly higher in energy and water efficiency (3.3 vs. 1 for energy and 3.3 vs. 2 for water). This can be attributed to advanced FM practices and technologies integrated into the CBE headquarters, such as energy-efficient HVAC systems, solar-powered lighting, and water-efficient fixtures. These technologies align with LEED standards that prioritize resource optimization, resulting in lower utility costs and reduced environmental impact. The non-certified building, lacking these advanced systems, relies on traditional infrastructure, contributing to lower scores. In Addis Ababa, where water scarcity and frequent energy shortages are common, the benefits of these technologies are particularly impactful. By integrating efficient systems, the LEED-certified building mitigates the socio-economic challenges associated with inconsistent utilities, while the non-certified building struggles to achieve comparable performance.
- 2. Sustainable Sites and Regional Priority:** The LEED-certified building also outperformed in Sustainable Sites (4 vs. 2.7) and Regional Priority (4 vs. 2.7). These higher scores reflect the building's adherence to site-specific sustainability measures, such as minimizing environmental disruption during construction and incorporating features like green spaces and renewable energy systems. The narrower gap in regional priority scores suggests that both buildings face shared challenges, such as

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water and energy resource constraints, as well as opportunities to implement localized sustainable FM practices. The overlap also indicates that even non-certified buildings adopt some basic sustainability measures due to increasing awareness and urban pressures.

- 3. Overall Facility Management and Shared Challenges:** The LEED-certified building scored higher in overall facility management (4 vs. 3), demonstrating its structured FM practices and proactive strategies. However, the narrower gap here suggests that both buildings contend with similar socio-economic challenges, such as limited budgets and regulatory inconsistencies in Addis Ababa. Despite the non-certified building's lower scores, its FM team likely employs practical measures to address tenant needs, reflecting efforts to maintain functionality in a resource-constrained environment.

- 4. Materials and Resources:** The most significant disparity in facility management practices emerged in Materials and Resources, where the LEED-certified building scored 2.0, compared to 1.3 for the non-certified building. This gap is primarily driven by the LEED-certified building's adherence to sustainability standards, which mandate the use of environmentally friendly, locally sourced, and recycled materials. In contrast, the non-certified building relies on conventional construction materials, often selected based on cost rather than sustainability criteria.

4.3.5 Conclusion

The study concludes that LEED-certified high-rise buildings in Addis Ababa outperform non-LEED-certified buildings in sustainability, operational efficiency, and occupant satisfaction. This demonstrates the effectiveness of green building certifications in improving FM practices. LEED-certified buildings achieve higher efficiency by integrating advanced technologies and structured FM systems, particularly in energy and water management. In contrast, non-certified buildings lack such systems, resulting in inconsistent performance and lower occupant satisfaction.

However, the findings also highlight shared challenges that affect both certified and non-certified buildings. Addis Ababa's unique urban and environmental factors, such as water scarcity, energy shortages, and regulatory inconsistencies, demand tailored FM solutions.

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The narrower gaps in regional priority and overall FM scores indicate these shared challenges, underscoring the need for adaptive strategies to sustain long-term performance across all building types.

To address these gaps, non-certified buildings can adopt elements of LEED-certified practices, such as implementing water-saving fixtures, energy optimization measures, and localized sustainability strategies. Additionally, citywide initiatives to improve resource efficiency, promote regulatory alignment, and enhance awareness of sustainable FM practices are essential. Such efforts would not only enhance FM performance but also align with Addis Ababa's broader goals for sustainable urban development.

4.3.6 Recommendations

Based on the findings, the following recommendations are proposed to improve FM practices in high-rise buildings in Addis Ababa:

1. For Non-LEED-Certified Buildings:

Non-LEED-certified buildings should adopt structured FM practices by implementing elements of LEED standards in phased steps to improve sustainability and operational efficiency. Specific recommendations include:

- **Water and Energy Monitoring Systems:** Begin with the phased adoption of energy and water monitoring systems to track and optimize resource use. Start with affordable solutions, scaling up to more advanced systems as budgets allow.
- **Waste Segregation Programs:** Implement waste segregation and recycling initiatives to reduce landfill contributions and support environmental sustainability. Begin with pilot programs to identify the most effective methods for each facility.
- **HVAC Maintenance and Renewable Energy Integration:** Invest in modern HVAC systems and explore renewable energy options, such as solar panels, to reduce energy costs and emissions. Start with small-scale renewable energy projects before scaling.

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- **Innovative Management Practices:** Incorporate practices from LEED-certified buildings, such as preventive maintenance schedules, tenant engagement, and sustainability training for FM teams.

2. For LEED-Certified Buildings:

LEED-certified buildings should continue enhancing performance by leveraging advanced technologies and engaging occupants. Specific recommendations include:

- **Automated Energy Management Systems:** Implement advanced energy monitoring and control systems to track, analyze, and optimize energy consumption in real-time. Utilizing smart meters, programmable thermostats, and energy-efficient HVAC controls can help reduce operational costs and improve overall building efficiency.
- **Tenant-Focused Mobile Apps:** Develop mobile applications for tenants to report issues, monitor building resource usage, and access sustainability tips. These apps can enhance communication, tenant satisfaction, and engagement.
- **Occupant Education Programs:** Conduct regular workshops or digital campaigns to educate occupants on the building's sustainability features and their role in maintaining high standards.
- **Continuous Monitoring and Adaptation:** Regularly review FM practices to adapt to evolving challenges, particularly in areas like water scarcity and energy efficiency.

3. Policy and Framework Development: To promote green building practices citywide, policies and frameworks need to:

- **Introduce Incentives:** Provide tax benefits, grants, or subsidies to encourage developers to adopt LEED certifications.
- **Conduct Awareness Campaigns:** Educate stakeholders, including property owners, developers, and the general public, on the benefits of green building certifications.

