UNIVERSITY OF NAIROBI

FACULTY OF BUILT ENVIRONMENT AND DESIGN

DEPARTMENT OF REAL ESTATE, CONSTRUCTION MANAGEMENT & QUANTITY SURVEYING

MANAGEMENT OF HEALTH AND SAFETY RISKS ON SITES DURING CONSTRUCTION PROCESS: CASE STUDY OF PRIVATE DEVELOPMENTS IN KIAMBU COUNTY, KENYA

BY

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March 25, 2024

DECLARATION

I hereby declare that this Research Project is my original work and it has never been submitted to any other university or institution of learning.

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This project has been submitted with my approval as the university supervisor.

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Mr. Nicky Nzioki

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DEDICATION

This project is dedicated to my family.

Zipporah my wife, we have walked this long journey together. You have inspired and encouraged me all along. You have constantly reminded me that I must finish this task. This is in your honour.

Ivy and Joy my daughters, may this inspire you to conquer the world

Gian and Asher my sons, though the journey started before you were born, may you build on this foundation.

ABSTRACT

Construction health and safety is a significant global concern, particularly in underdeveloped nations where the industry faces numerous hazards. Despite various safety initiatives and governmental programs, accidents and unsafe working conditions persist, especially in countries like Kenya, which experiences extensive construction activity. This study explores the management of health and safety risks on construction sites, focusing on private developments in Kiambu County, Kenya. Utilizing a hybrid research methodology that incorporates both numerical and descriptive analyses, this research aims to address the pressing health and safety challenges that construction workers face. The findings underscore the critical need for construction firms to continually update their health and safety policies to align with the actual conditions on sites. A robust health and safety policy, particularly in training programs, is essential for effective risk management. The study outlines several key areas for further investigation, including the impact of such policies on reducing workplace accidents and enhancing safe working conditions.

The study's objectives include evaluating the existing health and safety policies at construction sites in Kiambu County and assessing the implementation and effectiveness of these policies in managing health and safety risks. The literature review contributes insights into best practices in construction health and safety management and identifies key variables such as policy effectiveness, training quality, and accident rates. Grounded in systems theory, the research views construction sites as complex systems where various elements interact, providing a theoretical framework for the analysis.

The research methodology employs a mixed-methods approach, combining exploratory and descriptive strategies to capture a comprehensive view of the health and safety landscape in Kiambu County. The target population includes construction workers and site managers, with a stratified sampling technique ensuring representation across different construction sites. Individual construction sites within the county serve as the unit of analysis.

Conclusively, construction site health and safety must be managed throughout the process. The construction industry's exposure to hazardous materials underscores the necessity for proactive worker safety precautions.

Areas suggested for further study include investigating the long-term effects of safety training on accident rates and analyzing the economic impacts of improved health and safety standards on construction project budgets.

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CHAPTER ONE: INTRODUCTION

1.1. Background of the Study

The construction business is crucial to many economies, especially developing ones, where it drives economic growth. This sector affects several aspects of a nation's finances. According to Giang and Pheng (2010), the building industry accounts for 11% of most developing countries' GDP. This financial relevance emphasises the industry's economic importance. Despite its economic benefits, the building industry poses serious health and safety dangers. These dangers are complex and threaten worker safety and construction project success. These risks range from working at heights, where falls are common, to working in confined spaces and underground locations, where hazards are increased. Workers' proximity to falling materials and manual handling of big loads can also cause strains, sprains, and more serious injuries. Construction workers are exposed to chemical hazards that can have long-term health effects while handling hazardous substances (Kanyithia, 2020). Construction sites also have noise pollution from heavy machines and tools. The constant dust from building poses health and environmental dangers. Operators must navigate plant and equipment safely to avoid accidents and damage. Electrical problems, combustible materials, and welding activities can cause fires, requiring strict fire safety standards. Construction sites sometimes have a complex network of live cables and electrical lines that can electrocute if not maintained. Poor housekeeping can cause trip and fall hazards, and ergonomic neglect can cause persistent musculoskeletal difficulties in workers.

Due to the dominance of high-rise structures and the rapid expansion of complicated construction projects across multiple areas, urban health and safety mishaps are more common. Modernization of cities and the demand for housing, office spaces, shopping complexes, critical services, and other infrastructures due to urbanisation are driving this construction boom. Kenya's construction industry is crucial to satisfying these growing needs (Thuku, 2020). However, this crucial sector faces severe health and safety dangers, often related to building site safety management. The occupier of any workplace, including building sites, is responsible for worker safety. According to the 2007 OSHA, "occupier" includes both the owner and the employer. Armstrong (1980) stated that this responsibility is both legal and moral, stretching back to organised industrial activity. The construction profession is notoriously dangerous. The industry reports frighteningly high numbers of accidents and fatalities on building sites worldwide, justifying its reputation (Smallwood and Haupt, 2008).

Sohail (1999) observes that construction workers, regardless of location, are at higher risk than workers in other industries. Construction site risks can cause significant injuries, increasing risk. The complexity and multifaceted nature of construction projects, combined with the inherent risks of working at elevated heights, around heavy machinery, and in a constantly changing environment, require a robust and proactive health and safety approach. Failure to address these concerns endangers workers' lives and contributes to the industry's high accident rates, which hurt performance (Kanyithia, 2020). Thus, project owners, employers, regulatory bodies, and policymakers must work together to implement and enforce comprehensive health and safety measures to reduce construction worker risks and make the industry safer and more secure.

Health and safety in the construction sector are crucial for human and economic reasons, requiring good management and supervision. This sector has a notion that health and safety practises increase expenses (Adebiyi et al., 2020). Many construction managers believe that ensuring employee well-being will increase costs and diminish profitability. Misconceptions have slowed progress in the profession, so they must be debunked to create a safer, more economically sustainable construction business. Numerous research and experiences have shown that proactive construction health and safety measures can boost profitability. The idea that safety measures raise costs is false, and empirical data suggests it can be advantageous. Construction health and safety spending had many benefits (Mohammed, 2003). One of the biggest benefits was increased productivity. Improved safety measures allow construction workers to focus on their tasks with less risk, increasing productivity and production. This boosts project timeline and cost-effectiveness. In addition, a strong construction health and safety culture can boost staff morale. Job satisfaction and motivation rise when workers feel secure and appreciated. Motivated and happy workers perform better, improving productivity and quality. It also reduces attrition by making employees more loyal and stable. Construction companies must frequently recruit and train new hires, which increases costs and delays projects. Given these benefits, construction health and safety is a catalyst for profitability (Agyekum et al., 2021). By eliminating the myth that safety measures are expensive, construction businesses may be more proactive in protecting their workers. This research challenges these beliefs and perceptions to show the economic benefits and long-term sustainability of construction health and safety. Safety protects industry workers and lays the groundwork for economic progress.

Construction safety and health management involves steps managers at all levels can take to train and motivate personnel to undertake safe and productive construction work. The system should outline responsibilities and accountabilities of all parties and methods for hazard elimination and detection before they cause incidents (Sehsah et al., 2020). Modern construction workers' safety is a government priority (Helen & Stephen, 2005). A safe workplace is essential to health, security, and prosperity. Construction sites can be safe with enough clean water, sanitation, a healthy environment, understanding of machine, plant, and equipment handling, and hygienic practises. The worldwide Labour Organisation (ILO) sets building site safety standards based on worldwide occupational health and safety treaties and guidelines (ILO, 2002). Occupational Safety and Health Act 2007 enforces them in Kenya.

Construction produces buildings, roads, railways, ports, bridges, and jobs, but it also poses health and safety risks (Okumbe, 2001). Construction workers may be exposed to asbestos, lead, silica dust, organic solvents, sewage gases, welding fumes, radiation, noise, and vibration. Overexposure to these substances/agents can cause acute harm, chronic sickness, permanent disability, or death. Lack of concentration at work and exhaustion from poor health may increase accident risk (Perry, 2003). High worker turnover, shifting work conditions, and several contractors doing different sorts of work are typical of construction industry. These elements would enhance worker health risks. Construction site hygiene promotes good housekeeping by providing clean water, bathrooms, and washing facilities. Clean water and bathrooms promote workplace hygiene and prevent cross-contamination, protecting worker health and safety, Gahlot et al. (2002), The Department of Occupational Health and Safety Services in Kenya ensures that all workplaces have proper provisions to prevent occupational diseases and accidents. Even if these attempts are made, construction workers' safety and health in Kenya, especially in Kiambu County, the research area, continues to decline.

1.1.1 Analysis of the Situation

Mohammed (2003) states that the building business is both a huge economic driver and one of the most dangerous in terms of occupational safety. Accidents in this industry create pain and suffering for those affected and affect production, quality, project schedules, and environmental impact. Construction projects cost more due to these negative effects. Due to the widespread effects of construction accidents, construction health and safety management is a major concern for all stakeholders. Health and safety in construction project execution are typically neglected in underdeveloped nations because safety measures are seen as burdensome

(Mbuya and Lema, 2004). Health and safety should be included into project management, not viewed as secondary considerations. These factors should be considered with cost, quality, and time. Project managers prioritise safety and health alongside cost, quality, and schedule for three main reasons: the human element, legislation, and finances (Adan, 2004). First, people matter most. Construction projects often employ labourers, skilled craftsmen, engineers, and other professions. Accidents can cause physical and psychological harm to these people, therefore their safety and well-being should be a top priority. Prioritising safety protects workers' lives and health and allows them to operate without stress or fear. Second, legislation is vital to construction safety advocacy. Construction safety laws are enforced worldwide by governments and regulatory authorities. Compliance with these regulations is mandatory. Penalties, fines, and project shutdowns can come from violating these criteria. Therefore, following health and safety rules is not only a moral or ethical option but a legal need. Finally, financial effects are significant. Safety precautions are an investment in risk mitigation, not an extra expenditure. Accidents raise project costs, including medical bills, legal fees, and worker compensation (Thuku, 2020). Due to labour and equipment leasing costs, project delays might cost money. Construction businesses can avert these financial losses and assure project success by proactively implementing safety measures.

Unfortunately, many building sites prioritise health, safety, and environmental hazards only partially. Safety and health are routinely considered as a priority at site management meetings, but budget and time discussions take precedence. The collapse of two Nairobi buildings while under construction has put the construction industry in Kenya under attack, according to *The Daily Nation* (23 June 2011). Building collapses have raised issues about the duties of all construction participants and whose fault they are. According to Adan (2004), lack of information and expertise hinders building site health and safety interventions. Unfortunately, many accidents and illnesses go unreported, raising concerns. Construction projects in Kenya are further complicated by the extremely diverse range of people due to variations in education and cultural background among workers at construction sites, as most labourers migrate from rural to urban, cultural differences between employer (contractor) and workers, performing the actual work in the construction sites, and different health and safety awareness and requirements.

1.1.2 International Safety and Health Standards

In 2002, the International Labour Organisation (ILO) created international occupational safety and health guidelines. International conventions and recommendations on occupational safety and health underpin these requirements. The 1981 155th ILO Convention, which focused on occupational safety, health, and working conditions in many industries, particularly construction sites, was a major milestone. This convention outlines the fundamentals for a national occupational safety and health strategy. It outlines a state and workplace action plan involving the government, businesses, and trade unions. Each nation that ratifies this agreement must create, implement, and review a comprehensive occupational safety and health and working environment policy (Barasa, 2021). This periodic evaluation is critical for detecting key concerns and challenges that may have arisen over time. It helps build proactive and methodical ways for prioritising and tackling these issues. Implementing such a policy requires creating and enforcing laws to protect workers' rights. The success of these legislation depends on an acceptable inspection mechanism. Compliance with safety and health requirements requires rigorous workplace inspections. Additionally, the enforcement system must be able to inflict sufficient punishments for lawbreakers. Punishment is necessary to deter infractions and promote compliance and accountability in the workplace. The 155th ILO Convention of 1981 shapes nations' workplace safety and health policies. It highlights the ideas and practises needed to create a safe and healthy workplace and emphasises periodic evaluation, legal frameworks, and strong enforcement (Karuga, 2022). The ILO's objective to promote social justice and fair labour practises worldwide is supported by these regulations, which ensure workers worldwide may expect a safe and healthy workplace.

1.1.3 Workplace Safety Hazards

Safety hazards in the workplace can cause immediate and violent injury to workers. In 2002, the International Labour Organisation (ILO) listed these threats as poorly maintained equipment, unsafe machinery, and hazardous chemical exposure. The risks include hearing loss, eyesight loss, wounds, burns, bruising, fractured bones, and electric shock (ILO, 2002). Njuguna (2007) stresses that organisations must provide a safe workplace and mitigate risks. He stresses the importance of creating a workplace safety culture beyond compliance with rules. He believes a good safety culture rewards personnel for their safety awareness and commitment. Positive reinforcement like recognition and prizes can improve workplace safety culture. Joy (2005) suggests that incentives drive a positive workplace safety culture. Praise, promotions, and financial awards motivate workers to prioritise safety in their daily work. The premise is simple: motivated personnel act safer. Such behaviour decreases human mistake and harmful working situations. Thus, a culture where safety is preached and rewarded is essential to reducing safety dangers in the workplace.

Discuss management of the site health and safety risks

The management of health and safety risks on construction sites is a critical issue that demands a comprehensive approach to protect workers and ensure project success. Effective management begins with the systematic identification and assessment of potential hazards. This involves recognizing risks related to machinery, work at height, electrical installations, and the use of hazardous substances. Regular risk assessments are crucial as they help in determining the potential impact of identified hazards, which aids in prioritizing risk mitigation measures.

Effective health and safety management also requires the development and enforcement of robust health and safety policies. These policies should outline the required safety standards on-site and establish clear procedures for handling various risks. In locations like Kiambu County, construction firms are encouraged to frequently update their health and safety standards to reflect the actual conditions encountered on sites, including protocols for reporting accidents and near-misses. This approach fosters a proactive safety culture that emphasizes the importance of learning from incidents to prevent future occurrences.

Training and education play a pivotal role in equipping workers with the necessary skills to recognize and manage risks effectively. Comprehensive training programs are essential and should cover topics such as the correct use of personal protective equipment (PPE), emergency response procedures, and general safety awareness. The emphasis on a formal health and safety policy for training highlights its significance in risk management in the construction industry. Also, continuous monitoring of health and safety practices on-site ensures that safety measures are effectively implemented and adhered to. Regular safety audits and inspections help identify areas of non-compliance and opportunities for improvement. Establishing feedback mechanisms is also crucial for learning from past incidents and continuously refining safety measures.

Engaging all stakeholders, including project managers, workers, and clients, is essential for the successful management of health and safety risks. This engagement ensures that safety is prioritized throughout the project lifecycle and that all parties are committed to maintaining a safe working environment. The use of modern technology, such as software for risk management and mobile apps for safety training and compliance checks, can further enhance the management of health and safety risks. Technology facilitates better tracking, management, and reporting of safety-related data, making it easier to address risks promptly. Lastly, adherence to local and international safety regulations is non-negotiable. For instance, in Kenya, the Occupational Safety and Health Act provides the legal framework for managing health and safety risks on construction sites. Compliance with these regulations not only prevents legal consequences but also ensures a safe working environment. The collective implementation of these measures fosters a safe and healthy work environment, significantly reducing the incidence of accidents and enhancing overall productivity on construction sites.

1.2. Problem statement

One of the world's largest industries is construction. The sector has rebuilt places damaged by natural and man-made disasters and provided power, transport, and communications to fulfil global demands and expectations. Kenya's building industry employs many manual labourers despite mechanisation. The industry employs 9–12% of a country's workforce, sometimes 20% (Smallwood, 2008). Despite their importance to national growth, these professionals face several hurdles. Poor salary and working conditions cause safety and health issues. The worker may be exposed to materials that cause significant disease and long-term health problems. Construction worker health and safety hazards are rising worldwide and must be addressed immediately (OSHA 1999). Health and safety risk management on construction sites is crucial to worker safety and project performance. However, health and safety standards in private developments in Kiambu County, Kenya, are lacking. This Research Project investigates the main causes of inadequate health and safety risk management on construction sites and proposes ways to improve safety in regional commercial construction projects.

