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CLIMATE CHANGE MITIGATION STRATEGIES TO ENHANCE WORKER SAFETY IN THE PROPERTY DEVELOPMENT INDUSTRY: A CASE STUDY OF WESTPROP HOLDINGS PRIVATE LIMITED, LOCATED AT 17B LOMAGUNDI AND SECOND STREET, MOUNT PLEASANT HARARE.

BY

PAMELA NYABUNZE

(B221943)

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SUPERVISOR: MR D DZVENE

DECLARATION

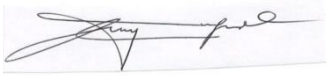
I, Pamela Nyabunze, declared that this work- related project is my own original work and has not been submitted to any other university or institution for the award of any degree, diploma, or professional qualification. All sources of information used in this study have been duly acknowledged and referenced in accordance with academic requirements.

Signature of the student 

Date 20/06/2026

Signature of the supervisor (Derek Dzvene) 

Date 20/06/2026

Signature of the chairperson (Tendai Nyamugure) 

Date 20/06/2026

DEDICATION

I dedicate this project to my family for their unwavering love, encouragement, and support throughout my academic journey. Their sacrifices, patience, and belief in my abilities inspired me to persevere and successfully complete this study

I also dedicate this work to my supervisor, lecturers, friends and mentors whose guidance and motivation contributed significantly to my educational and personal growth.

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I would like to express my sincere gratitude to the Almighty God for granting me the strength, wisdom, and perseverance to complete this study.

My heartfelt appreciation goes to my supervisor for the invaluable guidance, constructive criticism, and continuous support provided throughout the research process. Their expertise and encouragement greatly contributed to the successful completion of this study.

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ABSTRACT

This study assessed climate change mitigation strategies implemented to enhance worker safety in the property development industry using WestProp Holdings Private Limited as a case study. The research was motivated by increasing occupational hazards associated with rising temperatures and unpredictable rainfall patterns affecting construction workers in Harare. The study adopted a mixed-methods approach guided by the positivist research paradigm and utilised questionnaires and interviews to collect both quantitative and qualitative data from a sample of 100 respondents selected using purposive and simple random sampling techniques. Findings revealed that heat stress, dehydration, fatigue, slippery surfaces and trench collapse were the major climate-related occupational hazards affecting workers. The study further established that although the company had implemented measures such as provision of personal protective equipment, drinking water and safety training, climate-specific interventions such as heat action plans, adjusted working hours and early warning systems were still inadequate. The findings also showed that existing mitigation strategies were only partially effective in reducing occupational risks. The study concluded that climate change is increasingly affecting worker safety within the construction industry and recommended the adoption of structured climate-responsive safety frameworks, including flexible work schedules, shaded rest areas and weather-based safety planning, to improve occupational health and safety outcomes.

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CHAPTER ONE: PROBLEM AND ITS SETTING

1.0 INTRODUCTION

This chapter presents the foundation of the study on climate change mitigation strategies to enhance worker safety in the property development industry, with specific reference to WestProp Holdings Private Limited located at 17B Lomagundi and Second Street, Mount Pleasant, Harare. The chapter outlines the background to the study from a global to local perspective, the problem statement, research objectives, hypotheses and research questions, justification of the study, description of the study area, limitations of the study, and a chapter summary.

1.1 BACKGROUND TO THE STUDY

Climate change has increasingly become a major environmental and occupational safety concern affecting many industries worldwide, particularly the construction and property development sector where most activities are conducted outdoors. Global temperatures have risen by approximately 1.1°C above pre-industrial levels, leading to more frequent heat waves, heavy rainfall events and storms according to the Intergovernmental Panel on Climate Change (IPCC, 2022). These climatic changes have altered working conditions at construction sites, exposing workers to risks such as heat stress, dehydration, and unstable ground conditions and flooding. As a result, climate change is increasingly viewed not only as an environmental issue but also as a major occupational health and safety challenge affecting worker productivity and wellbeing.

In South America, research conducted in Brazil and Argentina shows that construction workers are among the most vulnerable occupational groups to heat stress due to prolonged outdoor exposure. Kjellstrom et al. (2019) found that rising temperatures in tropical regions of Brazil could reduce labour productivity by up to 15% during peak heat periods. Studies in Chile also reveal that extreme rainfall events increase construction site instability and accident risks in urban development projects (Vergara et al., 2020). These findings demonstrate that climate variability significantly affects worker safety and operational efficiency in the property development industry.

In North America, climate-related occupational hazards have also increased in the construction sector. Studies in the United States indicate that heat-related illnesses among construction workers have risen over the past decade. The Occupational Safety and Health Administration (OSHA 2021) reports that construction workers account for a significant

proportion of annual occupational heat-related fatalities. Research by Spector et al. (2016) further indicates that high temperatures reduce concentration and reaction time, increasing the likelihood of workplace injuries. Canada has also experienced safety challenges linked to extreme rainfall and storms that disrupt construction activities and increase exposure to workplace hazards (Government of Canada, 2020).

Across Europe, countries such as Spain and Italy have experienced increasing heat waves affecting outdoor labour productivity. The European Agency for Safety and Health at Work identifies heat stress as one of the fastest growing occupational hazards in the construction sector (EU-OSHA, 2019). Studies in Germany and France demonstrate that mitigation measures such as flexible working hours, shaded rest areas and access to drinking water significantly reduce heat-related health risks among workers (Bröde et al., 2018). These strategies highlight the importance of climate-responsive occupational safety practices in property development.

Across Asia, rapidly urbanising countries face similar climate-related occupational challenges. In India, construction workers experience severe heat exposure with productivity losses estimated between 10% and 20% during extreme heat periods according to the International Labour Organization (ILO, 2019). Research in China indicates that heavy rainfall linked to climate change increases structural failure risks at construction sites (Zhang & Wang, 2021). In the United Arab Emirates, midday work bans have been introduced during extreme heat to protect outdoor workers from heat stress (Tawatsupa et al., 2018).

Climate change impacts are also evident across Africa. In Egypt, rising temperatures exceeding 40°C during summer months have increased occupational heat stress among outdoor workers (World Bank, 2021). Algeria and Tunisia have also documented increased construction risks caused by extreme heat and flash flooding (UNEP, 2020). In West Africa, countries such as Nigeria and Senegal face similar challenges due to rapid urbanisation and weak enforcement of occupational safety regulations, leaving many construction workers exposed to extreme weather conditions (Akomolafe et al., 2020).

In Southern Africa, climate change has intensified environmental risks affecting construction activities. South Africa has recorded increasing heat waves and extreme storms that disrupt construction operations and threaten worker safety (DEA, 2019). Research by Mathee et al. (2020) also shows that higher temperatures are associated with increased workplace injuries

in the construction sector. Countries such as Namibia and Botswana face rising heat stress risks due to their semi-arid climates. In Mozambique, the impacts of Cyclone Idai highlighted the vulnerability of infrastructure and construction workers to extreme weather events (Government of Mozambique, 2019).

In Zimbabwe, climate variability has become more pronounced over recent decades, characterised by increasing temperatures and erratic rainfall patterns. The Meteorological Services Department of Zimbabwe reports that these climatic changes have significantly affected outdoor working conditions, particularly in urban construction projects (Government of Zimbabwe, 2021). The impacts of Cyclone Idai further demonstrated the vulnerability of infrastructure and workers to extreme weather events, causing damage estimated at more than US$600 million (Government of Zimbabwe, 2020).

Zimbabwe's National Development Strategy 1 emphasises climate resilience, environmental protection and occupational safety as key pillars for achieving Vision 2030 (Government of Zimbabwe, 2021). However, despite these policy commitments, limited research has examined how private property developers integrate climate change mitigation strategies aimed at protecting construction workers.

Westprop Holdings Private Limited, a major property developer operating in Harare, conducts construction activities in a climate-sensitive environment characterised by high temperatures and seasonal heavy rainfall. Although regulatory frameworks such as the Environmental Management Act and the Factories and Works Act require environmental and occupational safety measures, the extent to which climate-specific mitigation strategies enhance worker safety remains insufficiently documented. This study therefore assesses climate change mitigation strategies implemented to enhance worker safety in the property development industry, focusing on Westprop Holdings.

