ADDIS COLLEGE

DEPARTMENT OF CONSTRUCTION TECHNOLOGY AND MANAGEMENT

ASSESSMENT OF SAFETY PRACTICES IN PUBLIC BUILDING CONSTRUCTION: THE CASE OF ARADA SUB- CITY, ADDIS ABABA

By

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Addis Ababa, Ethiopia

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Assessment of Safety Practices in Public Building Construction: The Case of Arada Sub- City, Addis Ababa

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A Thesis Submitted to the Department of Construction Technology and Management of Addis College, in Partial Fulfillment for the Requirement of the Degree of Masters of Science Degree in Construction Technology and Management.

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Declaration

I, Feben Demissie declare that the project entitled " **Assessment of Safety Practices in Public Building Construction: The Case of Arad Sub- City, Addis Ababa**." is my original work and it has not been presented for a degree in any other university and all sources of materials used for the project have been duly acknowledged.

Declared by

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Approval

The undersigned certify that they have read and hereby recommend to Addis College to accept the Thesis submitted by Feben Demissie and entitled: Assessment of safety practices in public building construction: the case of Arad Sub- City, Addis Ababa, in partial fulfillment of the requirements for the award of a Master's Degree in Construction Technology and Management.

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Abstract

The objective of this research is to assess safety practices in public building construction in Arada Sub-City, Addis Ababa. This study employed a descriptive research design, utilizing both quantitative and qualitative approaches. The target population consisted of 150 employees and 50 stakeholders from the Office of Construction Control and Monitoring at the Arada Sub City Administration. A simple random sampling technique was used for distributing questionnaires, while a judgmental sampling technique was employed for selecting interview respondents. The research utilized both primary and secondary data sources. Data analysis included both descriptive and inferential statistics, conducted using the Statistical Package for Social Sciences (version 26.0). The study identified significant concerns regarding safety practices in construction, with many respondents expressing dissatisfaction with site inspections, compliance with personal protective equipment (PPE), and fall protection training. A lack of familiarity with safety laws and formal safety policies was prevalent, with over half of the respondents reporting insufficient knowledge. Key factors affecting workplace safety included management commitment, safety culture, job demands, and worker training. Inferential analysis confirmed strong relationships between these predictors and safety practices, explaining 37% of the variability observed. The study investigate for development a safety culture and collaborative training to mitigate risks and promote worker well-being. Additionally, it suggests that future research should adopt a holistic approach to thoroughly understand safety practices within the construction sector. The researcher recommends that construction firms implement tailored safety training programs and formal health policies, leveraging technology for hazard reporting and compliance tracking. Establishing clear communication channels and engaging subcontractors in safety planning will foster a strong safety culture and enhance overall safety practices in public building construction.

5 Keywords: Construction safety, Safety equipment, Public building construction, Safety regulations

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BoLSA = Bureau of Labor and Social Affair

ECPMI = Ethiopian Construction Project Management Institute

OSH = Occupational safety and health

CHAPTER ONE

1. Introduction

This study aimed to explore the relationship between construction work and safety practices in public building construction projects. The primary focus of this research was on construction safety practices, hazards, and risks. The following chapter covers the background of the study, statement of the problem, research objectives, research questions, scope of the study, significance of the research, and organization of the study.

1.1. Back Ground of the Study

Construction refers to the process of building or assembling something. It involves planning, designing, and putting together materials and labor to create structures such as buildings, roads, bridges, and other infrastructure (Forcael & Pulido-Arcas, 2020). Construction projects can vary in scale and complexity, from small residential renovations to large commercial developments.

The construction industry is a key driver of economic development, job creation, and societal progress (Opoku & Ahmed, 2021). It involves a collaborative effort between various professionals with diverse skills to successfully complete projects. Effective coordination, communication, and collaboration are essential for ensuring projects are completed safely, on time, and within budget.

Building construction is a vital part of the construction industry involving planning, design, and construction of various types of buildings (Ching, 2020). It goes through multiple stages like site preparation, foundation work, structural framing, system installation, finishing, and landscaping. Coordination among professionals is necessary to meet quality, safety, budget, and timeline requirements. Building construction contributes to shaping the physical environment and creating spaces for living, work, and recreation.

According to Zhang & Venugopal (2013), standard focuses on protecting the public on or near construction sites by identifying construction hazards and outlining best practices. It stresses the importance of conducting hazard assessments, particularly for falls, falling objects, and run-over/back-over incidents, and includes sections on various hazards like scaffolding, excavations, explosives, and fire prevention. The standard also highlights the need for emergency action plans, security measures,

and protocols for public safety. Additionally, it provides a public hazard control plan template for hazard identification, assigning responsibilities, and contacting authorities.

Building construction safety practices are crucial to ensuring the protection of workers, visitors, and the public on construction sites (Yiu & Sze, 2019). Key safety measures include providing and enforcing the use of personal protective equipment, fall protection systems, keeping the site organized, maintaining equipment properly, providing training and education on safety procedures, establishing clear communication channels, developing emergency response plans, and ensuring compliance with regulations. These practices help create a safer work environment and reduce the risk of accidents and injuries.

Organizational leadership commitment and resource allocation are crucial in shaping safety practices in public building construction (Flin & Yule, 2014). Leaders who prioritize safety and allocate resources for safety measures set a positive example for the organization. Demonstrating a commitment to safety through policies, training, and accountability fosters a safety-conscious culture among employees. Adequate resources for training and equipment further improve safety practices, showcasing a commitment to employee well-being. Ultimately, leadership commitment and resource allocation set standards, provide necessary resources, and establish a safety-focused culture, leading to a safer work environment and reduced accidents and injuries on construction sites.

Implementing and enforcing safety regulations in public building construction projects is challenging due to the complexity and diversity of regulations, inconsistent enforcement, and pressure to prioritize speed and cost over safety, resource constraints, and resistance to change within the industry (Mwelu & Watundu, 2018). Addressing these challenges requires effective communication, training, enforcement, and collaboration among all stakeholders.

In Ethiopia, buildings are classified into low-rise, mid-rise, high-rise, and mega high-rise categories based on the number of floors (Fasil, 2016). The construction of high-rise buildings is increasing in Addis Ababa and other major cities, but the industry faces challenges including accidents and fatalities. The construction sector, despite its economic benefits, is considered risky, with workers exposed to various health and safety hazards. Occupational safety and health (OSH) management is crucial in ensuring the safety of workers and the public on construction sites. Studies in Ethiopia have shown variations in OSH management practices, with Chinese contractors generally having better OSH practices than local grade-one contractors. Poor OSH practices have led to accidents and health

problems, indicating the need for improved safety measures in construction projects in Ethiopia (Amare, 2016).

Construction safety practice in the Ethiopian construction industry is vital due to extensive infrastructure development (Tsehay, 2022). The government mandates regulations and guidelines, with the Ministry of Labor and Social Affairs setting standards. Key aspects include compliance with regulations, safety training, risk assessment, site inspections, and stakeholder collaboration. The goal is to prevent accidents, safeguard workers, and foster a safety-oriented culture. Stakeholder collaboration is essential for maintaining a safe work environment and addressing safety concerns in construction projects.

This study objective focused on evaluating the current state of safety practices in public building construction, identify areas for regulation and guidelines for construction safety practices, and assess and control risk assessment and control measures. Site inspection practices propose recommendations for creating safer working environments. Ultimately, this research has been the potential to significantly impact the safety of public building construction projects and reduced the occurrence of accidents and injuries.

1.2. Statement of the Problem

Assessing safety practices in public building construction projects is complex due to multiple challenges, including non-compliance with safety regulations, weak safety culture, limited resources for safety management, communication issues among stakeholders, training gaps for workers and management, inadequate documentation, and difficulties in coordinating multiple contractors. Addressing these challenges is essential for enhancing safety standards and ensuring a safe working environment in the construction industry, as highlighted by Boadu and Wang (2021). Assessors must focus on these issues to improve overall safety practices.

The Addis Ababa construction office report underscored the severe consequences of unsafe practices in Ethiopia's construction industry, revealing that over 10 workers died and more than 42 construction professionals were either disabled or lost their lives during the 2016/17 period due to unsafe conditions (Belachew, 2020). It also noted significant gaps in accident recording over the past five years, hindering a full understanding of accident rates and trends. Additionally, the report highlighted that unsafe practices pose risks not only to workers but also to non-employees, including community members and

children near construction sites. These findings emphasize the urgent need to prioritize safety measures in construction projects to prevent accidents, injuries, and fatalities.

The Ethiopian Construction Project Management Institute (ECPMI) study reported 3,424 accidents in different building construction sites in Addis Ababa from 2012 to 2016 (Tilahun, 2020). Additionally, the report by the Addis Ababa City Administration Bureau of Labor and Social Affair (BoLSA) recorded the death of 58 construction workers in Addis Ababa in 2018-2019 due to falls from scaffolding and working at heights.

The Ethiopian Ministry of Labor and Social Affairs reported a total of 4,535 work-related accidents across 371 companies in the 2018/19 fiscal year, with 100 (2.21%) being fatal (MOLSA, 2020; Seblework, 2020). The construction industry was identified as the third most hazardous sector, with 5.16% of non-fatal work-related accident victims, following manufacturing and agriculture, hunting, forestry, and fishing. This highlights the significant risk of fatal accidents within the construction sector. Overall, construction-related injuries remain a critical issue globally, leading to higher rates of both fatal and non-fatal injuries among workers, which adversely impacts employee productivity and overall organizational performance (Karupannan & Arunachalam, 2020).

Previous studies have identified several factors contributing to the challenges in implementing effective occupational safety and health practices in companies, including a lack of commitment, knowledge, financial resources, and formalized routines, as well as a tendency to prioritize productivity and profitability over employee safety (Silaparasetti & Khan, 2017). In the construction industry, additional challenges such as inappropriate workplace design, poorly structured jobs, a mismatch between job demands and worker abilities, adverse working conditions, and inadequate management programs exacerbate workplace hazards and reduce productivity. Despite these issues, the integration of safety practices into overall operational performance is often neglected. Ensuring the safety, health, and welfare of employees is a fundamental human right, and all workers deserve access to a safe working environment free from hazards, regardless of their job responsibilities.

These rights are set out in legislation to ensure that employers are clear about the obligations and the consequences for neglecting them (Demirkesen & Arditi, 2015), However there have been problems, failure to observe its efficiency is the major problem in Ethiopian construction industry. It has been expensive to handle employees who get injuries at work place, in term of compensation and treatment.

There have been recurring accidents due to lack of preventive measures, personal protective equipment, and incompetence.

1.3. Research Question

1. What are the safety practices in public building construction in Arad Sub-City Administration?
2. What are the challenges faced in implementing safety practice regulations in public building construction projects?
3. What the key factors impact on effectiveness of safety practices in public building construction?
4. What strategies enhance safety practices in public building construction?

1.4. Research of Objective

1.4.1. General Objective

The general objective of this research was to assess safety practices in public building construction in the case of Arad Sub-City, Addis Ababa.

1.4.2. Specific Objective

The study aims to achieve the following specific objectives:

I. To assess the safety practices in public building construction in Arad Sub-City Administration.
II. To identify the key factors that impact the effectiveness of safety practices in public building construction.
III. To examine the challenges encountered in implementing safety regulations in public building construction projects.
IV. To evaluate strategies to enhance safety practices in public building construction projects.

1.5. Scope of the Study

1.5.1. Thematic Scope

The research focused on analyzing safety practices in public building construction projects in the Arada Sub City Administration of Addis Ababa. The chosen title of the research facilitates an in depth examination of trends, patterns, and changes in safety practices within the public building construction

sector over a three-year period. By exploring advancements in safety regulations, technologies, and practices during this timeframe, the study aims to understand how these developments have influenced safety management in public building construction and to identify best practices for improving safety outcomes.

The research would consider recent data to provide up-to-date insights into safety challenges, strategies, and the influence of leadership in public building construction projects. Additionally, the study would include case studies and interviews with project execution experts to gain practical insights into the real-world implications of construction safety. The research aims to offer valuable recommendations for policymakers, project managers, and stakeholders involved in public construction projects to enhance safety practices and ensure successful project delivery

1.5.2. Spatial Scope of the Study

This study was conducted as a case study for the Arada Sub City Administration in Addis Ababa, Ethiopia. The boundaries of the Arada Sub City are defined by neighboring sub-cities and zones. To the north, it borders Gullele Sub City and Addis Ketema Sub City. To the south, it borders Kolfe Keranio Sub City and Yeka Sub City. Additionally, to the east, it borders Akaky Kaliti Sub City and Kirkos Sub City, while to the west, it borders Lideta Sub City. This study investigated public building construction safety practices in the city.

1.5.3. Temporal Scope

The time scope of the study was set from 2020 to 2023. This time frame covered the three years leading up to the current year of the study.

1.6. Significant of the Study

The significance of this study lies in its potential to contribute to a better understanding of the factors that lead to construction cost overruns in public building projects. By identifying and analyzing the causes and impacts of cost overruns, this study could provide valuable insights for policymakers, project managers, and stakeholders in the construction industry, helping them develop strategies and interventions to mitigate cost overruns and improve project outcomes.

Understanding the significance of cost overruns in public building projects could lead to more effective project planning, budgeting, and risk management practices. This, in turn, could help optimize resource allocation, time management, and decision-making processes throughout the project lifecycle. By

addressing cost overruns proactively, stakeholders could reduce the financial burden on taxpayers, improve public trust and accountability, and enhance the overall efficiency and effectiveness of public building projects.

Furthermore, the findings of this study could also inform future research and policy development in the construction industry. By building upon the existing knowledge base and exploring new perspectives on cost overruns in public building projects, this study could contribute to the advancement of best practices, standards, and regulations that promote cost-effective and sustainable construction practices. Ultimately, the significance of this study lies in its potential to drive positive change and improvement in the management and delivery of public building projects for the benefit of society as a whole.

1.7. Limitation of the Study

This study acknowledges several limitations that may have hindered its accuracy, necessitating caution in interpreting the findings. Despite efforts to mitigate issues through a triangulation approach, the study's boundaries must be recognized. Nevertheless, the findings still present a strong case for construction safety practices and provide valuable insights specific to the Addis Ababa Arada Sub City Administration. Construction safety practitioners could use this study as a foundational basis to understand employees' perspectives on protective measures in on-site work. The major limitations include the researcher's limited knowledge of measuring construction safety regulations, time constraints for data gathering and analysis, a lack of relevant literature, insufficient advanced statistical skills, limited generalizability beyond the Arada Sub City Administration, and issues with respondent cooperation and bias. Considering these limitations was crucial in assessing the research outcomes.

1.8. Organization of the document

The research proposal is structured into five chapters and includes references throughout. The first chapter introduces the study, discussing its background, problem statement, research equation, objectives, scope, significant of the study and limitations. It also outlines the organization of the thesis. The second chapter focuses on the literature review, referencing previously conduct research in the field. The third chapter provides a detailed description of the methodology used in this research study. Data presentation and analysis are covered in the fourth chapter, which includes survey data, findings, and interpretations. Finally, the fifth chapter presents the conclusions and recommendations of the study.

CHAPTER TWO

LITERATURE REVIEW

2. Introduction

This chapter critically examines existing literature to identify a key issue that requires attention in the field of study and to establish a foundation for the research. It defines the concept of assessing safety practices in public building construction and reviews literature on the factors that influence the implementation of construction safety in public building projects. Additionally, it explores previous research on the role of leadership commitment, the implementation of safety practices, strategies for mitigating hazards and injuries on construction sites, and proposes a conceptual framework for the study.

2.1. Theoretical Literature Review

Public Building Projects: Refers to construction projects commissioned and funded by government or public entities for the purpose of providing public services, amenities, infrastructure, or facilities Bertone & Blair (2016). These projects may include schools, hospitals, government offices, transportation infrastructure, and other public buildings.

Project Management: The practice of planning, organizing, and overseeing the execution of a construction project, including coordinating resources, timelines, budgets, and stakeholders to ensure successful project delivery Schwalbe (2009). This involves managing risks, resolving issues, and monitoring progress to achieve project objectives.

Safety practices in construction: The specific actions, protocols, policies, and measures implemented to ensure the safety and well-being of individuals involved in public building construction projects Hinze & Baud (2013).

Factors influencing in construction: The various elements or variables that have an impact on safety practices in public building construction (Cheng, 2014). These factors can include organizational culture, worker behavior, project management, equipment, technology, regulations, and external influences.

Stakeholders: Individuals or groups who are involved or have an interest in the construction project, including government agencies, private contractors, designers, suppliers, community members, and other parties who may be impacted by the project Abas & Affandi (2020).