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- **Develop Localized FM Frameworks:** Create FM guidelines tailored to Addis Ababa's urban and environmental conditions, with a focus on efficient water and energy resource management.
- **Establish a Building Facility Management Code:** Develop and enforce a standardized FM Code, outlining minimum maintenance, safety, energy efficiency, and sustainability requirements for high-rise buildings. This code should include regulations for HVAC systems, fire safety, waste management, and water conservation, ensuring a structured and legally binding approach to FM.
- **Mandate FM Standards for New and Existing Buildings:** Implement FM compliance requirements for both new developments and existing HRBs, ensuring adherence to best practices in sustainability, maintenance, and tenant safety.

4. Training and Capacity Building: To strengthen FM teams and improve practices:

- **Sustainable FM Training:** Equip FM professionals with skills in modern, sustainable technologies such as BIM, CAFM, and AI.
- **Partnership Development:** Establish collaborations between property owners, government agencies, and environmental organizations to share resources and best practices.
- **Knowledge Exchange Programs:** Facilitate exchange programs with countries leading in LEED adoption, such as South Africa or Kenya, to learn effective strategies.

5. Future Research: Further studies should focus on:

- **Cost-Benefit Analyses:** Evaluate the financial and operational benefits of LEED certifications to encourage wider adoption.
- **Scaling Innovations:** Investigate methods to scale green FM practices in non-certified buildings, particularly in resource-constrained urban areas like Addis Ababa.
- **Localized Solutions:** Explore the integration of sustainable practices tailored to the socio-economic and infrastructural challenges of Addis Ababa.

4.4 Case Study Two: Comparative Evaluation of Facility Management Practices in Outsourcing FM and In-House FM High-Rise Buildings.

4.4.1 Introduction

This case study evaluates FM practices in high-rise buildings comparing outsourcing and in-house approaches to understand their effectiveness in Addis Ababa. As the city undergoes rapid urbanization, efficient FM is essential for maintaining building functionality, promoting sustainability, and ensuring occupant satisfaction.

Outsourcing FM provides access to specialized expertise, scalability, and operational flexibility. This model has been effectively adopted in cities like Nairobi, Lagos, and Accra. For example, in Nairobi, outsourcing FM has enhanced operational efficiency in buildings by leveraging energy management systems and streamlined maintenance processes. Similarly, in Lagos, established FM firms ensure high service standards and tenant satisfaction. However, outsourcing can pose challenges such as reduced managerial control, over-reliance on external providers, and inconsistent service quality, as noted in Accra (Dubem & Clinton, 2019; Nicholas, 2009; Oliver et al., 2020).

Conversely, in-house FM offers direct oversight and tailored solutions, enabling building managers to respond more effectively to tenant needs. This model is commonly used in smaller HRBs in cities like Nairobi, where closer communication with tenants ensures personalized service. However, in-house FM often faces challenges such as limited resources, insufficient training, and a lack of advanced technologies.

Addis Ababa's FM practices are influenced by unique socio-economic and infrastructural conditions. According to Tsegaye's (2022) study, FM companies like Commercial Nominees, Baladera Property Management, and ROC Spaces encounter challenges such as a lack of trained FM professionals, reliance on manual processes, and limited IT integration. Additionally, water scarcity, frequent energy shortages, and regulatory gaps exacerbate these issues, hindering efficient FM practices. For example, Baladera Property Management struggles with unplanned maintenance schedules due to limited access to specialized resources, while Commercial Nominees are in the process of acquiring IT systems to improve service delivery. Despite these challenges, there is a growing demand

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for FM services in Addis Ababa, particularly among private property owners and the diaspora community, as highlighted in Tsegaye's 2022 study. This increasing demand underscores the importance of improving FM practices in HRBs to meet the city's evolving needs.

By examining the strengths and weaknesses of outsourcing and in-house FM models, this study aims to identify strategies for enhancing FM practices in Addis Ababa's HRBs. Drawing lessons from cities like Nairobi and Accra, alongside insights from local FM companies such as Baladera and ROC Spaces, the study explores opportunities for improving service quality and operational efficiency in the city's rapidly developing urban environment.

4.4.2 Objective and Scope of the Study

For the study, two HRBs were selected to represent distinct FM models. The first building (2B+G+21) employs an in-House FM model, where all FM activities are managed internally by the building's staff. This building was chosen to provide insights into the strengths, weaknesses, and unique characteristics of self-managed FM practices. The second building (2B+G+16) follows an outsourcing FM model, where FM services are handled by an external service provider. This approach highlights the operational dynamics, challenges, and potential advantages of outsourcing FM. By selecting these two buildings, the study ensures a balanced comparison between the two FM models in a real-world context. Structurally, both buildings share similar features, such as a basement and multi-story design (2B+G+21 and 2B+G+16), which makes them comparable in terms of operational needs and FM requirements. These include essential systems like elevators, HVAC systems, and energy consumption demands. However, the slight difference in their height offers an additional dimension for analysis, allowing the study to explore whether the size of a building influences FM practices under each management model.

The selected HRBs also face common FM challenges, which are typical of high-rise buildings in Addis Ababa. These include issues related to energy management, regular maintenance, security, and cleaning. By focusing on these buildings, the study aims to identify these challenges in detail and propose practical recommendations for improving

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FM practices. Furthermore, these findings can serve as a reference for similar HRBs in the city, contributing to the enhancement of FM strategies in Addis Ababa.

4.4.3 Methodology

The study investigates the two models in terms of operational efficiency, cost-effectiveness, and service quality, aiming to identify best practices for optimizing FM in Addis Ababa’s HRBs. Data collection is conducted using structured questionnaires detailed in Appendix C, which assess key FM aspects, including operational efficiency, cost management, resource allocation, tenant satisfaction, energy management, regulatory compliance, communication, engagement, scalability, and flexibility. Respondents rate each indicator on a five-point scale, with 1 representing poor performance and 5 indicating excellent performance. By analyzing these ratings, the study provides actionable insights into FM strategies, helping facility managers and policymakers improve practices to meet the demands of a rapidly growing urban environment.

4.4.4 Result and Findings

This section presents the results and findings of the study. Two HRBs in the central business district were selected for the analysis one that applies in-house FM practices (2B+G+21) and the other that follows outsourcing FM practices (2B+G+16).