1.2 PROBLEM STATEMENT

Westprop Holdings Private Limited operates in an environment were rising temperatures and increasing rainfall variability is heightening occupational health and safety risks for construction workers. Construction activities undertaken by the company are largely outdoor-based, exposing workers to prolonged heat, intense solar radiation, and heavy rainfall during the wet season. In Harare, summer temperatures frequently exceed 30°C and can rise above 35°C during peak heat periods (Meteorological Services Department, 2021). These climatic

changes directly increase occupational exposure to heat stress, dehydration, fatigue and trench collapse, which can trap workers due to heavy rainfall that weakens the trench walls.

Westprop Holdings Private Limited is increasingly experiencing occupational health and safety challenges associated with climate change, particular rising temperature and unpredictable rainfall patterns. Construction workers operating on outdoor sites are exposed to extreme heat conditions that frequently result in heat stress, dehydration, fatigue and fainting. Records from site safety reports indicate that several workers have experienced heat related symptoms, including at least 1 documented case of a worker fainting due to dehydration during peak heat period on February 2026 at the Hills one of the Westprop site located corner Kirkman and Harare drive.

Heavy rainfall has contributed to unsafe ground conditions, leading to trench instability and at least 1 recorded trench collapse incident involving a worker on October 2025 at the Hills. The incident resulted in injuries that required medical treatment, with hospital expenses amounting to approximately $700 USD (Westprop, 2026), highlighting the financial and health impact of climate related workplace hazards. These incidents highlight a growing trend of climate related occupational hazards affecting worker productivity, health, and safety. Despite these occurrences, there is limited statistical documentation and structured risk assessment of climate induced hazards within the company making it difficult to effectively manage and reduce these hazards.

Zimbabwe's National Development Strategy 1 (2021–2025) emphasises climate resilience and improved occupational safety as central pillars toward achieving Vision 2030 (Government of Zimbabwe, 2021). However, a gap exists between national climate policy objectives and operational safety practices within private property development firms. This study seeks to address this gap by evaluating climate change mitigation strategies aimed at enhancing worker safety at Westprop Holdings Private Limited.

1.3 MAIN OBJECTIVE

To assess climate change mitigation strategies implemented to enhance worker safety in the property development industry, using Westprop Holdings Private Limited as a case study.

1.4 SPECIFIC OBJECTIVES

1. To evaluate climate change-related occupational hazards affecting workers at West Prop Holdings.

2. To examine climate change mitigation strategies implemented to enhance worker safety.
3. To assess the effectiveness of these mitigation strategies in reducing climate-related occupational risks.
4. To propose a climate-responsive worker safety framework for the property development industry in Zimbabwe.

1.5 RESEARCH QUESTIONS

1. What climate change-related occupational hazards affect workers at Westprop Holdings?
2. What mitigation strategies are implemented to enhance worker safety?
3. How effective are these strategies in reducing climate-related risks?
4. How can climate-responsive worker safety frameworks be strengthened in Zimbabwe's property development sector?

1.6 HYPOTHESES

H1: There is a significant relationship between rising temperatures and increased occupational health risks among construction workers.

H2: Climate change mitigation strategies significantly reduce worker exposure to climate-related hazards.

H3: Effective climate-responsive safety policies improve productivity and reduce accident rates.

1.7 JUSTIFICATION OF THE STUDY

Globally, the construction sector is among the most exposed to extreme heat, heavy rainfall and severe storms due to the outdoor nature of its operations. The International Labour Organization estimates that heat stress alone could result in productivity losses equivalent to 80 million full-time jobs by 2030, with construction identified as one of the most vulnerable sectors (ILO, 2019).

Government of Zimbabwe (2021) acknowledges increasing climate variability and the need for climate-resilient infrastructure under the National Development Strategy 1 (2021–2025). However, while national policy frameworks emphasise sustainability and resilience, there is

insufficient empirical assessment of how private developers are integrating climate-responsive occupational health strategies into daily construction operations. This creates a policy–practice gap, where strategic climate commitments exist at national level but their translation into workplace-level safety systems remains unclear. This study generates firm-level empirical evidence that can inform both regulatory authorities and private sector actors on practical climate mitigation interventions that directly enhance worker safety.

The study is further justified by its alignment with international development frameworks. It directly contributes to Sustainable Development Goal 8, which promotes decent work and safe working environments, and Sustainable Development Goal 13, which calls for urgent action to combat climate change and its impacts (United Nations, 2015). Worker safety under changing climatic conditions intersects these two goals, as unsafe working environments undermine productivity, economic growth and long-term infrastructure sustainability.

From an academic and practical perspective, the study contributes to knowledge on climate change and worker safety within Zimbabwe's construction sector. Previous studies have focused more on environmental sustainability rather than occupational safety under changing climatic conditions. By analysing mitigation strategies within a specific company context, the research provides evidence that can guide policymakers and private developers. The findings may help improve safety practices, reduce accident risks and enhance worker productivity. Ultimately, the study supports climate-resilient infrastructure development in line with Zimbabwe's Vision 2030 goals (Government of Zimbabwe, 2021).

1.8 DESCRIPTION OF THE STUDY AREA

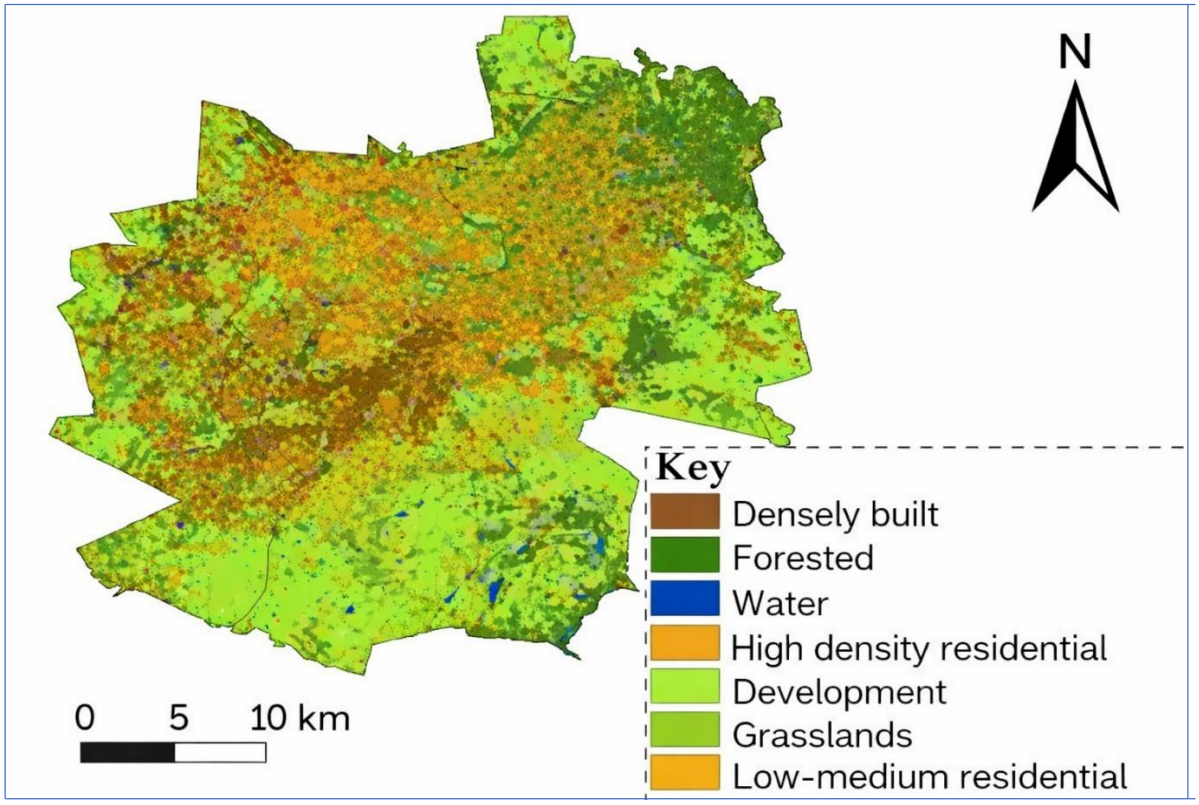


Figure1.1: Showing Study are map (Harare)

The study was conducted in Harare, Zimbabwe, focusing on developments undertaken by WestProp Holdings Private Limited in the northern growth corridor of the city. Harare is the political, administrative, and economic capital of Zimbabwe and is located in the north-eastern part of the country. Geographically, the city lies at an altitude of approximately 1,490 metres above sea level and is situated on the central watershed plateau of Zimbabwe. Its strategic location has made it a prime area for urban expansion and large-scale property development. The northern suburbs, including areas such as Borrowdale, Pomona, and Mount Hampden, have become key zones for residential and mixed-use developments due to their accessibility, relatively low population density, and availability of land.