Organizational leadership commitment: The dedication, support, and involvement of organizational leaders, such as executives, managers, and supervisors, in promoting and prioritizing safety practices within the organization Öztekin & Karadağ (2015). This commitment is crucial for creating a culture of safety and ensuring compliance with safety regulations.

Construction safety regulations: The rules, guidelines, standards, and legal requirements that are established by government agencies or regulatory bodies to promote and enforce safety in construction projects Windapo (2013). Safety regulations provide a framework for ensuring the well-being of workers and the general public.

Accident in construction: Construction accidents refer to incidents that occur on construction sites resulting in injuries, fatalities, or property damage. These accidents can be caused by various factors, including unsafe working conditions, lack of proper safety equipment, human error, inadequate training, or negligence. Construction accidents can have serious consequences for workers, their families, and the construction company involved. It is important for construction companies to prioritize safety measures, provide proper training for workers, enforce safety regulations, and conduct regular inspections to prevent accidents and ensure a safe working environment.

2.2. Safety Practice in Building Construction Industry

The construction industry is a high-risk sector due to the nature of the work, which involves hazards such as working at heights, operating heavy machinery, handling hazardous materials, and working in confined spaces Jones et al. (2019). To ensure the well-being and protection of workers, prioritizing health and safety is crucial. Companies should implement comprehensive safety programs that include risk assessments, safety training, and proper use of personal protective equipment, regular inspections, and emergency response plans. Moreover, strong safety leadership, clear communication of safety protocols, and fostering a safety culture within the organization can help reduce the likelihood of accidents and injuries on construction sites.

Regulatory bodies and industry organizations also play a critical role in establishing and enforcing safety standards and regulations to ensure compliance and promote best practices in health and safety

in the construction industry Trienekens & Zuurbier (2008). By prioritizing health and safety measures, construction companies can create a safer work environment, prevent accidents and injuries, and protect the well-being of their workers.

Health and safety in public building construction is crucial to protect workers, occupants, and visitors Krieger & Higgins (2012). Compliance with building codes, conducting risk assessments, providing safety training, managing hazardous materials, implementing site safety measures, preparing for emergencies, and conducting regular inspections are essential considerations. Prioritizing health and safety in construction ensures buildings meet regulations, protect well-being, and contribute to a positive community environment.c

2.3 Types of Building Construction Accidents

There are several types of health hazards that can be present in building construction projects. Here are some common examples:

1. Respiratory Hazards: Construction sites generate dust from activities like cutting, sanding, and drilling, which can pose significant respiratory hazards. Inhalation of crystalline silica dust, prevalent in materials like concrete and stone, can lead to silicosis, a serious lung disease. Similarly, exposure to other dust types, including coal and asbestos, can result in pneumoconiosis. These risks underscore the need for effective respiratory protection and proper ventilation on construction sites to safeguard worker health (National Institute for Occupational Safety and Health [NIOSH], 2021).

2. Chemical Hazards: Hazardous chemicals are commonly found in construction materials and products. Paints, solvents, adhesives, and sealants often contain volatile organic compounds (VOCs) that can be harmful if inhaled Doe et al. (2022). Additionally, workers may be exposed to hazardous substances such as lead, asbestos, and formaldehyde, along with various toxic materials utilized in insulation, fireproofing, or pest control Smith & Johnson (2023).

3. Noise Hazards: Construction sites are noisy environments due to the operation of heavy machinery, power tools, and equipment. Prolonged exposure to high levels of noise can lead to hearing loss and other auditory problems. Workers should be provided with adequate hearing protection such as earplugs or earmuffs, and sound control measures should be implemented to reduce noise levels where possible. Regular noise assessments and monitoring can help ensure a safe working environment for construction workers.

4. Musculoskeletal Hazards: Construction sites are inherently noisy environments due to the operation of heavy machinery, power tools, and various equipment Brown et al. (2023). Prolonged exposure to high levels of noise can lead to significant health risks, including hearing loss and other auditory problems Taylor & Wilson (2022).

5. Fall Hazards: Falls are recognized as one of the leading causes of injuries and fatalities within the construction industry Adams et al. (2023). Working at heights whether on scaffolding, ladders, or rooftops poses significant fall risks to construction workers. The absence of adequate fall protection systems, such as guardrails, safety nets, and personal fall arrest systems, can greatly increase the likelihood of accidents Chen & Roberts (2022).

6**. Electrical Hazards**: Construction sites frequently involve the use of electrical systems, wiring, and equipment, rendering workers susceptible to various electrical hazards (Johnson et al., 2023). Improper handling of electricity can lead to severe consequences, including electrical shocks, burns, and potentially fatal accidents Martinez & Nguyen (2022).

7. Heat and Cold Stress: Construction workers often face exposure to extreme temperatures, which can vary significantly according to climate and weather conditions Thompson et al. (2023). Working in high temperatures without sufficient hydration and effective heat stress prevention measures can lead to serious health issues, such as heat exhaustion and heat stroke Oliver & Lee (2022). On the other end of the spectrum, working in cold environments without appropriate protective clothing can lead to hypothermia, frostbite, and other cold-related health issues (Lee, 2023).

8. Biological Hazards: Construction sites can present various biological hazards, such as mold, bacteria, and other microorganisms that pose significant risks to workers' health Harris et al. (2023). Conditions like poor ventilation, water damage, and inadequate sanitation often foster environments conducive to microbial growth, which can lead to serious health issues, including respiratory problems, allergies, and other adverse health effects Carter & Brown (2022).

2.4 Construction Safety Practice in Ethiopia

Construction safety in Ethiopia is a crucial concern that needs urgent attention to protect workers, the environment, and public infrastructure Belachew (2020). The country faces significant challenges in this area, stemming from limited experience and knowledge of modern construction practices. To reduce accidents and fatalities, Ethiopia must adopt strong safety measures and comply with

international safety standards. This approach will not only ensure worker safety but also enhance the sustainability of construction projects. A heightened emphasis on safety can also lead to reduced waste, minimized environmental impact, and improved public safety.

Ethiopia has identified the construction sector as a vital component of its development agenda, directing a significant portion of its annual budget to projects like dams, roads, and railroads Mengistu & Mahesh (2020). However, challenges exist due to the country's limited experience in modern construction practices, which require specialized knowledge. Safety is a critical concern that minimizes waste, protects the environment, and ensures public safety. As Ethiopia acquires foreign loans, it must effectively utilize its resources to support debt repayment and drive sustainable development. Prioritizing safe construction practices is essential for successfully completing projects and achieving national development goals.

2.5 Construction Accident in Ethiopia

In Ethiopia, like in many other countries, building construction accidents can occur due to various factors. Some of the common types of building construction accidents that have been reported in Ethiopia include:

1. Falls from Height

Falls from height are a significant risk in the construction industry in Ethiopia (Adane et al., 2013). Workers may fall from scaffolding, roofs, ladders, or other elevated surfaces, leading to injuries or fatalities. Common causes of falls from height include lack of proper fall protection equipment, inadequate training on how to work safely at heights, and failure to install guardrails or safety nets. Additionally, poor maintenance of scaffolding or working on unstable surfaces can increase the risk of falls. Employers in Ethiopia must prioritize the use of fall protection systems, provide adequate training, and conduct regular inspections to prevent falls from height accidents.

2. Structural Collapse

The collapse of structures during construction poses a severe risk to workers and bystanders in Ethiopia (Ferede, 2020). Factors contributing to structural collapse accidents include the use of substandard materials, poor construction practices, inadequate supervision, and failure to adhere to building codes and regulations. Lack of proper structural design and construction quality control measures can also increase the likelihood of structural collapse accidents. To mitigate these risks, construction companies

in Ethiopia should ensure the use of quality materials, employ qualified engineers and supervisors, conduct regular inspections, and adhere to building standards and regulations.

3 Electrocution

Electrocution accidents can occur when construction workers come into contact with live electrical wires, equipment, or faulty electrical systems Chi et al. (2009). In Ethiopia, inadequate grounding, improper installation of electrical systems, and lack of safety measures can contribute to electrocution incidents on construction sites. Workers may also be at risk of electric shocks when using electrical tools or working in wet conditions. To prevent electrocution accidents, employers should provide proper training on electrical safety, implement lockout-tag out procedures, conduct regular inspections of electrical systems, and ensure the use of personal protective equipment.

4. Machinery Accidents

The operation of heavy machinery and equipment on construction sites in Ethiopia presents risks of accidents such as entrapment, crushing, and collisions (Siotos te al., 2018). Inadequate training on machinery operation, poor maintenance of equipment, and failure to follow safety protocols can lead to machinery-related accidents. Employers should provide comprehensive training for operators, perform routine maintenance on machinery, conduct pre-use inspections, and establish clear communication protocols to prevent machinery accidents. Additionally, implementing safety barriers and warning signs can help reduce the likelihood of accidents involving heavy machinery.

5. Fires and Explosions:

Fires and explosions can occur on construction sites in Ethiopia due to hot work activities, improper storage of flammable materials, electrical faults, or inadequate fire safety measures (GIRMA, 2020). These incidents pose significant risks to workers' safety and can cause extensive damage to property. Employers should implement fire prevention and response plans, store flammable materials properly, provide fire extinguishers and other firefighting equipment, and ensure that electrical systems are installed and maintained correctly. Conducting regular fire drills and training workers on emergency procedures can help prevent fires and explosions on construction sites.

2.6. Challenges in Implementing Safety Regulations in Public Building Construction Projects

According to Ibukun (2020), implementing safety regulations in public building construction projects can pose several challenges. Here are some common challenges that organizations may face:

Compliance Awareness: Ensuring that all stakeholders including contractors, subcontractors, and workers are aware of safety regulations and understand their responsibilities is a significant challenge. Lack of awareness or misinterpretation of these regulations can result in non-compliance and increased risks on construction sites Hayes (2023).

Complex Regulatory Environment: The construction sector is subject to a multitude of safety regulations from various authorities at local, state, and federal levels. Navigating this complex regulatory landscape can be daunting, making it difficult to ensure compliance with all relevant requirements Mitchell (2022).

Resource Constraints: Implementing and adhering to safety regulations often necessitates additional resources such as personnel, equipment, training, and documentation. Limited budgets and resource constraints can hinder the allocation of sufficient resources to meet these safety requirements effectively Wong (2023).

Enforcement and Monitoring: Consistent enforcement of safety regulations across construction sites poses a significant challenge. Monitoring compliance, conducting inspections, and addressing non-compliance issues require dedicated personnel and effective coordination between regulatory bodies and construction stakeholders Hayes (2023).

Contractor Management: Public building projects frequently involve multiple contractors and subcontractors. Ensuring that all parties adhere to safety regulations and maintain a unified safety culture can be difficult. Effective contractor management systems and clear communication channels are essential in addressing safety concerns across various contractors Mitchell (2022).

Language and Cultural Barriers: In diverse construction teams, language and cultural barriers may obstruct effective communication and understanding of safety regulations. Establishing clear communication channels, utilizing translation services, and developing culturally sensitive training materials can help mitigate these challenges Wong (2023).

Evolving Safety Standards: Safety regulations and standards are continually evolving to tackle emerging risks and incorporate best practices. Staying updated with the latest regulations and ensuring their implementation can be challenging, necessitating ongoing training and awareness initiatives Hayes (2023).

2.7. Key Factors Impacting the Effectiveness of Safety Practice

The literature on workplace safety practices highlights the importance of various factors that can influence an organization's safety culture and outcomes. At the organizational level, management commitment and leadership are critical factors that can shape employee behavior and outcomes. A study by Zohar (2010), found that management commitment to safety is a key predictor of a positive safety culture, while a study by Glendon & Lappalainen (2012), found that leadership plays a significant role in shaping safety behaviors and outcomes. Additionally, job demands and workload, employee engagement and participation, and physical environment can all influence employee behavior and outcomes.

Individual factors, such as worker experience and training, risk-taking behavior and attitude, job satisfaction and motivation, and demographic factors, also play a crucial role in determining workplace safety. A study by Hale et al. (2014), found that worker experience and training are associated with improved safety knowledge and behavior, while a study by Griffin et al. (2014), found that risk-taking behavior is associated with increased risk of injury.

Environmental factors, such as physical environment, worksite conditions, and weather conditions, can also impact employee behavior and outcomes. A study by Sauter et al. (2015), found that physical environmental factors, such as noise and lighting, can influence employee behavior and outcomes, while a study by Guldenmund et al (2019), found that worksite conditions can also impact employee behavior and outcomes.

Finally, regulatory factors, such as compliance with safety regulations, effectiveness of safety policies, and level of enforcement, can also impact workplace safety. A study by Hofmann et al (2003), found that compliance with safety regulations is associated with reduced risk of injury, while a study by Griffin et al. (2014), found that effectiveness of safety policies is associated with improved safety outcomes. Furthermore, the level of enforcement is critical to ensuring compliance with safety regulations.

2.8. Strategies to Enhance Safety Practices in Public Building Construction

Ensuring safety in public building construction projects is crucial for protecting both workers and the surrounding community. Here are some effective strategies to enhance safety practices:

Hazard Assessment and Planning: Before commencing any construction work on a public building project, it is essential to conduct a thorough hazard assessment Memarian & Trahan (2020). Consider the unique challenges of working in a public space, including the presence of occupants, adjacent properties, and potential impacts to the surrounding environment. Regularly reassess hazards as new tasks are introduced or site conditions change. Develop a comprehensive emergency action plan that outlines procedures for responding to emergencies on the job site, as well as measures to restrict public access to areas under construction.

Protecting the Public on Construction Sites: Safeguarding the public from potential hazards on a construction site is paramount Tabish & Jha (2015). Implement measures such as covering or barricading excavation areas, installing guardrails on stairs and landings, using barricades or safety netting to prevent falling debris, restricting access to hazardous or flammable materials through secured storage lockers, adjusting perimeter lighting for visibility, and maintaining a high standard of housekeeping to minimize risks to the public.

Safety Culture and Training: Cultivating a robust safety culture within the organization is crucial for ensuring the effectiveness of safety practices in public building construction projects Kines & Zohar (2010). Emphasize safety as a top priority by integrating safety protocols and expectations into the site safety plan. Provide regular and comprehensive safety training for all workers to equip them with the knowledge and skills necessary to work safely. Regularly service and update equipment to maintain its safety and operational efficiency, ensuring that workers have access to properly functioning tools and machinery.

Communication and Transparency: Enhancing communication channels among workers, supervisors, and the public fosters a safer working environment on construction sites Choudhry (2014). Simplify reporting procedures by implementing construction safety checklists or incident reporting systems that streamline the process of reporting safety concerns or incidents. Foster a culture of safety awareness by encouraging open communication and transparency regarding safety-related issues.

Establish a system for sharing safety information and updates with all stakeholders to ensure everyone is informed and engaged in maintaining a safe work environment.

Invest in Staff and Proper Gear: Prioritize investment in the training and education of construction staff to enhance their understanding of safety practices and procedures Zhang & Zhao, (2017). Provide workers with the appropriate personal protective equipment (PPE) required for their tasks, such as hard hats, safety glasses, high-visibility vests, and fall protection gear. Utilize tools such as predictive insights or data analysis to identify and address potential safety risks proactively, empowering workers to anticipate and mitigate hazards before they escalate. By supporting a well-trained workforce equipped with the proper gear, construction projects can enhance safety standards and reduce the likelihood of incidents or accidents in public building construction.

The study "Leading or lagging? Temporal analysis of safety indicators on a large infrastructure construction project" by Lingard et al. (2017) examined the relationship between safety indicators and incident rates over a 12-month construction project. It found that most safety incidents occurred during the project's early stages, with incident rates decreasing as the project advanced. The research revealed a lagging effect, indicating that improvements in safety indicators did not immediately result in fewer incidents. The authors concluded that solely focusing on leading indicators is inadequate; a more comprehensive safety management approach, incorporating both leading and lagging indicators, is essential for understanding safety performance effectively.

The study by Windapo and Jegede (2013) highlights significant deficiencies in health, safety, and environment (HSE) practices among Nigerian construction companies. Only 20% of the companies surveyed had a comprehensive HSE policy, and many lacked formal training for employees. Additionally, most companies did not have systems in place for reporting and investigating incidents, hindering hazard identification and risk mitigation. Common hazards included falls, electrocution, and vehicle-related accidents, often due to inadequate supervision and poor site management. The study also noted a failure to establish systems for monitoring environmental impacts, emphasizing the critical need for improvements in HSE practices to enhance safety and reduce environmental harm in the construction sector.

A qualitative study by Zhang et al. (2020) examined the factors influencing on-site safety behaviors among construction workers through in-depth interviews with 30 workers and 12 site supervisors. The research identified key influences on safety behaviors, including job demands and workload,

organizational culture, social norms and peer pressure, training and experience, leadership, and personal factors. Workers under pressure to meet deadlines may compromise safety, while a strong safety culture and management commitment can promote safe practices. Peer behavior also significantly impacts workers' decisions regarding safety. The study recommends that construction companies focus on fostering a positive safety culture, providing adequate training, and promoting safety-oriented social norms.