The management of health and safety risks on construction sites is crucial, especially considering the significant differences in occupational health statistics across countries. For example, Kenya's construction industry reports a high fatality rate of 64 per 100,000 workers, starkly contrasting with the UK's lower rates of 0.56 fatalities per 100,000 employees in 2012 and 0.44 in 2014 (Ma et al., 2022; Smallwood et al., 2008). This disparity underscores the need for robust health and safety policies, systematic risk assessments, comprehensive training programs, continuous monitoring, stakeholder engagement, and strict adherence to safety regulations to mitigate risks and enhance worker safety globally. According to the China Statistical Yearbook, China had 3.8 deaths per 100,000 construction workers in 2013 (Ma et al., 2022), while Smallwood et al. (2008) reported 25.5 fatalities in South Africa. These data highlight the serious occupational health and safety issue in Kenya and Africa's construction sector. The huge difference in death rates between Kenya and various other nations highlights the need to strengthen construction site health and safety management in Kenya. Kenyan construction workers had a much higher risk of injury and death than those in the UK, China, and South Africa (Debela et al., 2021). In the context of private developments in Kiambu County, Kenya, which exemplify the Kenyan construction industry's issues, this startling gap is concerning. The root causes of these high fatality rates must be identified, and effective strategies developed to improve health and safety risk management in construction sites to reduce fatalities and injuries and create a safer working environment for Kenyan construction workers.

A study by Otieno (2023) illuminated key issues affecting building site health and safety, notably in Kenya. The study found that "Reluctance to Invest in Safety" was the most important element at 12%, reflecting construction stakeholders' attitudes. This unwillingness to invest in safety indicates a deeper issue of insufficient financial and organisational resources for safety. The study also included "Lack of training" and "Poor enforcement of regulations" as important issues (11.9 and 11.7%, respectively) (Otieno, 2023). This emphasises the need of worker preparation and regulatory enforcement. These findings are linked to construction site health and safety management. Hughes and Ferret (2008) say a good health and safety management system has numerous parts. These include creating a complete health and safety policy, monitoring and reviewing standards, and defining clear goals. These aspects create a proactive safety culture that reduces construction risks and mishaps. A well-defined management structure, ideally from the top, is also crucial. A top-down commitment to safety prioritises safety and promotes a culture of safety throughout the organisation. Finally, safety measures and initiatives need financial backing to be durable and effective. The study found reluctance to invest in safety due to a belief that it adds expenses to the construction process, yet these investments reduce accidents, injuries, and fatalities. Addressing this reluctance and providing adequate training and enforcement can help Kenyan construction companies, including those in private developments in Kiambu County, create safer workplaces, reduce alarming fatality rates, and comply with international health and safety standards (Balate, 2022). Due to the foregoing issues and the need for efficient occupational health and safety management, this study examined the Management of Health and Safety Risks at Construction Sites in Kiambu County, Kenya. The most important person in construction occupational health and safety management must be identified. Everyone's responsible, but it takes a leader, expertise, and continuous improvement initiatives to internalise it (Business Daily, 4 October 2016).

1.3. **Objectives of the Study**

This study examines health and safety management at building sites in Kenya, specifically Kiambu County. The project seeks to:

1 Assess the Presence and Implementation of Health and Safety Management Standards: Initially determine the presence of established health and safety management standards at construction sites in Kiambu County. Following this, evaluate the effectiveness of these standards in managing health and safety risks.

2 Analyze the Impact of Building-Project Client Management: Investigate how the involvement of building-project clients influences the management of occupational health and safety at construction sites. Focus on the role of client management in the enforcement and adherence to health and safety protocols during the construction process.

3 Evaluate the Project Management Team's Role: Examine the contribution of the project management team in implementing and maintaining health and safety measures at construction sites. Assess their effectiveness in addressing and mitigating health and safety concerns.

1.4. **Research Questions**

The researcher studied the following research questions to meet study objectives:

1. What safety standards are in place to control health and safety concerns at building sites in Kiambu County, Kenya?
2. What impact does Building-Project Client's management involvement have on reducing occupational health and safety risks at building sites in Kiambu County, Kenya?
3. Which role does the project management team play in controlling health and safety hazards at construction sites in Kiambu County, Kenya, and how does this impact safety outcomes?
4. How can collaboration between Building-Project Client management and the Project Management team improve health and safety risk management at construction sites in Kiambu County, Kenya, based on research findings?

1.5. Study Hypotheses

The study hypotheses:

Null Hypothesis (H0): There is no significant relationship between the implementation of health and safety management standards and the reduction of workplace accidents at construction sites in Kiambu County.

Alternative Hypothesis (H1): There is a significant relationship between the implementation of health and safety management standards and the reduction of workplace accidents at construction sites in Kiambu County

1.6. Justification and Rationale of the study

Infrastructure, economic growth, and job creation are critical to national development by the construction industry. The industry is important, but health and safety issues beset it. A wider examination of the construction sector shows a disturbing pattern: construction sites inconsistently apply health and safety standards, which causes several health and safety management issues. This causes frequent workplace accidents, injuries, and health issues that require hospitalisation and absenteeism. These factors have major effects on construction worker well-being and project success. Accidents and illness raise costs, delays, and wasted productivity. In view of this worrying situation, construction workers' health and safety issues must be examined. Construction safety and health stakeholders—government authorities, construction companies, workers, and project clients—must address these challenges. This study addresses construction industry concerns by examining the measures, problems, and enforcement of health and safety risk management at building sites in Kiambu County, Kenya. The research examines these aspects to identify the causes of construction health and safety issues, emphasise the challenges, and provide solutions to make the sector safer and more secure. This inquiry is essential to enhancing industry safety, worker well-being, and building project completion in Kiambu County and Kenya.

1.7. Significance of the study

The main goal of this study is to evaluate construction worker health and safety management in Kiambu County, Kenya. This research is crucial because it shows how health and safety affect national social and economic growth. The lack of well-documented health and safety statistics on Kiambu County, Kenya, building sites makes this study even more important. This work was inspired by this research gap.

Thus, this study should reveal important information about building site health and safety in Kiambu County, Kenya. These findings will be crucial for construction sector policymakers, law enforcement, real estate developers, and Kiambu county government officials. This research seeks to illuminate the existing health and safety landscape to inform and influence the creation of laws, regulations, and practises that improve construction worker safety and socioeconomic progress.

1.8. **Scope of the Study**

This study's focus on Kiambu County was carefully chosen for numerous reasons. Kiambu County's location, urban-rural mix, and economic importance in Greater Nairobi make it a good place for construction health and safety studies. Nairobi, Kenya's capital, is crucial to Kiambu County. Due to its proximity to Nairobi, the county is deeply involved in Kenya's economy, politics, and culture. This geographic advantage makes Kiambu County a dynamic place where construction health and safety dynamics are intimately tied to the national context. Kiambu County is also notable for its demographics and economy. With 60% urban and 40% rural, Kiambu County has a diversified and changing topography. This variability reflects the health and safety concerns in urban and rural building, giving the study a broad viewpoint. Kiambu County's economy is outstanding. Nearly 60% of Kenya's economic output comes from Greater Nairobi, which includes Kiambu. This economic vigour drives construction activity as the region competes with Nairobi for residential and commercial development projects. The concentration of construction projects in this region emphasises the need to improve construction health and safety. An interesting finding supports Kiambu County as the study's focus. Many important construction projects are happening in Kiambu. These include the ambitious Tatu City mixed development, Two Rivers, Thika Greens, and others of various sizes. The researcher can easily study and compare building project health and safety practises in Kiambu County due to their proximity. The study's focus on Kiambu County is pragmatic due to time and resource constraints. A nationwide survey would be costly and time-consuming. Thus, Kiambu County is a smart choice because it represents a microcosm of the country in terms of the factors studied. Its diversified and rich setting makes construction health and safety research relevant and enlightening for a wider context.

1.9. **Structure of the study**

The study is arranged into five chapters, each contributing to the research. Chapter 1 provides background information and analyses the study's context. This chapter will establish the problem statement, describe the research's goals, justifies the study, and explain its overall purpose. A full literature review follows in Chapter 2. This chapter explains the study's theoretical foundations and conceptual frameworks. Using a wide range of scholarly sources, this chapter synthesises current information and reviews relevant literature to place the research in the broader academic conversation. Chapter 3 covers study methodology. The researcher describes their study methodologies in this section. It outlines the data collection procedure, data analysis methods, and research tools. In this chapter, ethics and restrictions are discussed. The study's findings are presented in Chapter 4. The research data is carefully analysed and discussed in this part. The empirical evidence from the study supports key data insights, patterns, and trends. In Chapter 5, the findings are used to conclude the research. The study's primary findings and practical recommendations are presented in this chapter. A holistic review of the research's contributions and ideas for future research is included in the conclusion to guide field research.

1.10 Methodological Limits

Geographical Limitation: The study focuses exclusively on construction sites in Kiambu County, Kenya, which may not represent the health and safety practices of other regions or countries with different regulatory environments and cultural factors.

Sample Size and Selection: The sample may be limited to accessible sites that agree to participate, potentially excluding smaller or less formal operations that might present different challenges and insights into health and safety management.

Data Collection Constraints: Reliance on self-reported data from site managers and workers might introduce biases or inaccuracies. Limited access to direct observation due to safety or proprietary concerns can also restrict the depth of data collection.

Time Constraints: The study is conducted within a specific timeframe, which may affect the ability to observe long-term trends in health and safety management effectiveness.

Response Variability: The variability in compliance and enforcement of health and safety protocols among different construction sites could affect the consistency and reliability of findings.

1.11 Definition of Key Terms

Health and Safety Management Standards: These refer to the policies, procedures, and practices implemented to prevent workplace injuries and illnesses at construction sites.

Building-Project Client Management: This term describes the role and influence of clients who fund construction projects, particularly their involvement in setting and enforcing health and safety measures during the construction process.

Project Management Team: Refers to the group of individuals responsible for overseeing the construction process, including the planning, design, and construction phases, and their specific roles in health and safety management.

OSHA: Occupational Safety and Health Act (2007)

1.12 Assumptions

Compliance Assumption: It is assumed that construction sites have some level of health and safety protocols in place, which may not always be the case, especially in less regulated or smaller sites.

Accuracy of Reports: The study assumes that the data collected from surveys and interviews are accurate representations of the actual practices at the construction sites.

Stability of Conditions: Assumes that the health and safety conditions at the construction sites remain relatively stable during the study period, not accounting for sudden changes in legislation or catastrophic events.

CHAPTER 2: LITERATURE REVIEW

The literature review is a critical component of the research process, providing a comprehensive overview of existing knowledge and research related to the chosen topic. In this study, the literature review aims to examine the theoretical foundations and insights relevant to the management of health and safety risks in the construction industry, with a focus on the application of systems theory. This introduction to the literature review will set the stage for a thorough exploration of the existing body of knowledge, highlighting key themes, theories, and empirical findings that inform the research on health and safety in construction.

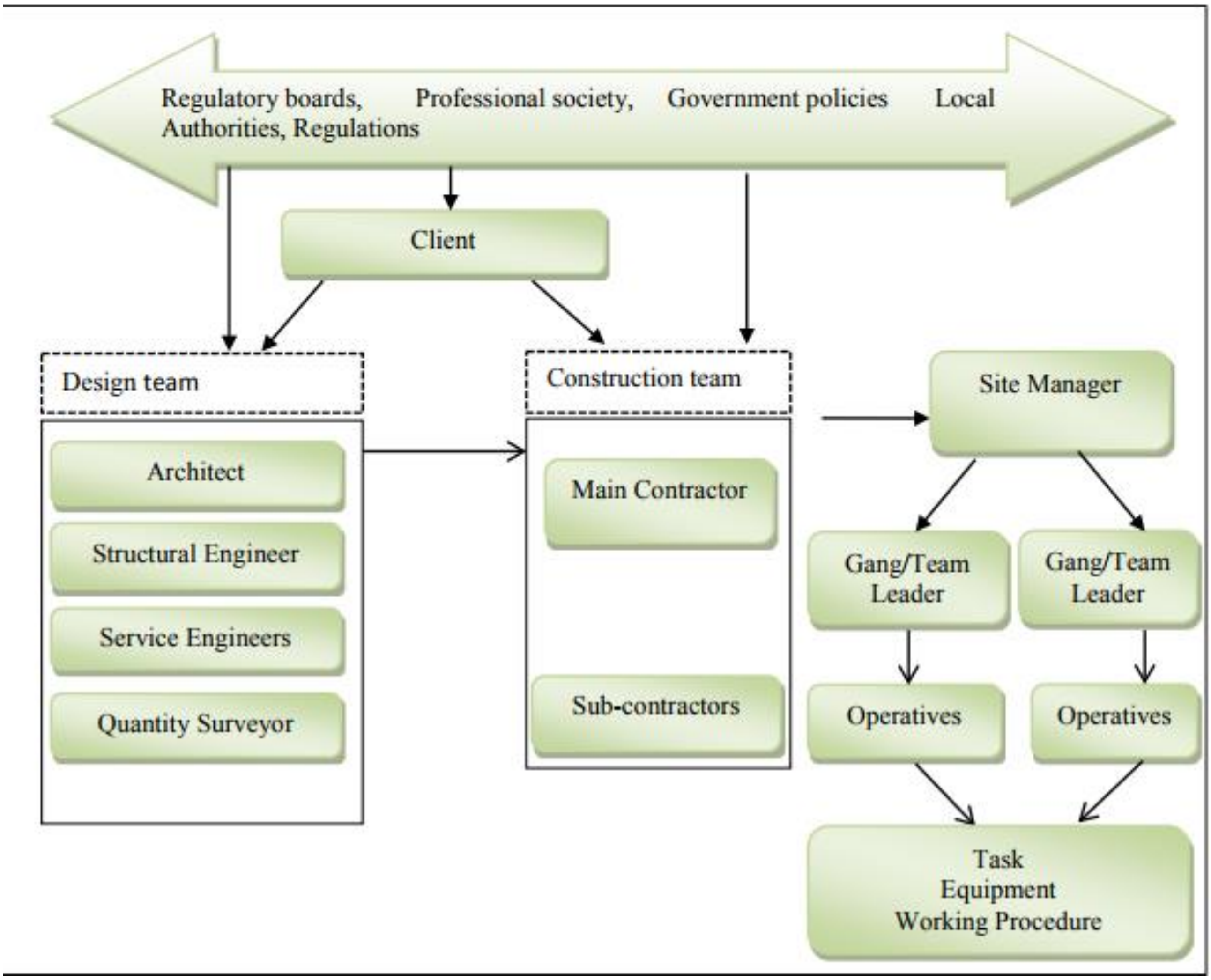
2.1 Systems theory

A system is a complicated whole whose components interact over time to achieve a goal. The elements are better understood in the context of interactions with other systems. Systems thinking emphasises multiple, mutual, or recursive causation in complex dynamic systems, emphasising that change in one element of a system has a major impact on others. Stephanson (2001) defines the construction system as a combination of people, procedures, plant, and hardware that perform a task in a specific context. This approach sees construction sites as complex systems with interconnected parts. Construction sites have clients, design teams, and contractors, who commission projects. Regulatory boards, professional groups, rules, and laws advise and govern building design and procedure (Wathua, 2020).

Mohamed (2004) emphasises project participants' crucial involvement in construction safety management. Mohamed believes that clients, designers, subcontractors, and contractors are essential to the safety management system. Key contributors provide systematic and step-by-step safety consideration throughout the project's life cycle. Safety should be included into the project from the start, not treated as a separate worry. It ensures that safety considerations are not afterthoughts but proactively handled, reducing accidents, injuries, and safety incidents. Figure 1 shows a typical building project setup, according to the study. This graphic matches the research's traditional procurement methodology. This map shows project participants and stakeholders' relationships. At various project stages, clients, designers, subcontractors, and contractors collaborate. The figure shows how these entities work together to complete a building project. In this framework, safety management is present throughout the construction process, from project initiation and design to construction and completion. Mohamed's statement emphasises the need to incorporate safety into the project. Proactively identifying and addressing risks and hazards early in the project's development reduces the likelihood of accidents and safety events. Mohamed (2004)'s approach supports the idea that safety should be part of the project's culture, not just a legislative necessity. This method emphasises project participants' collaboration and understanding that their activities make the workplace safer. Instead of an individual responsibility, safety is a shared obligation across stakeholders.