Physically, Harare is characterised by gently undulating terrain underlain predominantly by granitic rock formations. The soils in the northern parts of the city are largely sandy to sandy-loam in nature, derived from weathered granite. While these soils are generally suitable for construction, they are prone to erosion when vegetation cover is removed (Moyo & Phiri, 2020). The topography of the study area is generally favourable for infrastructure development because steep slopes are minimal. However, the presence of wetlands and

seasonal streams in some parts of northern Harare requires careful environmental management, particularly in light of increasing climate variability.

Climatically, Harare experiences a subtropical highland climate with three main seasons: a hot wet season from November to March, a cool dry winter from May to August, and a hot dry season from September to October. The city receives an average annual rainfall ranging between 750 mm and 1,000 mm, most of which falls during the summer months (Zimbabwe Meteorological Services Department, 2022). In recent years, rainfall patterns have become increasingly erratic, with more frequent droughts and occasional intense rainfall events. These changes have significant implications for property development, particularly in relation to storm water management, water supply systems, and infrastructure resilience (Government of Zimbabwe, 2021). Rising temperatures and prolonged dry spells have also intensified water shortages in the city, affecting both households and commercial developments.

Land use and land cover in northern Harare have undergone substantial transformation over the past two decades. Historically, much of the land in this area was used for peri-urban agriculture and open grassland. However, rapid urbanisation and population growth have led to increased conversion of agricultural and natural land into residential estates, commercial centres, and mixed-use developments. Built-up areas now dominate the landscape, with remaining patches of woodland vegetation and wetlands interspersed within urban developments. The expansion of impermeable surfaces such as roads, pavements, and rooftops has increased surface runoff and reduced groundwater recharge, thereby heightening flood risks in certain locations (UN-Habitat, 2020).

Economically, Harare serves as Zimbabwe's commercial hub and contributes significantly to national economic output. The city hosts major financial institutions, government departments, manufacturing industries, and service-based enterprises. The property development sector has experienced steady growth due to high demand for housing, investment from the diaspora, and urban expansion. Residents in the northern suburbs are predominantly middle- to high-income earners engaged in formal employment, entrepreneurship, and professional services. Real estate development plays a crucial role in stimulating economic activity through job creation, infrastructure provision, and investment attraction (ZIMSTAT, 2022).

Socially, the northern suburbs of Harare are characterised by relatively well-developed infrastructure and amenities. The area hosts reputable educational institutions such as St

John's College and Arundel School, as well as several private clinics, shopping centres, and recreational facilities. Residential developments often incorporate security services, controlled access systems, and landscaped green spaces, reflecting residents' preferences for safety and improved quality of life. Access to basic services such as electricity, telecommunications, and road networks is generally better than in high-density suburbs, although challenges related to water supply and waste management persist.

Demographically, Harare has an estimated population of over 1.6 million people, with continued growth driven by rural–urban migration and natural population increase (ZIMSTAT, 2022). The northern suburbs have experienced notable population growth due to new housing developments and increasing demand for suburban living. The demographic profile of the area includes young professionals, nuclear families, and returning diaspora investors. Household sizes in these suburbs tend to be smaller compared to high-density residential areas, and literacy levels are relatively high. Population pressure has, however, increased demand for land, housing, and infrastructure, placing additional stress on natural resources and urban systems.

Overall, the study area represents a rapidly urbanising environment characterised by favourable physical conditions, evolving land use patterns, strong economic activity, and expanding social infrastructure. At the same time, it faces growing environmental and climate-related challenges that necessitate the integration of sustainable and climate-resilient strategies in property development. The characteristics of Harare's northern suburbs therefore provide an appropriate context for examining climate change mitigation strategies within the private property development industry in Zimbabwe.

1.9 LIMITATIONS OF THE STUDY

The study was limited by restricted access to proprietary company safety records, internal accident statistics and detailed occupational health reports from Westprop Holdings Private Limited. To address this challenge, the researcher relied on aggregated data provided by management and triangulated it with interviews from site supervisors and workers. Additional information was obtained from national statistics produced by National Social Security Authority. This approach ensured the reliability of the findings while respecting corporate confidentiality requirements.

Time constraints also limited the ability to conduct a long-term assessment of climate-related occupational incidents across multiple years. Climate change impacts are progressive and are

often better understood through longitudinal analysis. To mitigate this limitation, the researcher utilised historical climate data from the Meteorological Services Department of Zimbabwe. Secondary information from national climate reports was also incorporated into the study. These sources helped contextualise workplace risks within broader climatic trends affecting construction environments in Harare.

Financial limitations further restricted the scope of fieldwork and the ability to conduct extensive site observations across several development projects. To manage this challenge, the researcher focused on selected active project sites representing typical operations of the company. Data collection was conducted through structured questionnaires and key informant interviews with workers and supervisors. This targeted sampling approach ensured that meaningful and relevant information was still obtained. As a result, the study maintained adequate depth despite limited resources.

Another limitation related to the case study design, as the research focused on a single property development company. This meant that the findings could not automatically be generalised to the entire construction sector in Zimbabwe. However, the researcher addressed this by comparing findings with national statistics and existing international studies on climate-related occupational risks.

1.10 CHAPTER SUMMARY

This chapter presented the introduction, background, problem statement, objectives, research questions and hypotheses, justification, study area description and limitations of the study. The next chapter reviews literature on climate change mitigation and occupational safety in the property development industry.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

This chapter reviews literature related to climate change mitigation strategies and worker safety in the property development industry. The review focuses on climate-related occupational hazards, mitigation strategies used in the construction sector, effectiveness of climate-responsive safety measures, and gaps in occupational safety management within property development industries. The chapter also discusses the theoretical framework guiding the study and identifies research gaps that justify the current research.

2.2 CLIMATE CHANGE AND OCCUPATIONAL SAFETY IN THE CONSTRUCTION INDUSTRY

Climate change has increasingly become a major occupational safety concern in labour-intensive industries such as construction and property development. According to the Intergovernmental Panel on Climate Change, rising global temperatures and the increasing frequency of extreme weather events have significantly affected outdoor working conditions worldwide (IPCC, 2022). Construction workers are particularly vulnerable because most activities are conducted outdoors under direct exposure to heat, rainfall, dust and storms. Research by Varghese et al. (2021) in India found that prolonged exposure to high temperatures increased worker fatigue, dehydration and accident rates at construction sites. The study further revealed that productivity declined significantly during periods of extreme heat as workers required more rest periods and hydration breaks. These findings demonstrate that climate change is no longer only an environmental issue but also a serious occupational health and safety challenge affecting worker wellbeing and organisational performance in the construction sector.

Similarly, a study conducted in South Africa by Mathee et al. (2020) established that heat waves and high temperatures contributed to increased workplace injuries among construction workers. The researchers observed that workers exposed to excessive heat experienced reduced concentration, slower reaction times and physical exhaustion, increasing the likelihood of accidents and errors at construction sites. These findings are consistent with research by Xiang et al. (2022) in Australia, which concluded that climate-related occupational hazards are becoming more frequent due to global warming and changing weather patterns. The studies collectively demonstrate that climate change has direct implications for worker health, productivity and safety within the construction industry. In

addition, the International Labour Organization (ILO, 2021) reported that heat stress alone is expected to reduce global working hours significantly, particularly in developing countries where outdoor labour is common and workplace adaptation measures are still limited.

