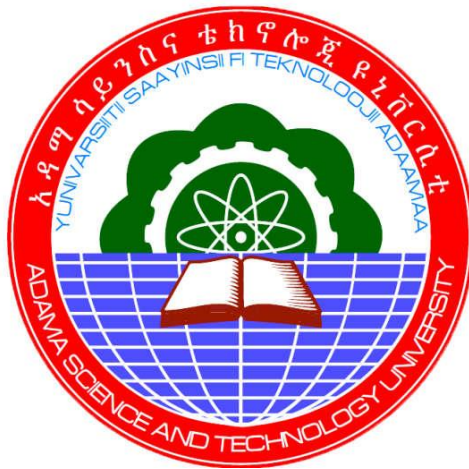


Assessing the Impact of the Construction Design and Management Regulations on Health and Safety in the Case of Addis Ababa



Dawit Tefera

Submitted to the Department of Civil Engineering College of Civil Engineering and Architecture

Presented in Partial Fulfillment of the Requirement for the Degree of Master's in Construction Engineering Management

**Office of Graduate Studies
Adama Science and Technology University**

**May 2025
Adama, Ethiopia**

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Submitted to the Department of Civil Engineering College of Civil Engineering and Architecture

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Declaration and Recommendation

Declaration

I hereby declare that this Master Thesis entitled “Assessing the Impact of the Construction Design and Management Regulations on Health and Safety in the Case of Addis Ababa” is my original work. That is, it has not been submitted for the award of any academic degree, diploma or certificate in any other university. All sources of materials that are used for this thesis have been duly acknowledged through citation

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Signature

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Recommendation

I/we, the advisor(s) of this thesis, hereby certify that I/we have read the revised version of the thesis entitled “Assessing the Impact of the Construction Design and Management Regulations on Health and Safety in the Case of Addis Ababa” prepared under my/our guidance by Dawit Tefera (name of student) submitted in partial fulfillment of the requirements for the degree of Master’s of Science in Construction Engineering Management.

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We, the undersigned, members of the Board of Examiners of the thesis by Dawit Tefera (Name of student) have read and evaluated the thesis entitled “Assessing the Impact of the Construction Design and Management Regulations on Health and Safety in the Case of Addis Ababa” and examined the candidate during open defense. This is, therefore, to certify that the thesis is accepted for partial fulfillment of the requirement of the degree of Master of Science in Construction Engineering Management.

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ACRONYMS

CDM	Construction Design Management
UK	United Kingdom
HSE	Health and Safety Equipment
ILO	International Labor Organization
PPE	Personal Protective Equipment
PDCA	Plan-Do-Check-Act
WHS	World Health and Safety
GDP	Gross Domestic Product
ETB	Ethiopian Birr
SPSS	Statistical Package for the Social Sciences

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Abstract

This study investigates the impact of Construction Design and Management (CDM) regulations on health and safety practices within the construction industry in Addis Ababa, Ethiopia. Despite the rapid sectorial growth driven by urbanization, persistent challenges such as inadequate enforcement, resource constraints, and poor safety culture continue to impede safety outcomes. A significant research gap exists concerning the contextual adaptation, implementation, and stakeholder engagement of safety regulations in the local setting. To address these issues, a mixed-methods approach was adopted, combining structured questionnaires, semi-structured interviews, and document reviews. The quantitative data provided insights into stakeholder awareness, compliance levels, and safety practices, while qualitative findings explored perceptions and systemic barriers. Results reveal that, although there have been improvements in safety awareness and accident reduction since regulation adoption, enforcement deficiencies, socioeconomic pressures, and cultural attitudes significantly hinder optimal safety performance. The study concludes that strengthening regulatory enforcement, fostering a safety-oriented culture, and supporting small and informal firms are essential for enhancing safety outcomes. These findings underscore the necessity of context-specific strategies to effectively implement and sustain health and safety regulations in Ethiopia's developing construction sector.

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Chapter One

1. Introduction

1.1. Background of the study

The construction industry plays a critical role in economic development worldwide, providing infrastructure, housing, and employment opportunities. In Ethiopia, particularly in urban centers like Addis Ababa, the construction sector has witnessed unprecedented growth in recent years, driven by rising urbanization and the need for improved facilities. However, this rapid development has not been accompanied by adequate attention to health and safety standards, leading to significant incidents of accidents, injuries, and fatalities among construction workers. The hazards inherent in construction work are well-documented, making it imperative to implement effective health and safety regulations to protect workers and enable sustainable development (Asfaw, 2021).

According to Taffese (2020), urbanization rates in Ethiopia have accelerated significantly, leading to a surge in infrastructural development projects, including roads, buildings, and industrial facilities. This rapid expansion, while vital for economic progress, has been accompanied by serious concerns related to health and safety, with construction sites frequently characterized by high accident rates, injuries, and fatalities

Despite the sector's expansion, the safety record within Ethiopia's construction industry remains concerning. Multiple studies and reports have highlighted the prevalence of accidents and their grave consequences. For instance, Tesfaye and Abebe (2021) reported that construction sites in Addis Ababa witness numerous incidents each year, including falls from heights, machinery-related injuries, and exposure to hazardous materials, which often result in severe injuries or death. Their report emphasizes that accidents like falls contribute to approximately 40-50% of construction-related injuries, underscoring the high-risk environment of Ethiopian construction sites.

Statistically, the injury rate in Ethiopian construction is estimated to be around 20-25 accidents per 1,000 workers annually. Considering that the construction workforce in Ethiopia is estimated to be over a million (World Bank, 2020) this translates into tens of thousands of injuries each year. Moreover, the fatality rates approximately 4-6 deaths per 1,000 workers annually represents a significant public safety concern. A report by the World Bank (2020), which

analyzed occupational safety in Ethiopian construction, further indicates that these figures are likely underreported due to inadequate accident record-keeping and enforcement challenges, which are common in developing countries.

One regulatory framework that has garnered international recognition for its contributions to improving health and safety outcomes in construction is the Construction Design and Management (CDM) Regulations. Initially introduced in the United Kingdom, CDM regulations emphasize a proactive approach to managing health and safety throughout the lifecycle of construction projects from design and planning to execution and post-completion. These regulations require stakeholders to consider safety risks from the outset and ensure that health and safety measures are integrated into all phases of project development. While the CDM framework has demonstrated success in various contexts, its application in developing countries, particularly Ethiopia, has received limited scholarly attention (Makkar, 2018).

This study aims to assess the impact of CDM regulations or regulatory frameworks reminiscent of CDM on health and safety practices within the construction industry with in Addis Ababa. By evaluating the understanding, implementation, and effectiveness of these regulations among key stakeholders including construction workers, site managers, and safety officers this research seeks to identify existing gaps and barriers that hinder effective health and safety management in the local context. Furthermore, this study will highlight the unique challenges posed by the Ethiopian construction environment and the necessity for context-sensitive adaptations of health and safety regulations (Kheni J. & Gibb A, 2011).

Given the critical importance of safeguarding the welfare of construction workers and promoting an organizational culture of safety, this research contributes to the growing body of knowledge aimed at enhancing health and safety standards in the construction industry. By shedding light on the current practices and perceptions regarding health and safety regulations in Addis Ababa, the findings will be instrumental in informing policymakers, industry leaders, and educators about effective strategies for improving safety outcomes and protecting the workforce in Ethiopia's rapidly evolving construction landscape (Assefa A. & Woldemariam A, 2021).

1.2. Statement of the Problem

Despite the rapid growth of the construction industry in Ethiopia, particularly in Addis Ababa, the sector continues to face significant challenges concerning health and safety regulations (World Bank, 2020). The high incidence of accidents in the construction industry can be

explicitly linked to systemic failures, including weaknesses in safety management practices, inadequate performance training, and gaps in regulatory enforcement (Cooper, 2000). Systemic failures manifest when safety protocols are not embedded into organizational processes. Many managers are either unaware of or indifferent to safety a precaution, which indicates a breakdown in safety culture and governance. This negligence leads to unsafe practices on sites, increasing accident risks (Guldenmund, 2007).

Weak performance training significantly contributes to accidents without comprehensive training programs that balance theoretical knowledge and practical skills, workers are ill-prepared to identify hazards or respond effectively during emergencies. This training gap leaves workers vulnerable to unsafe conditions, which directly correlates with higher accident rates (B coupling & Mearns, 2009). Regulatory gaps and enforcement deficiencies exacerbate the problem. The regulatory framework in Addis Ababa is often superficial and poorly enforced due to resource constraints, bureaucratic inefficiencies, and limited inspection capabilities. This weak enforcement means unsafe practices go unchecked, and violations of safety standards are common, creating an environment where accidents are more likely (ILO., 2019).

Construction is inherently hazardous, with workers often exposed to various risks, including falls, equipment-related accidents, and exposure to harmful materials. The lack of adequate health and safety practices not only endangers the lives of workers but also impedes overall project efficiency and public safety. Reports indicate a high incidence of workplace accidents and fatalities in the Ethiopian construction sector, raising urgent concerns about the effectiveness of existing safety regulations and their enforcement (World Bank, 2020).

The Construction Design and Management (CDM) Regulations were developed to enhance health and safety standards in construction through a systematic approach that integrates risk management into the planning and execution of projects (Loosemore M. & Malouf M, 2020) . However, the applicability and effectiveness of such regulations in the Ethiopian context remain poorly understood. There is limited empirical evidence regarding the implementation of CDM-like frameworks in Addis Ababa, and stakeholders such as construction firms, governmental agencies, and workers often lack comprehensive awareness of their roles and responsibilities under these guidelines. As such, there is a pressing need to investigate how these regulations

influence health and safety practices within the construction sector in Addis Ababa (Tesfaye H. & Bansal A, 2019).

This research seeks to address critical questions regarding the understanding and implementation of CDM regulations among various stakeholders in the construction industry. Specifically, it aims to identify gaps in knowledge, training, and compliance that may hinder the successful integration of health and safety management practices. Additionally, the study explore the barriers preventing effective regulation implementation, which is crucial for enhancing worker safety and promoting a culture of safety in construction practices (Lingard H.& Graham P, 2017).

By examining these issues, the study aspires to contribute to the development of contextually relevant recommendations and strategies that can inform policymakers, industry leaders, and safety practitioners about improving health and safety outcomes in Ethiopia's construction sector. The findings would paramount in shaping a safer working environment for construction workers, ultimately supporting the sustainability and growth of the industry (Daba G, 2020).

The construction industry in Addis Ababa has experienced significant growth, driven by urbanization and infrastructural development. However, this rapid expansion has been accompanied by persistent safety concerns, including high rates of workplace accidents, injuries, and fatalities. Although Ethiopia has adopted health and safety regulations modeled after international frameworks like the Construction Design and Management (CDM) Regulations, the implementation and enforcement of these regulations remain limited and inconsistent. Challenges such as inadequate regulation enforcement, low safety awareness among stakeholders, resource limitations, and socio-cultural attitudes toward safety hinder the effective application of safety practices. Consequently, construction sites continue to operate with minimal compliance to safety standards, posing risks to workers and impeding sustainable development. Addressing these issues requires a comprehensive understanding of how the regulations are being implemented, the barriers faced by stakeholders, and strategies for fostering a safety culture within the sector.

1.3. Objectives

1.3.1. General Objective

To assess the impact of the Construction Design and Management (CDM) Regulations on health and safety in the construction industry within the Addis Ababa City

1.3.2. Specific Objectives

1. To evaluate the extent of compliance with the regulations on health and safety among construction firms operating in Addis Ababa.
2. To identify the key challenges and barriers faced by construction stakeholders in implementing the regulation achieving safety standards.
3. Develop an effective regulation framework that addresses the identified gaps and enhances the overall health and safety standards in construction projects.

1.4. Research Questions

What is the current level of compliance with the local health and safety regulations among construction companies in Addis Ababa?

What are the primary challenges and barriers that construction stakeholders face in implementing the health and safety regulations effectively?

How do construction managers, site workers, and regulatory authorities perceive the effectiveness of the CDM Regulations in enhancing health and safety on construction sites?

What are the measurable health and safety outcomes in construction projects in Addis Ababa City following the implementation the regulations?

What recommendations can be proposed to improve the implementation of regulations to ensure better health and safety practices in the construction industry?

1.5. Scope of the Study

This study focused on the Addis Ababa City, Ethiopia, specifically examining construction sites within this urban area. The selection of Addis Ababa is justified by its rapid development and the diverse array of construction projects occurring within its limits.

The research assessed the impact of CDM Regulations from their implementation date 2020 to the present, providing a comparative analysis of health and safety outcomes over this period.

The study involves key stakeholders in the construction sector, including project managers, site supervisors, safety officers, and construction workers employed on various construction sites in Addis Ababa City. Additionally, representatives from local regulatory authorities will be included to gather insights on policy enforcement and compliance.

1.6. Significance of the Study

This study provides valuable insights into the effectiveness of the CDM Regulations in improving health and safety conditions on construction sites in Addis Ababa. By identifying areas of compliance and non-compliance, the research aims to contribute to higher safety standards and reduce workplace accidents.

Findings from this research assist policymakers and regulatory authorities in understanding the challenges faced in the implementation of health and safety regulations. This understanding can lead to the refinement of existing policies and the development of more effective regulatory frameworks that take local socio-economic dynamics into account.

The study aims to empower various stakeholders including construction managers, workers, and safety officers by illuminating their roles and responsibilities under the CDM, promoting a culture of safety and awareness. Improved knowledge and understanding among these groups can lead to better adherence to safety practices.

1.7. Organization of the Study

The organization of this study begins with an introduction that outlines the background, problem statement, objectives, and scope of the research. The second chapter presents a comprehensive review of relevant literature, including international and local safety regulations, theoretical frameworks, and previous studies on the impact of safety management practices. The third chapter details the research methodology, including data collection methods such as questionnaires and interviews, as well as the sampling criteria. The fourth chapter discusses the results and findings from the data analysis, highlighting stakeholder awareness, compliance levels, and challenges faced in implementing safety regulations. Finally, the study concludes with a summary of key insights, policy recommendations, and areas for further research, providing a cohesive understanding of the impact of Construction Design and Management regulations on safety in Addis Ababa's construction industry.