Systems theory emphasises the role of risks in social systems, which are closely linked to specific rationalities within societal subsystems. In construction projects, the system is hierarchical and all levels and sublevels influence each other. Construction sites are microcosms of the complex health and safety risk management process in the building sector. The building business is part of a larger system that includes political, market, and regulatory factors that affect its operations (Joy, 2005). Construction project risk assessment and communication tactics reflect market, political, and regulatory changes. In the construction industry, risk management is challenging since responses to risk are context-dependent and modified by external variables (Joy, 2005). Many factors affect health and safety risk assessment on building sites. These include customer type, project brief, design process complexities, and procurement systems. The nature of construction enterprises and their management systems also shape the construction process and risk assessment (Njuguna, 2007). At the ground level, construction site managers, foremen, and workers, along with the work environment, greatly impact risk assessment. These people's decisions and actions are deeply influenced by their system. Political systems and regulatory frameworks in the country, the client, the working conditions, the project management team, the organization's culture, and the project itself are all part of this system. This study emphasises the complex interactions that affect construction industry health and safety risk management.

Figure 1:Composition of Construction Project as a System



Source: Health and Safety Executive (2004)

2.2 Application of systems theory

Health and safety are crucial in every industry, but especially in the high-risk construction industry. Health and safety have long been important, especially in occupational accidents. In wealthy countries, health and safety risks have been reduced, but in underdeveloped nations, they remain. Alarming figures indicate that the construction business particularly dangerous for workers in these places (Sohail, 1999). Many developed nations have addressed health and safety problems. Based on experience and technical concepts, they have implemented best practises, rules, and standards to reduce these hazards. These measures have improved construction safety and continue to guide development (International Labour Office, 1999; Joy, 2005). Since health and safety issues are global, governments worldwide should prioritise and push for safety in all industries. Most developed nations have improved building site health and safety by adopting best practises and regulatory requirements (International Labour Office, 1999; Joy, 2005). However, the building industry still faces obstacles to safety improvement. The construction sector in developing nations relies on addressing and mitigating health and safety concerns to ensure a safe workplace. This Research Project proposes the systems approach to construction health and safety concerns from a new perspective. This choice is based on systems theory, which underpins this research. Systems theory suggests that a lack of project system synergy may explain the construction industry's health and safety issues (Helen & Stephen, 2005). Systems theory underpins this research and provides a holistic perspective to examine construction health and safety management's complex dynamics.

2.3 Health and Safety in the Workplace

The 2001 International Labor Organization (ILO) definition of occupational health and safety includes proactive measures to protect workers' physical, mental, and social well-being and prevent work-related health issues. It involves protecting workers from health risks and placing them in workplaces that meet their physical and psychological needs. So "health" is protecting people from illnesses caused by workplace materials, procedures, or activities, whereas "safety" means preventing physical injuries (Hughes and Ferret, 2008). Safety means no possible danger or mishaps that could cause damage. A strong commitment to occupational health and safety helps achieve material and economic goals and improves professional work performance. Despite these aims, many jobs in many nations nonetheless pose significant and occasionally severe health hazards. Certain dangers can lower well-being, job capability, and lifespan in certain professions.

2.3.1 Construction Health and Safety

Construction workers encounter several health and safety hazards. Long and intense work hours cause occupational diseases and injuries in this business (Koigi, 2019). Construction labor involves various dangerous tasks, making health and safety measures crucial. Heavy use of machinery, equipment, and other advanced tools in building is dangerous. Building requires these resources, but they can imperil operators. This issue is exacerbated by the fact that many workers utilizing such machinery lack safety training. Heavy machinery and complex construction equipment demand particular training and safety procedures. Aligning job assignments with workers' physical and mental health and competencies helps construction manage health and safety risks (Ogetii, 2019). Assignments based on employees' strengths and weaknesses increase well-being and decrease accidents and injuries. Matching the correct person to the task reduces health risks and improves workplace safety. The employer is also responsible for workplace safety. Employees should be managed by employers who prioritize safety. This requires creating a safety-focused company culture where employees value safety standards. Employers must encourage workers to report dangers and near misses to address them swiftly. Construction companies must follow safety and health requirements. Legal and necessary for worker safety, these rules must be met. Compliance with safety and health regulations reduces construction hazards. Perry (2005) emphasizes the importance of these requirements for construction worker safety. This requires equipment maintenance, safety training, and a safe environment for employees to raise safety concerns.

Developing countries face several health and safety management challenges. Bad infrastructure is a serious issue. Poor infrastructure in many developing nations causes construction site accidents and casualties (Abuya, 2020). Poor roads, bridges, and healthcare access may make emergency response and medical care difficult. Infrastructure gaps risk construction workers' health and safety. Developing country health and safety management also faces literacy-related communication issues. Many workers lack formal education, making safety information harder to express. Illiteracy can make safety rules, warning signs, and written procedures confusing. When a big portion of the workforce cannot read or interpret written instructions, safety protocols become difficult to explain, heightening safety issues. Unregulated construction sites are common in underdeveloped countries, often leading to compromised safety standards and increased risk of accidents and fatalities among workers. Safety practices may not be harmonized without strict rules and enforcement. Unsupervised workers are at risk. Worker safety may be compromised on construction sites without safety rules, inspections, and compliance checks (Nyaruai, 2019). Traditional working habits can be hard to maintain in emerging countries. These methods may lack modern building safety. Workers accustomed with traditional procedures may resist safer ones. Resistance to change may hinder modern safety measures, raising building site risks. Insufficient modern construction equipment hurts health and safety management. Safety can be compromised by insufficient machinery, tools, and PPE. Equipment misuse due to lack of training or knowledge can cause accidents and safety hazards. This underlines the importance of proper equipment and personnel training. Health and safety management is complicated by extreme weather in many developing nations. Workers may suffer heat-related infections, hypothermia, and slip-and-fall accidents in extreme heat, cold, or monsoons (Xie et al., 2022). These scenarios necessitate extra safety measures that may not be available or applied on construction sites, compromising worker safety. In poor countries, corruption can impair health and safety. Building projects can be damaged by bribes, unethical practices, and permit shortcuts. Safety is occasionally neglected to speed up construction or cut costs, resulting in violations. Poor countries' building industries ignore health and safety. Competitive tendering and low-bid public contracting force contractors to decrease costs. Contractors may prioritize cost over worker safety to obtain contracts. Cheaper materials, less safety equipment, and poor safety training can jeopardize construction workers.

Unorganized construction sites bring accidents and safety risks. This applies especially to busy, chaotic, or poorly planned sites. Chaos increases the risk of falling materials and worker-plant collisions (Ammad et al., 2021). Workers' safety and building companies' finances are at risk. Injury, project delays, and legal concerns can result from falling object mishaps. Urban construction sites are space-constrained. A strategy may struggle to combine worker safety and production. Urban workplaces may make safe and healthy site layouts difficult. Such situations necessitate managerial planning. Planning and budgeting are essential for safe and efficient construction. Zuhdi et al. (2022) say a well-planned site reduces space and urban building dangers. Unfortunately, building materials and equipment are often scattered, causing trips and falls. These events can cause minor scrapes and bruises to catastrophic injuries. Stepping on timber nails can cause puncture wounds, infection, and more significant medical issues (Zhang et al., 2020). Workplace cleanliness and organization reduce dangers. Keeping supplies and equipment safe and removing dangers protects construction workers.

Construction sites are risky, so always have first aid and emergency gear. Building site size and crew count determine equipment needs (Windasari et al., 2020). Construction sites must integrate worker safety and well-being essentials. Emergency blankets and stretchers are included. Large construction sites with over 200 people need a properly equipped first aid area. This specific area should feature bandages, antiseptics, medications, and other medical items. Large construction sites need first aid rooms for minor and catastrophic injuries. First aid and emergency response are coordinated here. Large construction sites must have at least one national-level first aid trained worker every shift. This ensures someone can attend to injured workers and medical emergencies. Large sites with higher accident and injury risk need this. Rapid first aid reduces injury severity and improves medical emergency outcomes. Daily work on construction sites requires an accident book. It captures everything from minor scrapes to catastrophic events that cause disabilities or death (Cermelli et al., 2019). Complete and accurate workplace records are vital for several reasons. Records reveal accident patterns and inform prevention. Legal and insurance documentation are essential. The accident register book promotes worker safety transparency by recording building site safety accidents.

Cermelli et al. (2019) found a construction site safety issue, particularly first aid. Building sites with first aid boxes lacked supplies. These boxes held mostly spirit, bandages, and cotton wool. Basic resources are insufficient to treat many construction site accidents and medical emergencies. Construction workers' health-related event preparedness is threatened by this lack of first aid resources. The study also found a large gap in meeting the national-standard first aid training requirement for at least one person on every shift. Interestingly, none of the responders had first aid training. Since first aid can save lives and construction sites are dangerous places with many accidents and injuries, this lack of training is concerning (Selleck et al., 2023). Accidents on construction sites may be more dangerous without trained first aiders. First aid facilities are needed due to the prevalence of construction site accidents, according to witnesses. Accidents can be minor or fatal. First aid facilities and trained staff are needed to treat injured workers quickly and save lives.

2.3.2 Health and Safety Warning Signs and Policy on Safety

Safety signs and signals are essential for communicating health and safety information in workplaces and other settings. They give safety instructions and warnings and help protect people (Min et al., 2019). The study observes that these safety signs use lit signs, hand gestures, fire alarms, and spoken communication. Pipework with dangerous materials is also marked with safety indicators. Traditional safety signs include prohibition and warning signs, fire exit signs, fire action plan announcements (including fire drills), and fire-fighting equipment signs. Clear communication is key to using safety signs and signals effectively. These signals must be clearly comprehended by people who see them. Safety signs in the workplace must meet certain standards to be effective. Signs should be large and visible to ensure visibility and comprehension. Clear and visible signals are essential for people to grasp and recognize their information. Safety signs' usefulness depends on their durability and tight fastening (Bochkovskyi & Sapozhnikova, 2019). These signage must endure weather and site wear. Safety signs must be properly maintained to avoid being misinterpreted or ignored. A fading or broken safety sign could cause confusion or failure to follow safety warnings, endangering lives. Avoiding overuse or overcrowding safety signs is also important. Safety signs are essential but only useful if they are visible and understandable. Placing too many signs together might confuse and obscure crucial information. Therefore, safety indicators must be strategically placed and used properly to be effective.

Site managers are crucial to construction worker safety and wellness. Thus, site managers must create a detailed documented safety policy for their building company. The company's safety and health standards are outlined in this policy. This policy must identify the top executive responsible for achieving these standards. This senior executive should also be able to assign and oversee all management and supervisors (Bochkovskyi & Sapozhnikova, 2019). Before starting a construction project, site managers and operational companies must create a construction safety policy. This safety strategy is crucial to building a safe construction site. After creating the safety policy, include it into a thorough training program. All construction site workers, regardless of role complexity, must finish this training program before starting work. This obligatory training ensures that all personnel understand the safety regulations and practices that must be followed on site. This survey found no regular site meetings, which promote safety on construction sites. Workers can learn about construction site risks at site meetings (Johnson, 2020). Supervisors and site management can also discuss health and safety issues with workers at these meetings. Regular site briefings help personnel understand dangers and safety measures, improving their preparedness. The lack of site meetings in this survey highlights a missed opportunity to improve construction site safety. Regular site meetings are needed to discuss health and safety, share important information, and involve workers in a productive discourse (Min et al., 2019). Site meetings educate workers on health and safety issues, ensuring that everyone is educated and involved in a safe workplace.

Assessing health and safety risks

Health and safety risk assessment is crucial to construction safety and injury prevention. Generally, risk is the likelihood of a substance or situation causing harm and a composite measure that combines the likelihood of a hazardous event or exposure with the severity of injury or illness that could result (Merve, 2019). These definitions emphasize the complexity of risk and the need to assess both the likelihood and degree of harm. Regulations and standards require construction employers to analyze health and safety risks to employees and others on construction sites. Health and Safety Executive standards clarify this role. Employers must understand that health and safety risk assessment and mitigation are different from construction management. Risk assessment is a proactive and systematic way to detect hazards, analyze their likelihood, and decide their severity. It is the foundation of planning and implementing risk control measures and maintaining them. Construction site risk evaluations are crucial. According to Pan & Zhang (2021), these assessments are essential to creating a safe workplace and reducing risks. Employers comprehend construction site health and safety hazards by methodically identifying and analyzing risks. They can create effective risk management methods with this knowledge. The following measures control and minimize the identified risks to reduce accidents, injuries, and diseases. When five or more individuals work on a construction site, recording important risk assessment results is best practice and legal necessity. This paperwork is essential for documenting the risk assessment process, identified risks, and mitigation strategies. It provides transparency, accountability, and risk control effectiveness monitoring over time.

Construction Site Safety Training

Safety and health training is essential in industries like construction, where workers are exposed to several hazards. Nyabuto (2021) observes that this comprehensive training gives workers the skills to identify and handle workplace dangers. Occupational safety and health training teaches workers to recognize and control hazards. Workers must detect workplace hazards and know how to eliminate them. Physical, chemical, biological, ergonomic, and psychosocial dangers are recognized. By learning hazard recognition, workers can anticipate and prevent accidents and injuries. Training workers about safe work procedures is also important. This includes training them on safe job techniques. Cermelli et al. (2021) study shows that workers learn how to handle equipment and machinery properly, follow protocols, and behave safely to reduce accidents. Safe work practices ensure workplace safety and prevent injuries. Occupational safety and health training includes PPE use. Workers are trained on helmets, gloves, safety goggles, respirators, and other PPE selection, use, maintenance, and restrictions. Protecting against risks and protecting workers' safety requires PPE knowledge. Training covers emergency and preventive measures. Workers must respond quickly and efficiently to emergencies. Understand evacuation, first aid, and how to handle fires, chemical spills, and other emergencies. Workers are also taught how to prevent hazards and keep the workplace safe. According to Kirori et al. (2022), safety and health training also equips workers to research hazards and controls. Now they can actively implement hazard control programs and advocate for organizational changes that improve workplace safety. Workers become informed and proactive about workplace security.

To protect employees and the workplace, Ammad et al. (2021) indicates that comprehensive health and safety training is essential. Induction, job-specific, risk adaptation, and refresher training make up this dynamic process. Health and safety induction training is essential for new hires. This foundational training covers workplace safety basics. It usually covers first aid and fire safety. First aid training gives workers the skills to manage injuries and medical emergencies. Employees learn fire hazards, extinguisher use, evacuation procedures, and fire prevention in fire safety training (Windasari et al., 2020). New hires need induction training to learn about workplace safety and foster a safety culture. Beyond induction training, job-specific health and safety training is essential. This training is customized for employees' job duties. Construction workers may learn how to operate heavy machinery, while lab technicians may learn how to handle hazardous chemicals. Job-specific training prepares workers and reduces job risks. Employees must understand their job hazards and safety measures. Adapting to changing workplaces and risks is essential. New equipment, processes, and technologies can increase risks, so employees need training to handle them safely. Updated risks and safety procedures should be communicated to employees immediately. Selleck et al. (2023) further observes that this proactive approach reduces unfamiliar hazard accidents and injuries. Additionally, refresher training is necessary, especially for rarely used skills. Employees may forget or lose safety skills over time. Maintenance of safety competence requires periodic refresher training. This training helps employees maintain and update their knowledge and skills to respond to emergencies and follow safety protocols.