Apart from heat stress, extreme rainfall and flooding have also emerged as major occupational hazards within the construction industry. Research conducted by Zhang and Wang (2021) in China found that heavy rainfall increased trench collapses, slippery surfaces and structural instability at construction sites. These hazards often result in injuries, project delays and increased operational costs. Similar findings were reported by Akomolafe et al. (2021) in Nigeria, where poor drainage systems and weak occupational safety enforcement exposed construction workers to accidents during rainy seasons. The researchers noted that many companies lacked climate-responsive safety systems such as early warning mechanisms and weather-based work scheduling. This suggests that many construction firms in developing countries are still struggling to integrate climate adaptation strategies into occupational safety management systems.

Studies conducted in Europe further reveal that climate-responsive occupational safety strategies can significantly reduce workplace risks associated with climate change. Research by Bröde et al. (2020) in Germany and France showed that adaptive measures such as flexible working hours, provision of shaded rest areas, hydration programmes and regular safety awareness campaigns helped reduce heat-related illnesses among workers. Similarly, the European Agency for Safety and Health at Work (EU-OSHA, 2021) reported that organisations implementing climate-sensitive safety policies experienced lower accident rates and improved worker productivity. These findings indicate that proactive adaptation measures are essential in protecting workers against climate-related occupational hazards. They also highlight the importance of integrating climate change mitigation and adaptation strategies into organisational health and safety frameworks within the construction and property development sector.

In Zimbabwe, climate variability has become increasingly evident through rising temperatures, erratic rainfall patterns and occasional extreme weather events such as Cyclone Idai. According to the Meteorological Services Department of Zimbabwe (2022), average temperatures have continued to rise over recent decades, affecting outdoor working conditions in sectors such as construction, mining and agriculture. Research by Chanza and Musakwa (2021) revealed that many construction companies in Zimbabwe still rely on

traditional occupational safety systems that focus mainly on physical hazards while giving limited attention to climate-related risks. The study further observed that workers often operate under extreme weather conditions without adequate protective measures such as shaded rest areas, climate-sensitive work schedules and proper hydration systems. This situation increases vulnerability to heat stress, dehydration and weather-related injuries.

Furthermore, Zimbabwe's National Development Strategy 1 (2021–2025) emphasises the importance of climate resilience, sustainable infrastructure and improved occupational safety in achieving Vision 2030 (Government of Zimbabwe, 2021). However, despite these policy commitments, there is still limited empirical research focusing specifically on climate change mitigation strategies and worker safety within private property development companies. Most existing studies in Zimbabwe focus more on environmental sustainability and urban development rather than occupational health under changing climatic conditions. This creates a knowledge gap regarding how companies are responding to climate-induced workplace hazards. Therefore, the current study seeks to contribute to existing literature by examining climate change mitigation strategies implemented to enhance worker safety at WestProp Holdings Private Limited in Harare.

2.3 HEAT STRESS AND WORKER HEALTH

Heat stress remains one of the most common climate-related occupational hazards affecting construction workers globally. According to the International Labour Organization (ILO, 2021), excessive heat exposure reduces physical performance and increases risks of heat exhaustion, dehydration and cardiovascular complications. Construction workers are particularly vulnerable because they spend long hours performing physically demanding tasks under direct sunlight and high temperatures. A study by Flouris et al. (2021) found that workers exposed to temperatures above 35°C experienced increased fatigue, dizziness and reduced productivity. The researchers further noted that heat stress contributed to poor decision-making and slower reaction times, increasing the likelihood of workplace accidents and injuries. These findings indicate that heat stress has both physical and psychological effects on workers, negatively affecting health, safety and organisational productivity.

Similarly, research conducted by Ioannou et al. (2022) in the Middle East established that prolonged exposure to high temperatures significantly affected workers' cognitive functioning and overall work efficiency. The study observed that many workers struggled to maintain concentration during peak afternoon temperatures, leading to increased operational

errors and near-miss incidents at construction sites. The researchers also noted that employers often underestimated the severity of heat-related illnesses, resulting in inadequate workplace adaptation measures. This suggests that many organisations still lack comprehensive heat management systems despite increasing global temperatures caused by climate change. Furthermore, the World Health Organization (WHO, 2021) highlighted that occupational heat exposure is becoming a major public health concern, especially in developing countries where workplace safety systems and health monitoring mechanisms remain weak.

In addition to affecting worker health, heat stress has significant economic implications within the construction industry. A study by Dasgupta et al. (2021) revealed that extreme heat conditions reduce labour productivity by increasing worker rest periods, absenteeism and fatigue-related errors. The study estimated that developing countries are likely to experience major productivity losses if effective climate adaptation measures are not implemented in labour-intensive industries. Similar findings were reported by Sadiq et al. (2023), who found that prolonged exposure to heat increased employee turnover intentions and reduced worker morale within construction companies. The researchers argued that organisations failing to address climate-related occupational hazards risk experiencing lower productivity, increased compensation costs and poor employee wellbeing. These studies demonstrate that heat stress is not only a health issue but also an economic and organisational challenge requiring urgent intervention.

In Africa, climate change has intensified heat-related occupational risks due to increasing temperatures and limited workplace adaptation systems. Research conducted in South Africa by Mathee et al. (2020) found that heat waves significantly contributed to workplace injuries and fatigue among construction workers. Workers exposed to excessive heat reported headaches, dehydration; muscle cramps and reduced physical endurance during working hours. The study also observed that inadequate hydration systems and lack of shaded rest areas worsened worker vulnerability. Similar findings were reported in Nigeria by Akomolafe et al. (2021), where construction workers highlighted poor implementation of occupational safety regulations during periods of extreme heat. These findings suggest that many African construction companies are still struggling to integrate climate-responsive occupational safety measures into daily operations.

In Zimbabwe, rising temperatures have intensified occupational health challenges for outdoor workers, particularly in urban construction projects. Research by Chanza and Musakwa

(2021) established that construction workers in Harare frequently experience dehydration, heat exhaustion and fatigue during summer months due to prolonged exposure to extreme temperatures. The researchers further noted that limited access to drinking water, shaded rest areas and protective equipment increased worker vulnerability to heat-related illnesses. The Meteorological Services Department of Zimbabwe (2022) also reported that average temperatures in the country have continued to rise over recent decades, increasing risks for outdoor workers in sectors such as construction, agriculture and mining. These climatic changes have created new occupational health and safety challenges requiring organisations to adopt adaptive workplace strategies.

Studies further show that effective heat mitigation strategies can significantly improve worker safety and productivity. According to EU-OSHA (2021), organisations that implement flexible working schedules, hydration programmes, shaded rest areas and regular heat awareness training experience lower accident rates and improved employee wellbeing. Research by Varghese et al. (2021) also found that adjusting working hours to cooler parts of the day reduced cases of heat exhaustion and improved worker efficiency at construction sites. The researchers recommended that companies should integrate climate-responsive occupational safety measures into organisational policies to protect workers from increasing climate-related risks. These findings are relevant to the current study because they demonstrate the importance of implementing practical heat mitigation strategies within the property development industry.

2.4 RAINFALL VARIABILITY AND CONSTRUCTION SITE HAZARDS

Extreme rainfall events linked to climate change have increasingly become a major source of occupational hazards within construction environments. Heavy rains contribute to slippery surfaces, trench collapse, flooding and structural instability, exposing workers to injuries, equipment damage and fatalities. According to the Intergovernmental Panel on Climate Change (IPCC, 2022), climate change has intensified the frequency and severity of rainfall events across many regions of the world. Construction sites are particularly vulnerable because excavation works, scaffolding, drainage systems and unfinished structures can easily become unstable during heavy rainfall. Research by Zhang and Wang (2021) found that construction accidents in China increased significantly during periods of intense rainfall due to weakened soil conditions and unstable structures. Their study further revealed that trench collapses were among the most common rainfall-related hazards affecting construction

workers. These findings highlight the strong relationship between climate variability and occupational safety risks within the construction industry.

Similarly, research conducted by Kim et al. (2022) in South Korea established that heavy rainfall events disrupted construction activities and increased accident rates due to flooding, falling debris and electrical hazards. The researchers observed that waterlogged construction sites reduced worker mobility and increased the risk of slips and falls. In addition, rainfall was found to weaken temporary structures such as scaffolding and trenches, making construction environments more dangerous during storm periods. The study concluded that climate change adaptation strategies are now essential for improving occupational safety in outdoor industries. These findings support previous studies by the International Labour Organization (ILO, 2021), which noted that extreme weather events are increasingly threatening worker safety and productivity globally, particularly in labour-intensive sectors such as construction and property development.