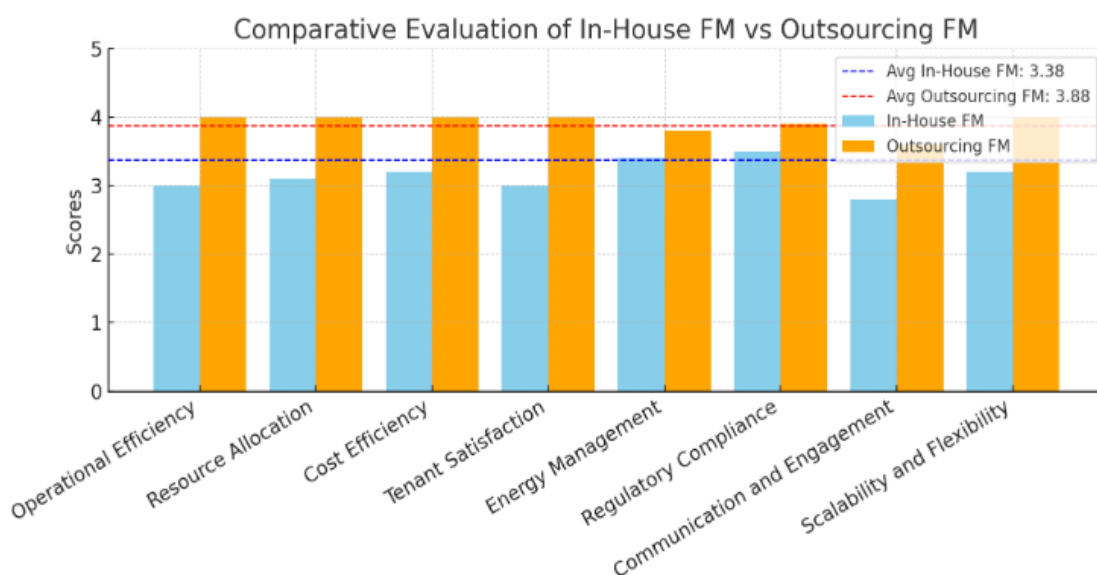


Figure 4.37 Comparison of FM practice by In-house and outsourcing

4.4.5 Analysis and Discussion

The comparative evaluation of in-house FM and outsourcing FM shows clear differences in their effectiveness:

A. Average Scores:

- Outsourcing FM: 3.88
- In-House FM: 3.38

B. Key Findings:

- Outsourcing FM outperforms in-house FM in operational efficiency, resource allocation, cost efficiency, tenant satisfaction, and scalability and flexibility.
- Both methods perform equally well in energy management and regulatory compliance.
- In-house FM excels in communication and engagement.

C. Outsourcing FM Performance

The study indicates that outsourcing FM scored higher (3.88 vs. 3.38) in operational efficiency, resource allocation, cost efficiency, tenant satisfaction, scalability, and flexibility. These results align with findings from Tsegaye's 2022 analysis of Baladera

Property Management and ROC Spaces, where outsourcing models demonstrated advantages in managing large-scale properties and providing advanced services, such as IT-supported security systems (Baladera) and defect identification (ROC Spaces).

However, Tsegaye's (2022) study also highlights challenges specific to outsourcing, including limited awareness of FM services among property owners and dependency on external service providers. These align with the current study's findings, where outsourcing FM occasionally suffers from reduced managerial control. Both studies support the notion that outsourcing FM can improve efficiency and scalability but emphasize the need for trust-building and better awareness campaigns to address owner concerns about reliability and quality.

D. In-House FM Performance

The in-house FM model excelled in communication and engagement, consistent with Tsegaye's (2022) findings on Commercial Nominees, a state-owned company that prioritizes direct interactions with tenants and owners. Commercial Nominees' in-house approach allows for customized service delivery and reliability, particularly for government-owned and diaspora-focused properties.

However, Tsegaye's (2022) study highlights significant gaps in in-house FM practices, such as the lack of qualified FM professionals and reliance on manual processes. This mirrors the current study's findings that in-house FM lags in resource allocation and operational efficiency compared to outsourcing FM. Both studies agree that in-house FM benefits from closer tenant relationships but struggles with efficiency due to resource and skill constraints.

E. Shared Challenges in Energy Management and Regulatory Compliance

The current study found that both FM models performed equally well in energy management and regulatory compliance, reflecting shared challenges in Addis Ababa's FM industry. Tsegaye's (2022) study supports this by emphasizing issues such as frequent energy shortages, limited IT integration, and weak regulatory frameworks affecting all FM firms. Both studies highlight the need for government-led initiatives to standardize FM practices, improve energy management, and enforce regulations across all FM models.

F. Opportunities for Improvement

The current study identifies opportunities for non-certified buildings to adopt structured FM practices, such as phased energy monitoring and waste segregation programs, to enhance performance. Tsegaye's (2022) study echoes this recommendation, particularly for Baladera and Commercial Nominees, which lack IT systems and advanced training programs. For certified buildings, the current study suggests leveraging advanced tools like AI-based energy management and tenant-focused mobile apps to further improve performance. Tsegaye's analysis of ROC Spaces supports this approach, as the company employs IT-supported systems for security and defect identification, albeit in a limited capacity. Both studies advocate for integrating advanced technologies and capacity-building initiatives to elevate FM practices in Addis Ababa.

4.4.6 Conclusion

The findings from the current study align closely with those of Tsegaye's (2022) research, supporting the notion that outsourcing FM offers superior operational efficiency and scalability, while in-house FM excels in communication and tenant engagement. Both studies emphasize the importance of addressing shared challenges, such as energy shortages, limited IT integration, and a lack of qualified FM professionals.

4.4.7 Recommendations

A. For Outsourcing FM:

- Expand IT integration to enhance operational efficiency and service quality.
- Develop trust-building campaigns to address owner concerns about reliability and accountability.