In another study, Onyango et al. (2021) addressed the barriers to safety implementation in Kenya's construction industry. They identified a critical lack of training and education on safety procedures among workers, which leads to poor understanding of safety protocols. Additional obstacles include inadequate resources such as personal protective equipment, limited enforcement of safety regulations, and poor communication among stakeholders. Cultural factors and traditional practices further hinder safety measures. The study underscores the need to address these barriers to enhance safety implementation in Kenya's construction sector.

2.9. Construction Safety and Health in Ethiopian Context

Construction safety and health in Ethiopia is a critical issue that requires attention due to the high rate of accidents and incidents on construction sites in the country. Several studies have highlighted the challenges and opportunities for improving safety and health practices in the Ethiopian construction industry.

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Construction safety and health in Ethiopia is a pressing issue, marked by a high incidence of accidents on construction sites. Several studies have identified key challenges and potential improvements in safety practices within the industry. Worku and Tesfaye (2017) found that many construction workers and contractors lack awareness and proper implementation of safety regulations, with inadequate training, poor safety culture, and limited access to safety equipment posing significant barriers.

The International Labor Organization (ILO) (2019) reported a high rate of accidents and fatalities, especially among informal workers and small-scale projects, highlighting the need for better enforcement of safety regulations, improved training programs, and greater collaboration among stakeholders to tackle safety challenges.

The Ethiopian Construction Industry Development Authority (ECIDA) has initiated efforts to enhance safety in the sector by developing safety regulation guidelines, providing training for workers, and conducting inspections to ensure compliance (ECIDA, 2020). Despite the existing challenges of awareness, training inadequacies, and enforcement issues Belachew (2020), ongoing initiatives by various stakeholders indicate a commitment to improving safety practices. Continued collaboration, investments in training, and rigorous enforcement of regulations are essential for fostering a safer working environment for construction workers in Ethiopia.

2.10. Successful Safety Practice in Building Construction

In construction safety practices, accountability and clear role assignment at all management levels are essential for effective safety measures Wu & Li (2015). Communication is key, ensuring employees are informed about safety risks, and regular training is vital for skill development. Continuous monitoring and evaluation of safety performance help identify areas for improvement.

The Safety Culture Framework highlights the integration of safety into organizational values and promotes employee engagement in safety management Wachter & Yorio (2014). By fostering a strong safety culture, organizations can further reduce risks of accidents and enhance workplace safety.

Internationally accepted best practices, such as ISO 45001, provide a structured approach to occupational health and safety management systems (OHSMS), potentially reducing workplace injuries and illnesses by up to 50% Purwanto (2020). This standard involves a risk-based approach for identifying and mitigating hazards. In Ethiopia, similar strategies are applicable. Improving safety culture, communication, and training can help tackle the construction industry's specific challenges.

Ethiopian Best Practices

The Ethiopian Labor Proclamation No. 647/2009 regulates labor and occupational health and safety in Ethiopia by outlining the rights and responsibilities of employers, employees, and the government. It mandates the establishment of safety committees, regular training on safety procedures, site

inspections, and the provision of personal protective equipment (PPE) for employees Nega & Wondie, (2020); Ethiopian National Standards Agency.

Regular site inspections are critical for construction safety in Ethiopia, significantly reducing accident risks by up to 90% by identifying hazards such as falling objects and electrical issues Zelalem (2015). Personal protective equipment (PPE) is essential for preventing injuries. Additionally, establishing safety committees that include management, labor unions, and employees is vital for addressing safety concerns and developing mitigation strategies. The International Labor Organization (ILO) notes that these committees can reduce accident risks by 75% through employee training and promoting awareness of safety policies.

Implementing an incident reporting system and providing training on safety procedures are two essential best practices in construction safety in Ethiopia (ENSA, 2019). An incident reporting system allows employees to report incidents such as accidents or near-misses quickly and easily, which helps identify trends and patterns in accidents and near-misses, allowing for targeted interventions to prevent future incidents. By implementing an incident reporting system, employers can demonstrate their commitment to learning from incidents and improving their overall performance. Similarly, providing regular training on safety procedures is crucial for ensuring that employees understand their roles and responsibilities in preventing accidents. This training can help reduce the risk of accidents by up to 80%, and should include topics such as hazard identification, risk assessment, and control measures. By prioritizing these two practices, construction companies in Ethiopia can significantly reduce the risk of accidents and improve their overall safety performance.

2.11. Construction Safety in Ethiopian Building Law

The legal framework for occupational safety and health (OSH) in Ethiopia traces back to the 1940s with the introduction of Proclamation No. 58/1945. This legal instrument was implemented in response to the country's development and was influenced by the fundamental principles outlined in prominent International Labor Organization (ILO) conventions on labor inspection. Subsequently, in 1964, a more comprehensive law on OSH management was enacted through Proclamation 232/1964. Ethiopia's legal framework for OSH management has been largely influenced by European countries, particularly France and the UK, as indicated by Tolera, (2016). Over the years, Ethiopia has implemented various laws related to OSH at different times. A detailed review of the country's legal documents pertaining

to OSH would provide a comprehensive understanding of the evolution and implementation of these laws.

2.11.1. The FDRE Constitution

The Ethiopian constitution, established by Proclamation No. 1/1995, serves as the supreme law of the country, outlining various articles related to conducive working conditions, occupational safety and health (OSH), and environmental protection Hefer, (2016). The constitution ensures that all laws, practices, and decisions must align with its provisions, emphasizing the importance of upholding human rights, labor rights, and a clean and healthy environment. It guarantees workers the right to form associations, bargain collectively, and work in a safe and healthy environment. Moreover, the constitution obligates the government to protect the health and welfare of the working population and ensure a clean environment for all citizens. The constitution's provisions on OSH reflect international human rights standards and serve as the basis for OSH laws and regulations enforced by governmental authorities in Ethiopia.

2.11.2. Ethiopian Building Proclamation

The FDRE Proclamation No. 691/2005 and Ethiopian Building Proclamation No. 624/2009 establish crucial regulations for construction and safety in Ethiopia. Urban administrations must appoint qualified building officers to ensure safety compliance, inspect older buildings, and issue occupancy permits for partially completed structures if safety standards are met. The regulations also require municipal administrations to create safety plans for construction. Penalties, including fines and imprisonment, are outlined for building owners who compromise public safety. However, there are concerns about insufficient oversight by building officers, particularly in enforcing comprehensive safety measures beyond personal protective equipment (PPE). Improved follow-up and oversight are necessary to enhance safety in construction projects.

The paper "Assessment of challenges in implementation of building permit and control system in Addis Ababa, Ethiopia" by Dereje & Minale, (2019), examines the challenges faced in the implementation of building permit and control systems in Addis Ababa, Ethiopia. The study found that the implementation of these systems is hindered by several challenges, including inadequate enforcement of regulations, lack of resources and capacity, and corruption. The authors also identified several gaps in the current system, including inadequate documentation, lack of public awareness, and inadequate communication between government agencies. The study highlights the need for better enforcement

and capacity building to improve the effectiveness of the building permit and control systems. The authors recommend several measures to address these challenges, including improving the regulatory framework, increasing transparency and accountability, and providing training and resources for officials responsible for implementing the system. They also suggest involving stakeholders, such as builders and residents, in the implementation process to ensure that their needs are taken into account.

2.11.3. Building Regulation of Addis Ababa city Administration

In response to the growing demands from stakeholders due to Addis Ababa's development, the City Administration Construction Bureau has created Building Regulations aligned with the Ethiopian Building Proclamation No. 624/2009. These regulations are divided into five sections, specifically addressing occupational safety and health (OSH) issues. Section two, Article eleven, point seven outlines the responsibilities of building officials, emphasizing their role in ensuring compliance with relevant building proclamations, regulations, and directives, while highlighting the significance of OSH in construction work as part of their duties.

Article 40 addresses the follow-up and inspection of construction activities, mandating that contractors and consultants obtain appropriate insurance coverage based on the project's capacity. The Regulation includes penalties for non-compliance with OSH requirements, with fines ranging from ETB 3,000.00 for Building Category B and ETB 5,000.00 for Building Category C. Additionally, contractors are required to purchase insurance ranging from ETB 500,000.00 to ETB 2,000,000.00 from recognized insurance firms in the country, depending on the building category. In Part four, clauses 32-44 of the Regulation, detailed safety precautions to be observed during the building construction period are specified. These precautions are designed to ensure the safety and well-being of individuals involved in the construction process and underscore the importance of adhering to OSH standards for all construction activities.

2.12. Empirical Literature Review

An empirical literature review systematically gathers and assesses existing studies on a specific topic. Such reviews are crucial for generating new knowledge, identifying gaps in the literature, and informing practice and policy decisions. They play an important role in understanding the current state of knowledge across various fields and are vital for developing evidence-based policies and interventions.

1. Safety Practice in Building Construction

According to Adeyemi & Ogunsemi (2018), conducted a study on the assessment of safety practices on construction sites in Nigeria. The findings revealed that only 20% of construction workers had received any safety training, with 60% having no training whatsoever. Furthermore, 70% of construction sites were found to have poor site management, with inadequate supervision and lack of clear communication among site personnel. Additionally, 40% of construction workers did not have access to personal protective equipment (PPE), such as hard hats, safety glasses, and gloves. The study also found that 30% of construction workers had experienced accidents or injuries on site, with 20% reporting serious injuries. The most common causes of accidents were identified as lack of training and experience (30%), poor site management (25%), inadequate provision of PPE (20%), and poor communication among site personnel (15%). The authors recommended that construction companies should provide regular safety training and awareness programs for workers, site managers should ensure adequate supervision and clear communication among site personnel, and construction companies should provide adequate PPE for workers. Finally, the authors emphasized the need for government agencies to enforce safety regulations and standards on construction sites to ensure a safer working environment for all construction workers.

In South Africa, the Occupational Health and Safety Act (OHSA) is the primary law governing workplace safety and health, aiming to ensure the well-being of employees and the safety of machinery users MACKENZIE & FİLİZ, (2023). The Compensation for Occupational Injuries and Diseases Act (COIDA) establishes the Compensation Fund (COID) to compensate workers injured or affected by occupational diseases. Since August 2014, incident reporting to COID has moved online. Oversight of OSH in South Africa involves three main government departments: Labor, Mineral Resources, and Health. The Department of Labor is responsible for overseeing OSH in commerce and industry. The key legislation under the Department of Labor's authority is the Occupational Health and Safety Act, accompanied by various regulations addressing specific workplace safety issues.

The literature review on safety practices in public building construction in Eritrea and Djibouti reveals a poor safety record in both countries, with a staggering 75% of construction sites in Eritrea lacking adequate safety equipment and resources Ghebremichael, (2018). The review highlights several factors contributing to this poor safety record, including lack of effective regulations and enforcement, with only 20% of construction sites in Djibouti having a safety management system in place Arega, (2020). Additionally, inadequate training and capacity building for construction workers is a major concern,

with only 30% of workers in Eritrea having received formal training on safety practices Gebremariam, (2019). To address these issues, it is recommended that the government, regulatory agencies, employers, and workers work together to strengthen regulations and enforcement mechanisms, invest in training and capacity building for construction workers, provide adequate safety equipment and resources, improve working conditions, and promote a culture of safety. The review also highlights the need for further research to identify the most effective strategies for improving safety practices in public building construction and to investigate the role of stakeholders in improving safety practices.

Another research paper on the assessment of safety practices in public building construction in Ethiopia is a study conducted by WEGEN, (2020). The study focused on the implementation of safety practices in the construction industry in Addis Ababa and its impact on the safety performance of public building projects. The researchers found that while there are regulations in place to ensure safety in construction projects, enforcement is lacking, leading to a high rate of accidents and injuries on construction sites. The study also highlighted the importance of safety training for construction workers and the need for better communication and coordination among all stakeholders involved in public building construction projects.

The research paper by Gebremedhin & Yemane, (2018) assesses safety practices in public building construction in Ethiopia. The study reveals that construction workers in Ethiopia often lack safety training and protective gear, resulting in a higher rate of accidents and injuries on construction sites. It also highlights a lack of awareness and commitment to safety practices among construction companies and government agencies. The researchers emphasize the importance of better enforcement of safety regulations, increased investment in safety training, and improved coordination among stakeholders in the construction industry.

The construction industry in Ethiopia faces high rates of work-related injuries and accidents, posing significant risks to worker well-being Tadesse & Israel, (2016). Despite previous studies, comprehensive data and research efforts remain limited. To address this gap, a collaborative framework is proposed for implementing targeted interventions to enhance safety standards and mitigate accident rates. Key challenges include work at heights, poor coordination, lack of proper training and equipment, inadequate supervision and monitoring, and insufficient emergency response plans. The proposed framework involves strengthening safety policies, improving training programs, enhancing workplace practices, and fostering coordinated action among stakeholders. By implementing this framework, the

construction industry in Ethiopia can develop a safer and more sustainable work environment. This requires government agencies to prioritize safety policies, construction companies to invest in employee training, worker representatives to advocate for improved working conditions, and industry stakeholders to collaborate on best practices.

2. Challenges of Safety Practice in Building Construction

The construction industry is a significant contributor to the UK economy, accounting for 8% of GDP and employing 10% of the working population Ball, (2014). Despite its importance, the sector faced a drop in output in recent years but is slowly returning to growth. There are over 300,000 construction enterprises in the UK, employing more than 2.5 million workers. However, research evidence indicates that the construction industry faces challenges such as productivity issues, skills shortages, and safety concerns. Productivity lags behind other industries, and there is a shortage of skilled workers in key trades like bricklaying and carpentry. Safety is also a significant issue, with construction being one of the most dangerous industries to work in. Addressing these challenges is crucial for the continued success of the construction industry in the UK, requiring investment in training, recruitment, digital technologies, and a strong focus on promoting a safety culture within construction firms.

The article "Compliance with occupational safety and health regulations: a review of Nigeria's construction industry" by Umeokafor et al., (2014), examines the compliance with occupational safety and health regulations in Nigeria's construction industry. The authors conducted a review of existing literature and found that the construction industry in Nigeria is characterized by poor compliance with occupational safety and health regulations. The study highlights several factors that contribute to this lack of compliance, including inadequate training and awareness of workers, lack of enforcement of regulations by regulatory agencies, and inadequate resources and infrastructure. The authors also identify several gaps in the current regulatory framework, including the absence of a comprehensive occupational safety and health law, inadequate provision for worker participation in safety and health decision-making, and lack of penalties for non-compliance. The study concludes that there is a need for a comprehensive review of the regulatory framework and enforcement mechanisms to improve compliance with occupational safety and health regulations in Nigeria's construction industry. Overall, the article highlights the importance of ensuring compliance with occupational safety and health regulations in high-risk industries like construction to prevent accidents and illnesses, and to promote a safer and healthier working environment.

A study conducted in Ghana assessed the safety practices on construction sites in the country Amoako & Agyeman-Budu, (2019). The findings revealed that poor site management, lack of personal protective equipment (PPE), inadequate training, and unqualified workers were major contributing factors to accidents on construction sites. The study also found that many construction sites in Ghana did not provide adequate PPE to workers, with 75% of sites not providing sufficient PPE. Additionally, 60% of workers did not receive adequate training on safety procedures, and 40% of construction sites had unqualified workers on site. The study highlighted the importance of implementing effective safety measures, including providing adequate PPE, conducting regular training and awareness programs, ensuring adequate supervision and communication, enforcing safety regulations and standards, and providing adequate resources and funding for safety initiatives.

While the research highlighted specific concerns in the construction sector in Kenya, additional studies have further explored the risks and challenges within the industry. The factors contributing to construction accidents in Kenya, emphasizing the importance of safety measures and training for workers. Similarly, a study by Ongori et al., (2018) focused on the health and safety practices in the construction sector, highlighting the need for improved regulations and enforcement to enhance worker protection. These studies underscore the importance of addressing safety issues in the construction industry to promote sustainable development and ensure the well-being of all stakeholders involved.

According to the report "Global estimates of occupational accidents and work-related illnesses in Kenya Hämäläinen et al., (2017), occupational accidents and work-related illnesses are a significant global concern. The report estimates that approximately 337,000 workers die each year due to work-related injuries, with the majority of these deaths occurring in low- and middle-income countries. Additionally, the report estimates that there are over 2.78 million non-fatal work-related injuries and illnesses each year, resulting in significant economic and social costs. The report highlights the need for improved workplace safety and health measures to reduce the incidence of occupational accidents and illnesses, and to prevent the loss of lives and livelihoods. It also emphasizes the importance of strengthening national occupational health and safety policies, laws, and regulations to protect workers' rights and promote a safer and healthier working environment.