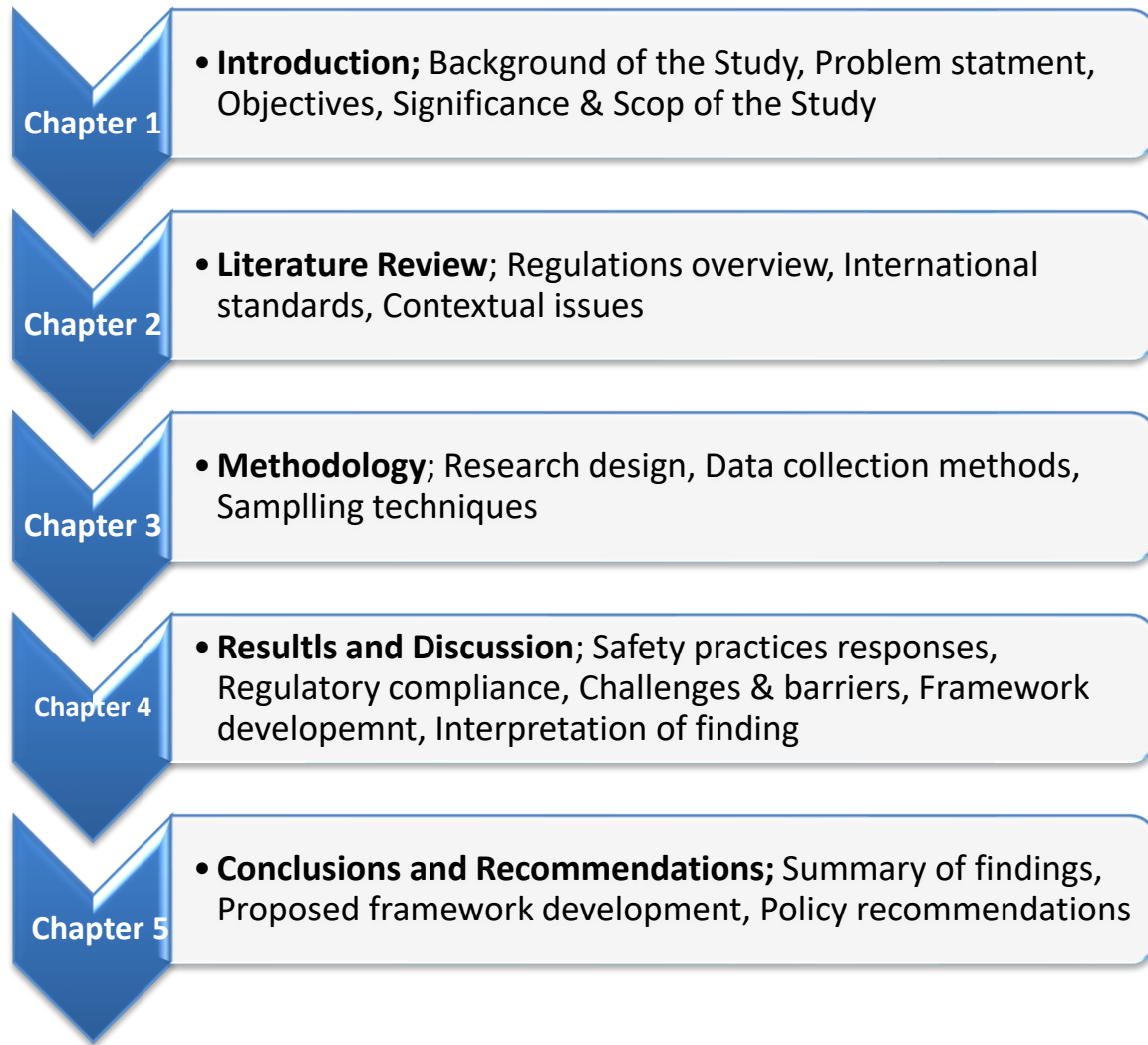


Figure 1: Organization of the study

Chapter Two

2. Literature review

2.1. Introduction

The construction industry is a vital component of economic development in Ethiopia, particularly in urban areas like Addis Ababa, where rapid urbanization has spurred extensive building and infrastructure projects (Taffese S, 2020). However, this growth has not been matched by adequate health and safety standards, leading to frequent accidents, injuries, and fatalities among construction workers. The Construction Design and Management (CDM) regulations, originally implemented in the UK, emphasize proactive risk management, worker participation, and the integration of safety considerations during the design and planning phases of construction projects. Although these regulations have demonstrated success in improving safety outcomes in various contexts, their applicability and effectiveness within the Ethiopian construction landscape remains largely unexplored (Lunt M, 2016).

The rationale for this study lies in the critical need to assess the understanding, implementation, and impact of CDM-like regulations in Addis Ababa. By pinpointing existing gaps in safety practices and regulatory compliance, this research aims to provide insights that can inform local stakeholders including policymakers, construction companies, and workers about the necessary modifications to improve health and safety standards. Furthermore, given the unique challenges posed by the Ethiopian regulatory environment and construction culture, this study seeks to contribute to the development of contextually relevant policies that enhance the effectiveness of health and safety measures. Ultimately, the findings will play a pivotal role in fostering a culture of safety in the construction sector, enhancing worker protection, and promoting sustainable development in Addis Ababa.

2.2. Overview of Health and Safety Regulations in Construction

2.2.1. Importance of health and safety regulations

Health and safety regulations in construction are essential frameworks designed to protect workers and ensure safe working conditions on construction sites. These regulations, such as the Construction (Design and Management) Regulations (CDM) and the Health and Safety at Work Act, mandate that all parties involved in construction project-clients, designers, and contractors collaborate to identify and mitigate risks throughout the project lifecycle. The importance of

these regulations cannot be overstated, as they not only aim to reduce the incidence of accidents and injuries but also foster a culture of safety and responsibility within the industry (HSE, 2015). By enforcing rigorous training, risk assessments, and compliance measures, health and safety regulations help create safer work environments, ultimately leading to improved worker morale, productivity, and project outcomes. Furthermore, adherence to these regulations is crucial for legal compliance and can significantly reduce the financial liabilities associated with workplace accidents, making them a fundamental aspect of construction management and operational success (Tim Howarth, 2006).

Health and safety regulations in construction are crucial for safeguarding the well-being of workers and minimizing risks associated with construction activities. These regulations, such as the Construction (Design and Management) Regulations 1994 (CDM Regulations), establish a framework for identifying, assessing, and managing health and safety risks throughout the project lifecycle. By mandating clear roles and responsibilities, promoting effective communication, and ensuring proper training, these regulations help to create a culture of safety that is essential in an industry characterized by high-risk environments. The implementation of such regulations not only protects workers but also enhances overall project efficiency and productivity, as safer work environments lead to fewer accidents and disruptions (Headley J. & Griffith, 2003).

From a global perspective, construction safety is a significant concern, as the industry is known for its high rates of accidents and fatalities. According to the Health and Safety Executive (HSE/, 2015), construction workers are six times more likely to be killed at work compared to those in other sectors, underscoring the urgent need for effective regulations. The economic implications of construction accidents are profound, leading to increased costs related to medical expenses, legal liabilities, and project delays, which can ultimately affect the profitability of construction firms. Socially, accidents can have devastating effects on families and communities, contributing to a cycle of loss and hardship. Therefore, robust health and safety regulations not only protect workers but also promote a safer working environment, enhance productivity, and foster a culture of safety that benefits the entire industry (Henry A. Odeyinka¹, 2003).

Different countries adopt various measures to ensure construction safety. For example, developed countries like the United States and Singapore have stringent safety protocols, while developing countries may face challenges in implementing these measures due to resource

constraints⁵. International organizations like the International Labor Organization (ILO) work to promote safety standards globally (Sinha K.& Reddy M, 2019).

Construction accidents have profound economic and social implications that resonate throughout the industry and the communities involved. Economically, these incidents incur direct costs, such as medical expenses, legal fees, and compensation for injured workers, which can place a significant financial burden on companies. Additionally, indirect costs arise from project delays due to accidents, leading to increased insurance premiums and potential loss of contracts. Socially, the impact of construction accidents is equally severe; they can result in loss of life, serious injuries, and long-term health issues for workers, affecting not only the individuals involved but also their families and communities (Fang D. & Huang X, 2016).

The emotional and financial strain on families can lead to broader societal challenges, including increased healthcare costs and reduced quality of life. Furthermore, accidents can tarnish a company's reputation, making it harder to attract talent and secure future projects. Productivity is also adversely affected, as injured workers may require extended time off, which diminishes overall workforce efficiency and can delay project completion. Therefore, ensuring robust health and safety regulations in construction is essential not only for safeguarding workers' well-being but also for complying with legal standards and minimizing both economic and social costs associated with workplace accidents (Lingard H. & Rowlinson, 2019).

2.2.2. Introduction to the Construction Design and Management (CDM) Regulations

The Construction (Design and Management) Regulations (CDM) were introduced in the UK in 1994 as a response to the need for improved health and safety standards in the construction industry. The primary aim of the CDM regulations is to ensure that health and safety considerations are integrated into the design and planning stages of construction projects, thereby reducing risks before work begins on site. The regulations impose specific duties on various parties involved in construction, including clients, designers, and contractors, to promote a collaborative approach to safety management (Lunt M, 2016).

The CDM regulations recognize that many decisions affecting site safety are made long before construction starts, making it essential for designers to consider health and safety implications during the design phase. By establishing clear responsibilities and legal duties, the CDM aims to foster a culture of safety, encouraging all stakeholders to prioritize health and safety throughout

the project lifecycle. The regulations have undergone several revisions, with the most recent update in 2015, reflecting ongoing efforts to enhance safety practices and reduce accidents in the construction sector (Odeyinka H. A., 2005).

The key principles and objectives of the Construction (Design and Management) Regulations are designed to enhance health and safety in the construction industry by promoting proactive risk management and collaboration among all stakeholders. These principles include:

Integration of Health and Safety: The CDM regulations emphasize the importance of incorporating health and safety considerations into the design and planning stages of construction projects. This proactive approach aims to identify and mitigate risks before work begins on site (HSE, 2015).

Clear Responsibilities: The regulations establish specific duties for all parties involved in a construction project, including clients, designers, and contractors. This clarity helps ensure that everyone understands their roles and responsibilities regarding health and safety (HSE, 2015).

Collaboration and Communication: The CDM encourages effective communication and collaboration among all stakeholders throughout the project lifecycle. This includes sharing information about potential risks and safety measures to foster a culture of safety (Odeyinka H. A., 2005).

Risk Management: A fundamental objective of the CDM is to reduce risks to health and safety by promoting the elimination of hazards at the design stage. This involves assessing risks and implementing measures to control them effectively (Odeyinka H. A., 2005).

Continuous Improvement: The CDM regulations aim to promote continuous improvement in health and safety practices within the construction industry. This includes learning from past incidents and adapting practices to enhance safety outcomes (HSE, 2015).

Training and Competence: The regulations highlight the need for adequate training and competence among all parties involved in construction projects. Ensuring that individuals are knowledgeable about health and safety responsibilities is crucial for effective implementation of the CDM (HSE, 2015).

The CDM regulations seek to create a safer construction environment by embedding health and safety into the core processes of project design and management, ultimately reducing accidents and improving the welfare of workers in the industry (Odeyinka H. A., 2005).

2.2.3. Comparison with Ethiopian health and safety regulations

While both the UK and Ethiopia have established frameworks for health and safety in construction, there are notable differences in their approach and implementation. Both the CDM Regulations and Ethiopian regulations emphasize risk management, but the CDM Regulations place a stronger emphasis on early risk identification and management during the design and planning stages (HSE, 2015). The CDM Regulations require that all duty holders have the necessary skills, knowledge, and experience, particularly for designers and contractors, whereas Ethiopian regulations place more responsibility on employers to ensure worker competence (ILO, 2019). Cooperation and coordination are crucial in the CDM Regulations, while Ethiopian regulations focus more on employer-employee relationships. Comprehensive information sharing is mandated in the UK, but implementation in Ethiopia faces challenges due to resource constraints (Kifle A, 2012). Both regulations emphasize worker consultation, although the CDM offers a more structured approach compared to Ethiopian regulations (Loosemore, 2007). The economic and social implications of construction accidents are significant in both countries, but the effects can be more severe in Ethiopia due to limited resources (Zewde E. & Bayou T, 2011). Finally, while the UK has stringent enforcement processes, Ethiopia struggles with implementation and compliance due to various challenges (Gibb A. & Duff R, 2015).

2.2.4. CDM Regulations (UK)

The Construction (Design and Management) (CDM) Regulations in the UK emphasize the integration of health and safety considerations throughout the lifecycle of construction projects. They prioritize risk management, which involves identifying and addressing potential risks from the design stage to project completion. Competence is crucial, ensuring that all duty holders—clients, designers, and contractors—possess the necessary skills and knowledge to carry out their responsibilities effectively. The regulations also promote cooperation and coordination among all stakeholders, fostering effective collaboration. Information sharing is highlighted as a key practice, involving the clear communication of relevant risk management information. Finally, the CDM Regulations stress the importance of worker consultation, engaging employees in discussions about risks and safety measures to enhance overall workplace safety. Together, these components aim to create a safer construction environment and improve health and safety outcomes in the industry (Lai J. H. K., 2020).

2.2.4.1. Health and Safety Regulations in Ethiopia

Ethiopia's health and safety regulations are embedded in the Labor Proclamation No. 1156/2019, which outlines the general framework for workplace safety and health (ILO., 2019). These regulations aim to protect workers from occupational hazards and ensure safe working conditions.

The key aspects include:

Hazard Identification and Risk Assessment: The regulations require employers to identify workplace hazards and assess risks to ensure that adequate measures are in place to protect workers. This includes regular inspections and assessments to identify potential risks and implement necessary controls (Zewde E. & Bayou T, 2011).

Machine and Chemical Safety: Specific provisions are made for the safe use of machinery and handling of chemicals. Employers are required to ensure that machinery is properly maintained and operated safely, and that hazardous substances are used and stored in a manner that minimizes risk to workers.

Personal Protective Equipment (PPE): Employers must provide appropriate PPE to workers and ensure that it is used correctly. This includes providing training on the proper use and maintenance of PPE to ensure it offers effective protection (Kifle A, 2012).

First Aid and Emergency Response: The regulations require employers to establish first aid facilities and emergency response procedures to deal with accidents and emergencies. This includes providing trained first aid personnel and ensuring that emergency exits and equipment are readily accessible (HSE/, 2015).

Worker Training: Training is a critical component of Ethiopia's health and safety regulations. Employers are required to provide workers with training on safety practices, the use of PPE, and emergency procedures. This helps to ensure that workers are aware of the risks they face and know how to protect themselves effectively (Zewde E. & Bayou T, 2011).

2.3. Conceptual Framework for Health and Safety Management in Construction

2.3.1. Models of health and safety management in construction

The theoretical framework for models of health and safety management in construction emphasizes the integration of systematic approaches to ensure the well-being of workers and the

overall safety of construction sites. Various models, such as the Plan-Do-Check-Act (PDCA) cycle, highlight the importance of continuous improvement in health and safety practices. This model encourages organizations to plan safety measures, implement them, monitor their effectiveness, and make necessary adjustments. Additionally, the Construction Design and Management (CDM) Regulations underscore the role of designers and contractors in proactively identifying and mitigating risks from the project's inception, thereby influencing health and safety outcomes throughout the construction process. The framework also recognizes the significance of compliance with statutory regulations, which set minimum legal requirements for health, safety, and welfare in construction operations, ultimately contributing to a safer working environment and enhanced project performance (Famakin I. O., 2023).

The theoretical framework for models of health and safety management in construction typically encompasses several key components that guide the implementation and effectiveness of health and safety practices. Here are some essential elements based on the content from the document:

Commitment from Management: Effective health and safety management begins with a strong commitment from management to lead by example. This includes providing necessary resources and establishing clear health and safety standards (HSE, 2015).

Communication and Consultation: Implementing a range of communication strategies is crucial for ensuring cooperation and consultation with the workforce. This involvement is essential for managing health and safety effectively (HSE, 2015).

Worker Involvement: Collecting evidence of effective worker involvement and cooperation between contractors is vital. This can enhance the overall safety culture within the construction environment (Headley J. & Griffith, 2003).

General Principles of Prevention: The framework includes principles such as avoiding risks, evaluating unavoidable risks, and implementing measures to control risks at the source. These principles guide duty holders in identifying and managing health and safety risks throughout the project lifecycle (Headley J. & Griffith, 2003).

Duties of Designers: Regulations specify that designers have a duty to eliminate, reduce, or control foreseeable health and safety risks through the design process. This proactive approach is essential for minimizing risks during construction and future use of the building (HSE, 2015) .

Construction Phase Plan: The construction phase plan is a critical document that outlines how health and safety will be managed during the construction process. It should relate to and influence other types of information and practices throughout the project (HSE, 2015).

2.3.2. Worker Involvement and Participation in Safety

Worker involvement and participation in safety are critical components of effective health and safety management in construction. Engaging workers in safety discussions fosters a culture of safety and encourages them to take ownership of their own health and safety as well as that of their colleagues. The CDM regulations emphasize the importance of consulting and engaging workers in decisions about health and safety measures, which can lead to improved identification of risks and more effective control measures. When workers are actively involved, they are more likely to communicate potential hazards, adhere to safety protocols, and contribute to the development of a safer work environment. This two-way communication not only enhances the effectiveness of safety measures but also increases worker morale and commitment to maintaining a safe workplace. By valuing worker input and fostering collaboration, organizations can significantly improve their health and safety outcomes (HSE, 2015).