B. For In-House FM:

- Invest in professional training to improve skill levels and modernize operations.
- Adopt advanced technologies to enhance resource allocation and timeliness of responses.

C. For Both Models:

- Collaborate with government bodies to establish national FM standards and promote sustainability initiatives.

D. Hybrid Model Approach:

- Consider adopting a hybrid FM model that combines the strengths of outsourcing (efficiency, scalability) and in-house FM (customized service and engagement) to achieve optimal results.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

To conclude this study, the final chapter synthesizes the key findings, underscores the implications for facility management practices in high-rise buildings, and provides actionable recommendations to address the identified challenges and opportunities. Based on this study, the following conclusions were drawn:

- 1.** This study provides an in-depth assessment of FM practices in high-rise buildings within Addis Ababa's CBD, revealing significant challenges, emerging opportunities, and areas for improvement. While FM is still in its early stages of development, findings indicate a heavy reliance on in-house FM services, with limited outsourcing, affecting scalability and cost-efficiency. Although facility managers possess relevant qualifications, their expertise varies due to diverse academic backgrounds, and small, specialized FM teams often struggle to meet the complex demands of HRBs.
- 2.** One of the major findings is that FM in the CBD remains reactive rather than preventive, with maintenance primarily driven by tenant complaints. Preventive maintenance is limited, largely due to resource constraints and budgetary limitations, which also affect technological adoption. While some buildings utilize BMS, automated controls, and advanced security systems, others face financial barriers that prevent full integration. Energy efficiency efforts are inconsistent, with LED lighting being the most common initiative but limited investment in efficient HVAC systems, renewable energy, or water conservation measures.
- 3.** Operational efficiency, financial constraints, tenant satisfaction, and regulatory compliance emerge as key FM challenges. While equipment and plumbing maintenance are relatively well managed, issues persist in electrical stability, HVAC performance, and elevator reliability. Budget limitations negatively impact service quality, while moderate tenant satisfaction in areas such as parking availability and vertical transportation highlights areas needing further improvement. Regulatory compliance is a pressing concern, especially regarding fire safety, environmental standards, accessibility, and energy efficiency, all requiring policy reinforcement and investment in training and monitoring mechanisms.

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4. Despite these challenges, the study identifies several opportunities for improving FM in Addis Ababa's HRBs. Transitioning from corrective to preventive maintenance can enhance building system reliability, minimize downtime, and reduce long-term operational costs. Expanding energy-efficient initiatives such as upgrading HVAC systems, improving insulation, and integrating renewable energy can lower utility costs and promote sustainability. Leveraging smart technologies, such as predictive maintenance tools and IoT-based monitoring, can optimize FM operations. Additionally, improving tenant engagement through interactive feedback mechanisms can foster better relationships between occupants and FM teams, enhancing service quality and satisfaction.
5. To align FM practices in Addis Ababa's HRBs with global best practices, key strategies should focus on enhancing preventive maintenance frameworks, increasing investment in advanced FM technologies, strengthening tenant communication mechanisms, and ensuring compliance with safety and sustainability regulations. Addressing these gaps will require coordinated efforts from policymakers, developers, and facility managers, as well as a shift toward long-term, sustainable FM planning. By implementing targeted improvements, the efficiency, reliability, and sustainability of FM in Addis Ababa's high-rise sector can be significantly enhanced.

5.2 Recommendations

To address the challenges and opportunities in FM for HRBs in Addis Ababa's CBD, the following short-term and long-term comprehensive recommendations are proposed:

A. Establishing a Building Facility Management Code

Short-Term Actions:

1. **Develop Regulatory Standards:** Collaborate with policymakers, industry experts, and FM practitioners to draft and introduce a standardized FM Code for HRBs in Addis Ababa, covering fire safety, energy efficiency, waste management, water conservation, and preventive maintenance.
2. **Compliance and Training Programs:** Implement mandatory training programs for FM professionals, ensuring they are equipped to comply with new standards and regulatory requirements.
3. **Facility Management Certification:** Introduce certification programs for FM professionals, aligned with international standards (e.g., ISO 41001, LEED, and BREEAM), ensuring consistency in FM practices across HRBs.

Long-Term Actions:

1. **Legislative Framework for FM Code Implementation:** Work with government agencies to enforce the FM Code as a legal requirement for HRBs, with periodic reviews and updates based on industry advancements.
2. **FM Code Compliance Audits:** Establish an FM regulatory body to conduct regular compliance audits, ensuring HRBs adhere to fire safety, sustainability, and maintenance protocols.
3. **Incentives for Compliance:** Introduce tax incentives, subsidies, or financial assistance for property owners who implement sustainable FM strategies and meet compliance standards.

B. Addressing Key Facility Management Challenges

Short-Term Actions:

1. **Improved Resource Allocation:** Increase staffing levels in FM teams, provide specialized training in energy efficiency and maintenance best practices, and implement multi-site FM models to optimize resource utilization.

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2. **Strengthening Tenant Engagement:** Establish digital feedback systems and transparent communication channels to address tenant concerns efficiently, particularly in elevator management, parking, and security.
3. **Regulatory Enforcement:** Enforce strict compliance with accessibility and environmental regulations in HRBs through policy revisions and inspections.

Long-Term Actions:

1. **Technological Integration for FM Efficiency:** Promote the adoption of BMS, predictive maintenance tools, and IoT-based monitoring solutions, ensuring technology-driven efficiency in HRBs.
2. **Sustainable Waste Management and Water Conservation:** Introduce waste recycling programs, smart water management technologies, and green landscaping policies to reduce environmental impact.

C. Enhancing Energy Efficiency and Sustainability

Short-Term Actions:

1. **Cost-Effective Energy Solutions:** Implement LED lighting, energy-efficient HVAC systems, and water-saving technologies as baseline sustainability measures in HRBs.
2. **Green Building Pilot Projects:** Launch pilot renewable energy initiatives, such as solar panel installations and rainwater harvesting systems, to assess feasibility and return on investment.