At workplace, Nyaruai (2019) observe that chemicals in construction pose serious health risks to workers. The construction industry uses insecticides, adhesives, cleaners, wood preservatives, fungicides, paints, and more. Many of these construction chemicals are toxic and can cause poisoning. Construction chemicals contain acute and chronic toxins. Chronic effects result from prolonged or repeated exposure, while acute effects cause harm immediately. These chemicals can be inhaled, touched, or ingested by construction workers (Costa et al., 2021). The authors further observe that to protect workers' health, these hazardous chemicals must be identified, managed, and minimized. Dust from various sources is a major construction hazard, along with chemicals. Dust can be inhaled, threatening respiratory health. Silica and asbestos dust can permanently damage lung tissues. Silicosis and asbestosis are well-known respiratory diseases caused by long-term dust exposure. Electricity cables, pipes, gutters, and lead sheet roofs contain lead, another toxic substance. Lead dust and fumes can poison. If lead enters the bloodstream through the lungs, it can cause constipation, abdominal pain, anemia, muscle weakness, and kidney failure. Cement mixes, a common construction material, can also cause skin diseases (Gopalakrishnan & Kumar, 2020). Wet cement can cause dermatitis after prolonged contact. If severe, this skin condition can cause redness, itching, and painful lesions. Health and safety measures are needed to reduce construction industry chemical, dust, and toxic material risks. These measures may include providing respirators, gloves, and eye protection and ensuring construction site ventilation and dust control. Workers should also receive extensive chemical and material handling and disposal training.

Construction work is physically demanding and often involves manual labor. This demanding workplace poses unique health risks for construction workers (Koigi, 2019). Construction sites are often dangerous and dirty, making welfare facilities essential for worker welfare and construction efficiency. Clean water is a basic welfare need for construction workers. Hydration is crucial for worker health, especially in physically demanding jobs. Providing a convenient and reliable drinking water source keeps workers hydrated throughout the day. Welfare infrastructure on a construction site includes washing facilities. Construction workers often get dirty, dusty, and grimy. Clean water, soap, and handwashing stations are essential for personal hygiene and skin and health protection. Construction site welfare requires sanitary facilities. Toilets should be clean and well-maintained for hygiene and dignity. Good sanitation facilities allow workers to meet their basic needs in a safe and private environment, promoting a healthy and respectful workplace (Costa et al., 2021). Changing accommodations allow workers to dress professionally and secure their belongings. In industries that require specialized gear, uniforms, or safety equipment, this is crucial. A space for changing clothes and storing personal items improves worker comfort and efficiency. Construction workers can take breaks and shelter from bad weather in restrooms and shelters. Workers need these spaces to recharge during shifts, reducing fatigue and improving health. Food preparation and eating facilities are also important for construction site welfare. A comfortable place for workers to prepare and eat their meals promotes healthy eating habits, which are essential for energy and health. Some remote projects may require temporary housing or transportation to and from the work site. These provisions help workers find suitable living arrangements while working away from home. Providing comprehensive welfare facilities in the construction industry is both compassionate and strategic (Xie et al., 2022). Worker fatigue, health, and well-being improve with adequate facilities, increasing construction site productivity. Employers and site managers must provide these essential facilities to ensure a safe, healthy, and respectful workplace.

Construction health and safety measures are lacking. The culture and attitudes of construction workers and site supervisors toward health and safety practices contribute to this worrying trend. Construction industry culture often encourages risk-taking and unsafe work practices, which undermines health and safety measures (Xie et al., 2022). Workplace culture greatly affects employee behavior. Construction workers often prioritize speed and productivity over safety. This culture can encourage risk-taking, where workers prioritize speed over safety. This attitude can lead to shortcuts, disregard for safety equipment, and acceptance of dangerous practices. Additionally, site supervisors and managers' attitudes shape construction site safety culture. If supervisors don't prioritize safety or enforce safety rules, workers may think safety is unimportant. A permissive environment can allow unsafe behaviors. In such situations, safety measures are compromised and incidents increase. Lack of health and safety education also contributes to poor construction site safety. Some workers may not realize the risks of their jobs or the consequences of unsafe practices. Ignorance can lead to complacency and neglecting safety. Safety equipment like hard helmets and reinforced boots may be avoided by some workers due to their discomfort. These safety measures may be uncomfortable and cause workers to ignore them. Lack of awareness of safety equipment's life-saving benefits often causes this reluctance.

2.4 Health and safety laws and enforcement

Cotton et al. (2005) raised a critical issue regarding developing countries' occupational health and safety institutional and legal governance frameworks. Their findings showed that these frameworks rarely have an impact, highlighting a major challenge in protecting workers in these regions. The prevalence of SMEs in developing countries' construction industries is a major issue. These contractors mostly operate in their domestic markets, where health and safety and labor standards are lax. The inability of these SMEs to follow comprehensive safety measures hinders construction site occupational health and safety improvement. Due to limited resources, occupational health and safety administration in developing countries struggles to enforce health and safety laws. These institutions struggle to monitor, enforce, and oversee safety standards due to financial and human resource constraints. This lack of oversight can lead to a lax safety approach, endangering construction workers. Strong contract provisions are needed to enforce labor laws in developing countries. Contracts between employers and employees shape the workplace and ensure health and safety compliance. In many developing countries, these contracts may not include worker rights and safety clauses (Wathua, 2020). A multifaceted approach is needed to address these issues. Developing countries must give occupational health and safety administration institutions more resources to enforce safety regulations. Legal frameworks should be strengthened to enforce labor laws and include comprehensive safety standards in contracts.

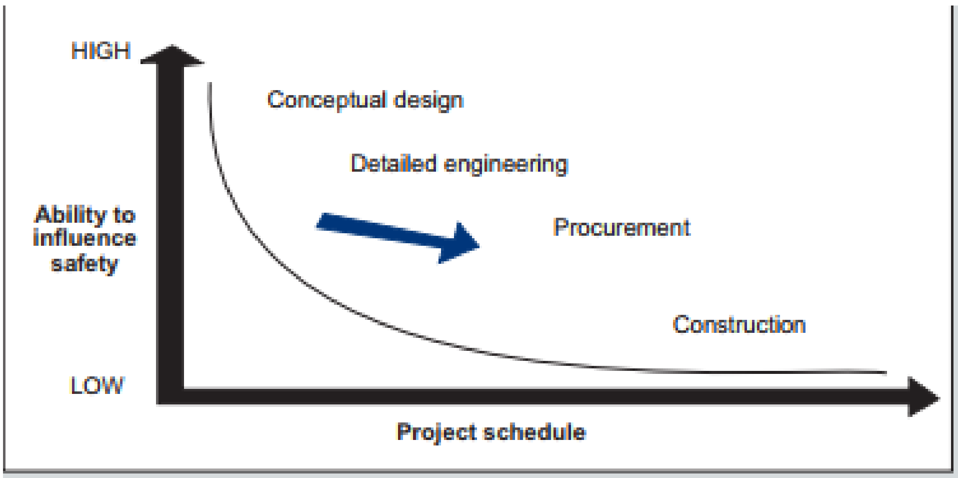
In Kenya, the legal framework governing the health, safety, and welfare of workers primarily centers around the Occupational Health and Safety Act (OSHA), which was enacted in 2007. The fundamental purpose of OSHA is to establish a comprehensive framework that safeguards the safety, health, and welfare of workers and all individuals lawfully present at workplaces within the country. Moreover, it provides for the establishment of the National Council for Occupational Safety and Health, underscoring the commitment to promoting workplace well-being in the nation. The core objective of OSHA is to ensure the safety, health, and welfare of all individuals engaged in work-related activities. This extends not only to those actively employed but also to persons who may be present at workplaces for various lawful reasons. The Act acknowledges the interconnectedness of safety and health in the workplace and aims to mitigate risks associated with work-related activities. In doing so, it contributes to creating an environment where the potential dangers and hazards that may arise from these activities are minimized. OSHA's applicability is broad and inclusive, encompassing all workplaces where any individual is engaged in work, be it on a temporary or permanent basis (Min et al., 2019). This means that the provisions and regulations outlined in the Act are universally relevant, covering a wide spectrum of industries and sectors. Importantly, this legislation extends its reach to the construction industry, considering construction sites as an integral part of this overarching framework. Within OSHA, the Act delineates the duties and responsibilities of both employers or occupiers and employees in ensuring safety, health, and welfare at the workplace. Employers and occupiers bear a significant burden in upholding these standards by creating and maintaining safe working conditions, implementing risk mitigation measures, and adhering to the regulatory requirements outlined in the Act (Pan & Zhang, 2021). These obligations are essential for preventing accidents, injuries, and illnesses that can occur within the construction industry.

2.5 Influence of Building-Project Client's management on the performance of occupational Health and safety risks at construction sites

The issue of health and safety (H & S) within the construction industry is complex and multifaceted, encompassing the protection of individuals from both physical injuries and health-related risks associated with workplace materials, processes, and procedures. Despite concerted efforts by the Department of Labour (DoL) and other relevant stakeholders to enhance H & S conditions, the construction sector in Kenya remains plagued by unacceptably high risks of injuries and fatalities. This dire situation results in considerable human suffering. Reports reveal that construction workers in Kenya account for a substantial proportion of industrial injuries, with injuries representing 9% of these incidents and fatalities accounting for 11.8% of industrial deaths (HSE, 2009). The Association of Insurance further reported 3,389 claims and 20 fatalities in 2015 (Zwikael & Sadeh, 2015). Investigations into the impact of building project client management on the performance of occupational health and safety risks during the construction process have been limited. In many instances, architects and design engineers tend to disavow responsibility for H & S issues related to construction work. However, a crucial shift occurs when clients insist that H & S matters be adequately addressed in their projects. This shift signifies that preventing accidents is the first step in H & S, and it emphasizes the importance of adhering to healthy and safe practices (Hudges & Ferrett, 2008). Although it is acknowledged that it is impossible to prevent all accidents on construction sites, entities beyond those directly engaged in the work play an essential role in enforcing and upholding proper safety standards. Given the far-reaching impacts of these issues, rules and regulations have been enacted within the construction industry to ensure the collective contribution of multiple stakeholders, including clients, designers, project managers, and quantity surveyors, in promoting H & S. These regulatory measures underscore the necessity of a collaborative approach that engages various players to enhance and maintain safety standards in construction sites. This approach also recognizes that safety should be a shared responsibility and a paramount consideration throughout the construction process.

Clients in various industries must recognize a fundamental concept in project management, which is the evolving impact of Health and Safety (H&S) considerations as a project progresses. This concept can be effectively illustrated through the Time/Safety Influence Curve, a valuable model developed by Szymberski. This curve, depicted in Figure 1, highlights a critical relationship between the passage of time and the influence of H&S on a project. By understanding and appreciating this curve, clients can make more informed decisions regarding the allocation of resources, priorities, and risk management strategies throughout the project lifecycle. The Time/Safety Influence Curve serves as a visual representation of how the significance of Health and Safety considerations changes over the course of a project. At the initial stages of a project, safety tends to have a relatively low impact on decision-making and resource allocation. During this phase, the focus may be primarily on planning, design, and conceptualization. However, as the project progresses, the influence of H&S steadily increases. This evolution reflects the growing importance of ensuring the safety and well-being of all stakeholders involved, including workers, contractors, and the general public. One key takeaway from the curve is that clients must acknowledge the increasing influence of H&S and adapt their strategies accordingly. While the curve does not imply that safety is neglected at the project's outset, it highlights the need to enhance safety measures as the project advances. Clients should be aware that complacency in this area can lead to increased risks, potential accidents, and unforeseen delays. Therefore, a proactive approach to safety, including ongoing assessments, training, and adjustments, is essential to mitigate these risks and minimize any adverse impact on the project. Clients must also recognize that regulatory requirements, industry standards, and public expectations often become more stringent as a project matures. These changes necessitate a corresponding increase in the attention given to H&S. Ignoring these evolving demands can not only jeopardize the well-being of those involved but also lead to legal and financial repercussions for the client and other stakeholders.

Figure 2: A curve of time/safety impact. Source: Adan (2004)



One of the most effective time in which to consider H & S and also do away with the potential hazards is during the design process, in the determination of the feasibility of a project and coming up with a conceptual design. The stakeholders in the construction industry would have a negative impact on the results of H & S construction or improve their contribution in the construction work environment. The influence of a client would manifest in terms of the project requirements that has been clearly defined during tendering. Helen and Stephen (2005) state that the major overlooked factors for instance limited pre-planning, inadequate choice of contractors or laissez faire attitudes are major contributors towards poor H & S.

The clients do not believe that health and safety issues in the construction sites is their sole responsibility and consider it to be the work of the contractors in complying with relevant environmental, safety or the regulations of health. Wider participation of the designer in the successful implementation of the H & S since the design professionals affect the results of the H & S either in a direct or indirect manner. Despite that, some argue that the designers are not able to be relied wholly on the success of H & S. Historically, the clients have delegated the duties and considered this as the completion of the responsibilities. Yet, it is the sole role of the clients to incur the costs of the accidents (Joy, 2005) If by getting the rock bottom price implies that people would be killed or getting injured, then the price can be low. Building project clients have a vested interest in terms of assuring for an effective construction safety program in the construction sites since they pay for the losses from the H & S risks.

The success in the construction projects is the outcome of effective planning and execution. Considering of the H & S in the initial stages in the building of projects is critical in making sure that H & S are in place, rather than being bolted on. The main causes of the accidents are as a result of the decisions on design, limited planning and methods of construction and procedures. In a study by Smallwood et al (2008) on the events in the construction sites, it revealed that 63 % of the fatalities could be traced to the pre-construction activities. The stakeholders in the construction industry would negatively affect or contribute positively towards improving construction environment. Construction of the H & S can be influenced successfully by the clients. The Kenyan Construction Regulations need the clients to take responsibility for the health and safety in each of the project stages such as planning, design, construction, maintenance or demolition. Despite that, there is little that has been written on the impact of the client involvement on the H & S within the Kenyan context and also the available literature is widely silent on the client influence on the H & S at the later stages in a project.

2.6 Review the occupational safety act (OSHA) kenya

To comprehensively review the Occupational Safety and Health Act (OSHA) of Kenya, it's essential to understand the legislation's framework, which mandates employers to provide a workplace free from hazardous conditions that could cause serious harm or death. The act requires that employers conduct regular risk assessments, ensure the proper use of protective equipment, and provide adequate safety training and emergency procedures (Government of Kenya, 2007). Despite these rigorous stipulations, challenges in compliance and enforcement are prevalent, particularly in the construction industry. Studies highlight that, although the law is comprehensive on paper, its practical application often falls short due to factors such as limited enforcement resources, lack of awareness among workers and employers, and issues of corruption (Odhiambo, 2019).

The impact of OSHA on health and safety management in the construction sector shows both improvements and ongoing challenges. Smaller construction sites and the informal sector often display poor compliance, attributed to less regulatory oversight and limited worker knowledge of their legal rights under the law (Kamau & Ngugi, 2020). To enhance the effectiveness of OSHA Kenya, especially in the construction industry, several recommendations have been proposed. These include increasing funding for the Directorate of Occupational Safety and Health Services to enable more frequent inspections and more thorough enforcement actions (Mutungi & Kariuki, 2021). Additionally, extending comprehensive safety training to employers and employees can help bridge existing knowledge gaps, while public awareness campaigns could educate workers about their rights and the critical importance of workplace safety, potentially empowering them to demand better conditions from employers (Chege & Wang, 2021; Ouma, 2022).

In conclusion, while OSHA Kenya sets a strong legislative foundation for workplace safety, the actualization of its goals is hindered by several practical challenges. Addressing these issues through enhanced enforcement, education, and public awareness is vital for improving compliance and fostering a safety culture that meets international standards and effectively protects workers across industries, including construction. These strategies are crucial for turning the legislative intent of OSHA into a practical reality that significantly improves occupational health and safety outcomes throughout Kenya.