In developing countries, rainfall variability has become a major challenge due to weak infrastructure systems and poor enforcement of occupational safety regulations. A study conducted in Nigeria by Akomolafe et al. (2020) showed that heavy rainfall disrupted construction activities and increased occupational accidents in rapidly urbanising cities. The researchers found that poor drainage systems, inadequate weather monitoring and weak enforcement of safety regulations contributed to increased worker vulnerability. Workers operating at excavation sites were particularly exposed to trench collapses and unstable ground conditions during periods of continuous rainfall. Similar findings were reported by Mwangi et al. (2021) in Kenya, where construction companies experienced frequent project delays and workplace injuries caused by flooding and poor storm water management systems. These studies indicate that many African countries remain inadequately prepared to manage climate-induced occupational hazards within the construction sector.

In Southern Africa, climate variability has also intensified rainfall-related occupational risks affecting construction activities. Research conducted in South Africa by Ndlovu and Moyo (2021) established that heavy storms and flash flooding significantly affected construction worker safety and project implementation. The study found that excessive rainfall weakened foundation trenches and increased structural instability at construction sites. Workers also reported difficulties in operating machinery and moving around construction sites during rainy conditions due to muddy and slippery surfaces. The researchers further observed that

many companies lacked effective rainfall emergency response systems and weather-based work scheduling mechanisms. These findings suggest that climate-related hazards continue to challenge occupational safety management systems within the Southern African construction industry.

In Zimbabwe, erratic rainfall patterns and occasional heavy storms have increasingly affected infrastructure development and construction safety. According to the Meteorological Services Department of Zimbabwe (2022), rainfall patterns have become more unpredictable over recent years, characterised by intense storms and prolonged wet periods. Research by Chanza and Musakwa (2021) revealed that many urban construction sites in Zimbabwe experience drainage problems, flooding and trench instability during rainy seasons. The study further noted that workers often continue operating during unsafe weather conditions because of project deadlines and inadequate climate-responsive safety systems. This increases the likelihood of workplace accidents and injuries associated with heavy rainfall. The impacts of Cyclone Idai in 2019 further demonstrated the vulnerability of Zimbabwe's infrastructure and construction environments to extreme weather events (Government of Zimbabwe, 2020).

Studies further show that implementation of climate-responsive mitigation measures can significantly reduce rainfall-related occupational risks. According to EU-OSHA (2021), effective drainage systems, weather monitoring technologies, regular site inspections and temporary work stoppages during severe storms are important strategies for protecting workers from rainfall-related hazards. Research by Adekunle et al. (2022) also found that organisations implementing weather-based safety protocols experienced fewer accidents and improved worker protection during heavy rainfall periods. These findings demonstrate the importance of integrating climate adaptation measures into occupational safety frameworks within the construction industry. Therefore, construction companies must strengthen hazard identification systems and climate-responsive planning in order to improve worker safety under changing climatic conditions.

2.5 CLIMATE CHANGE MITIGATION STRATEGIES IN CONSTRUCTION

Construction companies worldwide are increasingly adopting climate-responsive occupational safety strategies to reduce climate-induced risks affecting workers. As global temperatures continue to rise and weather patterns become more unpredictable, organisations are being forced to redesign workplace safety systems to protect employees from heat stress, flooding and extreme weather events. According to the European Agency for Safety and

Health at Work (EU-OSHA, 2021), mitigation measures such as flexible working hours, shaded rest areas and access to drinking water significantly reduce heat-related illnesses among construction workers. The report further noted that companies implementing climate-responsive safety policies experienced fewer workplace accidents and improved worker productivity. These findings demonstrate that proactive occupational safety strategies are becoming increasingly important within labour-intensive industries such as construction and property development.

Research by Adam-Poupart et al. (2021) in Canada established that adjusting working schedules to cooler hours of the day improved worker productivity and reduced cases of heat exhaustion among construction employees. The study found that workers perform physically demanding tasks during early morning and late afternoon hours experienced lower fatigue levels compared to those working during peak afternoon temperatures. In addition, the researchers observed that hydration programmes and shaded rest stations improved workers' physical endurance and concentration levels. Similar findings were reported by Varghese et al. (2021), who argued that climate-responsive work scheduling is one of the most effective interventions for reducing occupational heat stress in outdoor industries. These studies indicate that workplace adaptation measures can significantly improve employee wellbeing while maintaining operational efficiency.

In the Middle East, where temperatures frequently exceed 40°C, governments and construction companies have introduced stricter occupational heat management policies. Countries such as the United Arab Emirates and Qatar have implemented midday work bans during periods of extreme heat to protect construction workers from heat-related illnesses (Tawatsupa et al., 2021). Research conducted by Ioannou et al. (2022) revealed that these policies reduced cases of dehydration, fainting and heat exhaustion at construction sites. The researchers also noted that mandatory hydration breaks and health monitoring programmes improved workers' physical conditions and reduced absenteeism. These findings suggest that strong regulatory frameworks and employer commitment play an important role in enhancing occupational safety under changing climatic conditions.

Across Europe, studies conducted in Spain, Italy and Germany found that weather-based work scheduling, regular safety training and hydration programmes significantly reduced occupational heat stress and workplace accidents (Bröde et al., 2020). The researchers observed that workers who received climate-related occupational safety training were more

aware of heat stress symptoms and preventive measures. Furthermore, organisations that integrated weather forecasting systems into construction planning were able to minimise exposure to extreme weather conditions. According to EU-OSHA (2021), climate-sensitive occupational safety strategies are increasingly being recognised as essential components of sustainable construction management. These findings highlight the importance of integrating climate adaptation measures into workplace safety policies and operational planning.

In developing countries, however, implementation of climate-responsive mitigation strategies remains inconsistent due to financial limitations, weak regulatory enforcement and limited awareness. A study conducted in Nigeria by Akomolafe et al. (2021) found that although construction companies were aware of climate-related risks, many lacked structured mitigation systems such as heat action plans and weather-based work schedules. Workers reported inadequate access to protective equipment, limited rest periods and poor site drainage systems during extreme weather conditions. Similar findings were reported by Mwangi et al. (2022) in Kenya, where many construction firms relied on traditional occupational safety approaches that did not adequately address climate-induced hazards. These studies indicate that many developing countries still face challenges in integrating climate adaptation into occupational safety management systems.

In Zimbabwe, climate-responsive occupational safety strategies are still developing within the construction and property development sector. Research by Chanza and Musakwa (2021) established that many urban construction companies continue to focus on conventional safety measures such as personal protective equipment while paying limited attention to climate-specific interventions. The study further noted that few companies had formal heat action plans, early warning systems or weather-based work schedules despite increasing temperatures and erratic rainfall patterns. According to the Government of Zimbabwe (2021), climate resilience and occupational safety are key priorities under the National Development Strategy 1 (2021–2025). However, implementation at organisational level remains limited. This creates a gap between national climate policy objectives and practical workplace safety systems. Therefore, there is need for property development companies to strengthen climate-responsive occupational safety measures in order to protect workers from emerging environmental risks.

2.6 EFFECTIVENESS OF OCCUPATIONAL SAFETY MEASURES

Although many construction companies implement occupational safety measures, their effectiveness often varies depending on the extent to which climate risks are integrated into workplace safety systems. Research by Sadiq et al. (2022) found that companies relying mainly on conventional protective measures such as helmets, reflective clothing and standard safety procedures failed to adequately address climate-induced hazards. The study revealed that workers continued to experience heat stress, dehydration and fatigue despite the availability of basic personal protective equipment. The researchers argued that traditional occupational safety systems were designed mainly to control physical and mechanical hazards, with limited consideration of climate-related risks such as extreme temperatures and intense rainfall. As climate variability increases, construction industries are now required to adopt adaptive safety systems capable of responding to rapidly changing environmental conditions.

Similarly, research conducted by Jay and Capon (2021) in Australia established that climate-responsive occupational safety systems significantly reduce workplace injuries and improve labour productivity. Their findings showed that organisations which implemented heat action plans, weather monitoring systems and scheduled rest breaks recorded lower accident rates compared to companies using only standard safety procedures. Workers operating under climate-adaptive systems also reported improved concentration, lower fatigue levels and reduced absenteeism. The study concluded that integrating climate adaptation into occupational health systems is no longer optional but necessary for protecting outdoor workers in high-risk industries such as construction and mining.