Long-Term Actions:

1. **Mandatory Energy Audits for HRBs:** Establish a regulatory framework requiring periodic energy audits, ensuring HRBs comply with national energy conservation goals.
2. **Renewable Energy Incentives:** Develop government-backed incentives for property owners adopting solar energy, smart grid systems, and sustainable building materials.

D. Strengthening Professional Development and FM Outsourcing

Short-Term Actions:

1. **Training and Knowledge Enhancement:** Conduct capacity-building programs focusing on preventive maintenance, regulatory compliance, and smart FM technologies.

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2. **Outsourcing Critical FM Services:** Encourage the outsourcing of complex facility management tasks (e.g., HVAC maintenance, elevator servicing, and security management) to qualified external firms for efficiency.

Long-Term Actions:

1. **Data-Driven Decision-Making in FM:** Establish a centralized FM database to track building performance trends, maintenance schedules, and resource allocation efficiency, ensuring long-term operational improvements.
2. **Institutional Collaboration for FM Research:** Partner with universities and industry bodies to conduct research on smart FM technologies, sustainable building solutions, and HRB operational efficiencies tailored to Addis Ababa's urban setting.

E. Policy Reform and Government Support

Short-Term Actions:

1. **FM Advisory Board:** Establish an FM advisory board comprising government regulators, FM experts, and real estate developers, guiding the development and implementation of Addis Ababa's FM policies.

Long-Term Actions:

1. **Policy Reforms for FM Standardization:** Advocate for policy amendments that integrate FM best practices into urban development guidelines, ensuring FM regulations are enforced across all HRBs.
2. **Sustainability and FM Research Initiatives:** Encourage government-led research programs exploring renewable energy, waste reduction strategies, and digital FM innovations, fostering a data-driven approach to HRB facility management improvements.

5.2.1 Recommendation for further research areas

Here are several additional areas for future research related to FM practices in HRBs in Addis Ababa:

- 1. Financial Models for FM in HRBs:** Study the cost-efficiency of various FM delivery models, such as in-house FM versus outsourcing, in Addis Ababa's HRBs, while also exploring funding mechanisms for implementing advanced FM technologies and sustainable practices.
- 2. Comparative Analysis of FM Practices in Different Urban Zones:** Examine how FM practices vary between the CBD and other urban or suburban areas in Addis Ababa, considering the impact of socioeconomic and infrastructural differences on FM strategies.
- 3. Sustainable FM Practices:** Explore sustainable FM practices specific to Addis Ababa, including waste management, water conservation, and renewable energy. Investigate the impact of these practices on the environment and the potential for scalability across other urban areas.
- 4. Energy Management and Conservation Strategies:** Investigate the adoption and impact of energy-efficient technologies, such as LED lighting, smart HVAC systems, and renewable energy sources, on FM costs and environmental performance.

These areas could further deepen the understanding of FM in high-rise buildings and support more targeted interventions and policy development for sustainable urban growth.

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APPENDIX A: QUESTIONNAIRES

Questionnaires for Facility management Team

Thank you for participating in this survey. Your responses are crucial in helping us grasp the current practices, challenges, and opportunities in facility management within high-rise buildings in Addis Ababa. Your input is highly valuable and will greatly contribute to our research aimed at enhancing facility management practices in high-rise buildings. The survey includes both closed and open-ended questions to ensure a comprehensive understanding of the research topic. It is expected to take approximately 45- 60 minutes to complete and rest assured, your answers will remain confidential. Your cooperation is sincerely appreciated.

SECTION A: DEMOGRAPHIC INFORMATION

1. Please specify your position?
2. What is your highest level of education in facility management or a related field?
 - . Diploma . Master's degree
 - . Bachelor degree . PhD . Other: specify.....
3. How many years of experience do you have in facility management, specifically in high-rise buildings?
 - . Less than 5 years . 5 to 10 years . More than 10 years
4. How many personnel do you have to run the work?
 - . Less than 15 . 16-25 . 26-50 . More than 50
5. What type of facility management model applies to the administration?
 - . Office manager model . Single site model
 - . Localized site model . Multiple site model
6. Type of Building Managed?
 - . Residential High-Rise . Commercial High-Rise
 - . Mixed-Use High-Rise . Other (please specify): _____
7. Number of Floors in the Building?
 - 10-20 21-30 30-40 41 and above
8. Ownership Structure of the Building?
 - Privately Owned Publicly Owned
 - Mixed Ownership Other (please specify): _____

Assessment of Facility Management Practice in Addis Ababa’s Central Business District High-rise Buildings: Challenges and Opportunities

9. What is the method of facility management practice in your building?
 In-house administration Outsourcing
10. Does your building have a dedicated facility management team?
 Yes No
11. Approximate Number of Occupants in the Building?
 Less than 100 101-200 201-300 301-400 More than 400
12. How long has the building been in operation?
 Less than 5 years 5-10 years 11-15 years More than 15 years

SECTION B: CURRENT FACILITY MANAGEMENT PRACTICE

I. Maintenance strategy

1. How would you categorize your current maintenance strategy?
 Preventive maintenance Corrective maintenance
 Predictive maintenance Condition-based maintenance
 Reliability-centered maintenance Other (please specify)
2. How satisfied are you with the effectiveness of your chosen maintenance strategy?
 Very low Low Neutral High Very high

II. Frequency of maintenance activities

1. How often are routine maintenance activities conducted in your building?
 Daily Weekly Monthly Quarterly Annually
2. Are there specific seasons or periods when maintenance activities are increased? If yes, please describe.

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III. Use of Technology in Facility Management

1. What types of technology do you currently use for facility management?
 Building management systems (BMS)
 Computerized maintenance management systems (CMMS)
 Internet of Things (IoT) devices Energy management systems
 Automated systems for HVAC, lighting, etc. None Other (please specify)
2. How integrated are these technologies in your facility management processes?
 Very low Low Neutral High Very high

Assessment of Facility Management Practice in Addis Ababa’s Central Business District High-rise Buildings: Challenges and Opportunities

IV. Energy Efficiency Measures

1. Which energy efficiency measures have been implemented in your building?
 - LED lighting
 - Energy-efficient HVAC systems
 - Solar panels or renewable energy sources
 - Building insulation improvements
 - Energy audits and monitoring
 - None
 - Other (please specify)
2. Have these measures resulted in noticeable energy savings? If yes, please estimate the percentage of savings.....