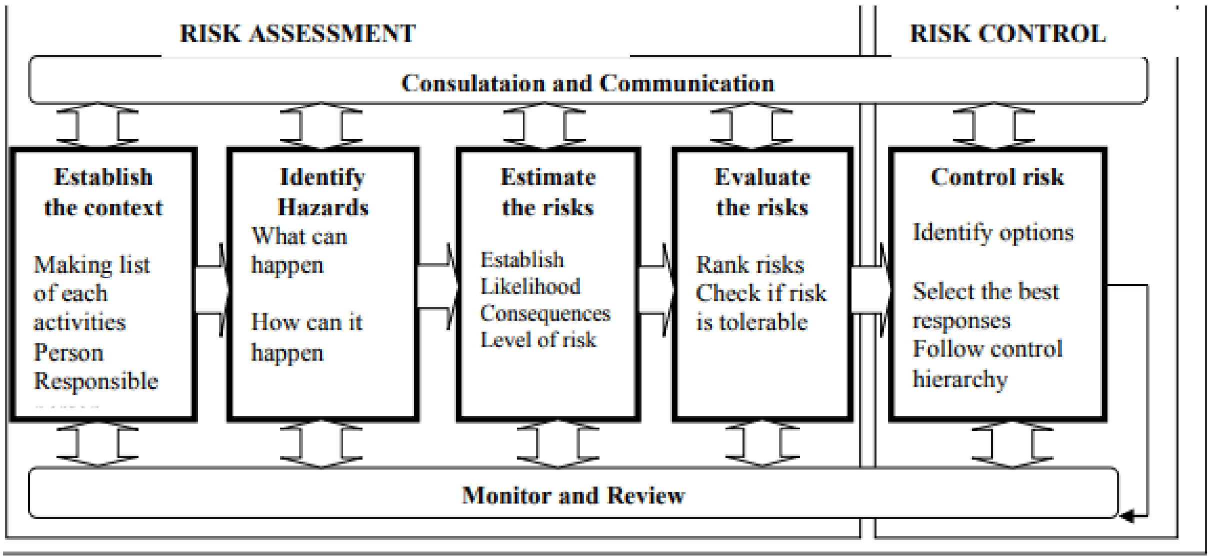
2.7 Project management team and their involvement in health and safety risks in construction sites

The project management team has been considered to have various roles in the construction process. Adan (2004) states that construction project provides benefits to customer/ client based on the level of satisfaction and it includes business development, profit or resource utilization. Since the project team has a significant role during the construction process, they are involved in the project from the time of start to finish. According to Raina (2006) project health and risk management is one of the major difficult aspects in the project management. Project managers are required to recognize and identify the root causes of risks and also trace causes throughout the project process to the end. Considering that health and safety risks in the construction process is quite a comprehensive process and systematic way in identification, analysis and responding to the risks in meeting the objectives of a project. Use of project management team from the initial stages in a project, in which the decisions for instance choice of alignment and methods of construction are important. The importance of having project management team in the health and safety management in the construction process improve effective use of resources to identify the risks and have proper way to control them.

Perry (2005) asserts that the construction industry is characterized by heterogeneity and widely. Success of project parameters in terms of time completion, within budget and technical requirements; however, health and risks are the major barriers which affect successful project completion. The complexity in the risk evaluation, risk communication as well as rick control relies to a larger extent on the factors for instance size of organization, workplace situation in the organization as well as the nature, complexity or significance of risks in the organization. Despite that, it has been argued widely that, it is essential to evaluate risk in each stage in a project life cycle and the input for the key stakeholders and the participants of a project be sought. Further evaluation of this topic indicate that, when project management team is involved in the health and safety risk evaluations, it offers opportunities in designing out any features to build or structure which pose a threat in the health and safety of the crews in the construction process. On the same note, Rwamamara (2007) commented about effective risk management process that required cross disciplinary team and be supported by a free and open communication and consultation with project stakeholders.

Figure 3 shows the four stages of involving project management team in management of health and risk in the construction sites during the construction process. It involves risk evaluation, establish of the context, identifying of risk and evaluation of risk or control on the risk. Project management team evaluates the step wise process that consist of interrelated but then distinct stages. Therefore, the context should be established prior to identification of the hazards. This is similar in the estimation of risk stage, where it cannot begin up to the time of finishing identification in the hazard phase. Figure 3 also shows the risk assessment, risk communication and control as not being linear. It is cyclical in nature in which every stage there is a communication process, monitoring and review. Because of the constant changes in the construction environment, in which there are new or emergent risks which need to be assessed and the changes in the construction environment require control.

Figure 3: Project management team in risk management



Source: adopted and modified from Australian and New Zealand Standards Management (2004)

In Kenya, the project management team's engagement in the control of health and safety concerns on building sites is inadequate. One of the reasons for this is the high perceived difficulty and cost of involving the project management team, given the inherent uncertainty of the construction process. Contractors and clients alike typically try to avoid spending more than necessary on building a project, and cutting costs is usually one of the top priorities. According to statistics, over a thousand people die on Kenyan building sites every year, making the construction industry the most dangerous in the country. When compared to workers in other industries, those in the construction industry had a mortality rate three times higher than the national average. The accident expenses are extremely high for the project owner. All of these issues have been blamed on the country's inadequate project management group.

The risk management approach relies heavily on the project management group. Project management teams bear legal and moral obligation, which motivates them to encourage a lot of ideas and participation from everyone involved. According to Sohail (1997), ensuring those who need to be involved are given sufficient opportunity and are informed on the developments in understanding the risks and measures to be taken in dealing with them is not a task that requires only communication but a plan and execution of tasks in health and risk management process.

Slovic (2001) claims that the presentation of risk information can have a significant impact on the appraisal and decision-making processes related to health and risk on building projects. Studies of risk have revealed an awareness of the variety of threats faced by various cultures. Some have argued that the public's view of construction site communication makes it difficult for project management teams to be involved in health and risk management.

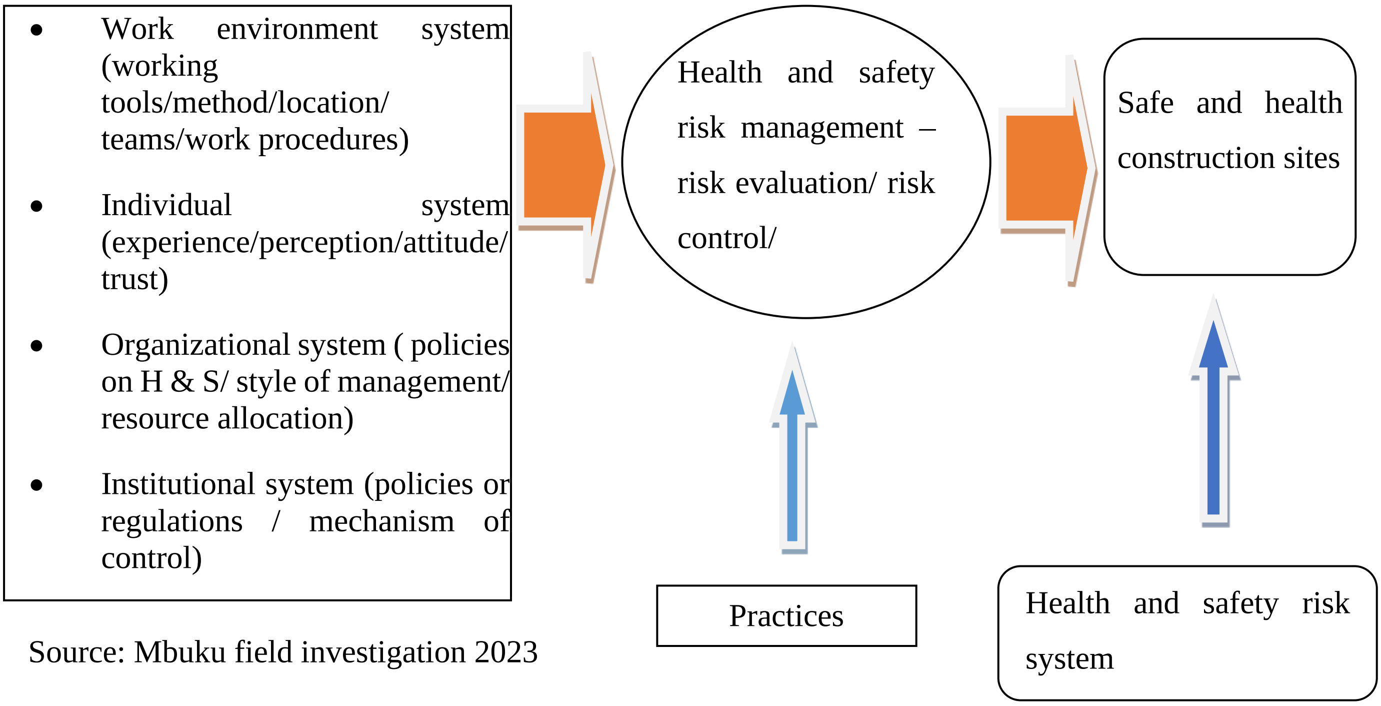
2.8 Conceptual Framework

In the realm of systems theory, the literature review delves into an extensive exploration of health and safety risks within construction sites throughout the construction process. This investigation reveals that these risks are not isolated occurrences but are intricately linked to a web of factors that influence their occurrence and management. Four major variables emerge as central to this intricate system, each of them playing a crucial role in shaping the landscape of health and risk management within construction sites. First and foremost, the institutional system stands out as a pivotal variable in the study of health and safety risks. This component refers to the overarching structures and regulations established by governing bodies, industry associations, and regulatory authorities. The institutional system sets the legal and compliance standards that construction projects must adhere to, and its effectiveness directly impacts the mitigation of risks at construction sites. Sub-variables within this system could encompass the specific laws, regulations, and guidelines that pertain to construction safety. The organizational system is another crucial element in understanding health and safety risks in construction. It refers to the internal workings of construction companies and their policies, procedures, and cultures related to safety. How an organization prioritizes and implements safety measures has a profound influence on risk management. Sub-variables here might include safety training programs, reporting mechanisms, and the safety culture prevalent within the organization. The individual system focuses on the human component in the construction process. Construction sites involve a diverse workforce with varying levels of experience, skill, and responsibility. The actions and decisions of individual workers, from laborers to project managers, have a significant impact on safety. Sub-variables within this system could involve factors such as worker training, experience, and psychological factors affecting safety behaviors. The work environment system encompasses the physical and environmental conditions at construction sites. It includes factors like machinery, equipment, weather conditions, and site layout. A well-designed work environment that minimizes hazards and maximizes safety measures can greatly reduce risks. Sub-variables here might encompass the state of equipment maintenance, weather patterns, and the spatial layout of the construction site. The conceptual framework, as summarized in Figure 4, provides a visual representation of these major variables and their associated sub-variables. It serves as a roadmap for understanding the interplay and dependencies between these elements in the context of health and safety risk management in construction sites. This systems-based approach enables a more holistic understanding of the multifaceted nature of health and safety risks in the construction industry and provides a foundation for developing comprehensive risk mitigation strategies. By examining each of these variables and sub-variables, researchers and practitioners can better address the challenges and complexities inherent in construction site safety and ultimately improve the well-being of those working in this high-risk environment.

From figure 4, the conceptual framework for this study has been provided. It is clear that health and safety risk management is affected by institutional system in a given country, organizational system / culture, individual system or the work environment. The institutional systems include norms, regulations or the mechanisms of control. This study intends to look at the regulatory approaches in establishing of rules, laws or sanctions in ensuring effective control mechanism for the health and safety risks in the construction sites. Institutions such as Occupational Safety and Health Authority (OSHA) and the Contractors Registration Board (CRB) are essential in guiding the day to day functioning of the health and risk management in the construction sites (HSE, 2009). In Kenya, this is regulated by the Directorate of Occupational Safety and Health Services (DOSHS) and the National Construction Authority (NCA). The organizational system relies on the management to show commitment in regard to establishing and meeting the goals on health and safety risk, offer the required resources both human and financial and offer education to the employees about the issues on health and safety. Therefore, by considering the policy in organizations about health and safety, allocation of resources as well as commitment in training of health and safety risks, then it goes a step higher in regard to addressing risk in the construction sites.

The conceptual framework presented in Figure 4 offers a comprehensive view of the factors that influence health and safety risk management within the context of construction sites. This framework underscores the multi-faceted nature of risk management, highlighting that it is not solely dependent on one variable but rather shaped by a complex interplay of various elements. Four key pillars of influence emerge from this framework: institutional systems, organizational systems/culture, individual systems, and the work environment. Institutional systems play a vital role in shaping the landscape of health and safety risk management. These systems encompass the norms, regulations, and control mechanisms that govern construction sites within a specific country. The study emphasizes the significance of regulatory approaches in this context, which involve the formulation of rules, laws, and sanctions to establish effective control mechanisms for health and safety risks. Regulatory bodies like the Directorate of Occupational Safety and Health Services (DOSHS) and the National Construction Authority (NCA) are instrumental in providing guidance and oversight for daily health and risk management activities on construction sites. These institutions serve as the custodians of best practices and legal requirements, ensuring that safety standards are upheld within the construction industry. The organizational system, on the other hand, places a considerable onus on management. In this context, the commitment of organizational leadership is paramount. Management must not only establish but also actively pursue the attainment of health and safety goals. This commitment extends to the provision of essential resources, both human and financial, to support health and safety initiatives. Furthermore, organizations are expected to impart knowledge and education to their employees regarding health and safety issues. This includes training programs aimed at equipping workers with the necessary skills and awareness to identify and mitigate risks. The policies set by organizations regarding health and safety, the allocation of resources to address these concerns, and their dedication to training and education collectively contribute to a proactive approach in managing risks within construction sites. By addressing the policy framework and commitment in organizations, as outlined in this conceptual framework, a significant step is taken towards improving risk management within the construction industry (Ogetii, 2019). This approach recognizes that effective risk management is not merely a matter of compliance with regulations but also necessitates a proactive stance at the organizational level, with a commitment to providing the necessary support and education to employees. When these elements are aligned and reinforced, they work in synergy to create a safer and more secure environment within construction sites, ultimately reducing the potential for accidents and health-related issues among workers.

Figure 4: Conceptual Framework



Source: Mbuku field investigation 2023

Understanding and effectively controlling risk in any work environment, particularly in the construction industry, is a multifaceted challenge. On one hand, it's crucial to recognize that the decisions individuals make regarding risk management are heavily contingent on their comprehension of the nature of the work and the various health and safety risks inherent to their specific tasks. In this regard, the level of trust individuals have in their colleagues and the existing power dynamics within the construction site play a pivotal role in how risk is communicated and managed, as suggested by Helen & Stephen (2005). Individual factors are paramount in this equation. First and foremost, an individual's experience within the construction industry significantly influences their ability to assess and mitigate risk. An experienced worker is more likely to identify potential hazards and take proactive measures to prevent accidents. Moreover, an individual's educational background contributes to their understanding of safety procedures and risk assessment methodologies, further enhancing their capacity to manage risks effectively. The perception of specific risks also varies among individuals. Some may perceive certain risks as more severe or likely than others, which can influence their risk management strategies. Additionally, the power relations among workers, supervisors, and management within the construction site can shape how risks are communicated and addressed. A workforce that feels heard and respected is more likely to raise safety concerns and collaborate on risk mitigation. Trust is another crucial element within this context (Adebiyi et al., 2020). Trust among colleagues is vital for effective communication and cooperation in risk management. Workers who trust each other are more likely to share concerns, insights, and information related to safety. A lack of trust, on the other hand, can hinder the flow of critical safety-related information. The work environment in construction is complex, involving a multitude of stakeholders working together to achieve the project's goals. Effective communication is essential for risk evaluation. Information must flow seamlessly from one team, such as the design team, to another, like the construction team. This exchange of information is invaluable for assessing and mitigating risks, as it ensures that all parties are aware of potential hazards and can collaborate to address them (Sehsah et al., 2020). The working procedures, tools, and methods employed in construction, along with the availability of resources, have a direct impact on health and safety risks. Outdated equipment, insufficient safety protocols, or inadequate resources can significantly increase the likelihood of accidents and injuries. Therefore, improving the work environment by investing in modern equipment, comprehensive safety measures, and adequate resources can greatly enhance the positive evaluation and management of risks. Ultimately, achieving a safer construction site is a collective effort that relies on a thorough understanding of individual factors, effective communication, and a conducive work environment.