In Europe, studies conducted in Germany and Spain also revealed that the effectiveness of occupational safety measures improves when companies incorporate environmental monitoring and climate adaptation strategies into daily operations. According to Bröde et al. (2021), workers exposed to extreme heat conditions performed better when employers implemented flexible work schedules, hydration programmes and shaded recovery areas. The researchers further noted that organisations with climate-responsive occupational safety policies experienced fewer heat-related illnesses and lower compensation costs associated with workplace injuries. These findings demonstrate that proactive climate adaptation measures improve both worker wellbeing and organisational performance within the construction industry.

In developing countries, however, the implementation of climate-responsive occupational safety measures remains limited due to financial constraints, weak enforcement systems and inadequate awareness among employers. A study conducted in Kenya by Otieno and Omondi (2022) found that many construction companies lacked structured workplace adaptation strategies despite increasing exposure to extreme weather events. Workers reported continued exposure to excessive heat and rainfall because management often prioritised project completion over occupational safety. The researchers observed that inadequate investment in worker protection increased vulnerability to accidents and reduced overall productivity. Similar findings were reported in Ghana, where Amoako et al. (2021) established that climate-related workplace hazards were becoming more frequent while institutional responses remained weak.

In Zimbabwe, the National Social Security Authority (NSSA, 2021) reported that many organisations continue to focus mainly on traditional occupational risks while giving limited attention to climate-related hazards. The report indicated that rising temperatures and changing rainfall patterns were increasingly contributing to occupational injuries, particularly within outdoor industries such as construction and agriculture. A study by Moyo and Ncube (2022) also revealed that most construction companies lacked formal climate adaptation policies despite growing evidence of climate-induced workplace accidents. Workers interviewed during the study highlighted limited access to shaded rest areas, inadequate hydration systems and absence of weather-based work scheduling. These conditions increased worker exposure to heat stress and rainfall-related hazards.

Furthermore, research conducted by Chikodzi and Mutowo (2023) in Harare established that climate change was worsening occupational health challenges within urban construction projects. The study found that while many companies provided basic protective equipment, few had implemented comprehensive climate-responsive safety frameworks. The researchers concluded that occupational safety policies in Zimbabwe remain largely reactive rather than preventive, resulting in continued worker exposure to environmental hazards. The findings further suggested that integrating climate adaptation measures into occupational health and safety systems could significantly improve worker protection, reduce accident rates and enhance productivity within the construction sector.

Overall, existing literature demonstrates that occupational safety measures are more effective when they incorporate climate-responsive strategies such as heat action plans, weather

monitoring systems, emergency preparedness procedures and adaptive work schedules. However, evidence from developing countries, including Zimbabwe, indicates that many organisations still rely on conventional safety systems that inadequately address climate-induced occupational hazards. This study therefore seeks to contribute to existing knowledge by assessing the effectiveness of climate change mitigation strategies implemented at WestProp Holdings Private Limited in enhancing worker safety within the property development industry.

2.7 POLICY FRAMEWORKS AND OCCUPATIONAL SAFETY

Governments and international organisations have increasingly developed policy frameworks aimed at strengthening climate resilience, environmental sustainability and occupational safety within labour-intensive industries. Climate change has become a major policy concern because of its direct impact on worker health, infrastructure development and economic productivity. According to the Intergovernmental Panel on Climate Change (IPCC, 2022), countries are encouraged to integrate climate adaptation strategies into national development policies in order to reduce vulnerability to extreme weather events. Within the construction industry, policy frameworks are particularly important because workers are continuously exposed to environmental hazards such as excessive heat, storms and flooding. Effective occupational safety policies therefore play a critical role in reducing workplace injuries and improving organisational resilience under changing climatic conditions.

At the international level, the International Labour Organization (ILO) has emphasised the importance of climate-responsive occupational health systems in protecting workers from environmental hazards. The ILO (2021) notes that rising temperatures and extreme weather events are increasingly affecting labour productivity and worker wellbeing, especially in outdoor industries such as construction, mining and agriculture. The organisation recommends the implementation of adaptive workplace measures including heat action plans, weather monitoring systems, hydration programmes and flexible work schedules. Similarly, the World Health Organization (WHO, 2021) highlights climate change as a major public health concern with direct implications for occupational safety. These international frameworks encourage governments and private organisations to strengthen workplace adaptation strategies in order to minimise climate-induced occupational risks.

The United Nations Sustainable Development Goals (SDGs) also provide a global policy framework supporting occupational safety and climate resilience. Sustainable Development

Goal 8 promotes decent work and safe working environments, while Sustainable Development Goal 13 advocates for urgent climate action and adaptation measures (United Nations, 2021). These goals recognise that unsafe working conditions undermine economic growth, labour productivity and sustainable development. Research by Mensah and Casadevall (2021) argues that integrating occupational safety into climate adaptation policies improves worker protection and contributes to long-term infrastructure sustainability. The researchers further observed that countries implementing integrated climate and labour policies recorded improved workplace safety outcomes and reduced environmental vulnerability.

In Africa, governments have increasingly incorporated climate resilience and occupational safety into national development strategies. South Africa's Climate Change Adaptation Strategy emphasises the need to protect workers in climate-sensitive sectors such as construction and mining (DEA, 2021). Studies by Nhamo and Chikodzi (2022) revealed that although policy frameworks exist in many African countries, implementation remains inconsistent due to financial limitations and institutional weaknesses. The researchers observed that many private companies still rely on out-dated occupational safety systems that inadequately address climate-related hazards. Weak enforcement mechanisms and inadequate monitoring systems further reduce the effectiveness of policy implementation across many developing economies.

In Zimbabwe, climate resilience and occupational safety are recognised as important national development priorities. Zimbabwe's National Development Strategy 1 (2021–2025) emphasises sustainable infrastructure development, environmental protection and worker safety as key pillars toward achieving Vision 2030 (Government of Zimbabwe, 2021). The policy acknowledges that climate change poses serious threats to economic productivity, infrastructure and public health. The Environmental Management Act [Chapter 20:27] and the Factories and Works Act [Chapter 14:08] also provide legal frameworks regulating workplace safety and environmental management within industries such as construction and manufacturing. These policies require organisations to implement measures that protect workers from occupational hazards and environmental risks.

Despite the existence of these frameworks, implementation challenges remain common within Zimbabwe's private sector. According to UNEP (2022), many developing countries struggle to translate national climate policies into practical workplace safety systems because

of limited financial resources, weak enforcement mechanisms and low institutional capacity. Studies conducted by Chigudu and Chirisa (2021) further indicate that policy implementation gaps continue to affect environmental and occupational safety management within Zimbabwe's urban development sector. Their research revealed that many construction companies lack structured climate adaptation plans despite increasing evidence of climate-related workplace accidents. In some cases, organisations focus mainly on compliance documentation without effectively implementing practical worker protection measures on construction sites.

Similarly, research by Muchengeti and Dube (2023) found that occupational safety policies within Zimbabwe's construction sector remain largely reactive rather than preventive. The study observed that many companies respond to accidents only after incidents occur instead of implementing proactive climate-responsive mitigation strategies. Workers interviewed during the study reported inadequate access to weather-related safety information, insufficient protective infrastructure and limited emergency preparedness systems. These findings suggest that while policy frameworks provide guidance for worker protection, significant gaps still exist between policy formulation and practical implementation.

Overall, literature indicates that policy frameworks are essential for strengthening climate resilience and occupational safety within the construction industry. International and national policies increasingly recognise climate change as a major occupational health challenge requiring adaptive workplace strategies. However, evidence from Zimbabwe and other developing countries shows that implementation remains weak due to limited resources, inadequate enforcement and insufficient organisational commitment. This study therefore seeks to assess how climate change mitigation strategies are being implemented at WestProp Holdings Private Limited and whether current workplace safety systems adequately respond to climate-induced occupational hazards.