V. Can you describe your daily routine and main responsibilities in managing the facilities of your building?

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VI. How do you approach maintenance and upkeep of the building’s infrastructure?

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SECTION C: CHALLENGES IN FACILITY MANAGEMENT

I. Common Problems addressed in Daily Operations.

1. How often are the following issues well managed in daily operations? (Please rate each on a scale from 1 to 5, where 1 = Not well managed at all, 2 = Poorly managed, 3 = Moderately managed, 4 = Well managed, and 5 = Very well managed).

| No | Questions | Please tick (✓) for your response | | | | |
|----|----------------------------|-----------------------------------|-----|-----|-----|-----|
| | | (1) | (2) | (3) | (4) | (5) |
| 1 | Equipment performance | | | | | |
| 2 | Plumbing system efficiency | | | | | |
| 3 | Reliable electrical supply | | | | | |
| 4 | HVAC system stability | | | | | |
| 5 | Elevator reliability | | | | | |
| 6 | Effective pest control | | | | | |

2. On average, how manageable are the operational challenges you face?
(Likert scale: 1 = Not manageable, 2 = Slightly manageable, 3 = Moderately manageable, 4 = Manageable, and 5 = Very manageable).

Assessment of Facility Management Practice in Addis Ababa's Central Business District High-rise Buildings: Challenges and Opportunities

| No | Questions | Please thick (√) for your response | | | | |
|----|-----------------------------|------------------------------------|-----|-----|-----|-----|
| | | (1) | (2) | (3) | (4) | (5) |
| 1 | Equipment reliability | | | | | |
| 2 | Plumbing system maintenance | | | | | |
| 3 | Electrical supply stability | | | | | |
| 4 | HVAC system consistency | | | | | |
| 5 | Elevator operations | | | | | |
| 6 | Pest control measures | | | | | |

II. Financial Sufficiency and Budget Management

1.How sufficient is your current budget in meeting FM needs? (Likert scale: 1 = Very insufficient, 2 = Insufficient, 3 = Neutral, 4 = Sufficient, and 5 = Very sufficient).

. Very insufficient . In sufficient . Neutral . Sufficient . Very sufficient

III. Tenant Management Improvements

1.How satisfied are tenants with the overall FM services provided? (Likert scale: 1 =Very dissatisfied, 2 = Dissatisfied, 3 = Neutral, 4 = Satisfied, and 5 = Very satisfied).

. Very dissatisfied .Dissatisfied .Neutral .Satisfied .Very satisfied

2.How often do tenants express satisfaction regarding the following aspects?

(Please rate each on a scale from 1 to 5, where 1 = Not satisfied at all, 2 = Slightly satisfied, 3 = Moderately satisfied, 4 = Satisfied, and 5 = Very satisfied).

| No | Questions | Please thick (√) for your response | | | | |
|----|---------------------------------------|------------------------------------|-----|-----|-----|-----|
| | | (1) | (2) | (3) | (4) | (5) |
| 1 | Cleanliness and sanitation | | | | | |
| 2 | Noise management | | | | | |
| 3 | Maintenance response times | | | | | |
| 4 | Safety and security measures | | | | | |
| 5 | Parking space management | | | | | |
| 6 | Elevator availability and performance | | | | | |

IV. Ease of Regulatory Compliance

1.How easy is it for your building to comply with the following regulations?

(Please rate each on a scale from 1 to 5, where 1 = Very difficult, 2 = Difficult, 3 = Neutral, 4 = Easy, and 5 = Very easy).

Assessment of Facility Management Practice in Addis Ababa’s Central Business District High-rise Buildings: Challenges and Opportunities

| No | Questions | Please tick (✓) for your response | | | | |
|----|--------------------------------------|-----------------------------------|-----|-----|-----|-----|
| | | (1) | (2) | (3) | (4) | (5) |
| 1 | Fire safety regulations compliance | | | | | |
| 2 | Environmental regulations adherence | | | | | |
| 3 | Meeting building codes and standards | | | | | |
| 4 | Accessibility requirements | | | | | |
| 5 | Energy efficiency standards | | | | | |
| 6 | Health and safety regulations | | | | | |

2.What are the most significant challenges you face in managing high-rise building facilities, and how do you address them?

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SECTION D: OPPORTUNITIES FOR IMPROVEMENT

I. Priority Areas for Strengthening Facility Management

1.How effective are the following areas currently in your facility management practices? (Rate each on a scale from 1 to 5, where 1 = Not effective at all, 2 = Slightly effective, 3 = Moderately effective, 4 = Effective, and 5 = Highly effective).

| No | Questions | Please tick (✓) for your response | | | | |
|----|----------------------------|-----------------------------------|-----|-----|-----|-----|
| | | (1) | (2) | (3) | (4) | (5) |
| 1 | Maintenance response times | | | | | |
| 2 | Communication with tenants | | | | | |
| 3 | Energy efficiency | | | | | |
| 4 | Security measures | | | | | |
| 5 | Cleaning and sanitation | | | | | |
| 6 | Waste management | | | | | |

II. Satisfaction with Current Practices

1.How satisfied are you with the current facility management practices in the following areas? (Rate each on a scale from 1 to 5, where 1 = Very dissatisfied, 2 = Dissatisfied, 3 = Neutral, 4 = Satisfied, and 5 = Very satisfied).