2.9 Summary

This chapter has examined the literature review related to health and safety risks in the construction sites. The systems thinking has been widely discussed since it is the foundation of this study. This means that health and safety risks need to be assessed in each stage within the life cycle of a project and need to involve all the major stakeholders as well as the participants in a project. The major argument in this section is that the process of health and safety risk evaluation is a systems construction that is influenced by project management team and project client management. The commitment of the management, individual factors such as perception, previous experience, trust and the power relations and the work environment factors also influence successful management of health and safety risks. This formed a major part of the conceptual framework provided. The next chapter presents the methodology part of the study.

CHAPTER THREE: METHODOLOGY

This chapter provides details on the procedures of conducting this study. It places focus on the background of the study, the research strategy or design, target population, sample and sampling techniques, methods of data collection and analysis. In addition, it presents means of ensuring reliability and validity of data and the results respectively. The clarity in the procedures enables any interested person to be able to replicate this research whenever the need arises.

3.1 Research strategy and design

The choice to employ mixed qualitative and quantitative research strategies, as proposed by Creswell in 2003, represents a strategic approach to research that combines the strengths of both qualitative and quantitative methodologies. Such a research strategy acknowledges the complexity of the research questions and aims to provide a more comprehensive and nuanced understanding of the topic under investigation. In the following paragraphs, we will delve deeper into the rationale behind using this mixed approach, the expected data, and how the data will be analyzed according to the qualitative and quantitative approaches. One fundamental reason for adopting a mixed research strategy is to address the multifaceted nature of the research question or topic. Certain research inquiries may involve exploring not only the "what" and "how" of a phenomenon (typical of quantitative research) but also the "why" and "in-depth meaning" aspects (typical of qualitative research). This is particularly true for studies where a richer contextual understanding is necessary to complement statistical data. By incorporating both quantitative and qualitative data, researchers can achieve a more holistic perspective, which is often essential for addressing complex research objectives. In the research, it is anticipated that the collected data will encompass both numerical and descriptive information. The inclusion of numerical data aligns with the quantitative component, enabling the quantification of specific variables or aspects of the research problem. This quantitative data could be derived from surveys, experiments, or structured observations, offering a quantitative foundation to the research. Meanwhile, descriptive data will offer a more qualitative dimension, potentially derived from interviews, open-ended surveys, or content analysis. Descriptive data helps to unravel the meaning behind numerical findings, allowing for a deeper understanding of the phenomena being investigated. To analyze these distinct types of data effectively, the research strategy outlines a twofold approach. Quantitative data will be subjected to statistical analyses and quantitative techniques. This approach will allow researchers to draw patterns, trends, and associations within the numerical dataset. In contrast, qualitative data will undergo qualitative analysis techniques, such as thematic coding or content analysis. These methods will unearth themes, categories, and insights that emerge from the descriptive data, providing context and depth to the research findings. Ultimately, the decision to adopt a mixed research strategy hinges on the nature of the data required to address the research objectives effectively. In this case, it is informed by the recognition that the research goals are multifaceted and necessitate a comprehensive understanding that can only be achieved by blending quantitative and qualitative methodologies. This approach not only enhances the robustness of the research but also enriches the insights generated, contributing to a more profound understanding of the subject matter.

3.2 Target population, sample and sampling population

For the purpose of this study, the target population is defined as all construction sites currently underway within Kiambu County. The accessible population, from which our sample is drawn, focuses on a representative subset of this larger target population. The decision to focus on this subset is primarily due to constraints related to time and available resources, which are inherent to academic research with specific time limitations. Consequently, this study centers on a representative sample of the target population, consisting of 43 construction sites, ensuring that the sample size adheres to the recommended minimum of 30 participants for robust statistical analysis. The ideal sampling frame would encompass all active construction sites throughout Kiambu County. However, given the vast geographical expanse of Kiambu City, constructing such a comprehensive frame within the project's time and resource constraints poses a significant challenge. Notably, Kiambu County is home to numerous ongoing and completed projects. This study specifically targets construction sites like Eden Ville, Fourways Junction, Tatu City, Two Rivers Mall, and Thika Greens. These sites are selected because they represent formal construction projects initiated by private developers with complete design teams and contractual agreements between the developer and the contractor. Focusing on private development projects is essential for this study because they constitute a significant portion of employment in the area and, consequently, necessitate a thorough examination of safety measures, as noted in Aden (2004). Moreover, it's worth highlighting that governance and management systems differ significantly between the private and public sectors. As a result, studying these two sectors separately is essential to better understand their respective safety practices and measures, as they cater to different demographic and regulatory factors.

3.3 Sampling method and justification

For the study focusing on health and safety management at construction sites in Kiambu County, Kenya, the stratified random sampling method is particularly well-suited. This sampling strategy involves dividing the entire population into distinct subgroups, or strata, that share similar characteristics. This is critical in ensuring that all segments of the population are adequately represented, which is particularly important in the construction industry where sites vary greatly in terms of size, type, and inherent safety risks.

The rationale for choosing stratified random sampling over other methods lies in its ability to minimize sampling error and enhance the representativeness of the sample. Construction sites in Kiambu County are not uniform; they range from small residential projects to large commercial developments, each with unique health and safety challenges. By stratifying the population by these criteria, we can ensure that each category is properly represented in the study, allowing for more precise and relevant conclusions to be drawn. This method is not only useful in highlighting common trends across the board but is especially valuable in identifying specific issues faced by different types of construction projects.

Moreover, stratified random sampling increases the accuracy of the research findings. By reducing variability within each subgroup, this method allows for a clearer analysis of the results. It ensures that the data collected are more closely aligned with real-world conditions, leading to more reliable and actionable insights. For instance, differentiating between high-risk and lower-risk construction sites allows the study to specifically address the varying levels of safety needs and to tailor recommendations that are both effective and practicable.

In terms of practical implementation, stratified random sampling begins with a careful definition of criteria for stratification. Once the strata are defined, a random sample is drawn from each group. This approach not only prevents sampling bias but also enhances the overall robustness of the study. The effectiveness of this method is particularly evident in its ability to facilitate detailed and subgroup-specific analysis, which is essential for developing targeted interventions.

In conclusion, using stratified random sampling for assessing health and safety at construction sites in Kiambu County is not only methodologically sound but also aligns perfectly with the practical demands and diversity of the construction industry. This method provides a systematic framework for addressing the complex and varied nature of construction projects, thereby ensuring that the findings are both comprehensive and applicable across different types of construction environments.

3.4 Instruments of data collection

In the research study, a comprehensive approach to data collection was employed, utilizing a combination of both qualitative and quantitative instruments. This multi-faceted strategy was adopted to ensure a robust and holistic exploration of the research problem at hand. The two primary instruments employed for data collection were semi-structured self-administered questionnaires and semi-structured interviews. The use of semi-structured self-administered questionnaires allowed for the collection of quantitative data. These questionnaires were carefully designed to include a set of standardized questions that could be answered with numerical values or categorical responses. This approach not only enabled the gathering of structured and measurable data but also facilitated the analysis of statistical trends and patterns. Quantitative data, in this context, served to provide numerical insights and quantifiable evidence, adding rigor to the research. In contrast, the semi-structured interviews were utilized to capture the qualitative aspects of the research problem. These interviews provided a platform for participants to express their thoughts, opinions, and experiences in a more open-ended manner. The semi-structured nature of the interviews meant that there was a core set of questions, but participants had the freedom to elaborate on their responses. This allowed for a deeper exploration of individual perspectives and the extraction of rich, context-specific information. Qualitative data from interviews offered a nuanced understanding of the subject matter and contributed to a more holistic interpretation of the research problem. By combining both quantitative and qualitative data collection methods, the study aimed to achieve a comprehensive understanding of the research problem. The quantitative data provided a broad overview, while the qualitative data added depth and context. This mixed-methods approach ensured that the research was well-equipped to address the complexities of the problem, accommodating diverse types of information and perspectives. The integration of these instruments was a deliberate choice to facilitate thorough investigations, yielding a well-rounded dataset that could be analyzed from multiple angles and contributing to a more robust research outcome.

3.5 Data analysis and presentation

In the study of health and safety management at construction sites in Kiambu County, Kenya, content analysis was a crucial methodological approach used to systematically evaluate the qualitative data gathered from interviews, surveys, and observational notes. This analytical technique enabled the research team to categorize and interpret the data methodically, leading to the identification of significant recurrent themes that shed light on various aspects of workplace safety within the construction industry.

The content analysis process involved several key themes that emerged prominently from the data. These themes included Compliance with Safety Regulations, which explored how effectively construction sites adhere to established safety standards and the various challenges or enablers influencing this compliance. Another major theme was Safety Training and Awareness, focusing on the nature and impact of safety training provided to workers and assessing its adequacy and effectiveness in influencing safe practices. The Role of Management and Leadership was also a critical theme, examining how leadership practices and management's commitment affect the implementation and sustainability of safety measures. Worker Engagement and Behavior was investigated to understand workers' attitudes towards safety, including their participation and communication about safety issues. Lastly, Barriers to Effective Safety Management identified the obstacles impeding effective safety management, such as limited resources, cultural factors, and resistance to change.

Analysis of data was done using statistical package for social sciences (SPSS) software. There are two major statistical procedures that shall be used and include descriptive statistics and inferential statistics. Descriptive statistics will be done to offer a summary of the variable data and hence improve understanding and their usage (Fera, 2009). Further, this will be done in order to confirm the completeness of the data sets. Descriptive statistics shall include the use of mean scores, median, variance, standard deviation, frequencies, kurtosis and skewness (Flybjerg, 2001). In addition, inferential statistics shall be done in order to make judgments on the observed findings and this is by testing the hypothesis through chi-square at significance level of 0.05.

3.6 Reliability and validity

Reliability and validity influence the level in which data is accurate and representative for the results respectively while replicability indicates repeating a study by using similar methodology results to the same findings. Mugenda et al (1999) states that reliability measures the degree in which research instruments provide consistent results after repeated trials. In this study, the research instruments have been designed in a way to reduce errors.

The questionnaires were simple, precise and also clear without any kind of ambiguities while interviews have been as objective as possible to avoid any kind of bias. Research assistants that helped in conducting the interviews were trained before the exercise so as to ensure of accuracy and objectivity. Instruments of research were pre-tested and adjusted in accordance so as to improve accuracy of data. the unit of analysis was individual construction sites, allowing for a detailed investigation of site-specific safety practices and management strategies. To ensure reliability and validity, the study employed several strategies: triangulation was used to verify findings across multiple data sources such as interviews, surveys, and observations; consistent data collection procedures were standardized across all sites to maintain uniformity; pilot testing of survey and interview tools was conducted to refine questions and ensure clarity; and expert validation involved industry experts reviewing the coding scheme for content analysis to enhance the accuracy of thematic results. These measures were crucial in bolstering the study’s reliability and validity, ensuring that the findings were dependable and reflective of actual conditions on construction sites.

On the other hand, Neuman (2007) states that validity is a maeasure of accuracy in which the results represent a phenomenon under study or if the results from a sample can be generalized in a target population. Validity of research shall be improved through adoption of systematic random sampling technique to make sure that data is only sought in areas where it was deemed to be available (Creswell, 2003). By having a clearly defined procedure in undertaking a study means that similar results would prevail by repeated trials implying that the study would be replicated.

CHAPTER FOUR : RESARCH FINDINGS

4.1 Introduction

This chapter presented the research findings. The important construction health and safety findings are summarized. The chapter analyzes and presents study data in detail. The chapter helps explain construction site health and safety by matching findings with research aims. The data interpretation component helps comprehend supplied information and understand construction sector health and safety risks. This chapter helps link research objectives to real results and sheds light on construction health and safety issues.

4.2 Response rate by respondents

Table 4.1: Response rate

Item No.	Item Description	Response
1	No. of Questionnaires Issued	43
2	No. of Questionnaires Returned	30
3	Percentage Response	70 %

Research accuracy and dependability depend on a decent response rate, which affects the results' representativeness to the target population. The response rate is the percentage of sampled individuals or entities who provided meaningful and useable data to the research instrument. At least 50% response is recommended by Mugenda and Mugenda (2003). Many researchers agree that this standard ensures a reasonable sample representation. A greater response rate suggests a more robust and comprehensive dataset, which strengthens the study's findings. The study had a 70% response rate. This is remarkable because it exceeds the acceptable 50% level. The higher response rate suggests that the sampled community is more engaged in the research. The importance of a 70% response rate goes beyond statistics. It suggests that most Kiambu County building sites actively participated in the survey, making the results more representative of the population of interest. This high response rate increases the study's external validity, making it more likely to apply to Kiambu County's construction context. A 70% response rate gives researchers a deeper knowledge of the issues. It reduces the danger of non-response bias, where non-participants have different attitudes or traits than participants. This improves the study's internal validity by making data correlations and patterns more likely to reflect population phenomena.

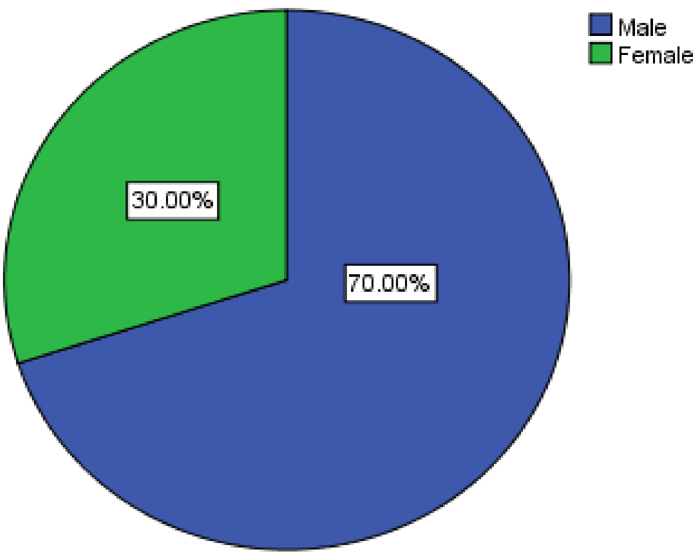
4.3 Demographic information

Demographic data was examined in detail to understand research participants' traits. The demographic profile examined gender, age, base of work, kind of employer, job title, experience, and education level to provide a comprehensive image. The research sought a nuanced understanding of the respondents' diverse backgrounds and professional contexts to analyze potential patterns and correlations that may affect their perspectives or contributions to the study. This extensive demographic inquiry enriches the dataset and provides for a more nuanced interpretation of the findings in the context of the surveyed community. The findings are presented in below.

4.3.1 Gender of Respondents

An enquiry was made into the gender of the respondent. The findings revealed that 21 respondents were males which represented 70 % while 9 respondents were females which represented 30 %. This means that majority of the respondents were males.

Figure 5: Gender of the respondent



4.3.2 Age of Respondents

The survey involved obtaining information on the age distribution of the respondents, and the results, as presented in Table 4.2, reveal a diverse demographic profile. Notably, the majority of respondents fall within the 31-40 age bracket, comprising 40% of the sample. This age group is followed by those aged 41-50 years, constituting 30% of the respondents. Additionally, 13.3% were in the 20-30 age range, while 16.7% were above 51 years old. The concentration of respondents in the 31-40 age category suggests that this demographic segment plays a central role in the study, potentially influencing the dynamics and outcomes under investigation. The detailed breakdown of age groups provides valuable insights into the composition of the respondent pool, facilitating a more nuanced interpretation of the study's findings within the context of different age cohorts.