The high frequency of work-related injuries in the Ethiopian construction sector underscores the urgent need for research and interventions Tadesse & Israel, (2016). The lack of statistical information and minimal research efforts pose challenges in understanding and mitigating factors contributing to

construction accidents. Ethiopian Construction Professionals and Managers Institute highlight the common occurrence of accidents, attributing them to hazards like work at heights and lack of coordination. Comprehensive data collection, research, and targeted interventions are essential to improve safety standards and reduce injuries. Collaboration among stakeholders is crucial to effectively address these challenges and ensure worker well-being.

3. Effective Safety Practice in Building Construction

Research evidence on occupational health and safety (OSH) in France highlights the importance of the Labor Code in ensuring worker safety and well-being. The Code, supplemented by specific and technical decrees and guidelines from the Labor Ministry, mandates that employers take necessary measures to protect workers' physical and mental health Audiffren & Guarnieri, (2012). The incorporation of European Union legislation further enhances OSH standards in the country. This research evidence underscores the collaborative efforts between the government, employers, and workers to uphold OSH standards in France. By providing clear guidelines and regulations, the Labor Ministry plays a vital role in supporting employers in implementing safety measures to protect their employees. Additionally, the incorporation of European Union legislation ensures that OSH standards in France are in line with broader European directives.

"Safety inspection of building construction sites in Kolkata" by uha & Biswas, (2014), examines the safety practices and inspection procedures on construction sites in Kolkata, India. The study conducted a survey of 30 construction sites in Kolkata to evaluate the safety practices and identified several gaps and areas for improvement. The study found that the majority of the construction sites lacked proper safety measures, including inadequate training of workers, lack of personal protective equipment, and inadequate signage and warning systems. The study also found that many of the sites did not have a written safety policy or procedure in place. The authors also evaluated the safety inspection procedures on the construction sites and found that they were inadequate, with many inspections not being conducted regularly or thoroughly. The study identified several factors that contributed to the gaps in safety practices, including inadequate training and resources for inspectors, lack of enforcement of regulations, and lack of worker involvement in safety decision-making. The study highlights the importance of improving safety practices and inspection procedures on construction sites to prevent accidents and injuries. The authors recommend several measures to improve safety, including providing

regular training for workers, ensuring adequate resources and equipment for inspectors, and involving workers in safety decision-making.

The constitution of the Federal Democratic Republic of Ethiopia, the Civil Code (Proclamation # 165/1960), and the Labor Code (Proclamation No 377/2003) serve as the general legal basis for health and safety rules in the country TILAHUN, (2020). These laws contain numerous articles and provisions that address the health and safety of individuals. The Labor Code specifically focuses on worker-employer relations and aims to maintain industrial peace by outlining the powers and duties of the entity responsible for inspecting labor administration, including labor conditions, occupational safety, health, and the environment. Article 92 of the Labor Code outlines the essential obligations of employers to ensure that workplaces are safe, healthy, and free of any dangers that may jeopardize the well-being of workers. This includes implementing necessary measures to safeguard the health and safety of workers in the workplace.

4. Strategies Enhance Safety Practice in Building Construction

The "Safety4Site" program was implemented in the USA in May 2008 to reduce injuries and workers' exposure to occupational safety and health hazards Chen & Jin, (2011). The program focuses on on-site safety management and encourages practitioners to report any violations regulated by OSHA, such as improper equipment use or working near power lines. It aims to enhance safety awareness, attitude, and culture, as well as ensure accountability among general contractors, subcontractors, and materials suppliers. In the event of a violation, workers are removed from the job site for one day and must lead a huddle meeting on the violation the next day. Further discussions and commitments to the program are made between management and the workers involved. Second-time violators are separated from the general contractor for 30 days without pay but are eligible for rehiring. Overall, the program focuses on promoting safety through communication, accountability, and consequences for violations.

The Australian construction industry significantly impacts the economy and other sectors Martek & Durdyev, (2019). The Federal Safety Commissioner ensures safety standards in building works by promoting occupational safety and health. The Commissioner hires experienced consultants to support safety initiatives, address OSH issues, and ensure compliance with regulations. These consultants bring diverse backgrounds and skills to assist in various activities, such as site inspections and safety policy

development. Their involvement contributes to promoting safe working environments and improving safety standards in the construction sector.

According to Ayehu (2021), this research paper explores the importance of implementing and enhancing construction safety measures in Ethiopia. With the country's growing focus on the construction sector as a key driver of development, ensuring safety standards are in place is crucial to protect workers, the environment, and the public. The paper examines the current challenges faced in construction safety due to limited experience and expertise in modern construction practices the responsibility bodies supported. It also highlights the significance of adhering to international safety standards to improve the efficiency and sustainability of construction projects. Recommendations for enhancing construction safety in Ethiopia are provided based on an analysis of existing literature and best practices in the field.

The study by Abebe & Gebremedhin (2019), found that the prevalence of occupational injury among construction workers in Addis Ababa, Ethiopia, is 34.1%. The highest prevalence was found among workers exposed to hazardous conditions at 41.3% and those exposed to physical demands at 35.7%. Factors such as age, job type, exposure to hazardous conditions, and physical demands were identified as significant predictors of occupational injuries. Workers aged 30-39 years were more likely to experience injuries than those aged 20-29 years. Job type was also a significant factor, with construction workers being more likely to experience injuries than maintenance workers. Exposure to hazardous conditions and physical demands were also significant predictors of occupational injuries. The study underscores the need for addressing occupational injuries among construction workers in Addis Ababa, Ethiopia, suggesting measures such as safety training, improved working conditions, and worker well-being promotion could reduce the risk of injuries and improve worker health and safety.

The study "Effectiveness of safety training on knowledge, attitude and practice of construction workers in Addis Ababa, Ethiopia" by Bezabih & Mengesha, (2020), aimed to evaluate the effectiveness of a safety training program on the knowledge, attitude, and practice of construction workers in Addis Ababa, Ethiopia. The researchers found that the construction workers had a low level of knowledge and awareness about safety and health issues in the construction industry, despite having a generally positive attitude towards safety. However, their practices were often inconsistent with safety guidelines. To address this issue, a randomized controlled trial was conducted to evaluate the effectiveness of a 2-day safety training program that covered topics such as hazard identification, risk assessment, and

personal protective equipment use. The results showed that the safety training program significantly improved the knowledge and attitudes of construction workers towards safety. The program also led to a significant improvement in the practice of safety measures among workers. Specifically, the study found that workers who received the safety training were more likely to wear personal protective equipment, follow safety guidelines, and report hazards to their supervisors. The study concludes that the safety training program was effective in improving the knowledge, attitude, and practice of construction workers in Addis Ababa, Ethiopia. The researchers recommend that employers and regulatory authorities in Ethiopia provide regular safety training to construction workers to improve their knowledge and skills in safety and health.

The importance of stakeholder collaboration in promoting sustainable occupational safety and health in the Ethiopian construction industry Abiy & Tefera, (2021). The study found that effective stakeholder collaboration is essential for ensuring the implementation of occupational safety and health measures, and that lack of trust, communication breakdowns, and conflicting interests are major barriers to successful collaboration. To address these challenges, the authors recommend that stakeholders work together to develop and implement a comprehensive OSH strategy that takes into account the needs and concerns of all stakeholders. The study concludes that stakeholder collaboration is crucial for promoting sustainable OSH in the Ethiopian construction industry, and that by working together, stakeholders can create a safer and healthier work environment for all workers.

2.13. Conceptual Framework

The conceptual framework explores the factors that influence successful safety practices in public building construction projects. Four independent variables were examined: safety practices in public building construction work, challenges of safety practice implementation, the impact of key factors on safety practices, and enhanced safety practices. The dependent variable was successes safety practice, which measures the effectiveness of safety practices in building construction projects.

The aim of the study was identified the key factors that contribute to successful safety practices, how challenges affect these practices, and the most effective strategies for enhancing safety practices.

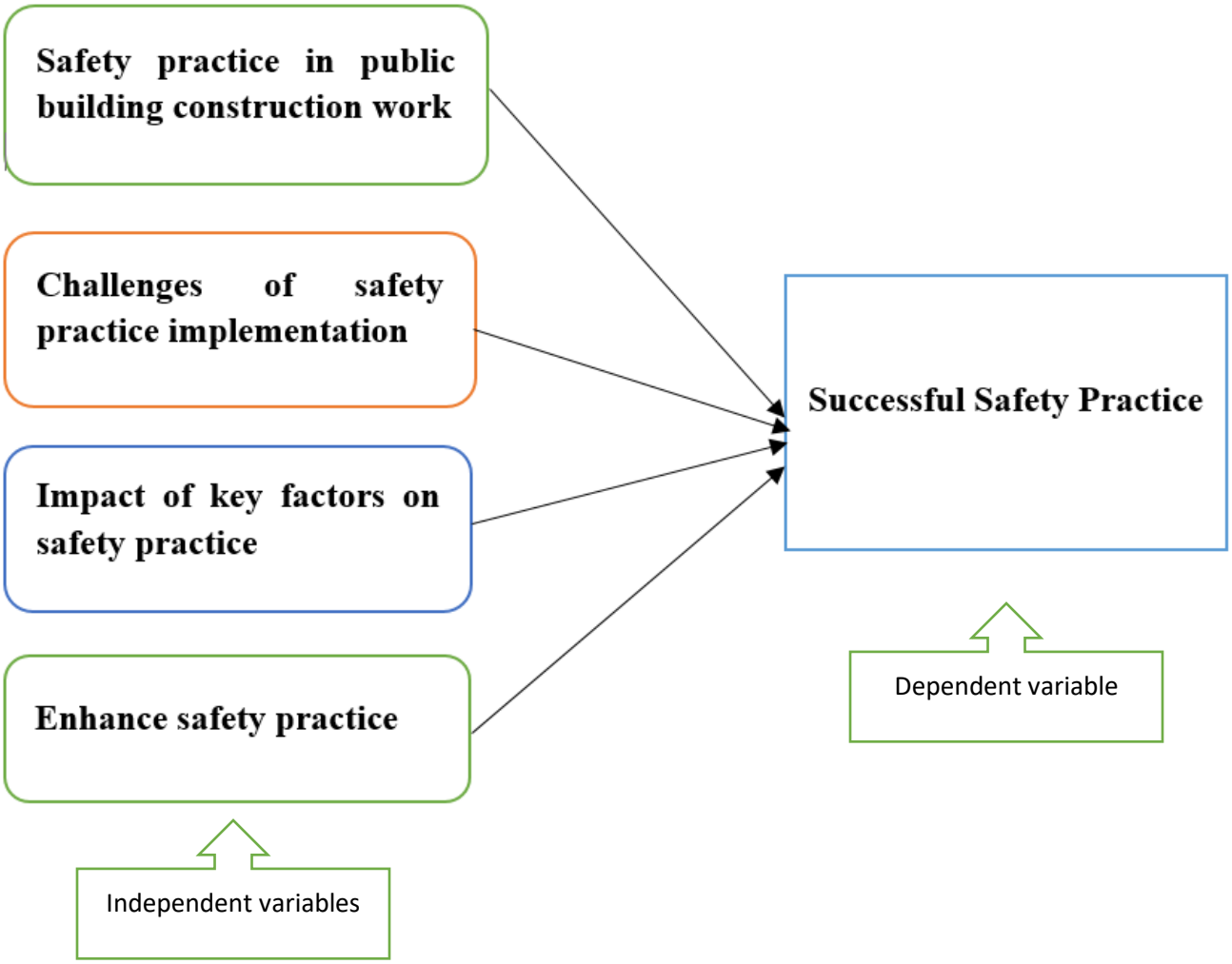


Figure: 2.1: Conceptual Framework Diagram

(Source: Theoretical and Empirical Literature review, 2024)

2.14. Research Gap

The literature review on occupational health and safety (OHS) in the construction industry provides a detailed overview of current knowledge based on empirical studies from various countries, including the UK, USA, Australia, India, and several African nations such as Ethiopia and Ghana. It highlights OHS as a critical issue in global construction, influencing sustainable development and the welfare of stakeholders. Key findings show that accidents and injuries stem from factors like insufficient worker training, inadequate personal protective equipment (PPE), poor site management, weak enforcement of safety regulations, and a lack of resources. The review stresses the importance of addressing these issues to improve safety standards and reduce injuries.

Moreover, it highlights gaps in existing research and suggests further studies on the effectiveness of safety interventions across different contexts. It emphasizes the involvement of all stakeholders responsible for the research area. The researcher distributed questionnaires to stakeholders, who reflected on the construction safety measures implemented at the construction work site during their observation period when they participated.

CHAPTER THREE

RESEARCH METHODOLOGY

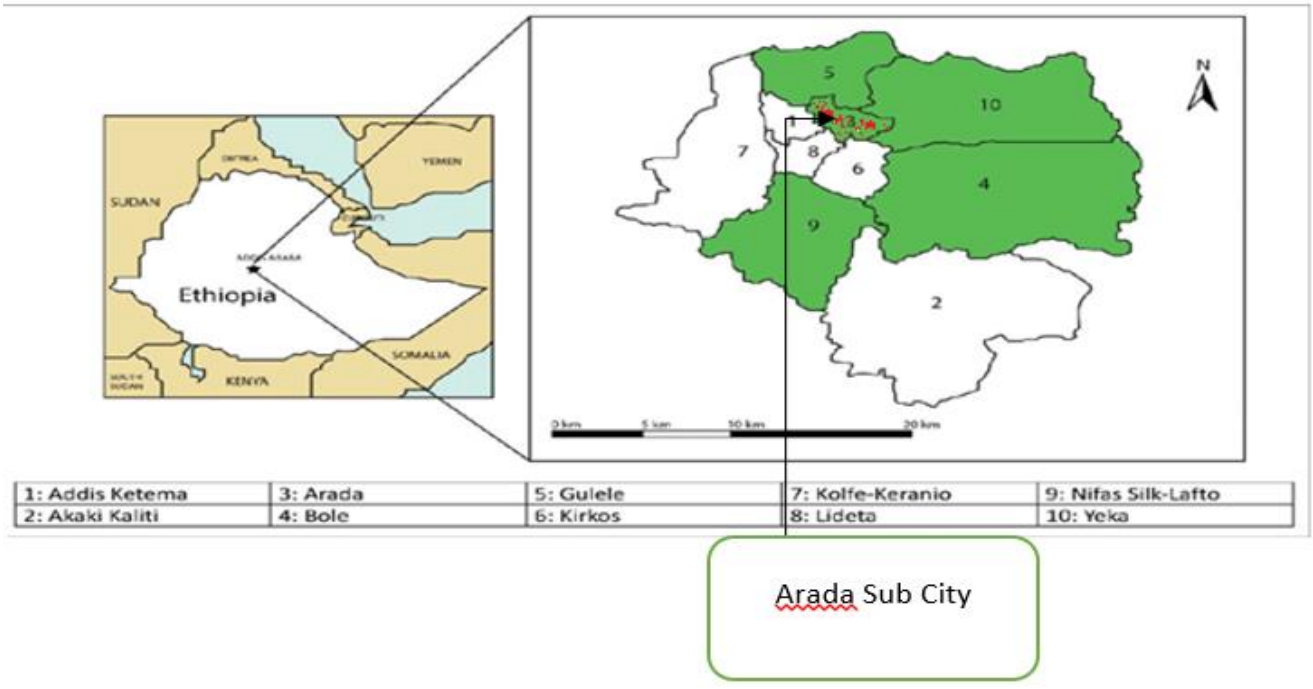
3. Introduction

This chapter provides a detail explanation of the methodology employed in the study. The chapter covered various aspects, including the study research area, research design, research approach, target population, sampling and sampling procedure, data source and collection methods, method of data analysis and instrument, reliability and validity.

3.1 The Study Area Conducted

The research investigate to assess safety practices in public building construction in the case of Arada Sub City, Addis Ababa. The study aims were evaluated the current safety measures and protocols implemented in the construction of public buildings within the jurisdiction of Arada Sub City. This includes analyzing the adherence to building codes, regulations, and industry standards to ensure the safety and well-being of workers, residents, and visitors in public buildings.

Figure 3.1: Arial Map of Arada City Administration



Source: Survey result, 2024

3.2 Research Design

A descriptive survey research design was utilized in this study to investigate how construction safety practices were implemented in public building construction. Direct observations were conducted during visits to construction sites to document hazards, tasks, job site organization, work practices, equipment, and tools used. Quantitative research methods were employed, with a questionnaire developed to collect data through surveys and interviews.