Assessment of Facility Management Practice in Addis Ababa's Central Business District High-rise Buildings: Challenges and Opportunities

| No | Questions | Please thick (√) for your response | | | | |
|----|----------------------------|------------------------------------|-----|-----|-----|-----|
| | | (1) | (2) | (3) | (4) | (5) |
| 1 | Maintenance response times | | | | | |
| 2 | Communication with tenants | | | | | |
| 3 | Energy efficiency | | | | | |
| 4 | Security measures | | | | | |
| 5 | Cleaning and sanitation | | | | | |
| 6 | Waste management | | | | | |

III. Interest in New Technologies

1. How beneficial do you believe the following new technologies or practices could be? (Rate each on a scale from 1 to 5, where 1 = Not beneficial, 2 = Slightly beneficial, 3 = Moderately beneficial, 4 = Beneficial, and 5 = Highly beneficial).

| No | Questions | Please thick (√) for your response | | | | |
|----|------------------------------|------------------------------------|-----|-----|-----|-----|
| | | (1) | (2) | (3) | (4) | (5) |
| 1 | Smart building systems | | | | | |
| 2 | Predictive maintenance tools | | | | | |
| 3 | Energy management software | | | | | |
| 4 | Automated cleaning systems | | | | | |
| 5 | Tenant engagement apps | | | | | |
| 6 | Advanced security systems | | | | | |

IV. Current Technology Usage

1. To what extent are the following technologies integrated into your facility management practices? (Rate each on a scale from 1 to 5, where 1 = Not integrated, 2 = Slightly integrated, 3 = Moderately integrated, 4 = Well integrated, and 5 = Fully integrated).

| No | Questions | Please thick (√) for your response | | | | |
|----|-----------------------------|------------------------------------|-----|-----|-----|-----|
| | | (1) | (2) | (3) | (4) | (5) |
| 1 | Building management systems | | | | | |
| 2 | Energy management systems | | | | | |
| 3 | Automated HVAC controls | | | | | |
| 4 | Smart lighting systems | | | | | |
| 5 | Security monitoring systems | | | | | |

V. Willingness to Invest in Sustainability Initiatives 1. How willing are you to invest in the following sustainability initiatives? (Rate each on a scale from 1 to 5, where 1 = Not willing, 2 = Slightly willing, 3 = Moderately willing, 4 = Willing, and 5 = Very willing).

Assessment of Facility Management Practice in Addis Ababa's Central Business District High-rise Buildings: Challenges and Opportunities

| No | Questions | Please thick (√) for your response | | | | |
|----|----------------------------------|------------------------------------|-----|-----|-----|-----|
| | | (1) | (2) | (3) | (4) | (5) |
| 1 | Energy-efficient lighting | | | | | |
| 2 | Solar panels or renewable energy | | | | | |
| 3 | Water conservation systems | | | | | |
| 4 | Recycling and waste reduction | | | | | |
| 5 | Green building certifications | | | | | |
| 6 | Sustainable landscaping | | | | | |

VI. Current Sustainability Practices

1.To what extent are the following sustainability practices implemented in your building? (Rate each on a scale from 1 to 5, where 1 = Not implemented, 2 = Slightly implemented, 3 = Moderately implemented, 4 = Largely implemented, and 5 = Fully implemented).

| No | Questions | Please thick (√) for your response | | | | |
|----|---------------------------------------|------------------------------------|-----|-----|-----|-----|
| | | (1) | (2) | (3) | (4) | (5) |
| 1 | Energy-efficient lighting | | | | | |
| 2 | Use of renewable energy sources | | | | | |
| 3 | Water-saving fixtures | | | | | |
| 4 | Use of eco-friendly cleaning products | | | | | |
| 5 | Green space and landscaping | | | | | |

VII. Future Improvement Plans

1.How likely are you to implement the following improvements in the next five years? (Rate each on a scale from 1 to 5, where 1 = Not likely, 2 = Slightly likely, 3 = Moderately likely, 4 = Likely, and 5 = Very likely).

| No | Questions | Please thick (√) for your response | | | | |
|----|---|------------------------------------|-----|-----|-----|-----|
| | | (1) | (2) | (3) | (4) | (5) |
| 1 | Upgrading maintenance systems | | | | | |
| 2 | Enhancing tenant communication | | | | | |
| 3 | Implementing new energy efficiency measures | | | | | |
| 4 | Upgrading security systems | | | | | |
| 5 | Improving cleaning processes | | | | | |

1.In your opinion, what innovative strategies or technologies could improve the efficiency and sustainability of facility management in high-rise buildings?

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Assessment of Facility Management Practice in Addis Ababa's Central Business District High-rise Buildings: Challenges and Opportunities

SECTION E: BEST PRACTICE AND RECOMMENDATIONS

I. Effectiveness of Current Strategies

1. How effective have the following facility management strategies been in your high-rise building? (Rate each on a scale from 1 to 5, where 1 = Not effective, 2 = Slightly effective, 3 = Moderately effective, 4 = Effective, and 5 = Very effective).

| No | Questions | Please thick (√) for your response | | | | |
|----|-----------------------------|------------------------------------|-----|-----|-----|-----|
| | | (1) | (2) | (3) | (4) | (5) |
| 1 | Preventive maintenance | | | | | |
| 2 | Corrective maintenance | | | | | |
| 3 | Energy management practices | | | | | |
| 4 | Tenant engagement programs | | | | | |

II. Impact of Specific Practices on Efficiency and Sustainability

1. How much have the following practices enhanced operational efficiency in your building? (Rate each on a scale from 1 to 5, where 1 = No improvement, 2 = Slight improvement, 3 = Moderate improvement, 4 = Substantial improvement, and 5 = Significant improvement).

| No | Questions | Please thick (√) for your response | | | | |
|----|---|------------------------------------|-----|-----|-----|-----|
| | | (1) | (2) | (3) | (4) | (5) |
| 1 | Use of energy-efficient lighting | | | | | |
| 2 | Implementation of smart building technologies | | | | | |
| 3 | Staff training and development | | | | | |

III. Perceived Effectiveness of Regulatory Improvements

1. How effective do you believe the following regulatory improvements would be in enhancing facility management? (Rate each on a scale from 1 to 5, where 1 = Not effective, 2 = Slightly effective, 3 = Moderately effective, 4 = Effective, and 5 = Very effective).

| No | Questions | Please thick (√) for your response | | | | |
|----|--|------------------------------------|-----|-----|-----|-----|
| | | (1) | (2) | (3) | (4) | (5) |
| 1 | More stringent safety standards | | | | | |
| 2 | Enhanced environmental regulations | | | | | |
| 3 | Improved compliance monitoring | | | | | |
| 4 | Simplified permitting processes for upgrades | | | | | |
| 5 | Standardized training requirements for FM | | | | | |

IV. Recommendations for Best Practices

1. How beneficial would the following best practices be for other high-rise buildings based on your experience? (Rate each on a scale from 1 to 5, where 1 = Not beneficial, 2 = Slightly beneficial, 3 = Moderately beneficial, 4 = Beneficial, and 5 = Very beneficial).