Table 4.2: Age of the respondent

Age		Frequency	Percent	Cumulative Percent
Valid	20-30 years	4	13.3	13.3
	31-40 years	12	40.0	53.3
	41-50 years	9	30.0	83.3
	Above 51 years	5	16.7	100.0
	Total	30	100.0	

4.3.3 Types of employment

The investigation into the basis of employment among the respondents proved integral to understanding the diverse work arrangements within the studied population. As revealed in Table 4.3, a substantial portion, comprising 56.7% of the respondents, were engaged in temporary (daily basis) employment. This significant representation suggests that a majority of those surveyed experience the unique challenges associated with temporary work arrangements, particularly within the construction sector, where health and safety risks are prevalent. The prevalence of daily basis employment in the respondent pool highlights the potential vulnerability of this group to workplace hazards, making their insights particularly valuable in addressing health and safety concerns at construction sites. Their perspectives and experiences contribute essential information to the study's objectives, enriching the findings with a comprehensive understanding of the specific challenges faced by those engaged in temporary employment within the construction industry. Furthermore, the data from Table 4.3 also indicates that 26.7% of respondents were part-time employees, while 16.7% were in full-time positions. The distribution across these categories underscores the varied employment structures within the sample, allowing for a nuanced analysis of how different employment types may influence perceptions and experiences related to health and safety in construction. This detailed exploration of employment basis not only enhances the study's relevance to the industry but also positions it to provide targeted recommendations for improving health and safety practices, considering the distinct challenges faced by individuals in different employment arrangements.

Table 4.3: Types of employment

Types of employment		Frequency	Percent	Cumulative Percent
Valid	Part time	8	26.7	26.7
	Full time	5	16.7	43.3
	Temporary (daily basis)	17	56.7	100.0
	Total	30	100.0	

4.3.4 Type of employer

The respondents' employer types revealed construction industry organizational structures. Table 4.4 shows that 83.33% of respondents were employed by the primary contractor. None reported being directly hired by the customer, while 16.67% identified as subcontractors. This distribution suggests that a large majority of the questioned persons work for the principal contractor, a usual hierarchical employment structure in construction projects. The major contractor's concentration of personnel indicates a centralized source of employment on building sites. This organizational structure may affect health and safety management and enforcement since a centralized authority can impact working conditions and rules. The study's focus on this aspect illuminates construction industry dynamics and allows targeted analysis of health and safety risks connected with distinct employers.

Table 4.4: Type of employer

Type of employer		Frequency	Percent	Cumulative Percent
Valid	Client	0	0	0
	Main contractor	25	83.33	83.33
	Sub-contractor	5	16.67	100.0
	Total	30	100.0	

4.3.5 Job Title of Respondents

The responders' job titles illuminated the construction industry's numerous jobs and their unique duties. Table 4.5 shows that many respondents worked physically demanding and dangerous jobs. Importantly, 33.3% of respondents were masonry (block layers), and 46.7% were concreters. Construction workers who place blocks and pour concrete face higher risks of physical strain and safety dangers. Electricians, who work with risky electrical systems, made up 13.3% of responses. The concentration of respondents in these job categories shows that risky jobs are common on construction sites, underlining the need to address health and safety concerns for such workers. The distribution of job titles helps evaluate the study's findings because various roles face different risks and challenges. Given their higher on-the-job risks, masonry and concreting may be a good focus for construction sector health and safety measures. The survey helps identify occupational health and safety issues by showing how common these activities are among respondents, enabling the development of personalized solutions to reduce block laying, concreting, and related risks.

Table 4.5: Job Title

Job title		Frequency	Percent	Cumulative Percent
Valid	Carpentry	1	3.3	3.3
	Masonry (block layers)	10	33.3	36.7
	Mason (Concreting)	14	46.7	83.3
	Plumber	1	3.3	86.7
	Electrician	4	13.3	100.0
	Total	30	100.0	

4.3.6 Experience of the Respondents in the industry

The study examined respondents' construction industry experience to assess their knowledge of health and safety issues at construction sites. Table 6 shows interesting patterns in respondents' employer and construction site tenure. Interestingly, 63.3% of respondents had one year of employer experience. This suggests that many respondents were new to their jobs. When asked about construction site experience, 80.0% said they had more than a year, indicating a more experienced workforce with site-specific exposure. The contrast in experience between employment with the organization and on construction sites is important for understanding respondents' perspectives, as those with longer site experience are more likely to understand the practical challenges and nuances of health and safety risks in the construction industry. This thorough investigation of experience levels enhances the study's findings by contextualizing respondents' construction health and safety ideas and reactions.

Table 4.6: Experience of Respondents in the industry

		Column N %	Count
Experience with employer	1 year	63.3%	19
	1.5 years	6.7%	2
	2 years	13.3%	4
	5 months	3.3%	1
	8 months	13.3%	4
Experience on site	1 year	10.0%	3
	2 months	6.7%	2
	6 months	3.3%	1
	More than 1 years	80.0%	24

4.3.7 Education Level of the Respondents

The study examined the respondents' educational backgrounds to understand the sample's educational makeup. The results in Table 4.7 reveal respondents' educational backgrounds. Most respondents—70%—had finished secondary school. This shows that the surveyed persons had a core level of knowledge beyond primary school, indicating reading and acquaintance with normal educational processes. 16.7% of respondents had college degrees, a small yet considerable percentage. 13.3% had primary school education. The study's findings must be contextualized because participants' viewpoints, comprehension, and responses to questions about construction site health and safety issues depend on their education. The respondents' high secondary education rates reflect a baseline level of education that can inform and nuance their research responses.

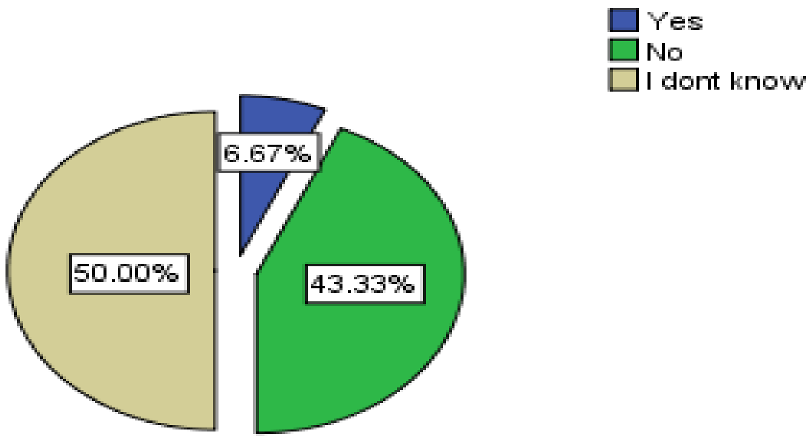
Table 4.7: Education level of Respondents

Education level		Frequency	Percent	Cumulative Percent
Valid	Primary	4	13.3	13.3
	Secondary	21	70.0	83.3
	College	5	16.7	100.0
	Total	30	100.0	

4.3.8 Health and Safety Management Policy

The study conducted an inquiry into whether organizations or employers had a written policy specifically addressing the management of health and safety risks. The results, as depicted in Figure 6, highlight a concerning trend regarding the awareness and existence of written policies among the respondents. A mere 6.67% of respondents affirmed the presence of such policies, while a substantial 43.3% indicated a lack of a written policy on managing health and safety risks within their organizations. Perhaps more significantly, half of the respondents, constituting 50%, stated that they did not know whether their organizations had a written policy in place. This prevailing lack of awareness among employees regarding the existence of written health and safety policies signals a potential gap in communication and transparency within organizations. The study emphasizes the importance of having a written policy to effectively manage health and safety risks at construction sites, stressing its role not only in compliance but also in aligning organizational efforts with business goals. The findings underscore the need for organizations to enhance communication and awareness initiatives to ensure that employees are well-informed about health and safety policies, fostering a safer and more informed work environment.

Figure 6: Availability of Written Policy for Management of H&S by Employer



In addition, the respondents who stated that their companies had written policy stated that it was signed by the health safety officer/coordinator that has been employed permanently and works with the site managers in the sites so as to foresee any form of health and issues of safety.

4.4 Frequency of updating Health and Safety Management Policy

The study delved into the frequency with which organizations update their health and safety policies by seeking responses from the respondents. The findings, as presented in Table 4.8, reveal a notable trend regarding the awareness and knowledge of respondents about the update cycles of health and safety policies within their organizations. A substantial 50% of respondents admitted to not knowing the frequency of updates, indicating a lack of awareness or clarity among employees about the specific timelines or conditions under which health and safety policies are revised. Additionally, 33.3% of respondents stated a two-year update cycle, suggesting that a significant portion of those who had some knowledge of the update frequency perceived it to be a biennial process. Notably, 13.33% mentioned a one-year update cycle, while a smaller proportion, 3.33%, indicated updates during changing conditions. The prevalence of respondents being unaware of the update schedule underscores a potential communication gap within organizations regarding health and safety policy revisions, signaling a need for improved transparency and information dissemination to enhance employee awareness and engagement in matters of workplace safety.

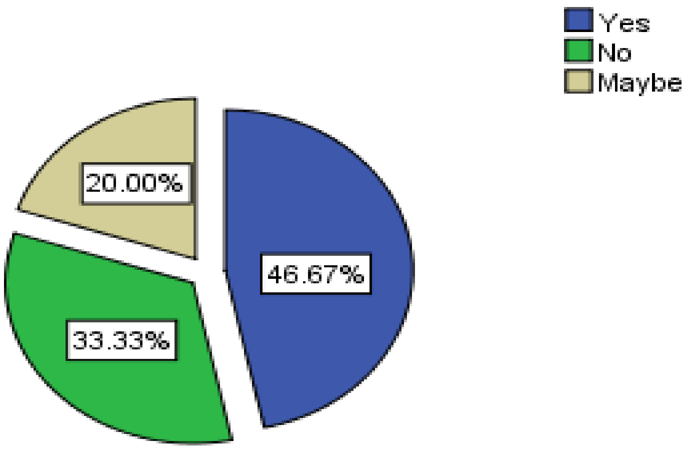
Table 4.8: Frequency of updating the health and safety policy

Frequency of Updating Policy	Frequency	Percent	Cumulative Percent
Valid			
one year	4	13.33	30.0
2 years	10	33.33	46.67
Changing conditions	1	3.33	50.00
Don’t Know	15	50.00	100.0
Total	30	100.0	

4.4.1 Employees Consultation on Health and Safety Management Matters

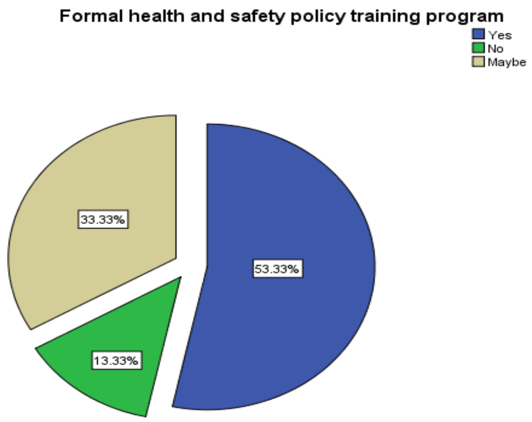
The study investigated how much employees were consulted on health and safety policy in their workplaces. Figure 7 shows how much employee input shapes health and safety policies. Notably, 46.67% of respondents said they were consulted, indicating that many employees actively participate in health and safety policy design. However, 33.33% opposed being consulted, and 20% said 'Maybe.' While the latter group may indicate employee uncertainty or variability, the dominant agreement among respondents suggests that a significant proportion of employees feel included in health and safety policy discussions and decisions in their organizations. This emphasis on consultation shows a more collaborative and inclusive approach to managing health and safety hazards, recognizing employees' valuable contributions and insights in policy creation and implementation.

Figure 7: Consultation with employees on health and safety matters



Respondents were asked if their firms had a documented health and safety policy on training programs, a critical factor in risk management. The results are presented in figure 8. The research shows that 53.3% of respondents said their firms had a formal health and safety training policy. This positive reaction emphasizes proactive risk management and shows that a large number of respondents recognize and value established training procedures in promoting safety. The 33.3% "Maybe" replies may indicate variable levels of awareness or uncertainty in particular organizational circumstances, while the 13.3% negative responses reflect that a very small fraction of firms lack formalized procedures. Overall, respondents agreed that a clear health and safety policy on training programs is essential to managing health and safety hazards in their workplaces.

Figure 8: Formal Health and safety policy training program



4.5 Influence of building-project client’s management on the performance of occupation health and safety risks at construction sites

4.5.1 Client involvement in various project stages

The study used a structured technique to rate respondents' agreement with statements about client involvement at project commencement, design and development, construction, and feasibility. Table 9 shows respondents' quantitative views on client interaction during a construction project. This systematic assessment provides a full grasp of client involvement's perceived relevance and a quantified basis for assessing its impact at each level. The table shows respondents' consensus on the level of customer interaction needed for effective project management and construction health and safety risk minimization.

Table 4.9: Client involvement in different project stages

STATEMENT	**Mean**	**Std. Dev**
Client responsible for the H & S	**4.57**	**0.0218**
More effective to consider all the phases in a project and eliminate the potential hazards	**4.51**	**0.1421**
Consultants should be responsible for the H & S	**4.36**	**0.245**
Contractors should be responsible for H & S	**4.27**	**0.0231**

From the responses, it is clear that the respondents strongly agreed that the clients are responsible for the H & S with a mean of 4.57; strongly agreed with more effective to consider all the phases in a project and eliminate the potential hazards with a mean of 4.51; agreed with the consultants being responsible for the H & S with a mean of 4.36 and contractors should be responsible for the H & S with a mean of 4.27. This is in line to the findings by Adan (2004) which showed that clients are important in every stage of a project so as to ensure that health and safety risks have been controlled.

4.5.2 Frequency of client actions on different stages in a project

The respondents were required to rate the extent of agreement with the statements on the frequency of client actions on different project stages such as project initiation, design and development construction, feasibility or construction. The findings are as shown in table 9 below.

Table 4.10: Frequency of client actions on various project stages

STATEMENT	Mean	Std. Dev
Offer information on site or the premise in advance	3.68	0.342
Develop the H & S culture on a project	4.21	0.536
Schedule and prioritize the requirements of H & S	4.01	0.562
Make sure on the information on what has been built has been provided to manage the H & S throughout its lifetime	4.45	0.124
Stress on the essence of H & S during the project hand over / briefing	4.23	0.241
Offer financial support to contractors’ efforts on H & S	3.98	0.345

Have H & S as an agenda during the client/contractor meetings	4.56	0.473
Request checklist on the H & S hazards	3.97	0.129

The findings showed that the clients offers information on site or the premise in advance had a mean of 3.68 which means that the respondents agreed with the statement; agreed with the statement on the development of the H & S culture on a project with a mean of 4.21; strongly agreed with the statement that they ensure on the information on what has been built has been provided to manage the H & S throughout its lifetime with a mean of 4.45; agreed with the statement that clients stress on the essence of H & S during the project hand over / briefing with a mean of 4.23; agreed with the statement that clients offer financial support to contractors efforts on the H & S with a mean of 3.98; strongly agreed that clients have H & S as an agenda during the client/contractor meetings and agreed with the statement that the clients request checklist on the H & S hazards with a mean of 3.97. This means that clients are important in different stages of project organization to ensure that they have controlled the health and safety risks in a project.

4.6 Adequacy of the involvement of the project management team in the management of health and safety risks at construction sites

Table 4.11

STATEMENT	Mean	Std. Dev.
Availability of technical resources	4.34	0.241
The care and attention from the contractors	4.01	0.647
Skills and experience that is brought by project management team	4.45	0.241
Care and attention by the project team	3.9	0.131

An enquiry was made to find out the adequacy of involvement of the project management team in managing the health and safety risks at the construction sites. The findings showed that the respondents agreed with the availability of technical resources agree with a mean of 4.34; the care and attention from the contractors with a mean of 4.01; the skills and experience that is brought by the project management team with a mean of 4.45 and the care and attention by the project team with a mean of 3.9. This means that the respondents agreed with the adequacy of involvement of the project management team in managing the health and safety at the construction sites in various stages of a project in your organization such as project initiation, concept/ feasibility, design and development or construction.