3.3 Research Approach

The researcher employed both quantitative and qualitative approaches Creswell et al. (2003). Combining these methods enhances the credibility of the study compared to relying on a single method. Given the significance of mixed methods in contemporary research, the researcher utilized a mixed-method approach to enhance the credibility of the results, improve interpretation, offset the weaknesses associated with using only one method, and achieve corroboration between the two methods (triangulation).

3.4 Sampling Design

3.4.1 Target Population of the Study and Sampling Technique

According to Abate (2018), a population comprises the entire set of individuals, objects, or events, while a sample is a subset of that population. In the context of this study, the focus was specifically on building construction projects undertaken by public entities. The target population for this study consisted of 200 employees. The researcher obtained information from a sample of 150 employees working in co the selected city administration, as well as 50 stakeholders sourced from the Office of Construction Control and Monitoring at the Arada Sub City Administration.

3.4.2 Sampling Technique

In this study, the researcher used simple random sampling technique. This sampling method ensured that every individual or element in the population had an equal chance of being selected for the sample. According to Hibberts et al. (2012), this method involved randomly selecting samples from a population without any specific pattern or criteria, ensuring that each member of the population had an equal probability of being chosen for the sample.

3.4.3 Sampling Size

The sample size referred to the number of observations used to estimate characteristics of a specific population. Sampling involved selecting a subset of individuals from a larger population to represent the entire group. While there were no strict guidelines, the sample size was typically influenced by the size of the population. Various methods could have utilized determined sample sizes, including calculating the number based on the total population. By employing Yamane's (1967) formula, a sample size of 150 employees and 50 stakeholder in Arada's sub-city construction sectors was calculated, considering a 95% confidence level and p = 0.05, as outlined in Yamane's formula for determining sample sizes in a study.

$$n = \frac{N}{1 + N * e2}$$

Where n = the sample size,

N= population size, and

e = level of precision.

$$n = \frac{200}{1+200*(0.05)2} = 133$$

The study would involve a sample size of 133 employees from selected contractors and stakeholders).

3.5 Source of Data

In accordance with Cooper and Schindler (2001) as cited in (Maniram, 2007), data for this study includes information collected from participants or observations, as well as published information classified as primary and secondary sources. Recognizing that no single source has a clear advantage over others in this study, both primary and secondary sources are utilized. The researcher collects primary data through closed-ended questionnaires administered to respondents and conducting open-ended interviews with a key informant, specifically the senior expert and project manager and stakeholder representatives.

The primary data collection method enabled the researcher to gather information on the construction safety practice of the organization under investigation, as well as recorded data of the injures. In addition, secondary data sources such as books, internet resources, journal articles, and both published

and unpublished Master's theses and dissertations conduct by other researchers were utilized complement and analyze the data obtained from the primary sources.

3.6 Data collection Method

Questionnaire: A questionnaire was a set of questions designed to be answered by respondents, allowing for the collection of information based on their responses. This questionnaire was developed using the relevant literature to effectively address the research question and fulfill the research objectives. For this study, data on occupational safety and health (OSH) practices in public buildings within the selected area were collected through the questionnaire. It consists of closed-ended questions employing a 5-point Likert scale, where "strongly agree" is scored as 5 and "strongly disagree" as 1. The researcher adapted the questionnaire from previous studies on similar topics and cross-referenced it with reliable sources such as academic journals, published materials, and feedback from senior experts within the organization.

Interview: - The research involved conducting key informant interviews with senior and junior managers from contracting and stakeholders. Specifically, two senior managers and three junior managers from the selected companies are chosen for the interviews using judgment sampling to gather more comprehensive information.

Observation: To achieve many data, different methods for collecting primary data, like observation, could be effectively combined. This involves observing workplace relationships among employees, as well as work processes and procedures. Researchers will record, describe, analyze, and interpret the behaviors of the subjects under study. Observations will include both structured observations and participant observations.

Documentary source: Documentary source data was a key component of the data collection methods. This includes written materials such as annual reports, administrative records, statutes, laws, regulations, and meeting minutes. Analyzing these sources helps to triangulate findings derived from primary data.

3.7 .Data Analysis and Presentations

Data were collected from a sample organization to objectively assess safety practices in public building construction in Arad Sub-City, Addis Ababa. Questionnaires were administered and analyzed using

qualitative data processed by the Statistical Package for Social Sciences (SPSS 26.0) evaluated frequency distribution. The researcher was responsible for ensuring logical completeness and consistency in the editing and coding of the respondents' data.

The researcher develops a multiple regression model for this analysis. Multiple regressions were the determination of a statistical relationship between two or more variables. The regression analysis was conducted know how much the independent variable explained the dependent variable. According to (Kothari, 2004), a simple linear regression was carried out to estimate the relationship between a dependent variable, Y, and a single explanatory variable, x, given a set of data that includes observations for both of these variables for a particular population, for independent variables, x, it could possible to find a dependent used $Yi = \beta0+\beta1xi+ei$ where β0 was the intercept and β1 was the slope of the line. The relationship between y and x was estimated by carried out a simple linear regression analysis. In multiple linear regressions, there were p explanatory variables, and the relationship between the dependent variable and the explanatory variables was represented by the following equation:

$$\mathbf{Y_i=\beta_0+\beta_1X_{1i}+ \beta_2X_{2i} + \beta_3X_{3i} \ldots\ldots\ldots \beta p\ Xpi + e_i}$$

Where:

The coefficients linking the p explanatory variables to the variables of interest were β1 to βp, while the constant term was β0. Therefore, simple linear regression was considered a specific instance of multiple linear regression, where p=1, or multiple linear regression could thought of as an extension of linear regression, where there were p explanatory variables. In multiple linear regression, the assumption was that y was directly related to a linear mixture of the explanatory factors used predicted the values of a dependent variable, Y, supplied a set of p explanatory variables (x1, x2... xp). Thus, in this study, multi-linear regression was conducted between the independent variables and the dependent variable. The model of the regression analysis was presented as follows:

$$Y=\beta_0+\beta_1SPPB+\beta_2CSPI+\beta_3IKFSP+\beta_4ESP + E$$

In the above equation,

Y…….. Successful Safety Practice

SP…… …….. Safety Practice Public Building

CSP…… ....Challenges of Safety Practice

FIESP…….. Factors Influencing Effective Safety Practices

ESP…….. .....Enhance Safety Practices

E…….Error

3.8 Validity and Reliability of the Research

3.8.1 Validity

To achieve validity, the questionnaires include a diverse array of questions developed based on insights gathered during the literature review, ensuring their representativeness. Content validity was further reinforced by maintaining consistency in questionnaire administration. To this end, the researcher personally distributed the questionnaires to the subjects. Additionally, the questions were formulated in simple language for clarity and ease of understanding, with clear instructions provided to the participants.

To enhance the strength of the questionnaires, feedback from the research advisor and results from a pilot test were utilized to make necessary amendments. These included reorganizing questions to align with the research objectives, eliminating unnecessary questions, and correcting grammatical errors.

3.8.2 Reliability

According to the researcher (Kothari, 2004), a measuring instrument was reliable if it provides consistent results. Cranach's alpha is a coefficient of reliability. It was commonly used as a measure of the internal consistency or reliability of a psychometric test score for a sample of examinees. For testing the liability of the data instrument, Cronbach's Alpha is calculated to test the reliability of the research instrument. According to the researchers (Okumu, 2020), scales with coefficient alpha between 0.8 and 0.95 were considered to have very good quality, scales with coefficient alpha between 0.7 and 0.8 were considered to have been good reliability, and coefficient alpha between 0.6 and 0.7 indicates fair reliability. The researcher measured the reliability of the data using Cronbach's alpha, detail seen in the table 3.1 shows respectively.

Table 3.1: Reliability Test of Variables by Pilot Survey

S.no.	Description of items	Cronbach values	No. of questions
1	Safety practices	0.79	9
2	Challenges of safety practice implementation	0.76	6
3	Impact of key factors on safety practices	0.81	16
4	Enhanced safety practices	0.75	7

5	Successes safety practice	0.73	6

Source: Survey result, (2024)

Based on Cronbach's alpha, the variables good to very good reliability, with most scores above 0.7. The exceptions value which have scores of 0.73 and 0.81, respectively. The above result show that the researcher go further analysis step.

3.9 Ethical considerations

In this research, all individuals participating in the study were guaranteed the rights to privacy and dignified treatment. The information gathered was held in strict confidence by the researcher. Any assistance, collaboration, or sources contributing to the research were duly acknowledged. The study adheres to the following ethical considerations: a) Fair treatment, b) Transparent intentions, c) Disclosure of research methods, d) Respect for the integrity of individuals, and e) Informed voluntary consent from participants to partake in the research activities.

CHAPTER FOUR

RESULTS, AND DISCUSSIONS INTRODUCTION

4 Response Rate and Demographical Information of Respondents

4.1 Response Rate

In the previous chapter, the researcher identified the sample size of the study as one hundred thirty-three (133). The data on questionnaire responses reveals a high level of participant engagement. With a total sample size of 133, all questionnaires were successfully distributed to the intended participants. Out of these, 123 questionnaires were returned, resulting in a remarkably high response rate of approximately 92%. This substantial response rate indicates that the majority of participants were willing to provide feedback, reflecting positively on the effectiveness of the outreach and engagement strategies employed during the survey distribution process. Additionally, the low number of unreturned questionnaires only 10 suggests a minimal level of non-response, which typically enhances the reliability and validity of the collected data.

4.2 Demographical Information of Respondents

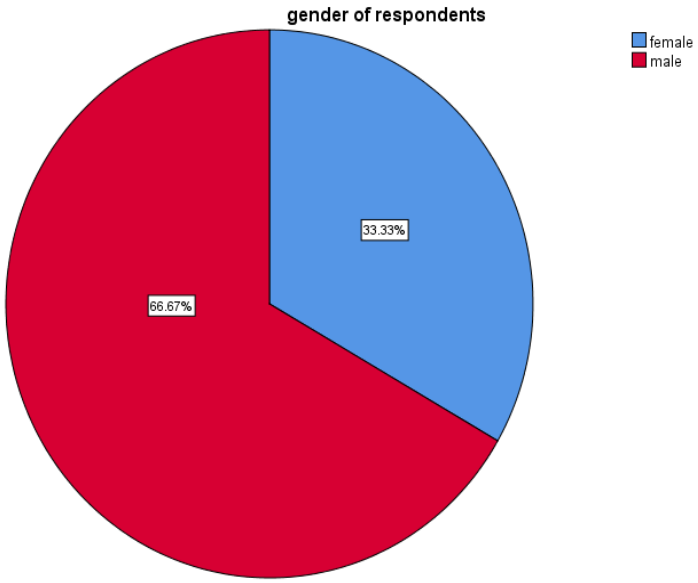


Figure 4.1: Gender of Respondents

Source: Survey result, (20240

The above figure shows that the majority of respondents in this study were male, accounting for 66.7% of the total sample. In contrast, female respondents made up 33.3% of the sample. This indicates a

significant gender disparity among the participants, with male respondents being approximately double the number of female respondents.

Table 4.1: Respondent profile

No.	Description		Frequency	Percent
1	Educational level	Diploma	39	31.7
		Degree	66	53.7
		Master degree and above	18	14.6
2	Work experience of the company	0-5 years	76	61.8
		6-10 years	36	29.3
		10 and above years	11	8.9
3	Work experience of the employee's	0-5 years	56	45.5
		6-10 years	54	43.9
		10 and above years	13	10.6
4	Job title of the respondents	Project Manager	12	9.8
		Site Engineer	33	26.8
		Safety Officer	31	25.2
		daily labour	47	38.2

Source: Survey result, (2024)

The majority of respondents hold a Bachelor's degree (53.7%), followed by those with a diploma (31.7%). A smaller proportion (14.6%) attained a Master's degree or higher. This suggests that the workforce is primarily composed of individuals with undergraduate qualifications, indicating a potential for more advanced training and education in the field.

A significant portion of respondents (61.8%) has been with their current companies for 0-5 years, indicating a relatively young workforce in terms of company tenure. The declining percentages for the 6-10 years (29.3%) and 10 years or more (8.9%) categories suggest that the company may experience a high turnover rate or that it primarily hires newer employees. This could affect company culture, knowledge transfer, and continuity.

The data reveals that nearly half of the respondents (45.5%) have 0-5 years of work experience in their respective fields, while a similar percentage (43.9%) have 6-10 years of experience. Only 10.6% of

employees have more than 10 years of experience. This indicates a workforce that is primarily less experienced, which could have implications for mentorship, productivity, and the organization's ability to navigate complex projects.

The largest portion of respondents are classified as daily labourers (38.2%), reflecting a workforce heavily skewed towards manual labour roles. Site engineers (26.8%) and safety officers (25.2%) represent a substantial segment of the workforce as well, while project managers make up a smaller fraction (9.8%). This distribution suggests a potential focus on operational roles rather than management or strategic positions, which may affect decision-making processes and project oversight within the organization.

The assessment of safety practices in public building construction highlights several important implications related to workforce characteristics. With many employees possessing degrees, targeted training focused on construction regulations and risk management can improve safety awareness, particularly for those with less experience. Mentorship programs are recommended to facilitate knowledge transfer from experienced workers to new hires, contributing to a strong safety culture. Given that a large portion of the workforce consists of daily labourers, hands-on safety training is crucial, alongside clearly defined roles for safety officers to enforce measures. Project managers should actively promote a safety-first culture through regular audits and inspections to ensure compliance. Organizations must also remain updated on evolving safety regulations and adapt their training programs accordingly. Furthermore, establishing accessible channels for reporting safety concerns will enhance accountability and foster timely hazard responses. Together, these steps are essential for cultivating a robust safety culture that safeguards worker well-being in public building construction.

4.3 Safety Practices in Public Building Construction Work

Table 4.2: Safety Practices

Safety Practices		**Scale of agreement**				
			Freq.	**%**	**Mean**	**SD**
1	Conducting site visits and inspections to identify potential hazards	Strongly disagree	11	8.9	3.13	1.35
		Disagree	44	35.8		
		Neutral	14	11.4		
		Agree	28	22.8		
		Strongly agree	26	21.1		
2	Ensuring all workers wear PPE, such as hard hats, safety glasses	Strongly disagree	24	19.5	2.88	1.39
		Disagree	35	28.5		
		Neutral	15	12.2		
		Agree	30	24.4		

		Strongly agree	19	15.4		
3	Providing fall protection training to workers	Strongly disagree	22	17.9	2.73	1.35
		Disagree	49	39.8		
		Neutral	9	7.3		
		Agree	26	21.1		
		Strongly agree	17	13.8		
4	Using electrical testing equipment to identify potential hazards	Strongly disagree	19	15.4	2.55	1.17
		Disagree	59	48.0		
		Neutral	11	8.9		
		Agree	26	21.1		
		Strongly agree	8	6.5		
5	Installing fire alarms and extinguishers	Strongly disagree	21	17.1	2.47	1.14
		Disagree	59	48.0		
		Neutral	14	11.4		
		Agree	22	17.9		
		Strongly agree	7	5.7		
6	Ensuring materials are properly stacked and secured	Strongly disagree	27	22.0	2.46	1.26
		Disagree	55	44.7		
		Neutral	10	8.1		
		Agree	19	15.4		
		Strongly agree	12	9.8		
7	Maintaining a clean and tidy construction site	Strongly disagree	38	30.9	2.41	1.33
		Disagree	42	34.1		
		Neutral	8	6.5		
		Agree	25	20.3		
		Strongly agree	10	8.1		
8	Ensuring workers know what to do in case of an emergency	Strongly disagree	27	22.0	2.59	1.32
		Disagree	55	44.7		
		Neutral	10	8.1		
		Agree	19	15.4		
		Strongly agree	12	9.8		
9	Conducting regular inspections of the construction site to identify potential hazards and risks	Strongly disagree	24	19.5	2.72	1.38
		Disagree	48	39.0		
		Neutral	8	6.5		
		Agree	25	20.3		
		Strongly agree	18	14.6		

Source: Survey result, (2024)

The data reflects a concerning trend regarding safety practices within the construction industry. Each safety practice listed has a mean score indicating varying levels of agreement, with many respondents showing significant disagreement. Several safety practices in the construction environment showed notably high levels of disagreement among respondents. Notably, 48.0% disagreed with the implementation of ensuring all workers wear personal protective equipment (PPE), as well as using electrical testing equipment to identify potential hazards and installing fire alarms and extinguishers.

Additionally, 44.7% disagreed with ensuring materials are properly stacked and secured, while 65.0% disapproved of maintaining a clean and tidy construction site. Furthermore, 44.7% also disagreed with ensuring workers know what to do in case of an emergency. Overall, these percentages highlight significant concerns about safety practices and adherence within the construction sector.