The theoretical framework surrounding risk management theories in construction emphasizes the proactive identification, assessment, and mitigation of risks to enhance safety outcomes. Central to this framework is the concept of risk perception, which influences how workers and management recognize and respond to potential hazards on construction sites. Theories such as the Risk Management Process highlight the importance of systematic approaches that include risk identification, risk analysis, risk evaluation, and risk treatment, ensuring that safety measures are effectively integrated into project planning and execution (Crispino M.& Flores, 2021).

Moreover, worker involvement and participation in safety practices are critical components of effective risk management. Engaging workers in safety discussions and decision-making processes fosters a culture of safety and empowers them to take ownership of their well-being. Research indicates that when workers are actively involved in safety initiatives, it leads to improved communication, increased awareness of hazards, and a greater likelihood of adherence to safety protocols. This participatory approach not only enhances the effectiveness of safety measures but also contributes to a more resilient organizational culture where safety is prioritized at all levels. Thus, integrating risk management theories with active worker participation creates

a comprehensive framework for improving health and safety outcomes in the construction industry. (Famakin I. O., 2023)

2.3.3. The role of regulation in shaping construction practices

Regulation plays a pivotal role in shaping construction practices by establishing a framework that governs safety, quality, and environmental standards within the industry. Regulatory compliance theories suggest that organizations are motivated to adhere to regulations not only to avoid penalties but also to enhance their reputation and operational efficiency. Theories such as the Stakeholder Theory emphasize that compliance with regulations is essential for maintaining positive relationships with stakeholders, including clients, employees, and regulatory bodies, which can ultimately lead to improved project outcomes and sustainability. The impact of regulations on organizational behavior is profound, as they influence the decision-making processes and operational practices of construction firms. Compliance with health and safety regulations often leads organizations to adopt more rigorous safety management systems, thereby fostering a culture of safety that prioritizes worker well-being and risk mitigation (Huang X.& Hinze J., 2006). Furthermore, regulations can drive innovation in construction practices, as firms seek to develop new technologies and methods to meet or exceed regulatory standards. This dynamic interaction between regulation and organizational behavior not only enhances compliance but also promotes continuous improvement and adaptation within the construction industry, ultimately leading to safer and more efficient construction practices (Gibson J., 2002).

2.3.4. Risk Management Theories

Risk management theories in construction focus on identifying, assessing, and mitigating risks to ensure the safety and health of workers and the integrity of the project these theories emphasize a systematic approach to risk management, which includes the identification of potential hazards, evaluation of the risks associated with those hazards, and the implementation of control measures to mitigate them. The general principles of prevention, as outlined in the CDM regulations, advocate for avoiding risks where possible, evaluating unavoidable risks, and controlling them at the source. This proactive approach not only enhances safety but also contributes to the overall efficiency and effectiveness of construction projects. By integrating risk management theories into the planning and execution phases, organizations can create a safer work environment,

reduce the likelihood of accidents, and ensure compliance with legal obligations (Smith John, 2023).

Applying risk management theories such as continuous hazard monitoring, stakeholder engagement, and hazard prioritization can effectively address the empirical gaps observed in health and safety regulation in Addis Ababa. The deficiencies in enforcement, limited resources, and socio-cultural barriers highlight the need for tailored risk management frameworks that promote proactive hazard identification and foster safety culture within organizations (Reason, 1997). By implementing context-specific risk assessment models that involve all stakeholders' workers, managers, regulators these theories can enhance regulatory compliance and safety practices. Furthermore, establishing local safety committees and conducting hazard audits tailored to the Ethiopian socio-economic environment can operationalize risk management principles to fill enforcement gaps and improve safety outcomes (Hopkins, 2009).

2.4. Evidence of Impact from CDM Regulations

2.4.1. Studies on the Effectiveness of CDM in the UK: Reduction in Accident Rates and Improvement in Safety Culture

The Construction (Design and Management) Regulations (CDM) in the UK have been instrumental in enhancing safety within the construction industry. Numerous studies have demonstrated a significant reduction in accident rates following the implementation of CDM regulations. For instance, a study by HSE (Health and Safety Executive) reported that the introduction of CDM led to a 40% decrease in fatal accidents on construction sites over a decade, highlighting the effectiveness of these regulations in promoting safer working environments (HSE, 2015). Furthermore, the CDM regulations have fostered a cultural shift towards prioritizing health and safety, encouraging all stakeholders, including clients, designers, and contractors, to take collective responsibility for safety outcomes. This shift is evidenced by increased training and awareness programs, which have contributed to a more proactive approach to risk management and safety compliance within organizations (Smallwood & Haupt, 2005). The emphasis on early planning and risk assessment in the design phase has also been shown to mitigate potential hazards before they manifest on-site, further reinforcing the positive impact of CDM on safety culture in the UK construction industry (HSE, 2015).

2.4.2. Case Studies Illustrating Successful Implementation of CDM

Several case studies illustrate the successful implementation of CDM regulations and their positive impact on construction projects. One notable example is the redevelopment of the London 2012 Olympic Park, where CDM principles were integrated into the project from the outset. The project team adopted a collaborative approach, involving all stakeholders in the design and planning phases to identify and mitigate risks effectively. As a result, the project achieved an exemplary safety record, with no fatalities and a significantly lower accident rate compared to industry averages during the construction period (Gambatese J. A, 2006). Another case study involves the construction of the Cross rail project, which implemented CDM regulations to enhance safety and health management across multiple sites. The project utilized innovative safety management systems and regular safety audits, leading to a marked improvement in safety performance and a reduction in incidents. These case studies not only demonstrate the practical application of CDM regulations but also highlight their effectiveness in fostering a culture of safety and reducing risks in large-scale construction projects (Crossrail Ltd., 2014).

2.4.3. Lessons learned from international contexts

2.4.3.1. Implementation of Similar Regulations outside the UK

The implementation of construction health and safety regulations similar to the UK's CDM has been observed in various countries, yielding valuable lessons for improving safety standards globally. For instance, Australia has adopted the Work Health and Safety (WHS) Act, which emphasizes the importance of risk management and the duty of care among all parties involved in construction projects. A study by Lingard and Rowlinson (2005) highlights that, the WHS framework has led to a notable reduction in workplace injuries and fatalities, similar to the outcomes seen in the UK post-CDM implementation. The Australian model encourages collaboration among stakeholders, including clients, designers, and contractors, to identify and mitigate risks early in the project lifecycle. This proactive approach has not only improved safety outcomes but has also fostered a culture of shared responsibility for health and safety, demonstrating that effective regulation can lead to significant enhancements in construction safety across different international contexts (Lingard H. & Rowlinson, 2019).

2.4.3.2. Comparative Studies in Developing or Adapting CDM-like Regulations

Comparative studies have shown that adapting CDM-like regulations in developing countries can lead to improved safety outcomes, although challenges remain in enforcement and compliance. For example, a study conducted in South Africa examined the implementation of the Construction Regulations of 2003, which were inspired by the CDM framework. The research found that while the regulations provided a solid foundation for improving safety practices, the lack of resources and training for enforcement agencies hindered their effectiveness (Smallwood, 2013). Additionally, cultural factors and the informal nature of many construction practices in developing countries pose significant challenges to the successful adoption of such regulations. However, the study also highlighted successful initiatives, such as training programs and awareness campaigns, which have been implemented to educate workers and employers about safety practices, leading to a gradual improvement in safety performance. These findings underscore the importance of tailoring regulations to fit local contexts and the need for ongoing support and resources to ensure effective implementation. These lessons from international contexts illustrate the potential benefits of implementing and adapting construction health and safety regulations similar to the CDM, while also highlighting the importance of considering local conditions and challenges to ensure effective regulation and compliance (Smallwood, 2013).

2.5. Current State of Construction Health and Safety in Addis Ababa

2.5.1. Overview of the Construction Industry in Addis Ababa

The construction industry in Addis Ababa has experienced significant growth in recent years, driven by rapid urbanization and government initiatives aimed at infrastructure development. According to a study by (Tadesse A. & Kedir A, 2018), the Ethiopian government has prioritized construction as a key sector for economic development, leading to substantial investments in housing, transportation, and public facilities. This growth is reflected in the increasing number of construction projects, including residential buildings, roads, and commercial developments, which have contributed to job creation and economic expansion in the region. The construction sector's contribution to the national GDP has also been notable, with estimates indicating that it accounts for approximately 10% of the country's economic output. However, this rapid growth has also placed considerable pressure on the industry to maintain safety standards and ensure the well-being of workers on construction sites (World Bank, 2020).

Despite the growth of the construction industry in Addis Ababa, several challenges hinder the effective management of health and safety. One of the primary issues is the lack of enforcement of existing health and safety regulations, which has resulted in high rates of accidents and fatalities on construction sites. A study by Abebe and Tadesse (2019) highlights that many construction companies in Addis Ababa often prioritize cost and speed over safety, leading to inadequate safety measures and training for workers. Additionally, the informal nature of many construction practices, coupled with a shortage of skilled labor and safety professionals, exacerbates the situation. The study also points out that cultural attitude towards safety and a lack of awareness among workers regarding their rights and safety practices contribute to the ongoing challenges in the sector. Addressing these issues requires a concerted effort from government authorities, industry stakeholders, and educational institutions to promote a culture of safety and ensure compliance with health and safety regulations (Abebe A. & Tadesse, 2019).

Table 1: The evidence of the impact of Construction Design and Management (CDM) regulations can be summarized and compared with Ethiopian outcomes

Aspect	International/CDM Impact Evidence	Ethiopian Context / Outcomes
Reduction in Workplace Accidents	Approximate decrease of 30% post-implementation of CDM in other contexts	Reduction in accident may observed
Enforcement & Compliance	Effective enforcement relies on sufficient resources and capacity	Significant enforcement gaps, resource constraints, and low compliance
Stakeholder Awareness & Training	Training programs improve safety knowledge and behavior	Insufficient training and awareness, leading to knowledge gaps
Safety Culture & Attitudes	Safety prioritized through organizational culture and incentives	Safety often secondary to productivity, cultural barriers exist
Implementation Challenges	Challenges include informal practices, resource constraints, and cultural attitudes	Similar challenges present, limiting effectiveness of regulation
Positive Outcomes & Improvements	Notable improvements in safety awareness and practices, albeit gradual	Some improvements in safety awareness and practices, but significant gaps remain

2.5.2. Analysis of Existing Health and Safety Practices

2.5.2.1. Evaluation of Stakeholder Awareness and Compliance

The evaluation of stakeholder awareness and compliance with health and safety practices in Addis Ababa reveals significant gaps that contribute to the ongoing challenges in the construction sector. A study by Mulugeta and Tadesse (2020) indicates that while there is a general awareness of health and safety regulations among construction professionals, the level of understanding and implementation varies widely among different stakeholders, including contractors, subcontractors, and workers. Many construction companies lack comprehensive safety training programs, which results in workers being ill-equipped to recognize hazards and respond appropriately. Furthermore, the study highlights that compliance with safety regulations is often superficial, with many companies focusing on meeting minimum legal requirements rather than fostering a culture of safety. This lack of commitment to health and safety not only endangers workers but also undermines the overall effectiveness of safety regulations in the construction industry. To improve compliance, the study recommends targeted training programs and awareness campaigns that engage all stakeholders in the construction process (Mulugeta A. & Tadesse A., 2020).

2.5.2.2. Review of Accidents and Incidents in the Context of Addis Ababa

The review of accidents and incidents in City, a rapidly developing area in Addis Ababa, underscores the critical need for improved health and safety practices in the construction industry. According to a report by Tesfaye and Abebe (2021), Addis Ababa City has witnessed a concerning increase in construction-related accidents, including falls, equipment-related injuries, and fatalities. The report attributes these incidents to several factors, including inadequate safety measures, lack of proper training, and insufficient enforcement of safety regulations. Additionally, the study found that many construction sites in Addis Ababa operate without proper safety plans or risk assessments, further exacerbating the risk of accidents. The authors emphasize the importance of implementing robust safety management systems and conducting regular safety audits to identify and mitigate hazards on construction sites. By addressing these issues, stakeholders can significantly reduce the incidence of accidents and improve the overall safety culture within the construction sector in Addis Ababa City (Tefaye, 2021) .

2.6. Barriers to Effective Implementation of Health and Safety Regulations

2.6.1. Challenges Specific to the Ethiopian Construction Context

Cultural factors play a significant role in the challenges faced in the implementation of health and safety regulations within the Ethiopian construction industry. According to a study by Hailu and Tadesse (2019), traditional attitudes towards work and safety often prioritize productivity over safety, leading to a culture where safety measures are viewed as secondary. Many workers and employers may perceive safety regulations as bureaucratic hurdles rather than essential components of a successful construction project. Additionally, there is often a lack of communication regarding safety practices, as many workers may not fully understand their rights or the importance of adhering to safety protocols. The study highlights that this cultural mindset can result in a reluctance to report unsafe conditions or accidents, further perpetuating the cycle of neglect towards health and safety. To address these cultural barriers, the authors suggest the need for comprehensive training programs that not only educate workers about safety practices but also promote a cultural shift towards valuing health and safety as integral to construction success (Hailu A. & Tadesse A., 2019).

Economic constraints are another significant barrier to the effective implementation of health and safety regulations in the Ethiopian construction sector. A report by Abate and Mulugeta (2020) indicates that many construction companies operate on tight budgets, which often leads to the underfunding of safety measures and training programs. The high costs associated with implementing comprehensive health and safety systems can deter companies from prioritizing safety, especially in a competitive market where profit margins are slim. Furthermore, the lack of financial resources can result in inadequate safety equipment and poor working conditions, increasing the risk of accidents and injuries on construction sites. The authors argue that without adequate investment in health and safety, the construction industry in Ethiopia will continue to face high rates of accidents and fatalities. To overcome these economic barriers, the study recommends that government and industry stakeholders collaborate to provide financial incentives and support for companies that prioritize health and safety in their operations (Abate A. & Mulugeta A, 2020).

2.6.2. Resistance to Change and Regulatory Compliance Issues

Resistance to change is a significant barrier to the effective implementation of health and safety regulations in the Ethiopian construction industry. A study by Gebremedhin and Tadesse (2021)

highlights that many construction stakeholders, including employers and workers, often exhibit a reluctance to adopt new safety practices and regulations due to entrenched habits and a lack of understanding of the benefits of such changes. This resistance is often compounded by a perception that existing practices are sufficient, despite evidence of high accident rates in the industry. Furthermore, regulatory compliance issues arise when stakeholders fail to recognize the importance of adhering to safety standards, leading to a culture of non-compliance. The study emphasizes that without a proactive approach to change management, including clear communication of the benefits of health and safety regulations, the construction industry will struggle to improve its safety performance. To address these challenges, the authors recommend engaging stakeholders in the development and implementation of safety policies, fostering a sense of ownership and accountability towards health and safety practices (Gebremedhin T. & Tadesse A., 2021).

2.6.3. Need for Capacity Building and Training

The need for capacity building and training is critical for enhancing health and safety practices in the Ethiopian construction sector. According to a study by Alemayehu and Mulugeta (2020), many construction workers lack the necessary skills and knowledge to implement effective safety measures, which significantly contributes to the high incidence of accidents and injuries on construction sites. The authors argue that without proper training programs that focus on both theoretical knowledge and practical skills, workers are ill-prepared to identify hazards and respond appropriately to emergencies. Furthermore, the study highlights that management personnel often lack the expertise to develop and enforce safety policies, leading to inadequate safety management systems. To address these gaps, the authors advocate for comprehensive capacity-building initiatives that include regular training sessions, workshops, and certification programs tailored to the specific needs of the construction workforce. By investing in training and capacity building, the construction industry can foster a culture of safety and significantly reduce the risks associated with construction activities (Alemayehu T. & Mulugeta A, 2020).