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| No | Questions | Please thick (√) for your response | | | | |
|----|--|------------------------------------|-----|-----|-----|-----|
| | | (1) | (2) | (3) | (4) | (5) |
| 1 | Implementation of advanced building management systems | | | | | |
| 2 | Continuous staff training and professional development | | | | | |
| 3 | Active tenant engagement programs | | | | | |
| 4 | Adoption of energy-saving technologies | | | | | |

V. Future Focus Areas for Improvement

1. How important do you consider focusing on the following areas for future improvements in facility management? (Rate each from 1 to 5, where 1 = Not important, 2 = Slightly important, 3 = Moderately important, 4 = Important, and 5 = Very important).

| No | Questions | Please thick (√) for your response | | | | |
|----|--|------------------------------------|-----|-----|-----|-----|
| | | (1) | (2) | (3) | (4) | (5) |
| 1 | Enhanced energy efficiency | | | | | |
| 2 | Improved tenant satisfaction | | | | | |
| 3 | Greater use of technology | | | | | |
| 4 | Increased safety and security measures | | | | | |
| 5 | Better regulatory compliance | | | | | |
| 6 | More sustainable building practices | | | | | |

1. Based on your experience, what are some best practices in facility management that you believe should be widely adopted in high-rise buildings in Addis Ababa and What recommendations would you make for future improvements in facility management to support sustainable urban development?

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VII. Interview Questions

1. **Current Practices:** What are the key facility management practices currently implemented in this building?
2. **Challenges:** What are the main challenges you face in managing this building?
3. **Opportunities for Improvement:** In your opinion, what opportunities or innovations could enhance facility management practices in this building?
4. **Best Practices:** Can you share any best practices or success stories in facility management that you believe other high-rise buildings could adopt?
5. **Stakeholder Collaboration:** How do you collaborate with stakeholders (e.g., building owners, tenants, service providers) to ensure effective facility management in this building?

APPENDIX B: QUESTIONNAIRES FOR CASE STUDY ONE

Rating Criteria for LEED-Certified and Non-LEED certified High-Rise Buildings

| Category | Subcategory | Indicators | Rating Scale (1-5) | Remarks/ Observations |
|-----------------------------------|---------------------------|---|---------------------------|------------------------------|
| 1. Sustainable Sites | Site Maintenance | Regular maintenance of vegetation, stormwater systems, and outdoor facilities | | |
| | Accessibility | Ease of access to public transportation and pedestrian pathways for occupants | | |
| | Heat Island Reduction | Maintenance of reflective surfaces, green roofs, or shaded areas | | |
| 2. Water Efficiency | Indoor Water Management | Efficient operation and maintenance of water-saving fixtures | | |
| | Outdoor Water Management | Regular upkeep of irrigation systems, rainwater harvesting, or xeriscaping (eliminates the need for irrigation) | | |
| | Water Monitoring | Use of systems to track and reduce water consumption | | |
| 3. Energy & Atmosphere | Energy Monitoring Systems | Active monitoring and optimization of energy consumption | | |
| | Equipment Maintenance | Routine checks and servicing of HVAC, lighting, and renewable energy systems | | |
| | Renewable Energy Use | Integration and maintenance of solar panels, wind turbines, or other renewable systems | | |
| | Building Automation | Use of smart systems for energy management | | |

Assessment of Facility Management Practice in Addis Ababa's Central Business District High-rise Buildings: Challenges and Opportunities

| Category | Subcategory | Indicators | Rating Scale (1-5) | Remarks/ Observations |
|---------------------------------------|--------------------------------------|---|---------------------------|------------------------------|
| 4. Materials & Resources | Recycling Program | Effectiveness of waste segregation and recycling initiatives | | |
| | Maintenance of Sustainable Materials | Regular inspection and upkeep of sustainable or recycled materials used in construction | | |
| | Waste Management | Efficient handling of operational and maintenance waste | | |
| 5. Regional Priority | Local Adaptation | FM strategies tailored to Addis Ababa's climate and infrastructure challenges | | |
| | Energy & Water Scarcity | Measures to address local energy and water challenges | | |
| | Cultural Integration | Maintenance practices that incorporate local building techniques and traditions | | |
| 6. Overall Facility Management | Long-term Sustainability Practices | Strategies for ensuring the long-term sustainability of the building | | |
| | Occupant Feedback | Satisfaction of occupants regarding FM services | | |

APPENDIX C: QUESTIONNAIRES FOR CASE STUDY TWO

Comparative Rating Questionnaire for In-House FM vs. Outsourcing FM

| Category | Indicators | Rating Scale (1-5) | Remarks/ Observations |
|-------------------------------------|---|--------------------|--------------------------|
| Operational Efficiency | Timeliness of maintenance response | | |
| Resource Allocation | Availability of adequate staffing and technical expertise | | |
| Cost Efficiency | Cost-effectiveness of FM operations and maintenance | | |
| Tenant Satisfaction | Overall satisfaction of occupants with FM services | | |
| Energy Management | Effectiveness in implementing energy-efficient systems | | |
| Regulatory Compliance | Adherence to safety, environmental, and accessibility standards | | |
| Communication and Engagement | Effectiveness of communication with tenants and stakeholders | | |
| Scalability and Flexibility | Ability to handle increased FM demands or expand services | | |