This idea supported by According to Adeyemi and Ogunsemi (2018), a study on safety practices in Nigerian construction sites revealed alarming statistics: only 20% of construction workers had received any safety training, while 60% were completely untrained. Moreover, 70% of construction sites exhibited poor management characterized by inadequate supervision and unclear communication. Additionally, 40% of workers lacked access to essential personal protective equipment (PPE), and 30% reported experiencing accidents, with 20% of those being serious injuries. The main causes of these accidents included insufficient training (30%), poor site management (25%), inadequate PPE (20%), and poor communication (15%). The authors recommended regular safety training, improved site supervision and communication, provision of adequate PPE, and stricter enforcement of safety regulations by government agencies to enhance worker safety on construction sites.

4.3.1 Challenges of Safety Practice in Building Construction

Table 4.4: Challenges of Safety Practice

Challenges of Safety Practice		**Scale of agreement**				
			Freq.	**%**	**Mean**	**SD**
1	Familiar with the FDRE Constitution, law about Safety & Health-related laws at work.	Strongly disagree	26	21.1	2.71	1.35
		Disagree	41	33.3		
		Neutral	14	11.4		
		Agree	27	22.0		
		Strongly agree	15	12.2		
2	The management of the company has a written Safety & Health policy.	Strongly disagree	28	22.8	2.10	0.94
		Disagree	73	59.3		
		Neutral	7	5.7		
		Agree	12	9.8		
		Strongly agree	3	2.4		
3	The contractor conducts regular site safety inspections.	Strongly disagree	14	11.4	2.77	1.19
		Disagree	52	42.3		
		Neutral	15	12.2		
		Agree	32	26.0		
		Strongly agree	10	8.1		
4	The consultant enforcement and monitoring construction safety on the site.	Strongly disagree	25	20.3	2.59	1.37
		Disagree	56	45.5		
		Neutral	5	4.1		
		Agree	19	15.4		
		Strongly agree	18	14.6		

5	The safety inspection results documented and communicated.	Strongly disagree	26	21.1	2.58	1.31
		Disagree	50	40.7		
		Neutral	9	7.3		
		Agree	25	20.3		
		Strongly agree	13	10.6		
6	The company provides safety induction & training to employees.	Strongly disagree	25	20.3	2.82	1.39
		Disagree	42	34.1		
		Neutral	7	5.7		
		Agree	39	31.7		
		Strongly agree	10	8.1		

Source: Survey result, (2024)

The result highlights significant challenges in workplace safety practices, as evidenced by respondents' perceptions, which are reflected in various mean values. A considerable majority (54.4%) reported a lack of familiarity with the FDRE Constitution and safety-related laws, leading to a mean score of 2.71, indicating a pressing need for enhanced education and awareness. Furthermore, 82.1% stated that their company lacks a formal written safety and health policy, which is underscored by a mean value of 2.10, suggesting that management should prioritize establishing structured protocols. Additionally, over half (53.7%) of respondents indicated that regular safety inspections by contractors are insufficient, with a mean score of 2.77, underscoring the necessity for more systematic oversight.

The effectiveness of consultant enforcement of safety measures was also questioned, with 65.8% expressing dissatisfaction and a mean value of 2.59, signaling a critical gap in external monitoring. Safety inspection results are not being adequately documented or communicated, as indicated by 61.8% of respondents who disagreed or strongly disagreed on this matter, reflected by a mean of 2.58, thereby highlighting a breakdown in communication that could jeopardize safety.

The above result suggests pervasive deficiencies in safety awareness, policy formulation, regular safety inspections, enforcement, communication of safety results, and employee training within the organization. These studies collectively underscore the urgent need to address safety issues in the construction industry to promote sustainable development and safeguard the well-being of all stakeholders involved. Similarly, the high incidence of work-related injuries in Ethiopia's construction sector highlights the pressing need for research and interventions Tadesse & Israel, (2016). The limited statistical data and minimal research efforts hinder the understanding of factors leading to accidents. The Ethiopian Construction Professionals and Managers Institute attributes these common accidents to hazards such as working at heights and poor coordination. Therefore, comprehensive data collection,

targeted research, and collaborative stakeholder efforts are vital to improving safety standards and enhancing worker well-being.

4.3.2 Impact of Key Factors on Safety Practice

Table 4.5: Impact of Key Factors on Safety Practice

Impact of Key Factors on Safety Practice		Scale of agreement				
			Freq.	%	Mean	SD
1	Management commitment and leadership	Strongly disagree	8	6.5	3.63	1.23
		Disagree	21	17.1		
		Neutral	12	9.8		
		Agree	49	39.8		
		Strongly agree	33	26.8		
2	Safety culture and climate	Strongly disagree	25	20.3	3.52	1.22
		Disagree	51	41.5		
		Neutral	12	9.8		
		Agree	27	22.0		
		Strongly agree	8	6.5		
3	Job demands and workload	Strongly disagree	17	13.8	3.41	1.38
		Disagree	19	15.4		
		Neutral	10	8.1		
		Agree	49	39.8		
		Strongly agree	28	22.8		
4	Worker experience and training	Strongly disagree	7	5.7	3.49	1.36
		Disagree	25	20.3		
		Neutral	21	17.1		
		Agree	51	41.5		
		Strongly agree	19	15.4		
5	Risk-taking behavior and attitude	Strongly disagree	13	10.6	3.42	1.31
		Disagree	25	20.3		
		Neutral	8	6.5		
		Agree	43	35.0		
		Strongly agree	34	27.6		
6	Job satisfaction and motivation	Strongly disagree	14	11.4	3.21	1.39
		Disagree	21	17.1		
		Neutral	10	8.1		
		Agree	50	40.7		
		Strongly agree	28	22.8		
7	Demographic factors	Strongly disagree	13	10.6	3.15	1.38
		Disagree	25	20.3		
		Neutral	9	7.3		
		Agree	50	40.7		
		Strongly agree	26	21.1		

Source: Survey result, (2024)

The data reveals key factors affecting safety practices in organizations, with varying levels of respondent agreement. Management commitment and leadership were rated highest (mean score of

3.63), with 66.6% affirming their importance in creating a positive safety culture. Safety culture and climate had a mean of 3.52, but significant disagreement (61.8%) points to improvement needs.

Job demands and workload (mean of 3.41) and worker experience and training (mean of 3.49) were also seen as critical, with 62.6% and 57.0% agreement rates, respectively. Risk-taking behavior and attitude garnered recognition from 62.6% of respondents (mean of 3.42). Job satisfaction and motivation showed a mean of 3.21 with 63.5% agreeing on their influence, while demographic factors had a mean of 3.15, with 61.8% acknowledging their relevance to safety practices.

The results indicate a positive perception of the key factors influencing safety practices, particularly management commitment, safety culture, and training; however, considerable disagreement exists regarding the state of safety culture and specific job-related demands. This highlights the need for targeted interventions to improve perceptions and practices related to workplace safety. Environmental factors, including physical environment, worksite conditions, and weather, significantly affect employee behavior and outcomes. Sauter et al. (2015) highlighted that elements like noise and lighting can influence employee behavior, while Guldenmund et al. (2019) found that worksite conditions similarly impact outcomes. Additionally, regulatory factors play a crucial role in workplace safety; Hofmann et al. (2003) noted that compliance with safety regulations is linked to a reduced risk of injury, and Griffin et al. (2014) found that the effectiveness of safety policies correlates with improved safety outcomes. The level of enforcement of these regulations is also vital for ensuring compliance.

4.3.3 Strategies and Enhance Safety Practices in Public Building Construction

Table 4.6: Enhance safety practices in building construction

Impact of Key Factors on Safety Practice		**Scale of agreement**				
			Freq.	**%**	**Mean**	**SD**
1	Assigning skilled and experienced workers in the site.	Strongly disagree	34	27.6	3.48	1.33
		Disagree	40	32.5		
		Neutral	10	8.1		
		Agree	29	23.6		
		Strongly agree	10	8.1		
2	Allocating workers with proper work load.	Strongly disagree	23	18.7	3.22	1.40
		Disagree	45	36.6		
		Neutral	13	10.6		
		Agree	22	17.9		
		Strongly agree	20	16.3		
3		Strongly disagree	29	23.6	3.55	1.33
		Disagree	37	30.1		
		Neutral	18	14.6		

	Hazard Assessment and Planning work on the site regularly	Agree	26	21.1		
		Strongly agree	12	9.8		
4	Supporting skilled workers with technological devices.	Strongly disagree	33	26.8	3.18	1.36
		Disagree	48	39.0		
		Neutral	9	7.3		
		Agree	20	16.3		
		Strongly agree	13	10.6		
5	Participation of management in accident investigation on the site work	Strongly disagree	33	26.8	3.39	1.25
		Disagree	43	35.0		
		Neutral	9	7.3		
		Agree	22	17.9		
		Strongly agree	16	13.0		
6	Train workers on hazard identification and controls	Strongly disagree	25	20.3	3.42	1.23
		Disagree	51	41.5		
		Neutral	14	11.4		
		Agree	22	17.9		
		Strongly agree	11	8.9		
7	Establish effective communication on the site each employees	Strongly disagree	23	18.7	3.21	1.27
		Disagree	63	51.2		
		Neutral	7	5.7		
		Agree	18	14.6		
		Strongly agree	12	9.8		

Source: Survey result, (2024)

The survey highlights significant concerns about safety practices on construction sites. While aspects like assigning skilled workers (mean 3.48) and hazard assessments (mean 3.55) received moderate approval, over 59% expressed disagreement, signaling issues. Key concerns include inadequate workload allocation (mean 3.22, 55.3% disagreed) and insufficient technological support for skilled workers (mean 3.18, 65.8% disagreed).

Management's role in accident investigations was rated moderately at 3.39, but over 61% found it lacking. Training for hazard identification (mean 3.42) was also viewed as inadequate by more than 61%. Additionally, communication barriers were notably problematic, with a mean score of 3.21 and 69.9% dissent. Overall, despite some support for safety practices, many respondents expressed dissatisfaction, particularly in workload distribution, support, management involvement, training, and communication, indicating diverse opinions among staff.

The above idea supported by Ayehu (2021) emphasizes the critical need for enhancing construction safety measures in Ethiopia, highlighting challenges due to limited expertise and the importance of

adhering to international safety standards to protect workers and the environment. Abiy and Tefera (2021) addressed the role of stakeholder collaboration in promoting sustainable occupational safety and health (OSH) in the Ethiopian construction industry, identifying barriers such as lack of trust and communication. They recommend comprehensive OSH strategies that consider the concerns of all stakeholders, concluding that collaboration is essential for creating safer work environments.

4.4 Inferential Analysis of the Study

Inferential analysis is a statistical method that involves drawing conclusions about a population based on a sample of data. Inferential analysis also used to test hypotheses, estimate population parameters, and understand relationships between variables.

4.4.1 Normality Test

A normal distribution, also known as a bell-shaped curve, is a type of frequency distribution where data is symmetrically distributed around the center Field, (2009) this means that most scores fall around the mean, with fewer scores at the extremes. A normal distribution has a skewness of 0, meaning it is not deviated from normal Field, (2009). If the skewness is above or below 0, it indicates a deviation from normal. In the 95% confidential interval, the value of Z-table is between -1.96 and 1.96. The table below shows that both skewness and kurtosis, divided by their standard error each items respectively, fall within this range. This result indicates that the data distribution is normally distributed.

Table 4.7: Normality Test

	N	Skewness		Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Std. Error
Safety Practice	123	-1.035	.218	2.109	.433
Challenges of Safety Practice	123	-.199	.218	-.253	.433
Impact of Key Factors on Safety Practice	123	.151	.218	-.080	.433
Enhance Safety Practices	123	5.391	.218	45.319	.433
Successful Safety Practices	123	.129	.218	.247	.433
Valid N (listwise)	123				

Source: Survey result, (2024)

A skewness distribution is not symmetrical, with the majority of scores (the tall bars on the graph) clustered at one end of the scale. Skewed distributions can be either positively skewed, where the frequent scores are clustered at the lower end and the tail points towards the higher or more positive

scores, or negatively skewed, where the frequent scores are clustered at the higher end and the tail points towards the lower or more negative scores Field, (2005).

Research has consistently shown that many types of data, including customer satisfaction scores, service quality ratings, employee performance metrics, and customer loyalty measures, often exhibit skewness and kurtosis Spreng et al., (2006); Cronin et al., (2000); Anderson et al., (2012); Ostrom et al., (2010). For example, studies have found that customer satisfaction scores tend to be skewed, with a majority of customers reporting high satisfaction levels and a smaller proportion reporting low satisfaction Anderson et al., (2012). Similarly, service quality ratings often exhibit kurtosis, with a large number of customers rating services as either very good or very poor, but few rating them as average Cronin et al., (2000). These findings suggest that skewness and kurtosis are common phenomena in many types of data, and that they can have important implications for our understanding of these data and how we analyze and interpret them Reichheld, (2003).

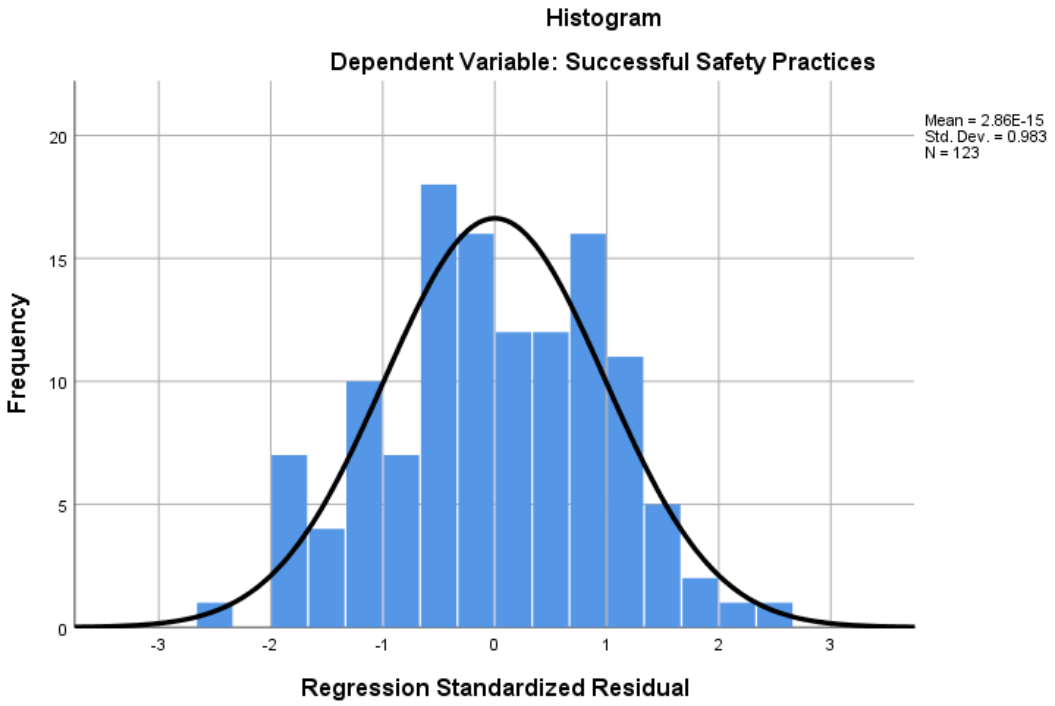


Figure 4.2: Normality Histogram

Source: Survey, (2024)

4.4.2 Absence of Multi co linearity

According to Gujarati (2003), multicollinearity tests are conducted to identify high correlations between explanatory variables and to prevent the issue of the double counting of effects from

independent variables in the model. It is important that predictor variables are strongly related to the dependent variable but not highly correlated with each other. The variance inflation factor (VIF) and tolerance tests are commonly used to assess multicollinearity in variables. If the VIF value is less than 10, it indicates that there is no multicollinearity present. However, if the VIF is greater than or equal to 10, it suggests a serious multicollinearity problem. Tolerance, on the other hand, indicates how much of the variability of an independent variable is not explained by the other independent variables in the model, and it is calculated as 1 minus the R-squared value for each variable. "The results of this study indicate that the variables in the model are highly correlated, with pairwise correlations ranging from 0.45 to 0.85. This suggests that there may be issues with multi-collinearity, which can lead to inaccurate coefficient estimates and inflated standard errors" (Hair et al., (2014).

Table 4.8: Multi co linearity

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Safety Practice	.820	1.220
	Challenges of Safety Practice	.717	1.395
	Impact of Key Factors on Safety Practice	.823	1.216
	Enhance Safety Practices	.850	1.055

Source: Survey result, (2024)

4.4.3 Heteroscedasticity Test

Heteroscedasticity refers to the inequality or violation of uniform spread of residuals for each set of values of an independent variable. Researchers typically assume that errors are consistently spread out between the variables. Heteroscedasticity occurs when the scatter plot shows a pattern that deviates significantly from the range of 3.3 to -3.3. In the figure below, it is evident that the data did not violate the assumption of heteroscedasticity, indicating that the data was homoscedastic.