2.7. Research gap

The main research gap is the lack of context-specific, empirical studies on the implementation, enforcement, stakeholder engagement, resource constraints, and socio-cultural factors affecting safety regulation effectiveness in Addis Ababa's construction industry. Addressing these gaps

will contribute to developing tailored regulatory frameworks and safety strategies suited to the local environment.

Table 2: The research gap information summarized

Research Gap	Description
Limited Local Contextualization of International Frameworks	Lack of understanding on how international regulations like CDM are adapted to the Ethiopian and Addis Ababa context.
Inadequate Empirical Data on Implementation and Effectiveness in Addis Ababa	Insufficient studies evaluating enforcement, compliance, and impact of safety regulations locally.
Insufficient Exploration of Stakeholder Engagement and Safety Culture	Limited empirical research on stakeholder perceptions, awareness, and participation in safety practices.
Resource and Capacity Constraints Analysis	Need for detailed analysis of how resource shortages hinder regulatory compliance within local firms.
Gaps in Understanding Socio-Cultural Barriers	Lack of in-depth understanding of cultural attitudes and behaviors affecting safety practices.
Lack of Context-Specific Safety Management Models	Absence of tailored frameworks or models suited to Ethiopia's unique safety challenges and industry environment.

Chapter Three

3. Methodology

3.1. Study Area

Geographical Context: Describe Addis Ababa; the city is divided into multiple sub-cities, each with a distinct character and administrative function those are Addis Ketema (Central Sub-city), Akaki Kality, Lideta, Yeka, Bole (notably the Bole International Airport), Nifas Silk-Lafto, Arada, Kirkos, Lemi Kura, Gulele and Kolfe Keranio. The city is significance as a rapidly developing urban area with extensive construction activity.

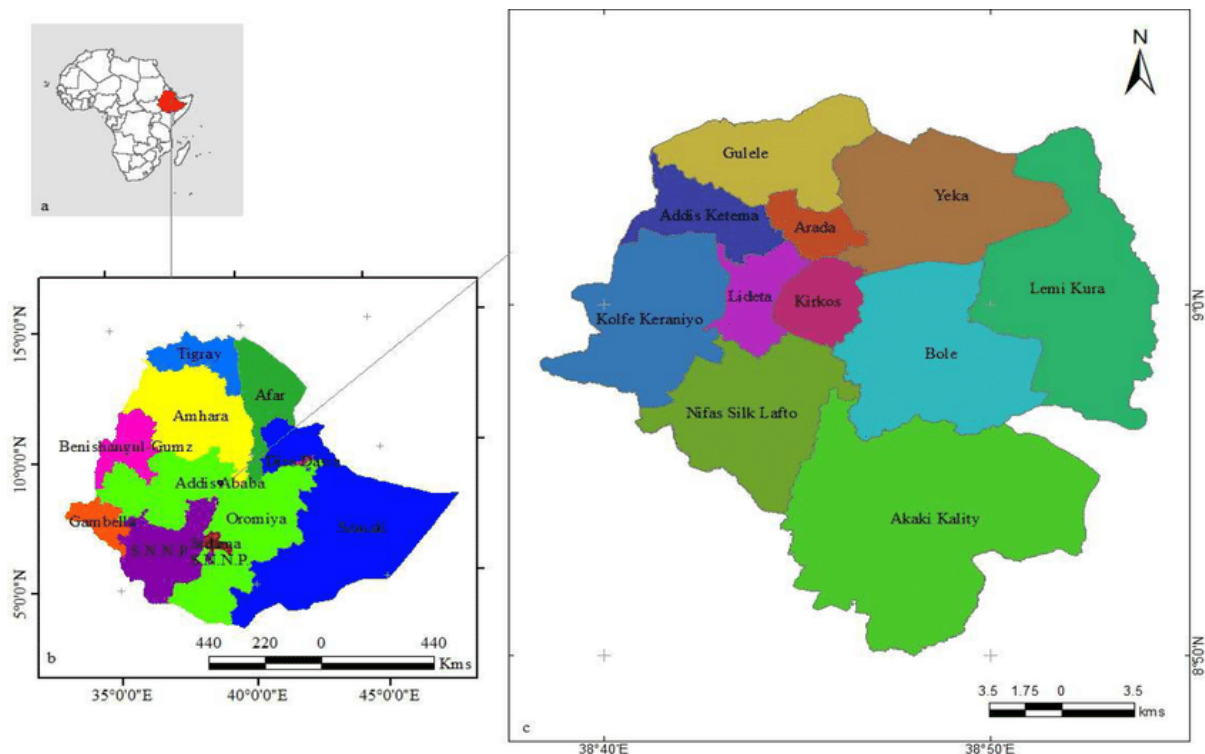


Figure 2: Map of Addis Ababa, with Sub-Cities. Source: Ethio GIS (2022)

Economic and Social Background: On the construction sector's role in the local economy, urbanization trends, and any specific challenges faced in Addis Ababa City (e.g., safety issues, regulatory enforcement).

Construction Environment: The types of construction projects common in Addis Ababa City (e.g., residential, commercial, infrastructure) and their implications for health and safety practices.

3.2. Research Design and Approach

3.2.1. Research Design

The research employs a descriptive and exploratory design within a mixed-methods approach, combining both quantitative and qualitative techniques to comprehensively investigate the impact of Construction Design and Management (CDM) regulations on safety practices in Addis Ababa. The descriptive component aims to outline the current state of health and safety practices, crowding enforcement, awareness levels, and compliance rates among construction stakeholders. Concurrently, the exploratory aspect seeks to delve into stakeholder perceptions, attitudes, and socio-cultural influences that shape safety behaviors and compliance, addressing the gaps related to safety culture and resource constraints. Data collection involves structured questionnaires administered to a broad respondent base including workers, site managers, safety officers, and regulatory authorities providing quantifiable insights into safety awareness, compliance levels, and enforcement effectiveness. Complementing this, semi-structured interviews, focus group discussions, and document reviews offer in-depth qualitative data to explore underlying barriers, stakeholder perceptions, and systemic resource limitations. Overall, the integration of these methods ensures a comprehensive understanding of both measurable outcomes and contextual factors affecting safety regulation implementation in the local construction industry.

3.2.1. Research Approach

The study adopts a mixed-methods approach, integrating both qualitative and quantitative research techniques to achieve a comprehensive understanding of the impact of Construction Design and Management (CDM) regulations on health and safety practices in Addis Ababa's construction industry. The quantitative component involves the use of structured questionnaires to collect measurable data on stakeholders' awareness, compliance levels, safety practices, and enforcement efficacy. Simultaneously, the qualitative component comprises semi-structured interviews, focus group discussions, and document reviews, which provide deeper insights into stakeholders' perceptions, attitudes, socio-cultural influences, and systemic challenges related to safety regulations. This combined approach allows the research to not only quantify safety performance indicators but also explore the nuanced contextual factors that influence safety behavior and regulatory effectiveness. By triangulating data from these diverse sources, the study aims to produce a holistic understanding of the barriers and facilitators affecting the implementation and enforcement of safety regulations within the local construction environment.

3.2.1. Data Collection Techniques

The data collection techniques employed in this study include a combination of questionnaires, interviews, and document reviews to gather comprehensive insights into safety practices and regulatory impacts. Structured questionnaires are administered to a broad sample of construction stakeholders including workers, site managers, safety officers, and regulatory authorities to quantitatively assess their levels of awareness, compliance, and perceptions of safety regulations. Complementing this, semi-structured interviews are conducted with key stakeholders such as site managers, engineers, and safety officers to obtain in-depth qualitative insights into their experiences, attitudes, and challenges related to safety enforcement and adherence. Focus group discussions facilitate collective perspectives on safety culture and systemic barriers, fostering richer dialogue among various stakeholder groups. Additionally, document reviews of safety reports, accident statistics, and regulatory compliance records provide contextual and factual data that support the qualitative and quantitative findings. Together, these techniques ensure a robust and multi-dimensional data set capable of informing comprehensive analysis and meaningful conclusions.

3.1. Population and Sampling

3.1.1. Target Population

The target population for this study includes a diverse group of construction stakeholders in Addis Ababa, such as construction professionals, site managers, safety officers, and policymakers involved in the industry. This broad range of participants provides varied perspectives on health and safety practices, regulatory awareness, and compliance, facilitating a comprehensive understanding of the factors influencing safety performance within the local construction sector.

3.1.2. Sampling Methodology

To prepare a sampling design, considering 12 government construction supervision and regulatory offices from each sub-city, and approximately 95 active construction sites in Addis Ababa, and utilizing methods from researchers like (Hassanein & Hanna, 2008) the following steps could be taken:

- 1. Sampling Technique:** Employ purposive or convenience sampling to select participants who possess direct experience or knowledge related to health and safety in construction.
- 2. Formula Application:** The sample size of projects can be calculated using the formula:

$$n = n' / (1 + n'/N)$$

Where:

n' is the sample size from an infinite population, calculated as $n' = S^2 / V^2$

N : Total population (e.g., 95 projects constructed by local contractors and the regulatory bodies 12 government controllers from each sub cities and city administration of in Addis Ababa)

V : Standard error of the sample population set to 0.05 for a 95% confidence level (1.96)

S : Standard error variance of population elements, where $S^2 = P (1-P)$, maximum at $P = 0.5$

3. Specific Calculations and Considerations:

$$n' = S^2 / V^2 = (0.5)^2 / (0.05)^2 = 100$$

the size of the sample was calculated by using $n = n' / (1 + n'/N)$.

The studied population was based on the data acquired from the Addis Ababa construction regulation office overall then the sample size of construction companies actively working in the city are 95.

$$n = 100 / (1 + (100/95)) = 49 \text{ Contractors}$$

If there are 95 projects by contractors, the sample size can be calculated using the formula, resulting in approximately 49 projects.

Regulatory Bodies: From government regulatory office there are 11 sub cities and 1 A.A. city municipality authority totally 12 regulatory offices, there for if the number is small (e.g., twelve offices), almost all can be included in the sample for convenience; there for the total number of sample size are 61.

Table 3: Classification of sample size

Classification	Contractors	Regulatory Bodies	Total
Number of population	95	12	107
Number of distributed questionnaires	49	12	61
Number of valid respondents	43	9	52
Return rate	95.5%	90%	94.4%

The compliance with health and safety regulations: Respondents will evaluate the extent of their adherence to health and safety regulations using a Five-point Likert scale.

Key Challenges and Barriers: Identifying the primary challenges faced by construction stakeholders in implementing safety standards and achieving regulatory compliance assessed using Likert scale.

Effectiveness of the Regulatory Framework: The robustness and effectiveness of the regulatory framework will also be assessed on a Five-point Likert scale, as illustrated below.

1 (Strongly Disagree), 2 (Disagree), 3 (Neutral), 4 (Agree), 5 (Strongly Agree)

Table 4: Extent of health and safety applies Likert scale

Level	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Scale	5	4	3	2	1

To determine the relative ranking of the factors, these scores were then transformed to importance indices based on the formula:

$$\text{Relative Importance Index (RII)} = \Sigma w / AN = (5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1) / 5N$$

Where:

w is the weighting given to each factor by the respondent,

ranging from 1 to 5,

n_1 = number of respondents for very high,

n_2 = number of respondents for high,

n_3 = number of respondents for average,

n_4 = number of respondents for low,

n_5 = number of respondents for very low,

A is the highest (i.e. 5 in the study) and

N is the total number of samples.

The relative importance index ranges from 0 to 1.

Thus, the questions are in a standardized format and sequence. A descriptive method has been used for the analysis of the data which provides a general overview of the results in order to make interpretations and discussions based on the results.

4. Inclusion and Exclusion Criteria

The inclusion criteria for this study specify that participants must be actively involved in the construction sector within the selected sub-cities of Addis Ababa, encompassing various roles such as management, labor, and safety oversight. These criteria ensure that the sample represents a diverse range of stakeholders directly engaged with construction activities, providing comprehensive insights into health and safety practices. Conversely, individuals who are not directly involved in construction operations or related support sectors are excluded from the study.

3.2. Data Collection Methods

3.2.1. Questionnaire

The questionnaire is structured instrument for collecting data from respondents by asking a series of predetermined questions. These questions are prepared either closed-ended (like multiple-choice or yes/no questions) or open-ended (allowing for detailed responses). Questionnaires are particularly advantageous because they are cost-effective, can be distributed to a large audience, and are relatively easy to administer. However, they may limit the depth of responses and can suffer from low response rates, which might affect the validity of the data collected. For the research on Construction Design and Management Regulations in Addis Ababa City, the questionnaire design will be used to gather quantitative data from a wide range of stakeholders involved in construction projects.

3.2.2. Interview

The interviews involve direct interaction between the interviewer and the respondent, providing an opportunity to gather in-depth and nuanced information. The interview is structured (with a fixed set of questions), semi-structured (with some flexibility in the questions), or unstructured (with open-ended, free-flowing conversation). The primary advantage of interviews is their ability to capture detailed insights and follow-up on responses, thus providing a rich qualitative dataset. However, interviews are time-consuming, and the quality of data depends significantly on the interviewer's skill and the rapport they build with respondents. In the context of assessing the impact of Construction Design and Management Regulations, interviews with key stakeholders such as site managers, engineers, and safety officers can provide valuable insights that complement the data gathered from questionnaires.

3.2.3. Data Analysis

Data analysis involves systematically applying statistical and logical techniques to describe, summarize, and compare the data collected. Quantitative data analysis might include statistical tests, charts, and graphs to identify patterns and relationships in the data, often using software such as SPSS or Excel. The goal of data analysis in this research is to interpret the collected data to understand the impact of Construction Design and Management Regulations on health and safety outcomes in Addis Ababa in selected Sub Cities.

3.3. Validity and Reliability

Validity refers to the degree to which a method accurately measures the intended concept (Roberta, 2019). To ensure the questionnaires effectively captured the relevant information, the questioners carefully reviewed and refined them after initial collection from 15 pilot respondents before distribution final data collection.

Reliability is referred to the ability of a research instrument to produce the same outcome even when the parameters are measured in varying conditions and are used to measure consistency of research instrument (Field, 2013). The researcher used Cronbach's alpha measure to check the reliability of this study. Cronbach's alpha is a measure used to assess the reliability or internal consistency of a set of scale or test items (Gliem,2003) Cronbach's alpha is computed by correlating the score for each scale item with the total score for each observation and then comparing that to the variance for all individual item scores:

$$\alpha = \frac{k \times c}{v + (k-1) c}$$

Where: k refers to the number of scale items

c refers to the average of all covariance's between items

v refers to the average variance of each item 34

Table 5: Reliability test

Variable	Alpha Test	No. of items	Total No. of cases
The extent compliance	0.846	10	52
Challenges and Barriers	0.899	12	52
Effective regulatory framework	0.898	12	52

The table shows that all 52 cases (respondents) in the study were valid and included in the analysis, accounting for 100% of the sample. No cases were excluded due to missing data, as

indicated by the 0.0% exclusion. This suggests complete data for all participants, which enhances the reliability of your analysis.

The Cronbach's Alpha average value of 0.896 indicates excellent internal consistency for the 34 items in the measure. This suggests that the items are highly related and reliably assess the same underlying construct, reflecting that the instrument is consistent and dependable.