4.7 Recommendations on the importance of strategic involvement

This study delved into the perceptions and responses regarding the role of the institutional system in maintaining health and safety risks at construction sites. The findings, as presented in Figure 9, reveal a significant acknowledgment among respondents regarding the impact of the institutional system on health and safety risk management. Notably, 43% of respondents emphasized the role of the institutional system in terms of stressing leadership and organizational culture, specifically in the evaluation and communication of health and safety risks. This recognition suggests that a robust institutional system, characterized by effective leadership and a supportive organizational culture, plays a crucial role in shaping attitudes, behaviors, and practices related to health and safety in the construction sector.

Furthermore, the study indicates that a majority, constituting 57% of respondents, believed that the institutional system has the capacity to improve the overall situation of health and safety risks on construction sites. This finding suggests that when the institutional system is actively involved and committed to health and safety, it contributes to a more comprehensive and effective management of risks within construction projects. The emphasis on improvement underscores the potential for positive changes in safety practices and outcomes when institutions prioritize and invest in health and safety initiatives.

However, the study highlights two notable challenges faced by the implementation of health and safety measures within the institutional system. Firstly, the lack of funds emerges as a significant barrier, indicating that financial constraints pose a hindrance to the implementation of robust health and safety measures. Secondly, the complexity in design is identified as another challenge, suggesting that the intricate nature of construction projects, coupled with the complexity of safety protocols, can create obstacles in the effective implementation of health and safety measures.

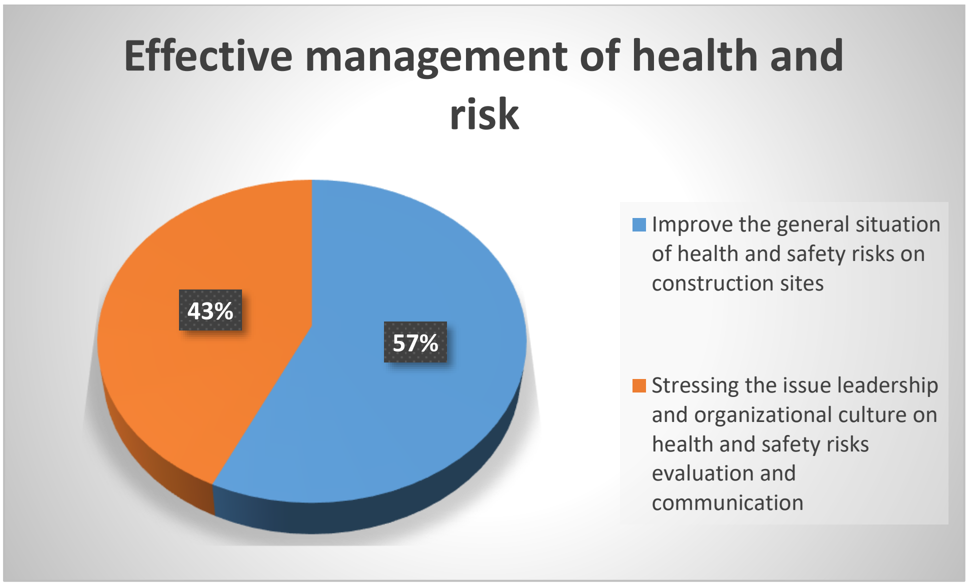


Figure 9: Effective Management of health and risk

The findings of this study are similar to those conducted by Adan (2004) who revealed that the construction firms put more emphasis on management of health and safety risks in their sites. This study shows that there is need to have effective management of health and safety risk by having set criteria for evaluation ill health problems that are caused by manual handling at the construction sites. The companys' policies are committed to health and safety management. Further discussion on how they fulfill such a commitment, is that they have two coordinators that are permanently employed by the organization. the coordinators work with the safety committee members for every construction site. The findings of this study are in line to the OSHA Act 2003 section (11) which requires that every construction site with over 50 employees to have a safety committee. They have to comply with the regulation and allow the site managers to have workers who handle the health and safety issues at the construction sites.

4.8 Review of Theoretical Framework

The findings suggest that the systems approach was effective in highlighting the interconnectedness of various elements that contribute to site safety. For instance, one key finding might show that the presence of comprehensive safety protocols (a system element) correlated with a reduced number of incidents. However, the effectiveness of these protocols was not uniform across all sites, suggesting variability in implementation fidelity or adaptation to specific site conditions.

This variability could be attributed to differences in management commitment, the physical layout of sites, or the safety culture within different teams. Such insights underscore the systems theory notion that outcomes are the result of complex interactions within the system. Therefore, the theory could be expanded to more explicitly account for the influence of organizational culture and leadership styles on safety outcomes, integrating more nuanced models of organizational behavior and change management.

The application of Behavior-Based Safety Theory likely yielded insights into individual and group behaviors that either promoted or hindered safety. If the data revealed that certain behaviors—like skipping safety gear use—were common among workers, this could highlight a gap between knowledge and practice that needs addressing through targeted behavioral interventions.

However, if the findings also showed that workers often bypass safety measures under time pressure or due to insufficient resources, this might suggest that external pressures and environmental constraints have a more significant impact on behavior than was initially considered. Thus, while BBS focuses on modifying individual behaviors, the findings could prompt a revision of the theory to incorporate more about the environmental or situational factors that strongly influence these behaviors.

The results might indicate that while both theories provide valuable insights, there is a need for a more integrated model that combines the macro-level systemic factors with the micro-level behavioral factors in a single, coherent framework. This integrated approach would not just look at what safety measures are in place (systems theory) or what unsafe behaviors are being practiced (BBS), but also why these behaviors persist despite known safety measures, considering the systemic pressures or incentives that might be influencing these behaviors.

For example, further research could develop a model that links leadership practices (a system element) with worker engagement in safety behaviors, mediated by factors such as job satisfaction and perceived support from management. Such a model could help to explain how system-level interventions (like improved leadership training) can lead to better individual compliance with safety protocols through enhanced motivation and commitment.

CHAPTER FIVE: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Introduction

This chapter provides a summary of the findings, conclusions and recommendations on the management of health and safety risks on the sites during the construction process. The findings of the study offer comprehensive insights into various aspects of health and safety in the construction industry, particularly focusing on the context of Kiambu County, Kenya.

5.2 Summary of Findings

The research achieved a robust response rate of 70%, indicating a high level of engagement from the sampled community. This not only enhances the external validity of the study but also reduces the risk of non-response bias, ensuring that the results are more likely to be representative of the broader population within Kiambu County's construction sector (Abuya, 2020). Demographic analysis revealed a predominance of male respondents, constituting 40% of the sample, with a detailed breakdown of age groups providing valuable insights into the composition of the respondent pool. The concentration of respondents in the 31-40 age bracket suggests a specific demographic profile that influences the study's findings and provides a nuanced interpretation within the context of different age cohorts.

Employment basis analysis uncovered that 56.7% of respondents are engaged in temporary work, emphasizing the vulnerability of this group to workplace hazards. Furthermore, organizational structures within the construction industry were highlighted, with 83.33% of respondents employed by the primary contractor. This hierarchical employment structure has implications for health and safety management, as centralized authority can impact working conditions and rules.

Job title analysis showed the prevalence of risky jobs on construction sites, with a significant percentage of respondents involved in masonry (33.3%) and concreting (46.7%). The concentration of respondents in these job categories underscores the need to address health and safety concerns for workers engaged in physically demanding and potentially hazardous tasks. The study looked at respondents' construction industry experience, revealing a contrast in experience levels. While 63.3% of respondents had one year of employer experience, indicating a relatively new workforce, 80.0% had more than a year of construction site experience, reflecting a more seasoned workforce with site-specific exposure. This difference in experience levels is crucial for understanding respondents' perspectives on health and safety risks in the construction industry.

Educational background analysis indicated a concerning lack of awareness regarding written policies on health and safety risk management. Only 6.67% of respondents affirmed the presence of such policies, while 43.3% indicated a lack thereof. This finding signals a potential gap in communication and transparency within organizations, emphasizing the need for enhanced initiatives to ensure employees are well-informed about health and safety policies. The study underscored the importance of having a written policy for effective health and safety risk management at construction sites. The lack of awareness among respondents regarding the existence of such policies emphasizes the need for organizations to enhance communication and awareness initiatives, fostering a safer and more informed work environment (Adan, 2004; Armstrong, 1980).

Analysis of the frequency of health and safety policy updates within organizations revealed that 50% of respondents were unaware of the update cycles. This lack of awareness or clarity among employees about specific timelines or conditions for policy revisions suggests a need for improved communication and dissemination of information regarding policy updates. Employee consultation on health and safety management matters was explored, with 46.67% of respondents indicating active participation in policy design. This outcome of high level of agreement is similar to Agyekum et al., (2021) and suggests that a significant proportion of employees feel included in health and safety policy discussions and decisions within their organizations. However, 33.33% opposed being consulted, indicating a diversity of opinions on this matter.

Respondents generally agreed on the importance of having a formal health and safety training policy in their firms, emphasizing its role in proactive risk management and safety promotion. This finding aligns with existing literature emphasizing the significance of training programs in managing health and safety hazards in workplaces (Ammad et al., 2021; Costa et al., 2021). Client involvement in construction projects was scrutinized, with respondents strongly agreeing on the client's responsibility for health and safety. This alignment with Umeokafor et al. (2022) study that suggests a consensus among respondents on the role of clients in ensuring health and safety on construction sites.

The adequacy of the involvement of the project management team in managing health and safety risks at construction sites was affirmed by respondents. Their agreement on the availability of technical resources, care and attention from contractors, skills and experience brought by the project management team, and the care and attention by the project team highlights the perceived effectiveness of the project management team in ensuring health and safety on construction sites (Barasa, 2021; Smallwood et al., 2008). Recognition of the institutional system's significant impact on health and safety risk management emerged from the findings. A majority of respondents believed that the institutional system has the capacity to improve the overall situation of health and safety risks on construction sites. This aligns with literature emphasizing the role of effective leadership and a supportive organizational culture in shaping attitudes, behaviors, and practices related to health and safety in the construction sector (Zuhdi et al., 2022). Two notable challenges faced by the implementation of health and safety measures within the institutional system were highlighted: the lack of funds and the complexity in design. These challenges are consistent with findings from previous studies (Johnson, 2020; Selleck et al., 2023).

5.3 Conclusion

The study concludes that construction site health and safety must be managed throughout the process. The construction industry's exposure to hazardous materials underscores the necessity for proactive worker safety precautions. The fact that these materials can cause long-term health problems highlights the importance of construction health and safety. The study correctly points out that construction worker health and safety hazards are rising and require prompt response. In reaction to changing building site conditions, construction firms must regularly update their health and safety regulations, according to the report. This dynamic approach recognises that building projects change, thus health and safety laws must adapt to protect workers. Frequent updates demonstrate the construction industry's commitment to risk management strategy improvement and adaptation. The report emphasizes the need for a training program health and safety policy. Training is essential to health and safety management, as recommended by best practices. Training policies give workers the information and skills to avoid hazards and foster a safety-conscious culture in the construction workforce. A proactive approach to training shows a dedication to accident prevention, risk reduction, and workplace safety.

The claim that clients should be involved in every stage of a building project to control health and safety concerns emphasizes clients' vital role in ensuring workplace safety. Client input is vital during project inception, design and development, construction, and feasibility. Clients provide crucial site information during project beginning to enable risk assessment and management. Client involvement shapes safety considerations during design and development, ensuring health and safety precautions are integrated into the project's plan. In the construction phase, client involvement is needed to handle new issues, adapt to changing conditions, and oversee safety standards. The emphasis on client effectiveness in different project stages emphasizes the necessity for sustained and proactive health and safety. Clients are encouraged to participate in decision-making to identify and manage risks. In the feasibility stage, where important health and safety decisions are decided, proactive involvement is necessary. The relationship between technical resources, contractor care, and project management team involvement shows how collaborative health and safety management is. Technical resources are crucial to risk minimization, and contractors' care emphasizes a shared responsibility for worker well-being. The fact that these factors affect the project management team's engagement shows that a coordinated effort involving clients, contractors, and the team is necessary to manage construction site health and safety. This collaborative strategy mobilises resources, attention, and skills to establish a safe and secure working environment throughout a construction project.

5.4 Overview of Study Limitations

This research study exhibits several limitations that should be considered when interpreting its findings. Firstly, potential sampling bias may have influenced the results, as participants who chose not to engage might differ significantly from those who participated. This could affect the generalizability of the findings to the broader construction industry in Kiambu County. Moreover, the study's external validity may be constrained, as the unique characteristics of the county's construction sector may not be representative of other regions or countries.

Secondly, relying on self-reported data introduces the possibility of response bias, as participants may provide answers influenced by social desirability rather than reflecting their true experiences. This could impact the accuracy of the health and safety information obtained from the respondents. Additionally, the cross-sectional design limits the study's ability to establish causal relationships or track changes over time. A longitudinal approach would enhance the study's capacity to capture trends and causation within the dynamic construction industry. Addressing these limitations is essential for a more nuanced interpretation of the study's outcomes and to guide future research endeavors aimed at comprehensively understanding health and safety practices in the construction sector.

5.5 Recommendations

The study on health and safety management at construction sites in Kiambu County, Kenya, has highlighted several potential areas for further research that could significantly enhance our understanding of safety practices. One area involves exploring the long-term impact of safety training on worker behaviors and accident rates to determine the sustainability of training impacts and the necessity for periodic refresher courses. Additionally, examining the influence of local cultural norms and practices on safety behavior at construction sites could lead to the development of more culturally adapted safety interventions.

Another promising research direction is the investigation into how emerging technologies such as wearables and IoT devices can monitor safety conditions and compliance, offering insights into the potential for technology to augment traditional safety measures. There's also a substantial interest in the psychological aspects of safety compliance, including what motivates individuals to adhere to or disregard safety protocols, their perceptions of risk, and how group dynamics influence safety practices.

Furthermore, conducting comparative analyses across different regions or countries could unveil unique challenges and successful strategies, providing valuable lessons that could be adapted or implemented in other settings. Additionally, exploring the direct impact of leadership styles and management engagement on safety outcomes could provide deeper insights into how effective leadership can be leveraged to enhance a safety culture. Lastly, after any updates to safety regulations, subsequent studies assessing the effectiveness of these changes could provide critical feedback on the efficacy of policy adjustments.

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Appendix 1: Questionnaire

Health and Safety Risk Management Questionnaire

Part A: Demographic Information

Age Group:

- Under 25
- 25-34
- 35-44
- 45-54
- 55 and above

Gender:

- Male
- Female
- Prefer not to say

Job Title:

Years of Experience in Construction Industry:

- Less than 1 year
- 1-5 years
- 6-10 years
- 11-20 years
- More than 20 years

Part B: Health and Safety Management Policy

Does your organization have a formal written health and safety management policy?

- Yes
- No

How often is the health and safety management policy updated?

- Annually
- Every 2 years
- Every 5 years
- When required by legal or regulatory changes

Part C: Employee Involvement and Training

Are employees regularly consulted about health and safety management matters?

- Always
- Often
- Sometimes
- Rarely
- Never

What type of health and safety training programs does your organization provide?

- In-house training sessions
- External training courses
- Online training modules
- On-the-job training
- No formal training programs

Part D: Building-Project Client's Management

How involved is the building-project client's management in health and safety risk management during the construction process?

- Very involved
- Moderately involved
- Slightly involved
- Not involved

Can you give examples of how the client’s management has influenced health and safety practices on site?

Part E: Project Management Team's Role

How would you rate the adequacy of the project management team's involvement in managing health and safety risks on site?

- Very adequate
- Adequate
- Inadequate
- Very inadequate

In what ways can the project management team improve their management of health and safety risks?

Part F: Recommendations and Improvements

Based on your experience, what recommendations would you make to improve health and safety risk management in construction sites in Kiambu County?

Are there any specific tools or resources that you think would enhance health and safety on construction sites?