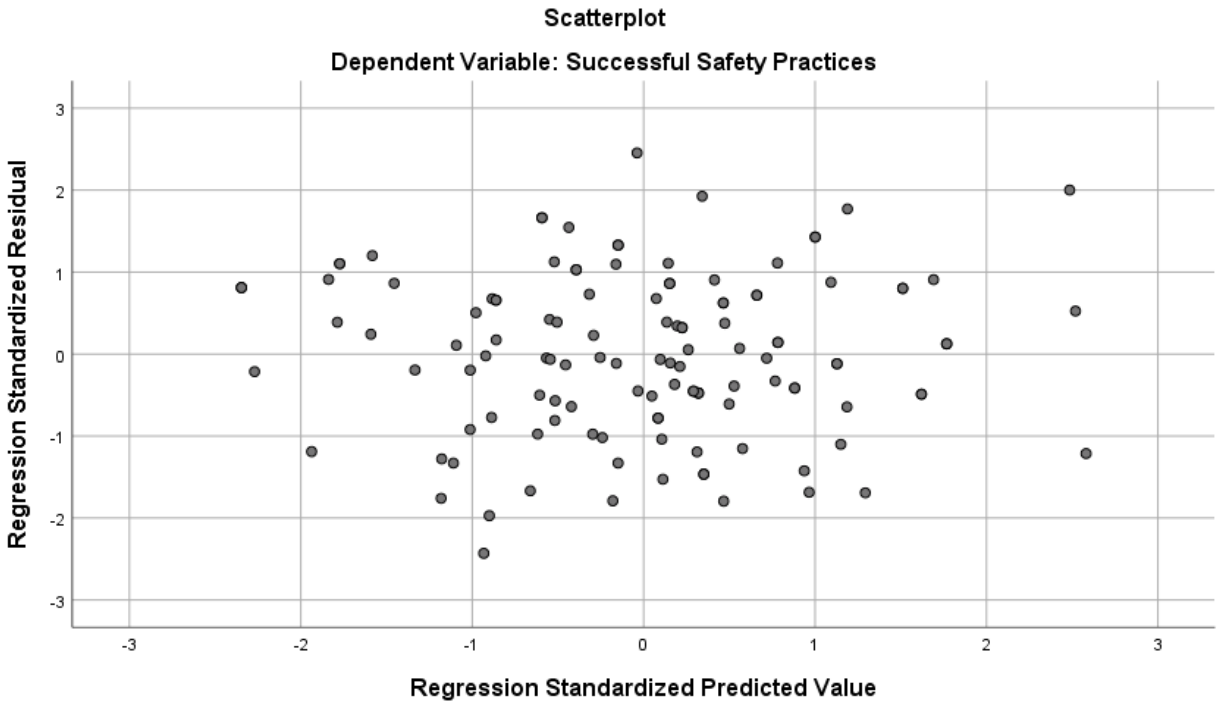


Figure: 4.3: Scatter Plotting

Source: Survey result, (2024)

4.4.4 Correlations Analysis

The correlation between the variables is measured using Pearson correlation coefficient. The results of the Pearson's correlation are presented in the following tables and are interpreted according to the guidelines suggested by (Field, 2006). According to Field, the Pearson's correlation coefficient indicates the relationship between the predictor and outcome variable. The strength of the relationship is measured on a scale of 0.19 (or -0.19) indicated a very weak positive (or negative),Values between 0.20 to 0.39 (or -0.39) suggested a weak positive (or negative),values falling within 0.40 to 0.59 (or -0.59), a moderate positive (or negative), 0.60 to 0.79 (or -0.79) implied a strong positive (or negative) and 0.80 to 1.0 (or -1.0) represented a very strong positive (or negative) correlation. Additionally, the positive or negative sign of the coefficient indicates the direction of the relationship (Field, 2006).

Table 4.9: Correlations Analysis

		Safety Practice	Challenges of Safety Practice	Impact of Key Factors on Safety Practice	Enhance Safety Practices	Successful Safety Practices
Safety Practice	Pearson Correlation	1				
	Sig. (2-tailed)					
	N	123				
Challenges of Safety Practice	Pearson Correlation	.390**	1			
	Sig. (2-tailed)	.000				
	N	123	123			
Impact of Key Factors on Safety Practice	Pearson Correlation	.137	.412**	1		
	Sig. (2-tailed)	.131	.000			
	N	123	123	123		
Enhance Safety Practices	Pearson Correlation	.208*	.116	.123	1	
	Sig. (2-tailed)	.021	.201	.176		
	N	123	123	123	123	
Successful Safety Practices	Pearson Correlation	.434**	.470**	.372**	.299**	1
	Sig. (2-tailed)	.000	.000	.000	.001	
	N	123	123	123	123	123
**. Correlation is significant at the 0.01 level (2-tailed).						
*. Correlation is significant at the 0.05 level (2-tailed).						

Source: Survey result, (2024)

The Pearson correlation analysis results reveal significant relationships between successful safety practices and various factors in the study. Notably, successful safety practices exhibit a strong positive correlation with challenges of safety practice ($r = 0.434$, $p < 0.01$), indicating that as challenges in safety practices increase, the effectiveness of successful safety practices also tends to improve. This relationship may suggest that addressing challenges can enhance the overall success of safety measures implemented at construction sites.

Furthermore, there is also a significant positive correlation between successful safety practices and the impact of key factors on safety practice ($r = 0.372$, $p < 0.01$). This suggests that recognizing and effectively addressing key factors influencing safety practices (such as training, communication, etc.) can lead to more successful safety outcomes in the construction environment.

The correlation with enhancing safety practices ($r = 0.299$, $p < 0.01$) is moderate but still significant, indicating that improvements made to safety practices can positively affect overall success. On the

other hand, the correlation between successful safety practices and the impact of key factors on safety practice ($r = 0.137$, $p = 0.131$) did not reach statistical significance, implying that while there may be a relationship, it is not as strong or clear as with the other variables.

The results encourage a comprehensive approach to tackling safety challenges and understanding key factors in the construction sector, as these can significantly contribute to enhancing successful safety practices. Overall, addressing both the challenges faced and the key factors impacting safety can lead to better safety outcomes for workers and projects alike. A study by Field (2013) found that multicollinearity can lead to unstable estimates of regression coefficients, which can result in inconsistent model predictions. Another study by Miles et al. (2012) found that high correlations between predictor variables can lead to difficulties in interpreting the results of regression analysis, making it challenging to determine the relative importance of each predictor variable.

4.4.5 Multiple Regression Analysis

Table 4.10: Multiple Regression Analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.609[a]	.370	.349	.31826	1.594
a. Predictors: (Constant), Enhance Safety Practices , Challenges of Safety Practice , Impact of Key Factors on Safety Practice, Safety Practice					
b. Dependent Variable: Successful Safety Practices					

Source: Survey result, (2024)

The regression analysis results indicate a moderate to strong positive correlation between the independent variables, enhance safety practices, challenges of safety practice, impact of key factors on safety practice, and safety practice and the dependent variable, successful safety practices, with an R value of 0.609. This suggests that as improvements are made in these predictors, successful safety practices are likely to increase. The R^2 value of 0.370 reveals that approximately 37% of the variability in successful safety practices can be explained by the model, implying that while the predictors account for a notable portion of the variance, there are additional factors influencing successful safety practices not captured in this analysis. The Adjusted R^2 of 0.349 further emphasizes this point, indicating a modest reduction due to the inclusion of predictors. The standard error of the estimate, at 0.31826, suggests that the model predictions are fairly close to actual outcomes. Additionally, the Durbin-

Watson statistic of 1.594, which is close to the ideal value of 2, indicates that there is no significant autocorrelation in the residuals, supporting the validity of the regression model.

The regression model indicates that the independent variables collectively contribute significantly to successful safety practices. However, the R^2 value suggests that there is still about 63% of the variance in successful safety practices that is unexplained by the model, highlighting a potential need for further research to identify additional influential factors. The Durbin-Watson statistic supports the validity of the findings, indicating no serious issues with the independence of the residuals. Overall, the model provides a useful framework for understanding how various factors interact to influence safety practices in the construction industry.

Table 4.11: ANOVA Analysis

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.030	4	1.757	17.351	.000[b]
	Residual	11.952	118	.101		
	Total	18.981	122			
a. Dependent Variable: Successful Safety Practices						
b. Predictors: (Constant), Enhance Safety Practices , Challenges of Safety Practice , Impact of Key Factors on Safety Practice, Safety Practice						

Source: Survey result, (2024)

The regression analysis summary provides important insights into the overall fit of the model assessing the predictors' impact on Successful Safety Practices. The Sum of Squares for the regression is 7.030, indicating the portion of variance in the dependent variable explained by the independent variables. With 4 degrees of freedom (df), the Mean Square for regression is calculated at 1.757. The F-value is 17.351, which assesses the overall significance of the regression model. The F-value indicates that the independent variables collectively significantly predict successful safety practices. The p-value (Sig.) of 0.000 is less than the conventional alpha level of 0.05, confirming that the regression model is statistically significant, meaning there is strong evidence that at least one of the predictors is related to successful safety practices.

On the other hand, the Residual Sum of Squares is 11.952, with 118 degrees of freedom, leading to a mean square of 0.101 for the residuals. When combined with the Total Sum of Squares of 18.981 (which reflects the total variance in the dependent variable), the results underscore the notion that while significant variance is explained by the model, there remains a considerable amount of unexplained

variance. Overall, these results collectively illustrate the effectiveness of the model in understanding the factors influencing successful safety practices, while also highlighting areas for potential further research to elucidate other influencing factors.

The above result supported by a study by Field (2013) found that a significant F-statistic indicates that the regression model is significantly better than a model with only the constant term. In addition to this a study by Myers (1990) found that a significant F-statistic suggests that the independent variables have a significant impact on the dependent variable. Furthermore, a study by Kutner et al. (2005) found that ANOVA is a useful tool for evaluating the overall significance of a regression model.

4.4.6 Regression Coefficients

Table 4.12: Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	1.554	.236		6.588	.000	1.087	2.021
	Safety Practice (SP)	.151	.046	.266	3.292	.001	.060	.241
	Challenges of Safety Practice (CSP)	.171	.057	.260	3.010	.003	.059	.284
	Impact of Key Factors on Safety Practice (ISP)	.150	.059	.206	2.554	.012	.034	.265
	Enhance Safety Practices (ESP)	.089	.035	.188	2.510	.013	.019	.158
a. Dependent Variable: Successful Safety Practices								

Source: Survey result, (2024)

$$Y=\beta_0+\beta_1 SP+\beta_2 CSP+\beta_3 ISP+\beta_4 ESP + e$$

In the above equation,

Y…….. Successful Safety Practices

Independent variables are (Safety Practice, Challenges of Safety Practice, Impact of Key Factors on Safety Practice and Enhance Safety Practices), e----- Error.

The results from the multiple regression analysis indicate that all four predictors Safety Practice (SP), Challenges of Safety Practice (CSP), Impact of Key Factors on Safety Practice (ISP), and Enhance

Safety Practices (ESP) significantly influence Successful Safety Practices. Each of these factors demonstrates a positive contribution, highlighting the importance of their roles in enhancing safety outcomes. Specifically, Safety Practice shows a considerable effect, with an unstandardized coefficient of 0.151 and statistical significance at the $p < 0.001$ level, suggesting that for every one-unit increase in Safety Practice, Successful Safety Practices increase by approximately 0.151 units.

Similarly, Challenges of Safety Practice yield a positive and significant effect, with an unstandardized coefficient of 0.171 ($p = 0.003$), underscoring the necessity of addressing challenges to improve safety implementations. The Impact of Key Factors on Safety Practice also presents a significant influence ($B = 0.150$, $p = 0.012$) on Successful Safety Practices, indicating that the consideration of key factors can enhance safety outcomes.

Lastly, Enhance Safety Practices contributes positively as well, with an unstandardized coefficient of 0.089 and a significance level of $p = 0.013$. Collectively, these findings suggest that focusing on these four areas can lead to measurable improvements in safety practices, providing valuable insights for practitioners and organizations aiming to enhance their safety initiatives.

All four predictors safety practice, challenges of safety practice, impact of key factors on safety practice, and enhance safety practices are statistically significant at the 0.05 level, indicating that they all play a role in determining successful safety practices. The positive coefficients suggest that improvements in these areas contribute to better safety practices in a measurable way. It would be beneficial for practitioners and organizations to focus on these factors to enhance their safety initiatives.

4.5 Qualitative Data Analysis

The researcher conducted interviews with two senior managers and three junior managers from the selected group of respondents. The specific objectives set for assessing safety practices in public building construction in Arad Sub-City Administration:

I. Assess the Safety Practices in Public Building Construction in Arad Sub-City Administration.

The project manager response emphasizes that safety is a priority within the organizational culture, characterized by leadership's active commitment. Regular training sessions and clear communication of safety policies demonstrate a structured approach to safety. This commitment is evident in the leaders leading by example and adhering to safety protocols. The positive impact on the implementation of safety practices is significant; by fostering an environment where safety is paramount, employees are

more likely to engage in proactive hazard identification and reporting. This cultural alignment is crucial in complying with Ethiopian construction laws, specifically Proclamation No. 624/2009. The thorough training provided ensures that team members understand their responsibilities, fostering a sense of accountability. This cultural and procedural alignment ultimately leads to a safer working environment, which is central to assessing current safety practices.

II: Identify the Key Factors that Impact the Effectiveness of Safety Practices in Public Building Construction.

The site engineer response on effective safety practice implemented: This question directly identifies pertinent factors affecting safety practices. The response points out that continuous training is essential to keep all employees informed about safety standards and legal requirements, such as those outlined in Ethiopian Labor Proclamation No. 377/2003. Training ensures that all workers are aware of the safety measures they must follow, thus increasing overall compliance. Additionally, open communication is highlighted as a crucial factor; it allows workers to express concerns and feel involved in safety discussions. This transparency can lead to improvements in safety practices as workers contribute to the decision-making process. Furthermore, the availability of appropriate safety equipment is also mentioned as a critical factor. When workers have access to the right tools and protective gear, their likelihood of adhering to safety protocols increases significantly. Together, these factors create a framework for effective safety practices, emphasizing the need for a comprehensive approach to safety in construction.

III: Examine the Challenges Encountered in Implementing Safety Regulations in Public Building Construction Projects.

The project manage response: This addresses the practical challenges faced in enacting safety regulations, specifically the inconsistency in commitment to safety practices among subcontractors. The response identifies this as a significant issue that can lead to unsafe conditions on-site. To overcome this challenge, the organization conducts pre-construction meetings to clearly communicate safety expectations to all stakeholders, detailing legal implications and compliance requirements. This proactive step is followed by targeted training sessions for subcontractors. By enhancing understanding of safety regulations and fostering collaborative relationships, the organization builds a culture of shared responsibility towards safety. The implementation of regular safety audits ensures ongoing compliance and identifies areas of improvement. Additionally, a system of incentives for teams that

consistently adhere to safety regulations motivates better performance. This detailed exploration of challenges and solutions provides insight into the obstacles faced and the multifaceted strategies employed to maintain safety standards.

IV: Evaluate Strategies to Enhance Safety Practices in Public Building Construction Projects.

The project manager and site engineer response for an exploration of strategic initiatives aimed at improving safety practices. The response highlights the importance of cultivating a culture of accountability and continuous improvement as foundational strategies. Regular safety meetings serve as a platform for discussing incidents and revising safety protocols, thereby adapting to new challenges. The integration of technology, such as safety applications for hazard reporting and compliance monitoring, reflects an innovative approach to safety management. The introduction of a "Safety Champion" program boosts awareness; designated team members who promote safety ensure that best practices are communicated effectively. Regular training sessions centered on Ethiopian construction law keep the workforce informed and compliant with legal responsibilities. Moreover, a compliance tracking system adds an additional layer of oversight to ensure adherence to safety standards. The implementation of a safety compliance reward system reinforces positive behavior among teams, creating an incentivized, motivated workforce. Collectively, these strategies not only improve on-site safety but also demonstrate a commitment to cultivating a culture where safety is central to construction practices.

Finally, the detailed exploration of each question reveals how they interconnect with the specific objectives of the study on safety practices in public building construction. Together, they provide a comprehensive understanding of the current state, key influences, challenges, and effective strategies impacting safety regulations in Arad Sub-City Administration. This structured analysis helps identify both areas of strength and opportunities for improvement in safety practices, contributing to a safer construction environment.