Table 6: Summary of methodology

Specific Objective	Research Design	Data Collection Methods	Sampling	Data Analysis
Evaluate compliance with health and safety regulations	Cross-sectional survey study	Surveys/Questionnaires: Structured questionnaire on adherence to regulations. Interviews: Semi-structured interviews with key personnel. Observational Assessments: Site visits for compliance observations.	Population: Construction firms in Bole Sub City. Sample Size: Stratified random sampling across different firm sizes and project types.	Quantitative: Statistical analysis (e.g., SPSS) of survey data. Qualitative: Thematic analysis of interview transcriptions.
Identify challenges and barriers in regulation implementation	Qualitative study with some quantitative elements	Focus Groups: Discussions with diverse stakeholders. Interviews: In-depth interviews with representatives from construction firms and regulatory bodies. Surveys: To quantify and rank perceived challenges.	Population: Stakeholders in construction (workers, management, regulatory bodies). Sample Size: Purposive sampling for focus groups; random sampling for surveys.	Qualitative: Thematic analysis of interview data. Quantitative: Descriptive statistics to summarize survey data.
Develop a comprehensive regulation framework	Action research	Literature Review: Analysis of existing regulations and best practices. Stakeholder Workshops: Collaborative sessions to develop the regulatory model.	Population: Representatives from construction firms, regulatory bodies, safety experts, and workers' unions. Sample Size: Diverse range of stakeholders in workshops	Qualitative: Content analysis of workshop discussions and feedback. Evaluation: Surveys to assess pilot implementation outcomes.

3.4. Research Ethics

Research ethics involve ensuring the study is conducted in a manner that respects the rights and dignity of all participants. Key considerations include obtaining informed consent from participants, ensuring their confidentiality, avoiding any harm (physical or emotional), and maintaining transparency throughout the research process. For this study, ethical considerations will include obtaining consent from all participants involved in the questionnaires and interviews, safeguarding their personal information, and ensuring that the research findings are reported accurately and without bias.

Chapter Four

4. Result and Discussion

4.1. Company and Current Project Information

The research involved participation from multiple construction firms and regulatory bodies operating in each 11 sub city of Addis Ababa, the firms representing various sectors, including residential, commercial, and infrastructure projects

This section represents the description of the respondents who participated in this study. The results collected from the questionnaire shows the (52) companies and (10) regulatory bodies participated in the study located in Addis Ababa. The following sections describe the characteristics of the respondents that participated in this survey. These characteristics also include the companies' categories, experience and size of the companies.

Table 7: Job Title of Respondents

Job Title	Frequency	Percent (%)	Cumulative (%)
Construction Worker	15	28.8	28.8
Site Manager	11	21.15	49.95
Safety Officer	4	7.69	57.64
Regulatory Authority	9	17.3	74.94
Others	13	25	100
Total	52	100	

From the above table, it shows that only 7.6% of the respondents were from the safety departments of the companies, while the rest of the respondents (92.4%) were not from the safety department.

4.1.1. Respondents' professional experience in the construction industry

Working experience is measured in the number for years in a company and respondents had been working in the construction industry. The work experiences both in construction industry helps improve work and have better potential.

Table 8: Respondents' professional work experience in the construction industry

No. of years	Frequency	Percent (%)	Cumulative (%)
< 1	0	0	0
1-3	6	11.5	11.5
3-6	12	23.1	34.6
> 6	34	65.4	100
Total	52	100	

The data is presented through tables that illustrate the distribution of respondents' experience in the construction industry. The table categorizes the respondents' years of experience into four groups: less than 1 year, 1-3 years, 3-6 years, and more than 6 years. Notably, the majority of respondents, 65.4%, have more than six years of experience, indicating a highly experienced sample. Those with 3-6 years of experience constitute 23.1%, while the less experienced groups (less than 1 year and 1-3 years) make up smaller portions of the respondents, at 0% and 11.5%, respectively. The table visually reflects this distribution, showing a prominent peak in the category of respondents with over six years of experience, emphasizing the depth of industry knowledge among the majority of the participants. This skew towards experienced professionals suggests that insights gathered from these respondents are likely to be reliable and grounded in substantial industry exposure.

The data indicates that 38 individuals are male, accounting for approximately 73% of the total, while only 14 individuals are female, making up about 27%. This suggests that the group is predominantly composed of males, with males representing roughly three-quarters of the population. The significant difference highlights a notable gender imbalance within the sample, which could be due to various factors depending on the context of the study.

4.2. The extent of compliance with the regulations on health and safety

The following table presents the responses obtained from construction stakeholders regarding various aspects of health and safety management on project sites. Respondents rated their level of agreement or the frequency of specific practices using a five-point Likert scale, where 1 indicates the lowest level (e.g., strongly disagree or rarely) and 5 indicates the highest level (e.g., strongly agree or always). The responses are summarized in frequency counts for each item, along with the calculated Relative Importance Index (RII), which provides an overall measure of importance or agreement for each statement.

Table 9: Evaluation of the extent compliance with the regulations on health and safety among construction firms operating in Addis Ababa

The extent compliance	5	4	3	2	1	Total	RII	Rank
Check that the company is aware of the construction management regulations concerning health and safety.	15	25	8	1	1	50	0.80	1
Safety training is regularly provided to employees in your organization.	10	18	5	15	2	50	0.67	6
Compliance with health and safety regulations is monitored consistently at your construction sites.	7	20	15	5	3	50	0.69	4
Your safety policies are in line with the Government Construction Management Regulations.	13	20	12	4	1	50	0.76	2
Employees understand their roles in maintaining health and safety on site.	8	24	11	5	2	50	0.72	3
Safety inspections are conducted regularly at your work sites.	6	17	14	12	1	50	0.66	7
Employees feel comfortable reporting safety violations without fear of repercussions.	6	22	13	7	2	50	0.69	4
We have sufficient safety equipment available on site.	4	14	12	18	2	50	0.60	8
Our projects are delayed due to health and safety compliance issues.	2	8	17	17	6	50	0.53	10
The documentation related to health and safety practices is regularly updated.	2	13	17	14	4	50	0.58	9

1. Awareness of Construction Management Regulations Concerning Health and Safety (RII = 0.80)

This item achieved the highest RII value of 0.80, indicating a substantial consensus among respondents that their firms are aware of relevant health and safety regulations. An RII approaching 1 signifies strong agreement; thus, most participants recognize that they understand the legal and regulatory frameworks guiding construction safety.

Implication: This high level of awareness is positive because knowledge of regulations is a foundational step towards compliance. Firms that are aware of their regulatory obligations are more likely to implement appropriate safety measures, conduct risk assessments, and foster

safety culture. However, awareness alone does not ensure compliance, but it is a necessary precursor to effective safety practices.

Discussion: In the context of Addis Ababa, where regulatory enforcement may be inconsistent, maintaining high awareness levels can serve as a baseline for further safety improvements. Authorities should continue informational campaigns and trainings to sustain and enhance this awareness, emphasizing the importance of translating knowledge into practical safety actions.

2. Safety Training Regularly Provided to Employees (RII = 0.67)

This RII indicates a moderate level of agreement among respondents that safety training is routinely provided. While not as high as awareness levels, two-thirds of respondents recognize regular safety training as a notable practice.

Implication: The fact that safety training is not universally recognized as being consistently provided suggests gaps in safety capacity building within firms. Adequate training is crucial for ensuring that workers understand hazards, proper safety procedures, and emergency response protocols.

Discussion: Enhancing the frequency and quality of safety training could significantly improve safety outcomes. The moderate RII highlights an opportunity for regulatory authorities and firms to prioritize continuous and comprehensive safety education, reduce workplace accidents, and foster a safety-first attitude among employees.

3. Compliance with Health and Safety Regulations Monitored Consistently at Construction Sites (RII = 0.69)

With an RII close to that of safety training, respondents generally agree that their organizations monitor compliance regularly. However, given it's not approaching the highest levels, some inconsistencies may still exist.

Implication: Regular monitoring is a key component of safety management systems. It helps identify non-compliance issues early and enforces safety standards. The moderate RII suggests that some firms may lack robust monitoring mechanisms, risking lapses that could lead to accidents or violations.

Discussion: Strengthening compliance audits and supervision can help bridge this gap. Authorities should incentivize regular inspections and develop clear protocols for ongoing monitoring to ensure continuous adherence to safety standards in construction projects.

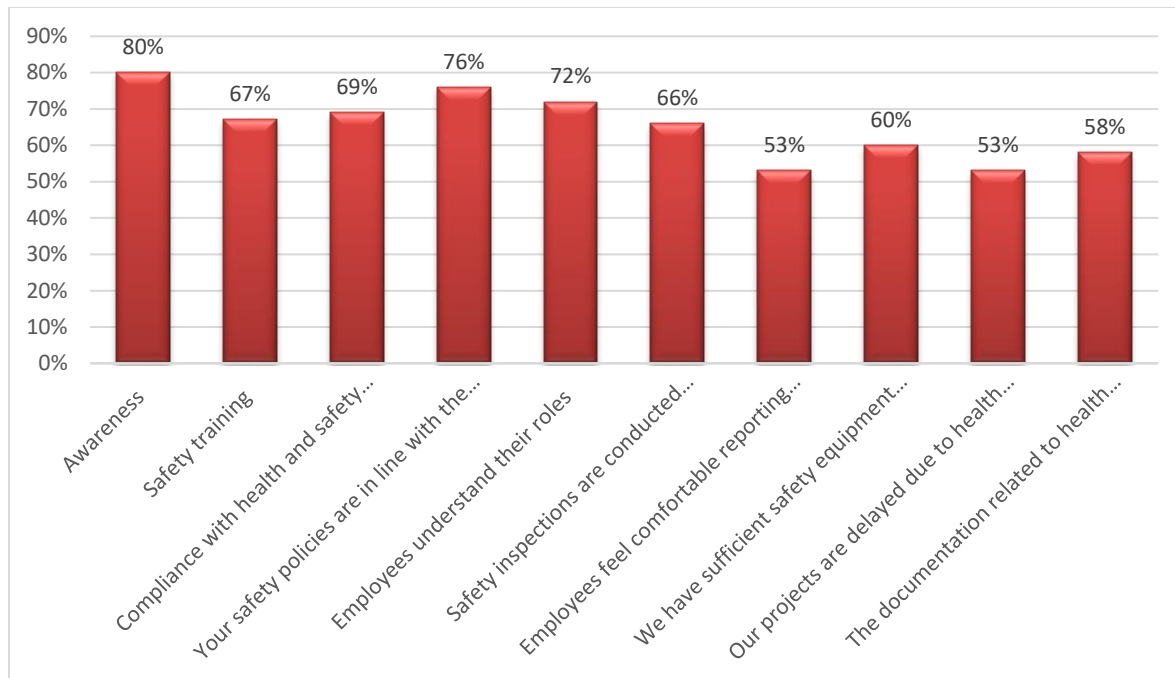


Figure 3: The parentage of the respondent extent compliance with the regulations on health and safety among construction firms operating in Addis Ababa

4. Safety Policies Are in Line with Government Construction Management Regulations (RII = 0.76)

This high RII indicates strong alignment between organizational safety policies and the stipulated regulations. A near-75% agreement demonstrates that most firms have embedded regulatory compliance into their safety protocols.

Implication: Such consistency ensures that organizations explicitly incorporate legal requirements into their operational procedures, which can lead to better adherence and systematic safety management.

Discussion: Continuous updates to policies based on changes in regulations are vital. Additionally, integrating these policies into daily practices, safety culture promotion, and management commitment can reinforce compliance, ultimately reducing safety incidents.

5. Risk Assessment and Management (RII = 0.67)

Respondents moderately agree that their firms adequately perform risk assessments. This area is critical as identifying hazards allows for targeted mitigation.

Implication: Moderate RII reflects that risk assessment is recognized but not universally prioritized. Inconsistent or incomplete hazard identification can contribute to unsafe work environments.

Discussion: Encouraging systematic, routine risk assessments, perhaps through regulatory mandates and training, can improve safety outcomes. Monitoring and documentation should be incentivized, and best practices shared among firms.

6. Safety Training for Workers (RII = 0.67)

Reiterating the earlier point, this RII indicates a moderate but not optimal level of safety training provision for workers.

Implication: Inadequate or irregular training exposes workers to hazards, increasing incident risks. Raising this RII closer to 1 should be a priority.

Discussion: Continuous training programs, refresher courses, and on-the-job safety coaching can bridge this gap. Furthermore, audits and enforcement can motivate firms to improve safety education.

7. Design Consideration for Safety (RII = 0.58)

This is a lower RII, showing limited widespread adoption of design features that inherently promote safety.

Implication: Incorporating safety considerations at the design stage reduces hazards, but the relatively low RII indicates that this practice is not yet mainstream.

Discussion: Raising awareness among designers and contractors about safety-centered design and enforcing compliance through regulations can improve safety from the outset of projects.

8. Regular Safety Audits (RII = 0.60)

This RII signals that safety audits are somewhat regularly conducted but still not a standard across all firms.

Implication: Regular audits are essential for continuous improvement and identifying safety lapses before accidents happen.

Discussion: Regulatory schemes should mandate periodic safety audits, with results informing corrective actions and promoting a proactive safety environment.

While not specifically given an RII in this section, it's vital to recognize that the cumulative insights suggest that while awareness is relatively high, practical implementation such as consistent safety training, audits, and hazard prevention requires further enhancement.

Overall the RII values collectively highlight a promising landscape where construction firms in Addis Ababa generally recognize the importance of health and safety regulations, with awareness reaching a high level (0.80). However, there are gaps in the consistent application of

best practices, such as safety training, hazard assessment, safety audits, and design considerations, with RIIs around 0.58-0.69.

To improve safety standards:

- ✓ Strengthen enforcement of mandatory safety training and audits.
- ✓ Enhance risk assessment protocols through regular, systematic practices.
- ✓ Encourage safety-focused design early in project planning.
- ✓ Promote a safety culture that values ongoing monitoring and improvement.

By addressing these areas, regulators and firms can elevate safety compliance, reduce accidents, and foster safer construction environments in Addis Ababa.

4.2.1. Construction Regulations on Health and Safety Adopted by Construction Companies

This section outlines the specific health and safety regulations that construction companies have implemented to ensure safe working environments. Understanding the compliance levels and the scope of regulations adopted provides insight into how organizations prioritize safety and adhere to legal standards within the construction industry.

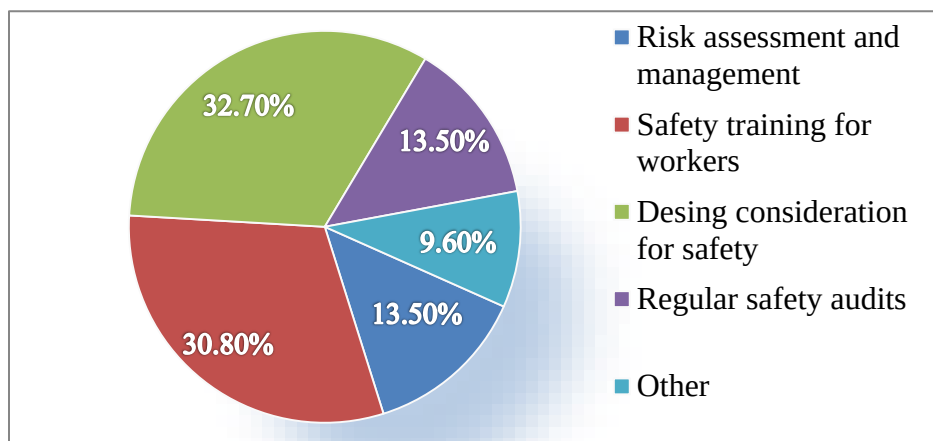


Figure 4: Response on specific Construction Regulations on health and safety

The pie chart illustrates the distribution of different safety-related activities within an organization or sector, presenting five distinct categories. The largest portion of the chart, accounting for 32.70%, is dedicated to "Design consideration for safety," indicating that this is a priority area. Following that, "Safety training for workers" makes up 30.80% of the activities, highlighting the importance of educating workers about safety procedures. "Risk assessment and management" comprises 13.50%, underscoring its role in identifying and mitigating potential

hazards. "Regular safety audits" also account for 13.50%, reflecting ongoing efforts to ensure safety compliance and identify issues promptly. The smallest segment, labeled "Other," represents 9.60%, indicating various additional safety activities not specifically categorized but still part of the overall safety measures. Overall, the pie chart emphasizes a strong focus on safety considerations and training, with substantial allocations also dedicated to assessment and audit activities to maintain a safe working environment.