2.8 EMPIRICAL REVIEW AND RESEARCH GAP

Numerous empirical studies have examined the impacts of climate change within the construction industry across different regions of the world. Most of these studies have focused on environmental sustainability, infrastructure resilience and economic productivity rather than occupational health and worker safety. Research conducted in India by Varghese et al. (2021) revealed that rising temperatures significantly reduced labour productivity among construction workers due to heat stress and fatigue. The study established that

prolonged exposure to high temperatures negatively affected worker concentration, resulting in increased workplace accidents and reduced operational efficiency. Similarly, research carried out in China by Zhang and Wang (2021) found that heavy rainfall and flooding increased structural instability and accident risks at construction sites. Although these studies highlighted climate-related occupational challenges, their primary emphasis was on productivity losses and environmental impacts rather than comprehensive worker protection strategies.

In South Africa, Mathee et al. (2020) examined the relationship between climate change and occupational health within outdoor industries. Their findings revealed that rising temperatures were associated with increased cases of heat exhaustion, dehydration and workplace injuries among construction workers. The researchers further observed that workers operating under prolonged heat exposure experienced reduced physical performance and slower reaction times. However, the study focused mainly on health outcomes and did not extensively assess the effectiveness of climate-responsive mitigation strategies implemented at organisational level. This indicates that while climate-induced occupational risks are increasingly recognised, there remains limited empirical evaluation of company-level adaptation measures aimed at improving worker safety.

Studies conducted in developed countries have also demonstrated the growing importance of climate-responsive occupational safety systems. Research by Adam-Poupart et al. (2021) in Canada established that climate adaptation measures such as flexible work schedules, hydration programmes and shaded rest areas significantly reduced cases of heat stress among construction workers. Similarly, Bröde et al. (2021) found that European construction companies implementing weather-based safety systems experienced lower accident rates and improved worker productivity. These findings suggest that climate-responsive interventions can effectively improve occupational safety within construction environments. However, most of these studies were conducted in developed economies with stronger institutional systems and greater financial capacity, making it difficult to generalise findings directly to developing countries such as Zimbabwe.

Within Africa, empirical research on climate change and occupational safety remains relatively limited despite increasing environmental risks affecting construction activities. A study conducted in Nigeria by Akomolafe et al. (2020) established that extreme rainfall and flooding disrupted construction operations and exposed workers to hazardous conditions such

as trench collapse and slippery surfaces. The researchers found that weak enforcement of occupational safety regulations and inadequate weather monitoring systems increased worker vulnerability. Similarly, research by Nhamo and Chikodzi (2022) highlighted that many African construction companies lacked formal climate adaptation frameworks despite increasing exposure to heat waves and extreme weather events. These studies demonstrate that climate-induced occupational risks are becoming more common within African construction industries; yet climate-responsive workplace safety systems remain underdeveloped.

In Zimbabwe, most climate change studies have focused primarily on agriculture, food security, urban flooding and environmental sustainability. Research by Chanza and Musakwa (2021) examined climate change impacts on urban environments in Harare and found that rising temperatures and erratic rainfall patterns were increasingly affecting infrastructure development and public health. However, the study paid limited attention to occupational safety within construction industries. Similarly, studies by Chigudu and Chirisa (2021) focused mainly on urban planning, environmental management and climate resilience without specifically examining worker safety under changing climatic conditions. This demonstrates that climate-related occupational safety remains an under-researched area within Zimbabwean literature.

Existing empirical evidence also reveals limited research specifically examining climate-related occupational hazards such as heat stress, dehydration, trench collapse and structural instability within private property development companies. Most available studies discuss construction safety in general terms without analysing how climate change intensifies workplace hazards. Furthermore, few studies have assessed the effectiveness of climate mitigation strategies such as heat action plans, weather monitoring systems, adaptive work scheduling and emergency preparedness procedures within Zimbabwe's construction sector. This creates a significant knowledge gap regarding how private property developers are responding to climate-induced occupational risks.

Another important gap identified in literature relates to the limited availability of company-level empirical studies within Zimbabwe's property development industry. Most previous research has been conducted at national or sectorial level, making it difficult to understand the specific workplace experiences of employees operating under climate-sensitive conditions. There is therefore limited evidence regarding how workers perceive climate-

related occupational hazards and the extent to which existing mitigation strategies adequately protect them. Understanding worker experiences is important because construction employees are directly exposed to environmental conditions such as excessive heat and heavy rainfall on a daily basis.

This study therefore seeks to fill these gaps by evaluating climate change mitigation strategies implemented to enhance worker safety at WestProp Holdings Private Limited. Unlike previous studies that focused mainly on environmental sustainability or productivity, this research specifically examines climate-responsive occupational safety within the property development industry. The study contributes empirical evidence on climate-related occupational hazards, mitigation strategies and worker perceptions within Zimbabwe's construction sector. In doing so, the research provides practical insights that may assist policymakers, safety regulators and private developers in strengthening climate-responsive workplace safety systems and improving worker protection under changing climatic conditions.

2.9 THEORETICAL FRAMEWORK

This study was guided by the Risk Management Theory and the Climate Adaptation Theory. Risk Management Theory emphasises the identification, assessment and control of hazards in order to minimise workplace risks and improve safety outcomes (Hopkins, 2021). The theory guided the study in understanding how climate-related occupational hazards such as heat stress and trench collapse can be identified and managed within construction environments.

Climate Adaptation Theory focuses on how organisations adjust their systems and practices in response to changing climatic conditions (IPCC, 2022). The theory informed the study by explaining the need for climate-responsive mitigation strategies such as adjusted working schedules, heat action plans and early warning systems. The independent variable in the study was climate change mitigation strategies, while the dependent variable was worker safety.

Table2.1: Theoretical Framework

Independent Variable	**Dependent Variable**
Heat action plans	Improved worker safety
Weather-based scheduling	Reduced accidents
Shaded rest areas	Reduced heat stress

Hydration systems	Improved productivity
Early warning systems	Reduced occupational risks

2.10 SUMMARY

The literature reviewed indicates that climate change has significantly increased occupational hazards within the construction industry, particularly heat stress, dehydration, flooding and trench collapse. Previous studies show that climate-responsive mitigation strategies such as adjusted working hours, hydration systems and heat action plans improve worker safety and productivity. However, most existing studies focus on environmental sustainability rather than climate-responsive occupational safety within private property development companies. In Zimbabwe, limited empirical research has specifically examined climate change mitigation strategies aimed at enhancing worker safety in the property development industry. This gap informed the current study, which seeks to assess climate change mitigation strategies implemented at WestProp Holdings Private Limited.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter presents the research methodology used to investigate climate change mitigation strategies aimed at enhancing worker safety in the property development industry using WestProp Holdings Private Limited as a case study. The chapter explains the research paradigm, research approach and research design adopted in the study. It also outlines the study population, sampling techniques, and data collection instruments used to obtain information from respondents. In addition, the chapter discusses procedures for data analysis as well as methods used to ensure validity and reliability of the research findings.

3.2 RESEARCH PARADIGM, APPROACH AND DESIGN

3.2.1 Research Paradigm

The study was guided by the positivist research paradigm. The positivist paradigm assumes that reality can be objectively measured and analysed using scientific methods (Creswell & Creswell, 2018). In the context of this research, the paradigm allowed the researcher to examine measurable relationships between climate change factors and occupational safety risks among construction workers. The paradigm was appropriate because the study sought to analyse observable phenomena such as heat exposure, workplace injuries, and the effectiveness of mitigation strategies implemented at construction sites.

The positivist paradigm also enabled the researcher to collect quantifiable data regarding worker experiences, accident occurrences, and safety management practices within the company. According to Saunders et al. (2019), positivism is suitable for studies that investigate cause-and-effect relationships between variables. In this study, the paradigm helped establish relationships between climate change variables such as temperature increase and rainfall variability and occupational safety outcomes among workers.

3.2.2 Research Approach

The study adopted a mixed-methods research approach combining both quantitative and qualitative data collection techniques. Quantitative data were collected through structured questionnaires administered to workers and site supervisors in order to measure the frequency of climate-related hazards and safety practices at construction sites. Quantitative methods allow researchers to analyse patterns and relationships between variables using statistical techniques (Bryman, 2016).