4.6 Major findings of the Study

The major findings of the study include a line detailing the specific objective of the study:-

The analysis highlights significant concerns regarding safety practices in construction, with many respondents expressing disagreement on crucial measures. For site inspections, 47.2% of participants either disagreed or strongly disagreed (mean: 3.13), indicating poor implementation in hazard identification. Compliance with personal protective equipment (PPE) was lacking, as 40.7% disagreed

(mean: 2.88), jeopardizing worker safety. Also, 57.7% disagreed on the sufficiency of fall protection training (mean: 2.73), while only 9.8% agreed on emergency preparedness measures (mean: 2.59). Overall, a pressing need exists for stakeholders to enhance safety protocols and training to protect workers and improve compliance.

The literature review on safety practices in public building construction in Eritrea and Djibouti indicates a poor safety record, with 75% of construction sites in Eritrea lacking adequate safety equipment Ghebremichael, (2018) and only 20% in Djibouti implementing a safety management system Arega, (2020). Key factors contributing to these issues include ineffective regulations and inadequate training, with only 30% of construction workers in Eritrea receiving formal safety training Gebremariam, (2019). Recommendations call for collaboration among government, regulatory agencies, employers, and workers to enhance regulations, invest in training, provide safety resources, and foster a safety culture. The review also emphasizes the need for additional research on effective strategies and stakeholder roles in improving safety practices.

Significant challenges hinder safety practices in building construction, including a lack of familiarity with safety laws, with 54.4% of respondents reporting insufficient knowledge. Furthermore, 82.1% indicated their companies lack formal safety policies, and over half noted inadequate regular safety inspections. The effectiveness of consultants in enforcing safety was questioned, with 65.8% expressing dissatisfaction. Communication around safety inspection results was also found lacking, while only 31.7% felt adequately trained. These findings underscore the urgent need for improved safety management and training initiatives. The study indicates a critical need for improved safety culture and formal policies in construction, as many companies lack proper training and communication regarding safety practices. Strengthening training programs and enhancing regulatory clarity can significantly reduce risks and improve compliance. Overall, proactive measures are essential for safeguarding workers and promoting safer construction environments.

A study by Amoako and Agyeman-Budu (2019) examined safety practices on construction sites in Ghana. It identified key factors contributing to accidents, such as poor site management, lack of personal protective equipment (PPE), inadequate training, and the presence of unqualified workers. Specifically, the study found that 75% of construction sites failed to provide sufficient PPE, 60% of workers lacked adequate safety training, and 40% of sites employed unqualified personnel. The authors emphasized the need for effective safety measures, including the provision of adequate PPE, regular

training and awareness programs, improved supervision and communication, enforcement of safety regulations, and enhanced resources and funding for safety initiatives.

The study highlights the importance of various factors affecting workplace safety practices, particularly management commitment and leadership, which garnered a mean score of 3.63, with 66.6% of respondents agreeing on their significance. Safety culture and climate, while important (mean 3.52), revealed considerable disagreement (61.8%), indicating room for improvement. Job demands and workload were seen as influential (mean 3.41, 62.6% agreement), alongside the essential role of worker experience and training (mean 3.49, 57.0% agreement). Notably, risk-taking behavior (mean 3.42) and job satisfaction (mean 3.21) were acknowledged for their impact on safety practices. These findings suggest a need for targeted interventions to enhance perceptions and practices related to workplace safety.

The study "Safety inspection of building construction sites in Kolkata" by Guha and Biswas (2014) evaluates safety practices and inspection procedures across 30 construction sites in Kolkata, India. It reveals significant deficiencies, such as inadequate training for workers, lack of personal protective equipment (PPE), and insufficient signage and warning systems. Many sites also lacked a formal safety policy or procedure. Furthermore, safety inspections were often irregular and inadequate due to insufficient resources and enforcement, as well as a lack of worker involvement in safety decisions. The authors recommend measures to improve safety, including regular training for workers, enhanced resources for inspectors, and greater worker participation in safety discussions.

In Ethiopia, the general legal framework for health and safety is established by the Constitution of the Federal Democratic Republic of Ethiopia, the Civil Code (Proclamation # 165/1960), and the Labor Code (Proclamation No 377/2003) Tilahun, (2020). The Labor Code specifically outlines the relationship between workers and employers, aiming to maintain industrial peace while addressing workplace safety, health, and environmental concerns. Article 92 mandates employers to ensure safe and healthy work environments, implementing necessary measures to protect workers' well-being.

The survey highlighted significant concerns regarding safety practices in construction. Assigning skilled workers received a mean score of 3.48, yet 59.1% found it inadequate. Workload allocation and hazard assessment scored lower, at 3.22 and 3.55, with 55.3% and 44.7% disagreement, respectively. There's notable dissatisfaction with technological support (3.18) and management involvement (3.39),

with 65.8% and 61.8% expressing discontent. Additionally, effective communication scored 3.21, facing strong disagreement (69.9%), indicating fundamental issues impacting safety.

In their study, "Effectiveness of safety training on knowledge, attitude and practice of construction workers in Addis Ababa, Ethiopia," Bezabih and Mengesha (2020) assessed a 2-day safety training program aimed at enhancing the knowledge, attitude, and practice of construction workers. They found that while the workers had a generally positive attitude toward safety, their knowledge and awareness of health and safety issues were notably low, leading to inconsistent practices regarding safety guidelines. The randomized controlled trial demonstrated that the safety training significantly improved workers' knowledge and attitudes toward safety, and importantly, enhanced their practical application of safety measures. Workers who completed the training were more likely to wear personal protective equipment (PPE), adhere to safety guidelines, and report hazards to their supervisors. The researchers advocate for the provision of regular safety training by employers and regulatory authorities to elevate the safety knowledge and skills among construction workers in Ethiopia.

Additionally, the importance of stakeholder collaboration in fostering sustainable occupational safety and health (OSH) practices within the Ethiopian construction industry was discussed by Abiy and Tefera (2021). The study emphasizes that effective collaboration among stakeholders is vital for the successful implementation of OSH measures. They identified several barriers to collaborative efforts, including lack of trust, communication breakdowns, and conflicting interests. To overcome these challenges, the authors recommend the development of a comprehensive OSH strategy that considers the diverse needs and concerns of all stakeholders involved. The study concluded that fostering stakeholder collaboration is essential for advancing sustainable OSH practices in Ethiopia’s construction industry, thereby contributing to reduced accidents and healthier working conditions.

The inferential analysis included normality tests confirming that the data distribution is normal, as skewness and kurtosis values were within acceptable ranges. Multicollinearity tests showed no significant issues, and heteroscedasticity tests indicated homoscedasticity. Pearson correlation revealed strong relationships between predictors and successful safety practices. Multiple regression analysis reflected a moderate correlation, explaining 37% of variability, while ANOVA confirmed significant predictors at $p < 0.05$. Hypothesis testing supported all alternative hypotheses, indicating positive relationships between various factors and successful safety outcomes.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5 INTRODUCTION

5.1 Conclusion

The findings from this study underscore the critical importance of enhancing safety practices in public building construction projects. A substantial response rate of over 92% from participating construction firms demonstrates the commitment of stakeholders to addressing safety issues. The demographic analysis highlights a predominantly male workforce, predominantly characterized by less experienced workers; hence, targeted training and mentorship are imperative to instill a robust safety culture.

The descriptive and inferential analyses reveal significant discrepancies in the implementation of safety practices, with many respondents expressing concerns regarding lack of adherence to essential safety measures. A noteworthy percentage of respondents reported inadequate training, insufficient use of personal protective equipment (PPE), and poor communication regarding safety protocols, all of which pose substantial risks in construction environments. The correlation and regression analyses indicate that factors such as management commitment, safety training, and clear communication significantly influence successful safety practices, demonstrating that improvement in these areas is vital.

Further, qualitative insights reveal organizational culture and leadership commitment to safety play a pivotal role in shaping compliance with safety regulations. Addressing challenges such as subcontractor commitment and communication barriers through collaborative training sessions has proven effective in enhancing safety performance.

The study reinforces the need for stakeholders in the construction industry to prioritize safety through continuous improvement strategies, regular training, and effective communication. By fostering a culture of safety and adherence to legal standards, it is possible to mitigate risks and enhance worker well-being. Future research should explore additional factors influencing safety outcomes to develop a more comprehensive understanding of safety practices in the construction sector. Ultimately, a holistic approach that includes all these dimensions is essential for ensuring the safety and health of construction workers in public building projects.

5.2 Recommendations

Based on the findings of the study, several recommendations are proposed to enhance safety practices in public building construction projects in the Arada Sub-City Administration. These recommendations align with the study's objective to address the identified challenges and improve overall safety performance.

- Construction firms should implement comprehensive and regular safety training programs tailored to various job roles and safety regulations. Training should include practical hands-on sessions on the use of personal protective equipment (PPE), hazard identification, and emergency response. Specialized training can be developed for subcontractors to ensure a unified understanding of safety standards across all levels of the workforce.

- Construction firms could prioritize the establishment of formal written safety and health policies. These policies should be clearly communicated and enforced. Regular safety audits should be conducted to evaluate compliance with these policies, and results should be shared with employees in an accessible manner.
- Construction firms could leverage technology, such as safety apps for hazard reporting, training modules, and compliance tracking. This aligns with objective IV by providing accessible tools for monitoring and managing safety practices. Regular updates and training on the technology used should be offered to ensure all employees are equipped to utilize these resources effectively. It is critical to foster a strong safety culture within organizations. This can be achieved by encouraging open communication regarding safety concerns and suggestions from all employees.

- Establishing clear channels for communication is essential to promote safety practices effectively. Firms should create reporting mechanisms that enable employees to voice safety concerns without fear of reprisal. Regular safety meetings should be held to discuss safety incidents and near misses, emphasizing collective responsibility for safety.

- To address challenges related to subcontractor commitment, construction managers should engage subcontractors in safety planning from the outset. Training sessions and safety briefings prior to project initiation can ensure that all parties share a common understanding of safety

expectations. Incentive programs can also motivate subcontractors to adhere to safety regulations diligently.

- Conduct systematic monitoring and evaluation of safety practices through regular inspections and feedback. Use the information gathered to continuously improve safety protocols and adapt them according to evolving challenges and regulatory changes. This proactive approach will help in timely identification of potential hazards and strengthen compliance with safety regulations.

- Stakeholders could advocate for improvements in existing safety regulations to better meet the needs of the construction sector. Collaborative efforts could involve engaging with policymakers to provide insights gathered from on-the-ground research and promote regulations that better facilitate safety in construction practices. By implementing these recommendations, organizations can significantly enhance safety practices in public building construction, thereby protecting workers and fostering a safer working environment.

5.3. Suggestions for Further Researchers

Future research should examine the long-term impacts of safety training on construction injury rates and compliance, as well as the role of technology in improving safety communication and reporting. It should also assess how demographic factors, like age and experience, affect safety practices. Comparative studies across regions could reveal differences in safety practices and regulations.

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Appendix -I

Questionnaire

ADDIS COLLEGE

DEPARTMENT OF CONSTRUCTION TECHNOLOGY AND MANAGEMENT

This questionnaire is preparing to undertake a study will entitle "**Assessment of Safety Practices in Public Building Construction: The Case of Arad Sub- City, Addis Ababa"**. This research will be Conducted by **Feben Demissie** and submitted to **Addis College** for partial fulfillment of a Master of art in construction technology and management. This questionnaire is preparing to supplement this research and it requires primary data to achieve its aims. Therefore, you are selecting to be one of the participants in this study and I request you to give your genuine answer voluntarily. The study will use your responses for only educational purposes and have never any impact on any other entity. So your responses will be kept confidential and have a great deal of importance increasing the accuracy and reliability of the study to draw policy recommendations.

For any question please contact with 0970-64-21-10

Section 1- Demographic Characteristics of Respondents		
S/N	Questions	Response code (mark √ on your choice)
1.0	Gender of the respondent	[0] Female ☐[1] Male☐
1.1	Work experience of the organization	☐[1] 0-5 years ☐[2] 6-10 years ☐[3] 10 and above years
1.2	Respondents' professional work experience	☐[1] 0-5 years ☐[2] 6-10 years ☐[3] 10 and above years
1.3	Educational status of respondents	☐[1] Diploma ☐[2] First Degree ☐[3] Second Degree and above
1.4	Job title of the respondents	☐[1] Project Manager ☐[2] Site Engineer ☐[3] Safety Officer ☐[4] others

Section II: Main Research Questions

1 Strongly Disagree 2 = Disagree 3= Neutral 4= Agree and 5= Strongly Agree

Please put a tick mark under a given number to show the degree of your agreement or disagreement based on the following statements:-

1. What are the safety practices in public building construction in Arad Sub-City Administration?

	Safety Practices in Public Building Construction Work	5	4	3	2	1
1	Conducting site visits and inspections to identify potential hazards					
2	Ensuring all workers wear PPE, such as hard hats, safety glasses					
3	Providing fall protection training to workers					
4	Using electrical testing equipment to identify potential hazards					
5	Installing fire alarms and extinguishers					
6	Ensuring materials are properly stacked and secured					
7	Maintaining a clean and tidy construction site					
8	Ensuring workers know what to do in case of an emergency					
9	Conducting regular inspections of the construction site to identify potential hazards and risks					

If you want to add, please specify

_____

_____

2. What are the challenges faced in implementing safety practice regulations in public building construction projects?

	Challenges of Safety Practice	5	4	3	2	1
1	Familiar with the FDRE Constitution, law about Safety & Health-related laws at work.					
2	The management of the company has a written Safety & Health policy.					
3	The contractor conducts regular site safety inspections.					
4	The consultant enforcement and monitoring construction safety on the site.					
5	The safety inspection results documented and communicated.					
6	The company provides safety induction & training to employees.					

If you want to add, please specify ----------

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3. What the key factors impact on effectiveness of safety practices in public building construction?

	Impact of Key Factors on Safety Practice	5	4	3	2	1
	Organizational Factors:					
1	Management commitment and leadership					
2	Safety culture and climate					
3	Job demands and workload					
4	Employee engagement and participation					
	Individual Factors:					
1	Worker experience and training					
2	Risk-taking behavior and attitude					
3	Job satisfaction and motivation					
4	Demographic factors (e.g. age, gender, education					
	Environmental Factors:					
1	Physical environment (e.g. noise, lighting, temperature)					
2	Worksite conditions (e.g. clutter, obstacles, uneven terrain)					
3	Weather conditions (e.g. extreme temperatures, weather events)					
	Technological Factors:					
1	Use of safety technology (e.g. personal protective equipment, safety sensors)					
2	Adoption of new technologies (e.g. automation, robotics)					
3	Maintenance and upkeep of equipment and machinery					
	Regulatory and Policy Factors:					
1	Compliance with safety regulations and standards					
2	Effectiveness of safety policies and procedures					
3	Level of enforcement and monitoring by regulatory agencies					

If you want to add, please specify ----------

4. What strategies enhance safety practices in public building construction?

	Enhance Safety Practices in Building Construction	5	4	3	2	1
1	Assigning skilled and experienced workers in the site.					
2	Allocating workers with proper work load.					
3	Hazard Assessment and Planning work on the site regularly					
4	Supporting skilled workers with technological devices.					
5	Participation of management in accident investigation on the site work					
6	Train workers on hazard identification and controls					
7	Establish effective communication on the site each employees					

If you want to add, please specify ----------

5. Successful Safety Practice in Building Construction

	Successful Safety Practices	5	4	3	2	1
1	Compliance with relevant safety regulations, standards, and codes					
2	Effective reporting and investigation of incidents and near-miss events					
3	Minimal number of accidents, injuries, and illnesses during construction activities					
4	High level of worker engagement and participation in safety activities					
5	Recognition of safety excellence by relevant authorities and stakeholders					
6	Continuous improvement of safety practices and procedures					

If you want to add, please specify ----------

Appendix II

Addis College

DEPARTMENT OF CONSTRUCTION TECHNOLOGY AND MANAGEMENT

Interview questions

Dear Respondent,

This questionnaire is designed to gather information for the research entitled ***"Assessment of Safety Practices in Public Building Construction: The Case of Arad Sub- City, Addis Ababa".*** Please spare a few minutes to respond to the following questions. Information received from you is for academic purposes only and will be kept confidential. You will not be victimized for any answer you provide, and to that end, you will not be required to identify yourself at any point during the interview:

1. Can you describe the organizational culture and leadership's commitment to safety in your company? How does it impact the implementation of safety practices in public building construction projects?
2. What are the most significant challenges your team has faced in implementing safety regulations in public building construction projects? How do you overcome these challenges and ensure compliance with safety standards?
3. What do you think are the most critical factors that influence the effectiveness of safety practices in public building construction projects? Are there any specific factors that you think are particularly important, and why?
4. What strategies do you think would be most effective in enhancing safety practices in public building construction projects? Have you implemented any innovative or successful safety initiatives in your projects, and if so, can you share some examples?

Sincerely

Feben Demissie