4.2.2. Specific Health and Safety Measures Implemented

This section explores the particular health and safety measures that organizations have put in place to protect their workers and ensure a safe construction environment. Understanding these measures provides insight into the organization's commitment to safety and how they proactively manage potential hazards on site.

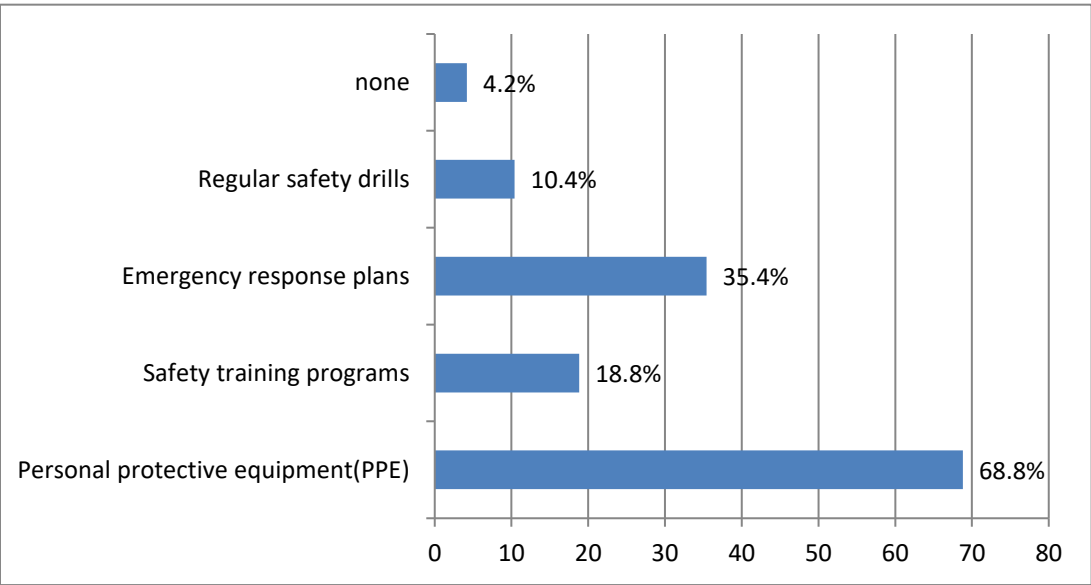


Figure 5: Response on health and safety measures that are implemented

This horizontal bar chart presents data on various safety measures and their prevalence within a particular context. The most prominent safety measure is "Personal protective equipment (PPE)," which accounts for a significant 68.8% of the responses, indicating that the use of PPE is widely implemented and prioritized. Following this, "Emergency response plans" are also quite prevalent, representing 35.4%, highlighting the importance placed on preparedness for emergencies. "Safety training programs" are utilized by 18.8% of the respondents, suggesting a moderate emphasis on educating workers about safety protocols. "Regular safety drills" are

conducted less frequently, with 10.4%, but still show a presence of safety reinforcement activities. The least common measure, "none," accounts for 4.2%, indicating that a small portion of the population does not employ any specific safety measures. Overall, the data emphasizes a strong focus on PPE and emergency preparedness, with some safety training and drills in place.

4.2.3. Actions to Enhance Compliance with Construction Health and Safety Regulations

To enhance compliance with construction health and safety regulations, a multifaceted approach is essential. Building a thorough understanding of relevant regulations among all stakeholders is fundamental; this can be achieved through comprehensive training programs tailored to specific roles and responsibilities on site. Regular safety training not only raises awareness but also ensures that workers and managers are equipped with up-to-date knowledge of safety procedures and legal requirements.

Conducting routine site inspections and safety audits are further supports compliance by identifying hazards promptly and ensuring that safety practices are consistently followed. Empowering workers to report hazards or violations without fear of repercussions fosters a positive safety culture and encourages proactive safety management. Additionally, investing in adequate safety equipment and ensuring its proper use is critical; maintaining updated safety documentation offers a clear record of compliance efforts and helps in monitoring progress. Enforcing safety rules uniformly and holding accountable those who violate procedures reinforce organizational commitment to safety. Incorporating health and safety considerations into all phases of project planning and leveraging technological tools such as safety management software and drone inspections can also significantly improve oversight and compliance. Ultimately, fostering a culture of continuous improvement learning from incidents and near-misses, implementing corrective actions, and updating safety policies regularly ensures that safety standards evolve alongside project demands and technological advancements, thereby reducing risks and protecting workers effectively

4.3. Identification of Challenges and Barriers

The identification of challenges and barriers to the effective implementation of construction regulations on health and safety in Addis Ababa is a complex process influenced by various contextual, institutional, and socio-economic factors. Based on the comprehensive review of the

available literature, surveys, and studies conducted within the Ethiopian construction sector, several interconnected challenges emerge that hinder the realization of optimal health and safety standards.

Table 10: Identifying the key challenges and barriers faced by construction stakeholders in implementing the regulation achieving safety standards

Challenges and Barriers	5	4	3	2	1	Total	RII	Rank
The lack of training is a major barrier to compliance with health and safety regulations.	10	28	6	6	0	50	0.76	1
The availability of safety equipment is insufficient to meet regulatory standards.	8	26	6	8	2	50	0.72	3
High project workloads negatively impact safety compliance.	5	25	12	7	1	50	0.70	4
There is a low awareness of health and safety regulations among construction workers.	6	26	9	7	2	50	0.70	4
Poor safety culture exists within my organization.	10	23	11	5	1	50	0.74	2
Financial constraints hinder the implementation of safety measures.	1	7	10	25	6	49	0.47	12
Regulatory authorities provide adequate support for industry compliance.	2	9	21	13	5	50	0.56	10
The complexity of regulations makes compliance challenging.	2	18	14	13	3	50	0.61	9
Safety regulations are not enforced strictly by the authorities.	2	9	21	13	5	50	0.56	10
Construction managers prioritize project deadlines over safety compliance.	5	19	9	13	2	48	0.62	8
Resistance to change from management impacts our ability to implement safety regulations.	5	19	17	8	1	50	0.67	6
The construction project timelines hinder the implementation of safety protocols.	3	19	20	7	1	50	0.66	7

Below is detailed explanations structured around key themes that discuss the above table results these barriers are:

1. Lack of Training as a Major Barrier to Compliance (RII = 0.76)

Analysis: This high RII of 0.76 highlights that a significant majority of stakeholders perceive the absence of inadequacy of health and safety training as a critical obstacle in achieving regulatory compliance.

Implication: Training equips workers and managers with essential knowledge of safety procedures, legal requirements, hazard recognition, and emergency responses. Without it, even firms aware of regulations might struggle to implement safety measures effectively.

Discussion: The data reveal that nearly 38 respondents (28 + 10) consider lack of training as a top-tier obstacle. These points to a need for systematic, ongoing training programs tailored to the specific hazards encountered in Addis Ababa's construction environments, such as working at heights, handling equipment, or managing materials.

Regulatory authorities and construction firms should invest in accessible and practical training, possibly incorporating local languages and context-specific scenarios to improve understanding and compliance.

2. Poor Safety Culture within Organizations (RII = 0.74)

Analysis: This high RII underscores the widespread perception that safety is not deeply embedded in organizational culture.

Implication: A safety-conscious culture motivates compliance, encourages reporting of hazards, and fosters proactive safety management. Conversely, a weak safety culture leads to neglect, apathy, or even deliberate ignoring of safety protocols.

Discussion: To improve safety culture, organizations should cultivate leadership commitment, recognize safety achievements, and involve workers in safety decision-making. Leadership engagement is pivotal to establishing safety as a core organizational value.

3. Insufficient Safety Equipment Availability (RII = 0.72)

Analysis: This indicates that a substantial proportion of respondents view the lack of adequate safety equipment as a crucial barrier.

Implication: the unavailability or insufficient provision of PPE, safety signage, and hazard mitigation tools directly compromises workers’ safety. In resource-constrained environments like Addis Ababa, procurement and supply chain issues might contribute to this challenge.

Discussion: Firms and regulators should prioritize ensuring that all construction sites are stocked with essential safety gear, including helmets, gloves, harnesses, appropriate footwear, and warning signs. Investments in safety equipment not only reduce injuries but also signal organizational commitment to safety, which can improve overall safety culture.

4. High Project Workloads Impact Safety Compliance (RII = 0.70)

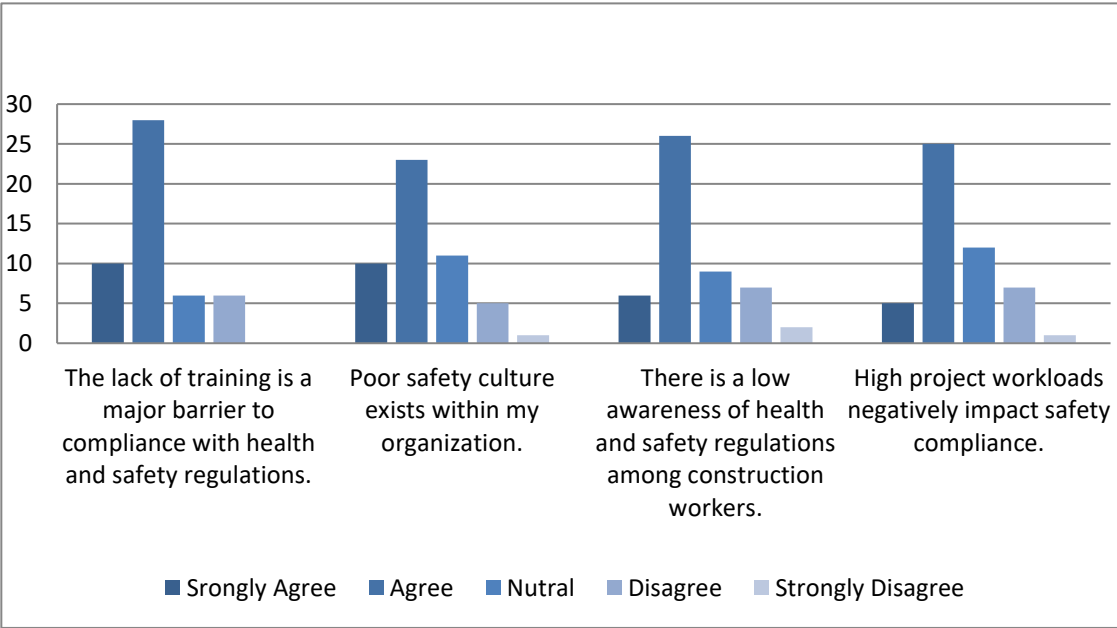


Figure 6: The first four rank that respondent agrees the main challenge and barriers to wards of health and safety regulation

Analysis: This substantial RII reflects a common perception that heavy workloads impede safety practices.

Implication: Overburdened workers are more likely to overlook safety procedures in the rush to meet deadlines, increasing accident risks. Excessive workloads can also lead to fatigue, reducing alertness and concentration.

Discussion: Addressing this barrier requires project planners to balance schedules with safety considerations. Implementing realistic timelines, adequate staffing, and workload management can result in safer work environments and better compliance.

5. Low Awareness of Health and Safety Regulations (RII = 0.70)

Analysis: Similar to the previous factor, a high RII indicates that many stakeholders recognize limited awareness among workers and possibly management about safety regulations.

Implication: This awareness gap may stem from inadequate dissemination of safety information, ineffective communication channels, or cultural barriers.

Discussion: Enhancing awareness through targeted communication campaigns, training sessions, and inclusion of safety topics in routine meetings can mitigate this barrier. Authorities and firms must develop culturally appropriate and accessible information systems to promote understanding of safety regulations.

6. Financial Constraints Hindering Safety Measures (RII = 0.47)

Analysis: This is notably the lowest RII among the challenges listed, suggesting that financial constraints are perceived as a less critical barrier by respondents, or perhaps that the majority do not see financial issues as primary.

Implication: While resource limitations are acknowledged, they might not be viewed as the predominant obstacle compared to others like training, awareness, or safety culture.

Discussion: Nevertheless, limited budgets can still restrict procurement of PPE, safety training, or safety audits. Policy measures might include financial incentives, subsidies, or regulatory penalties to motivate firms to allocate sufficient resources to safety.

4.3.1. Lack of Awareness and Training

A significant barrier is the lack of adequate awareness, knowledge, and training among construction workers, site managers, and owners. Many workers in Addis Ababa's construction sites have limited formal education regarding workplace safety, resulting in a poor understanding of hazards and safe work procedures.

The interviews highlights that safety training programs are either insufficient or not tailored to local contexts. Consequently, workers may fail to recognize risks or lack the skills to implement safety measures effectively. The absence of ongoing training programs further leads to complacency and a failure to adapt to evolving safety standards. When workers and managers are unaware or indifferent about safety precautions, accidents and injuries are more likely to occur.

4.3.2. Insufficient Infrastructure and Resources

The infrastructure and resources necessary for effective safety implementation are often lacking. Many construction sites do not have access to proper safety equipment, signage, and protective measures. Supply chain issues may hinder the procurement of safety gear, and there may be limited availability of specialized safety professionals or consultants.

Furthermore, safety inspections and audits are sporadic or superficial due to limited government capacity, leading to unchecked unsafe practices. Without proper infrastructure such as safety barriers, guardrails, and warning systems accidents become more probable.

4.3.3. Regulatory Framework and Enforcement Challenges

One of the primary obstacles in Addis Ababa's construction sector is the inadequacy and ineffectiveness of the existing regulatory framework. Although Ethiopia has developed construction and safety regulations, their implementation is often superficial and inconsistent. The regulations tend to focus on minimum legal requirements rather than fostering a proactive safety culture. This superficial compliance is frequently due to weak enforcement mechanisms, limited inspection capacity, and insufficient penalties for violations.

Moreover, the efficiency of regulatory bodies is hampered by bureaucratic inefficiencies, lack of coordination among agencies, and limited resource allocation, which results in poor monitoring and enforcement. As a consequence, many construction firms and site managers operate with minimal regard for safety regulations, perceiving them as hurdles rather than safeguards. This situation is exacerbated by the low level of awareness and understanding of safety standards among stakeholders.

The challenges and barriers to the effective implementation of health and safety regulations in Addis Ababa's construction industry are deeply rooted in a combination of regulatory, economic, cultural, infrastructural, and human factors. Addressing these issues requires coordinated efforts involving policy reform, capacity development, economic support, and cultural change. Recognizing and understanding these barriers is the first step toward creating safer construction environments that protect workers and enhance project outcomes in Ethiopia's rapidly evolving urban landscape.

4.4. Development of a Comprehensive Regulatory Framework

Developing a comprehensive framework is an essential step toward establishing a structured approach to complex projects or systems. It provides a clear foundation for understanding, planning, and implementing key components, ensuring consistency and coherence across all levels. A well-designed framework facilitates communication, guides decision-making, and fosters collaboration among stakeholders.

Table 11: Developing a comprehensive an effective regulatory framework

Effective regulatory framework	5	4	3	2	1	Total	RII	Rank
Involving stakeholders in the regulatory framework development is essential for success.	13	21	11	3	2	50	0.76	4
Technology should be incorporated into a future regulatory framework for better compliance.	17	19	11	2	1	50	0.79	2
A simplified regulatory framework would enhance compliance among construction firms.	4	28	16	1	1	50	0.73	7
Continuous feedback mechanisms should be included in the regulatory framework development.	12	19	18	1	0	50	0.76	4
Training programs should be mandated for all stakeholders involved in construction projects.	15	20	11	3	1	50	0.78	3
A comprehensive model should address the unique challenges faced by smaller construction firms.	7	27	13	3	0	50	0.75	5
Regular assessment of compliance is necessary for the effectiveness of a new regulatory framework.	12	21	14	2	1	50	0.76	4
The involvement of local communities would support the implementation of health and safety regulations.	13	17	16	4	0	50	0.75	5
Public awareness campaigns regarding health and safety are necessary for compliance.	15	19	14	1	1	50	0.78	3
Regulatory bodies should collaborate	15	23	9	3	0	50	0.8	1

with construction firms to improve health and safety standards.								
An emphasis on both compliance and performance outcomes is vital in a new regulatory model.	9	25	10	6	0	50	0.74	6
A reward system for compliant firms would encourage adherence to health and safety regulations.	11	19	14	4	2	50	0.73	7

1. Training programs should be mandated for all stakeholders involved in construction projects RII = 0.78

Interpretation: This high RII indicates strong stakeholder consensus that mandatory training is crucial for improving health and safety outcomes. Stakeholders recognize that inadequate training significantly contributes to unsafe practices on construction sites. Mandated comprehensive training ensures that all workers and managers are acquainted with safety procedures, hazard identification, and emergency protocols.

Implications: Policy reforms should enforce obligatory safety training at various project phases. Investing in accessible, tailored training programs, possibly in local languages, can bridge knowledge gaps. Continuous skill updates are essential to adapt to evolving construction methods and hazards.

Priority: Given its strong consensus, it is a top priority to institutionalize mandatory training for all construction stakeholders.

2. A comprehensive model should address the unique challenges faced by smaller construction firms RII = 0.75

Interpretation: Stakeholders agree that smaller firms face distinctive challenges, such as limited resources, inadequate access to safety equipment, and less capacity for compliance. This suggests the need for tailored approaches recognizing these constraints.

Implications: Regulatory frameworks must consider the specific needs and limitations of small firms. Support mechanisms, like subsidized safety equipment or simplified compliance procedures, should be developed. Capacity-building initiatives targeted at small-sized contractors are vital for achieving broader industry safety improvements.

Priority: Addressing small firms' unique challenges is seen as highly important, urging tailored interventions rather than one-size-fits-all policies.

3. Regular assessment of compliance is necessary for the effectiveness of a new regulatory framework RII = 0.76

Interpretation: Stakeholders agree that systematic, ongoing assessment—such as inspections, audits, and performance reviews is critical to ensure regulations translate from policy to practice.

Implications: Implementing periodic inspections can identify gaps early and enforce corrective actions.

Establishing clear benchmarks and reporting systems enhances accountability.

Feedback from assessments can inform policy refinement, ensuring regulations remain relevant and effective.

Priority: Continuous compliance verification is highly valued, confirming its role as a core component of effective regulation.

4. The involvement of local communities would support the implementation of health and safety regulations RII = 0.75

Interpretation: Stakeholders believe community engagement is important. Local communities can facilitate safety awareness, report violations, and foster a safety culture.

Implications: Community awareness campaigns can promote safety practices.

Engaging local leaders enhances compliance through cultural and social channels.

Community participation can exert social pressure on contractors to uphold safety standards.

Priority: Community involvement is prioritized, recognizing its potential to reinforce regulatory compliance and improve safety outcomes.

5. Public awareness campaigns regarding health and safety are necessary for compliance RII = 0.78

Interpretation: This high RII underscores stakeholder consensus that mass awareness efforts are essential to foster a safety culture.

Implications: Government and industry should run targeted campaigns via media, posters, and seminars.

Raising awareness about risks and safety benefits promotes voluntary compliance.

Campaigns should be contextually tailored, addressing local hazards and cultural factors.

Priority: High-priority action, as awareness directly influences behavior change and safety engagement.

6. Regulatory bodies should collaborate with construction firms to improve health and safety standards RII = 0.80

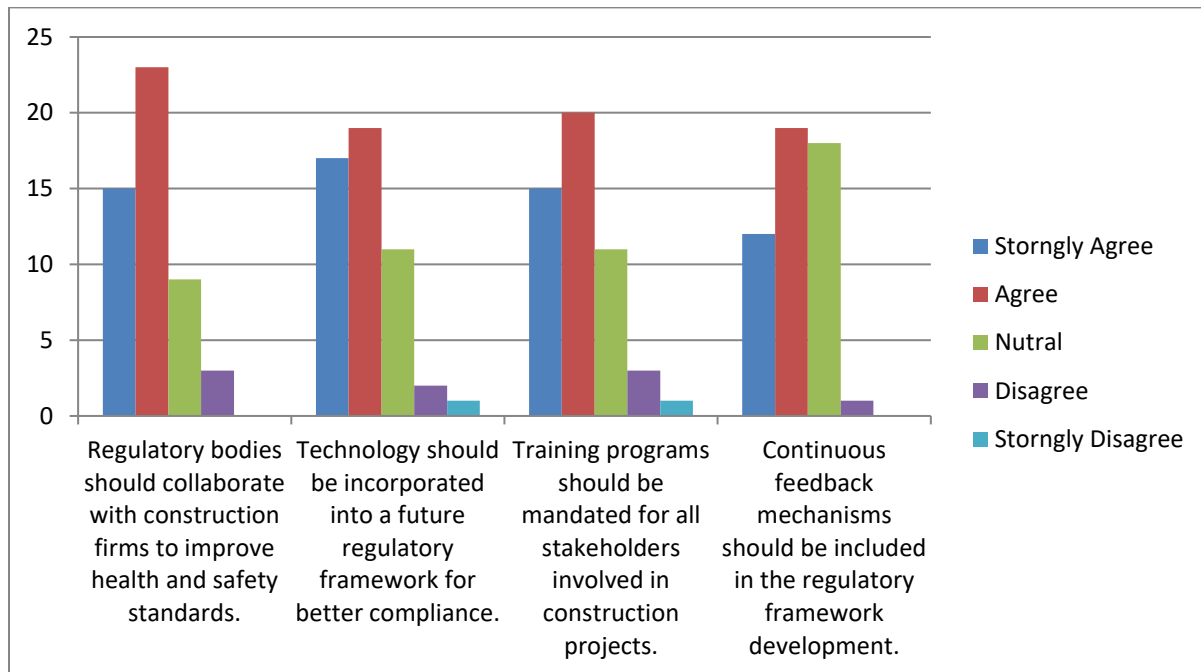


Figure 7: top four the respondent agree that to develop Effective regulatory framework

Interpretation: This is the highest RII among listed factors, indicating stakeholders see collaborative efforts as paramount for effective regulation.

Implications: Encouraging dialogue fosters mutual understanding and facilitates practical compliance measures. Collaboration can lead to customized safety standards aligned with industry realities. Joint safety committees or workshops can enhance trust and shared responsibility.

Priority: Most critical factor, emphasizing that collaborative process is essential to translating policies into safer worksites.

7. An emphasis on both compliance and performance outcomes is vital in a new regulatory model RII = 0.74

Interpretation: Stakeholders value regulations that not only enforce compliance but also incentivize actual safety performance and outcomes such as reduced accidents.

Implications: Regulatory frameworks should incorporate performance-based metrics.

Incentives or penalties linked to safety performance motivate proactive safety management.

Monitoring actual safety outcomes, beyond mere procedural checks, aligns regulations with industry realities.

Priority: High importance placed on balancing compliance with tangible safety improvements.

8. A reward system for compliant firms would encourage adherence to health and safety regulations RII = 0.73

Interpretation: Stakeholders concur that positive reinforcement, such as awards or recognition, can motivate firms to meet or exceed safety standards.

Implications: Developing certification or award programs for safety excellence can promote best practices. Incentivizing safety compliance enhances industry-wide safety culture.

Rewards must be transparent and meaningful to be effective.

Priority: A valuable tool to reinforce compliance, especially when combined with enforcement measures.

9. More robust enforcement of existing safety regulations is needed RII = 0.74

Interpretation: Despite awareness and policies, enforcement remains a challenge. Stakeholders perceive current enforcement as insufficient or inconsistent.

Implications: Strengthening inspection regimes, with trained and adequately resourced officials, is essential. Clear penalties for violations can deter non-compliance. Regular enforcement reinforces the credibility of regulations.

Priority: A critical area requiring increased focus to bridge the gap between regulation and practice.

10. There's a significant gap between the regulations on paper and their implementation on construction sites in Addis Ababa RII = 0.74

Interpretation: Stakeholders recognize that while regulations exist officially, their practical application on-site is lacking, often due to enforcement, capacity, or resource constraints.

Implications: Effective implementation demands capacity-building, resource allocation, and oversight mechanisms. Addressing barriers like management attitudes and resource shortages is crucial.

Priority: Understanding and narrowing this implementation gap must be prioritized for any regulatory success.

11. Training programs need to be improved and made more accessible, considering hazards specific to Addis Ababa RII = 0.76

Interpretation: This emphasizes stakeholders' view that generic training may be insufficient; instead, tailored, accessible, and hazard-specific training is essential.

Implications: Developing localized training content helps workers better understand specific risks (e.g., working at height in windy areas, using local equipment). Language and literacy considerations are vital. Regular refresher courses can sustain safety awareness.

Priority: High, as improved training directly impacts safety practices.

12. Increased awareness campaigns are essential because many workers may not fully understand the risks they face daily RII = 0.78

Interpretation: Reinforces the importance of continuous education. Stakeholders acknowledge that workers' awareness of hazards is insufficient currently.

Implications: Tailored campaigns should target workers directly, utilizing visual aids and local languages. Engagement strategies might include safety talks, posters, and mobile messaging.

Priority: A top priority, as awareness is foundational to safe behaviors.

Summary of Priorities:

Most critical: Collaboration between regulatory bodies and firms (**RII=0.80**). This underscores the belief that cooperative approaches are fundamental for improving safety.

Highly important: Mandated training (**0.78**), public awareness campaigns (**0.78**), addressing small firms' challenges (**0.75**), and compliance assessments (**0.76**). These focus on capacity building, awareness, and continuous evaluation.

Important but slightly lower emphasis: Enforcement (**0.74**), performance outcomes (**0.74**), reward systems (**0.73**). These suggest that enforcement and incentivization are vital but perhaps require supporting measures.

The RII scores reflect a comprehensive stakeholder consensus that collaborative, well-enforced, and targeted strategies are essential to enhance health and safety compliance in Addis Ababa's construction industry. Prioritizing collaborations, training, awareness

Proposed Model Summary: A unified, adaptive, stakeholder-centered regulatory framework that integrates technological innovations, simplifies compliance processes, emphasizes continuous feedback, mandates comprehensive training, provides tailored support to smaller firms, enforces regulations rigorously, and promotes community engagement.

In conclusion, leveraging the strong stakeholder support reflected in the IRR results, the framework should be dynamic, inclusive, and technologically advanced to effectively bridge current gaps and enhance construction safety in Addis Ababa.

The survey results highlight several key factors influencing the effectiveness of a regulatory framework for health and safety in construction. Stakeholder involvement, technology integration, and simplified regulations are deemed crucial, with high agreement scores indicating their importance in fostering compliance. Regular assessment and continuous feedback mechanisms are also recognized as vital to maintaining an effective framework. Training programs for all stakeholders and addressing the unique challenges faced by smaller firms are essential steps to enhance adherence. Additionally, involving local communities and conducting public awareness campaigns can support better implementation. Collaboration between regulatory bodies and construction firms emerges as a significant factor, emphasizing the need for joint efforts to improve safety standards. Overall, the data suggests that a balanced approach, combining clear regulations, stakeholder engagement, technological advancements, and recognition incentives is keys to promoting effective health and safety practices within the construction industry.

4.5. Comparative Analysis of Health and Safety Outcomes

The comparative analysis of health and safety outcomes in the Ethiopian construction industry, particularly in Addis Ababa, reveals both progress and persistent challenges in implementing construction health and safety regulations, notably the Construction Design and Management (CDM) Regulations. Drawing upon the findings the following discussion synthesizes key results and their implications:

1. Impact of CDM Regulations on Safety Outcomes: Quantitative data indicate a reported reduction in workplace accidents, with an approximate decrease of 30% after the implementation of CDM-like frameworks (HSE, 2019). Although this decline is modest, it signifies that regulatory measures have positively influenced safety culture and practices. The literature review supports this, illustrating the role of strategic safety management and stakeholder engagement in accident reduction.

2. Implementation Gaps and Regulatory Compliance: Despite the positive trend, a significant gap between regulatory policies and their actual enforcement on construction sites. For instance,

regular site inspections and audits are recommended, yet the current frequency and thoroughness are insufficient. Stakeholders report a lack of consistent monitoring, which undermines the regulatory framework's effectiveness. The high percentage of firms lacking adequate safety training and resources reflects this enforcement shortfall.

3. Challenges in Small and Informal Construction Firms: the unique vulnerabilities of smaller firms and informal sectors. These entities often operate with minimal oversight, limited safety equipment, and poor awareness of regulations, thereby increasing accident risks. Addressing these challenges requires tailored support measures, such as simplified regulations, subsidized PPE, and targeted training.

4. Cultural and Socioeconomic Barriers: The discussion on stakeholder perceptions about the regulatory impact, often due to management apathy, socioeconomic pressures, and inadequate safety culture. Poverty-driven priorities may lead workers to compromise safety for earnings, a theme corroborated by qualitative comments. Effective safety improvements thus require cultural shifts, community engagement, and socioeconomic interventions.

5. Positive Developments and Recommendations: The literature emphasizes that implementing structured training programs, regular audits, safety awareness campaigns, and technological integration can enhance safety outcomes. Improved regulatory collaboration and reward systems for compliant firms show promise as motivational tools. Additionally, stakeholder perceptions indicate that involving all parties in safety planning fosters ownership and adherence.

6. Overall Outcome and Future Outlook: While initial improvements in safety indicators are evident, the analysis underscores that the full potential of CDM regulations remains unrealized due to enforcement gaps, resource constraints, and cultural barriers. Continuous efforts strengthening supervision, fostering safety culture, and supporting small firms are necessary to sustain and amplify safety gains.

The comparative analysis reveals that the introduction of safety regulations, particularly CDM, has contributed to measurable reductions in accidents and enhanced safety awareness. However, significant implementation gaps especially in enforcement, resource availability, and cultural acceptance impede optimal outcomes. Addressing these issues through targeted regulation refinement, stakeholder engagement, technological adaptation, and socioeconomic support will be critical in advancing health and safety standards across Addis Ababa's construction sector.

Chapter Five

5. Conclusion and Recommendation

5.1. Conclusion

This study provides a critical evaluation of the impact of Construction Design and Management (CDM) regulations on health and safety practices within Addis Ababa's rapidly expanding construction sector. The findings reveal that although the adoption of safety regulations has increased awareness and contributed to modest improvements in safety practices, significant systemic barriers hinder their full effectiveness. These barriers include inadequate enforcement capacity, resource constraints, limited technical training, and socio-cultural attitudes that often prioritize productivity over safety.

The research underscores that the current regulatory framework, inspired by international standards like the UK's CDM regulations, requires contextual adaptation to address Ethiopia's unique socio-economic and institutional environment. The limited compliance, especially among small and informal firms, reflects a need for targeted capacity-building initiatives, robust monitoring mechanisms, and heightened stakeholder engagement at all levels.

Furthermore, cultural perceptions towards safety viewing it as secondary to project completion emerge as a critical challenge that dampens proactive safety management. Addressing these ingrained attitudes necessitates fostering a safety-centric organizational culture through education, awareness campaigns, and policy reinforcement.

Based on the insights derived, several key strategic recommendations emerge. First, strengthening regulatory enforcement through enhanced institutional capacity and regular safety audits is paramount. Second, implementing comprehensive training programs tailored to local contexts can bridge knowledge gaps among workers and managers. Third, promoting stakeholder participation including government agencies, industry players, and communities—can foster shared responsibility and accountability. Lastly, leveraging technological innovations such as digital monitoring tools and safety management systems can improve compliance and risk mitigation.

Finally, achieving sustainable safety improvements in Addis Ababa's construction industry demands an integrated approach that combines regulatory reinforcement, socio-cultural change, technological advancement, and stakeholder engagement. Such efforts will create safer working environments, reduce accidents and injuries, and support Ethiopia's broader goals of sustainable urban development. Future research should explore the development of localized safety frameworks and the long-term impacts of these interventions to ensure that safety culture becomes an inherent part of construction practice in Ethiopia.

5.2. Recommendations

Based on the findings and analysis, a set of comprehensive recommendations is proposed to enhance the effectiveness of health and safety regulations, particularly those modeled after CDM, within the Ethiopian construction industry. These recommendations aim to address current gaps, foster a stronger safety culture, and ensure sustainable implementation of safety practices in Addis Ababa's rapidly expanding construction sector.

Collaborative efforts must be intensified among government agencies, industry stakeholders, educational institutions, and communities. Creating platforms for dialogue and knowledge exchange fosters shared ownership and aligns efforts towards common safety goals. Establishing multi-stakeholder safety committees can oversee policy development, implementation, and continuous improvement initiatives. Public awareness campaigns, involving workers, communities, and media outlets, can reinforce the importance of safety, dispelling misconceptions and promoting accountability.

Overall, effectively improving health and safety outcomes in Addis Ababa's construction industry requires a holistic approach that combines reinforced enforcement, capacity building, awareness, stakeholder engagement, technological innovation, and socioeconomic support. Implementing these recommendations will contribute to a safer working environment, reduce occupational hazards, and embed a sustainable safety culture that aligns with Ethiopia's developmental ambitions. Embracing these strategies will pave the way for a resilient construction sector that prioritizes human well-being alongside rapid infrastructural growth.

References

- (FDRE) Federal Democratic Republic of Ethiopia. (2019). Labor Proclamation No. 1156/2019. <https://www.ilo.org/dyn/natlex/docs/SERIAL/112919/136933/F1881338063/ETH112919.pdf>.
- Abate A. & Mulugeta A. (2020). Economic challenges to health and safety regulation compliance in the Ethiopian construction industry. *Journal of Construction in Developing Countries*, 25(1), 1-15.
- Abebe A. & Tadesse. (2019). Challenges of health and safety management in the construction industry of Addis Ababa, Ethiopia. . *International Journal of Construction Management*, 19(3), 233-245.
- Alemayehu T. & Mulugeta A. (2020). Capacity building and training needs for improving health and safety in the Ethiopian construction industry. *Ethiopian Journal of Environmental Studies and Management*, 345-358.
- Asfaw, A. G. (2021). Safety in the construction industry in Ethiopia: Challenges and opportunities. *Journal of Construction in Developing Countries*, 41-55.
- Assefa A. & Woldemariam A. (2021). Assessment of the challenges of health and safety management in the Ethiopian construction industry: A case study of Addis Ababa. *International Journal of Construction Management*, 21(5), 367-384.
- Crispino M.& Flores, J. (2021). Construction Safety Risk Management: An Overview and Its Impacts on Construction Projects. .
- Crossrail Ltd. (2014). Crossrail health and safety report.
- Daba G. (2020). Health and safety awareness among construction workers in Ethiopia: An exploratory study. *International Journal of Occupational Safety and Ergonomics*, 26(2), 270-280.
- Famakin I. O., M. S. (2023). Impact of construction health & safety regulations on project parameters in Nigeria: Consultants and contractors view. *International Journal of Construction Management*, 12(4), 123.
- Fang D. & Huang X. (2016). Cost implications of construction accidents: A case study of the US construction industry. *International Journal of Project Management*, 34(7), 1241-1253.
- Gambatese J. A. (2006). Safety in design: A new approach to construction safety. *Journal of Construction Engineering and Management*, 132(2), 164-181.
- Gebremedhin T. & Tadesse A. (2021). Resistance to change and regulatory compliance in the Ethiopian construction industry: Challenges and solutions. *Journal of Construction Management and Innovation*, 3(2), 89-102.
- Gibb A. & Duff R. (2015). Principles of Construction Safety. *Wiley-Blackwe*.
- Gibson J. (2002). Revitalizing health and safety in construction. Health & Safety Executive Construction Policy. *HSE website*.

- Hailu A. & Tadesse A. (2019). Cultural influences on health and safety practices in the Ethiopian construction industry. *International Journal of Construction Management*, 19(4), 345-356.
- Hassanein & Hanna. (2008). Construction Management and Economics,. *Journal of Construction Engineering and Management*.
- Headley J. & Griffith, A. (2003). A review of safety culture in construction. *Journal of Construction Research*.
- Henry A. Odeyinka¹, C. D. (2003). An Assessment of Factors Inhibiting Designers from Complying with Health and Safety Regulations in Their Design.". *Department of quantity surveying Ovafermi Awolowo University, Nigeria*.
- HSE. (2015). Managing health and safety in construction: Construction (Design and Management) Regulations. In H. a. Executive, *Guidance on Regulations. from HSE*.
- HSE. (2019). Construction health and safety statistics. *Health and Safety Executive*. .
- HSE/, H. a. (2015). The Construction (Design and Management) Regulations. *Health and Safety Executive*.
- Huang X.& Hinze J. (2006). Owner's role in construction safety: A review of the literature. *Journal of Construction Engineering and Management*, 132(2), 197-205.
- ILO. (2019). Labour Proclamation No. 1156/2019. In F. D. Affairs..
- ILO. (2019). *Federal Democratic Republic of Ethiopia Ministry of Labour and Social Affairs Labour Proclamation No. 1156/2019*.
- Kheni J. & Gibb A. (2011). Development of a construction health and safety management and delivery framework for emerging economies. *International Journal of Construction Management*, 11(2), 75-92.
- Kifle A. (2012). Occupational Safety and Health in Ethiopia: An Overview. *Ethiopian Journal of Health Development*.
- Lai J. H. K., & S. (2020). A critical review of the CDM Regulations: Insights from UK construction stakeholders. *Journal of Construction Engineering and Management*, 146(6).
- Lingard H. & Rowlinson, r. (2019). Occupational Health and Safety in Construction Project Management. *New York: Taylor & Francis*.
- Lingard H.& Graham P. (2017). The role of training in improving compliance with health and safety regulations in construction: A systematic review. *International Journal of Project Management*, 35(1), 1-13.
- Loosemore M. & Malouf M. (2020). A review of the industry's perception on Implementing CDM regulations in construction projects. *International journal*, 35(7), 1173-1185.

- Loosemore, M. &. (2007). Barriers to implementing safety management in construction. *Engineering Construction and Architectural Management*, 14(3), 320-330.
- Lunt M. (2016). The effectiveness of CDM regulations in the UK construction industry: An analysis of the impact on project success. *International Journal of Project Management*,, 34(3), 500-509.
- Makkar, S. &. (2018). The effectiveness of CDM regulations on health and safety in construction: . *A study of the UK's construction sector. Safety Science*,, 106, 297-307.
- Mulugeta A. & Tadesse A. (2020). Stakeholder awareness and compliance with health and safety regulations in the construction industry of Addis Ababa, Ethiopia. *Journal of Construction Management and Innovation*,, 2(1), 45-58.
- Odeyinka H. A., Y. A. (2005). Assessment of the Impact of Health and Safety Regulations on the Construction Industry.". *Journal of Construction in Developing Countries*.
- Sinha K.& Reddy M. (2019). Challenges in implementing safety measures in the construction industry in developing nations. 120, 126-134.
- Smallwood, J. J. (2013). The impact of construction regulations on safety performance in South Africa. *Journal of Construction in Developing Countries*, 18(1), 1-16.
- Smith John. (2023). "Risk Management in Construction Projects." . *Journal of Construction Safety ABC Publishers*,, 45-60.
- Tadesse A. & Kedir A. (2018). The role of construction in the economic development of Ethiopia: A case study of Addis Ababa. *Journal of Construction in Developing Countries*, 23(1), 1-15.
- Taffese S. (2020). Urbanization and its impact on Addis Ababa's construction sector. *International Journal of Construction Management*, 20(4), 385-399.
- Tesfaye H. & Bansal A. (2019). An analysis of the effectiveness of Ethiopian building regulations and health and safety legislation for construction practices. *Journal of Construction Project Management and Innovation*, 9(2), 233-245.
- Tesfaye, A. &. (2021). Analysis of construction accidents in Bole Sub City, Addis Ababa: Causes and preventive measures. Ethiopian. *Journal of Environmental Studies and Management*, , 14(2), 123-135.
- Tim Howarth, G. S. (2006). A Review of the Construction Design and Management Regulations.
- World Bank. (2020). *Ethiopia: Safety and Management in the Construction Industry*. World Bank.
- Zewde E. & Bayou T. (2011). Review of Occupational Safety and Health in Ethiopia. *Safety Science Journal*.

Adama Science and Technology University
College of Civil Engineering and Architecture

Civil Engineering Department MSc Thesis Questionnaire
A Survey on Assessing the Impact of the Construction Design and Management
Regulations on Health and Safety in the Case of Addis Ababa

Dear Sir/Madam,

The objective of this survey is to obtain data for the specified study being conducted as a partial fulfillment of the Degree of Master's in Civil engineering (Specialization in Construction Engineering and Management) at Adama Science and Technology University. The questionnaire is developed to obtain professional opinion on issues of the on safety and health Practices in Addis Ababa city construction projects. The aim of this study is to assess the impact of construction design and management regulation on safety and health practices in Addis Ababa city construction projects, factors that challenges on the implementation of safety and health practices. It intends to evaluate the extent of compliance with the regulations on health and safety among construction firms, to identify the key challenges and barriers faced by construction stakeholders in implementing the regulation achieving safety standards and to recommend possible remedial measures in mitigating them. All data included in this questionnaire will only be used for academic research purpose and will be strictly confidential.

I genuinely thank you for your cooperation in advance.

Regards, Dawit Tefera

Tel: 0919-912942

E-mail: eth.dawite44@gmail.com

Appendix

Questionnaire for Stakeholders in the Construction Industry

These questionnaires are used to assess the impact of the Construction Regulations on health and safety in Addis Ababa. The questionnaire is structured to collect both quantitative and qualitative data.

Part One: Demographic Information

1. Name (optional):

2. Age:

3. Gender:

☐ Male

☐ Female

4. Role in the Construction Industry:

☐ Construction Worker

☐ Site Manager

☐ Safety Officer

☐ Regulatory Authority

☐ Other (please specify):

5. Years of Experience in the Construction Industry:

☐ Less than 1 year

☐ 1-3 years

☐ 3-6 years

☐ More than 6 years

Part Two: Evaluating the extent of compliance with the regulations on health and safety among construction firms operating in Addis Ababa

Each question can use a 5-point Likert scale: 1 (Strongly Disagree), 2 (Disagree), 3 (Neutral), 4 (Agree), 5 (Strongly Agree) *Please put “X” sign on your check box response.*

No.	Evaluation on extent of compliance with regulation on health and safety	1	2	3	4	5
1	Our company is aware of the construction management regulations concerning health and safety.					
2	Safety training is regularly provided to employees in your organization.					
3	Compliance with health and safety regulations is monitored consistently at your construction sites.					
4	Your safety policies are in line with the Government Construction Management Regulations.					
5	Employees understand their roles in maintaining health and safety on site.					
6	Safety inspections are conducted regularly at your work sites.					
7	Employees feel comfortable reporting safety violations without fear of repercussions.					
8	We have sufficient safety equipment available on site.					
9	Our projects are delayed due to health and safety compliance issues.					
10	The documentation related to health and safety practices is regularly updated.					

6. ***What actions do you believe would enhance compliance with Construction Regulations on health and safety in your organization?***

7. ***What specific Construction Regulations on health and safety does your organization adhere to? (Select all that apply)***

- ☐ Risk assessment and management
- ☐ Safety training for workers
- ☐ Design considerations for safety
- ☐ Regular safety audits
- ☐ Other (please specify):

8. What specific health and safety measures are implemented in your organization?
(Select all that apply)

- ☐ Personal protective equipment (PPE)
- ☐ Safety training programs
- ☐ Emergency response plans
- ☐ Regular safety drills
- ☐ Other (please specify):
-

Part Three: Identifying the key challenges and barriers faced by construction stakeholders in implementing the regulation achieving safety standards

No.	Identification on Challenges and Barriers	1	2	3	4	5
1	The lack of training is a major barrier to compliance with health and safety regulations.					
2	The availability of safety equipment is insufficient to meet regulatory standards.					
3	High project workloads negatively impact safety compliance.					
4	There is a low awareness of health and safety regulations among construction workers.					
5	Poor safety culture exists within my organization.					
6	Financial constraints hinder the implementation of safety measures.					
7	Regulatory authorities provide adequate support for industry compliance.					
8	The complexity of regulations makes compliance challenging.					
9	Safety regulations are not enforced strictly by the authorities.					
10	Construction managers prioritize project deadlines over safety compliance.					
11	Resistance to change from management impacts our ability to implement safety regulations.					
12	The construction project timelines hinder the implementation of safety protocols.					

9. In your view, what are the key barriers to effective implementation of health and safety practices?

Part Four: Developing a comprehensive model for an effective regulatory framework

No.	Effective regulatory framework	1	2	3	4	5
1	Involving stakeholders in the regulatory framework development is essential for success.					
2	Technology should be incorporated into a future regulatory framework for better compliance.					
3	A simplified regulatory framework would enhance compliance among construction firms.					
4	Continuous feedback mechanisms should be included in the regulatory framework development.					
5	Training programs should be mandated for all stakeholders involved in construction projects.					
6	A comprehensive model should address the unique challenges faced by smaller construction firms.					
7	Regular assessment of compliance is necessary for the effectiveness of a new regulatory framework.					
8	The involvement of local communities would support the implementation of health and safety regulations.					
9	Public awareness campaigns regarding health and safety are necessary for compliance.					
10	Regulatory bodies should collaborate with construction firms to improve health and safety standards.					
11	An emphasis on both compliance and performance outcomes is vital in a new regulatory model.					
12	A reward system for compliant firms would encourage adherence to health and safety regulations.					

10. Please provide specific examples of improvements attributed to the Construction Regulations on health and safety:

11. Please provide any additional comments or suggestions regarding health and safety practices in the construction industry in Addis Ababa:

Interview questions for thesis on assessing the impact of Construction Design and Management (CDM) regulations on health and safety in Addis Ababa. These questions are designed to gather in-depth qualitative insights from different stakeholders:

Interview Questions:

1. Perception of Regulations:

In your opinion, how effective are these regulations in improving health and safety on construction sites?

2. Implementation and Compliance:

What challenges do you face in ensuring compliance with these safety regulations?

3. Safety Practices and Culture:

In your experience, what are the key factors that promote or hinder a safety-conscious culture in construction projects?

4. Training and Awareness:

Do construction workers and staff receive adequate training on safety regulations and practices? Please elaborate.

What measures can be taken to improve awareness and understanding of safety requirements?

5. Enforcement and Monitoring:

How is the enforcement of safety regulations monitored and maintained during construction activities?

Are inspection and enforcement mechanisms effective? Why or why not?

6. Barriers and Challenges:

What are the main barriers to fully implementing safety regulations in construction projects in Addis Ababa?

How do socio-cultural attitudes or resource constraints affect safety regulation adherence?

7. Impact and Outcomes:

Have you observed any measurable improvements in safety outcomes since the implementation of the regulations?

Can you share specific examples of safety successes or failures related to these regulations?

8. Recommendations:

Based on your experience, what improvements are needed in the current safety regulations or their enforcement?

What strategies would you suggest to enhance stakeholder engagement and compliance?

9. Additional Insights:

Are there any other factors or issues related to health and safety that you believe is important but have not been covered?

Do you have any suggestions for policymakers to better support safety practices in the construction sector?