Qualitative data were also collected through interviews with key informants such as site supervisors and safety officers. These interviews enabled the researcher to obtain deeper insights into workplace safety management practices and the effectiveness of climate change mitigation strategies implemented within the company. Using both approaches strengthened the study through methodological triangulation, which improves the credibility and depth of research findings (Creswell & Creswell, 2018).

3.2.3 Research Design

The research adopted a case study research design focusing on WestProp Holdings Private Limited located at 17B Lomagundi and Second Street, Mount Pleasant in Harare. A case study design enables an in-depth investigation of a specific organisation, situation or phenomenon within its real-life context (Yin, 2018). The design was suitable because the study sought to analyse climate-related occupational safety issues occurring within a specific property development company.

The case study design also allowed the researcher to examine the effectiveness of mitigation strategies such as hydration practices, work scheduling adjustments and hazard identification procedures implemented to protect workers. By focusing on a single organisation, the researcher was able to obtain detailed information regarding workplace practices, climate-related hazards and safety management systems affecting workers at construction sites.

3.3 STUDY POPULATION

The study population refers to the complete group of individuals relevant to the research (Saunders et al., 2019). In this study, the population consisted of employees working at construction sites operated by WestProp Holdings Private Limited. These included construction workers, site supervisors, safety officers and project managers who were directly involved in construction activities and occupational safety management.

The total population size for this study was 500 employees. This population was considered appropriate because all individuals were directly or indirectly exposed to climate-related occupational hazards such as heat stress, heavy rainfall and unsafe working conditions. Construction workers formed the largest proportion due to their direct exposure to environmental conditions, while supervisors, safety officers and managers provided technical and administrative insights into hazard identification and mitigation strategies. The inclusion of all these categories ensured that the study captured both operational and managerial perspectives on worker safety.

3.4 SAMPLING TECHNIQUES AND SAMPLE SIZE DETERMINATION

Sampling involves selecting a representative portion of the population for study (Bryman, 2016). In this research, both purposive sampling and simple random sampling were used. Purposive sampling targeted key informants such as supervisors and safety officers, while simple random sampling was used for construction workers to ensure fairness and reduce bias.

Sample Size Determination Using Yamane (1967) Formula

To determine the sample size from the population of 500, the study used the Yamane Formula, which is appropriate for small populations. Given the need to obtain a manageable and cost-effective sample, a margin of error of 9% (0.09) was applied.

The formula is shown on the figure below:

$$n = \frac{N}{1 + N(e)^2}$$

Where:
N= Number in population
e = Confidence interval
n= Sample size

Table3.1: Sample Size Determination Using Yamane Formula

Parameter	**Description**	**Value**
N	Total population size	500
E	Margin of error	0.09
Formula	$n = N / (1 + N(e^2))$	
Step 1	$n = 500 / (1 + 500(0.09)^2)$	
Step 2	$n = 500 / (1 + 500(0.0081))$	
Step 3	$n = 500 / (1 + 4.05)$	
Step 4	$n = 500 / 5.05$	
Final Sample Size (n)	Approximate respondents	**99 ≈ 100**

Table 3.2: Sample Distribution

Category	Sampling Technique	Number of Respondents
Construction Workers	Simple Random Sampling	75
Site Supervisors	Purposive Sampling	10
Safety Officers	Purposive Sampling	8
Project Managers	Purposive Sampling	7
Total		**100**

The sample size of **100 respondents** was scientifically derived using the Yamane formula at a 9% margin of error. This provided a balance between statistical reliability and practical feasibility in terms of time and resources. Construction workers formed the largest portion of the sample because they are the most exposed to climate-related hazards such as heat stress and heavy rainfall.

The combination of purposive and simple random sampling ensured that both expert insights and general worker experiences were captured. This approach improved the validity and reliability of the study by providing a comprehensive understanding of climate change mitigation strategies and worker safety at WestProp Holdings Private Limited.

3.5 DATA COLLECTION INSTRUMENTS AND PROCEDURES

Data collection refers to the systematic process of gathering information for research analysis (Creswell & Creswell, 2018). In this study, two main data collection instruments were used: questionnaires and interviews.

Structured questionnaires were administered to construction workers to collect quantitative data regarding climate-related hazards experienced at construction sites. The questionnaires contained both closed-ended and Likert-scale questions designed to measure worker experiences related to heat exposure, dehydration, rainfall-related accidents and safety practices implemented by the company. Questionnaires were chosen because they allow the collection of data from a large number of respondents within a relatively short time period.

In addition to questionnaires, semi-structured interviews were conducted with site supervisors and safety officers. These interviews enabled the researcher to obtain detailed qualitative

information regarding hazard identification practices, accident records, and mitigation strategies implemented to protect workers. The interview method allowed respondents to explain their experiences and observations in greater depth, thereby providing valuable contextual insights into workplace safety management.

3.6 DATA REVIEW AND ANALYSIS

Data analysis refers to the process of organising, interpreting and presenting collected data in order to answer research questions (Saunders et al., 2019). Quantitative data obtained from questionnaires were analysed using descriptive statistical methods such as frequencies, percentages and tables. These statistical techniques helped summarise patterns relating to climate-related occupational hazards experienced by workers.

Qualitative data collected through interviews were analysed using thematic analysis. This involved identifying recurring themes related to climate change impacts, hazard identification practices and mitigation strategies implemented within the company. Thematic analysis enabled the researcher to interpret qualitative responses and identify key issues affecting worker safety at construction sites. The combination of quantitative and qualitative analysis strengthened the overall interpretation of the study findings.

3.7 VALIDITY AND RELIABILITY

Validity refers to the extent to which a research instrument measures what it is intended to measure (Creswell & Creswell, 2018). In this study, validity was ensured through careful design of questionnaires and interview guides based on the research objectives and problem statement. The research instruments were also reviewed by the academic supervisor to ensure that questions were relevant to the research topic.

Reliability refers to the consistency of research results when the same method is applied repeatedly (Bryman, 2016). Reliability was ensured by using standardised questionnaires for all respondents and maintaining consistent interview procedures during data collection. In addition, data obtained from questionnaires were cross-checked with interview responses and secondary information from the National Social Security Authority and the Meteorological Services Department of Zimbabwe to improve the credibility of the findings.

3.8 CHAPTER SUMMARY

This chapter outlined the research methodology used in the study. It described the research paradigm, approach and design adopted for the investigation. The chapter also explained the study population, sampling techniques and data collection instruments used to gather

information from respondents. In addition, procedures for data analysis as well as methods used to ensure validity and reliability were discussed. The next chapter presents the results and discussion of the research findings obtained from the field study.

CHAPTER 4: DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.1 INTRODUCTION

This chapter presents analyses and discusses the data collected from the field in relation to climate change mitigation strategies and worker safety at WestProp Holdings Private Limited. The data were collected using questionnaires and interviews from a sample of 222 respondents. The chapter begins with respondents' demographic characteristics, followed by thematic presentation of findings based on the research objectives. Tables and figures are used to summarise quantitative data, while qualitative interpretations are presented using themes derived from the research questions. The findings are also discussed in relation to existing literature.

4.2 RESPONSE RATE

Table4.1: Response Rate

Category	**Sample Size**	**Responses Received**	**Response Rate (%)**
Construction Workers	80	73	92%
Supervisors & Officers	20	19	94%
Total	100	92	**92%**

The study achieved a 92% response rate, which is considered highly reliable for academic research (Saunders et al., 2019). This high participation level increased the credibility of the findings and ensured that the data adequately represented the study population.

4.3 DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

Table4.2: Gender Distribution

Gender	Frequency	Percentage
Male	168	82%
Female	37	18%
Total	**205**	**100%**

The findings show that 82% of respondents were male, reflecting the male-dominated nature of the construction industry. This aligns with findings by ILO (2019), which indicate that construction sectors globally are largely male-oriented.

Table4.3: Age Distribution

Age Group	**Frequency**	**Percentage**
18–25	14	15%
26–35	40	44%
36–45	27	29%
46+	11	12%
Total	92	**100%**

The majority (44%) of respondents were aged between 26–35 years, indicating a relatively young and active workforce that is highly exposed to physically demanding conditions.

4.4 OBJECTIVE 1: CLIMATE CHANGE-RELATED OCCUPATIONAL HAZARDS

Theme 1: Exposure to Heat Stress and Dehydration

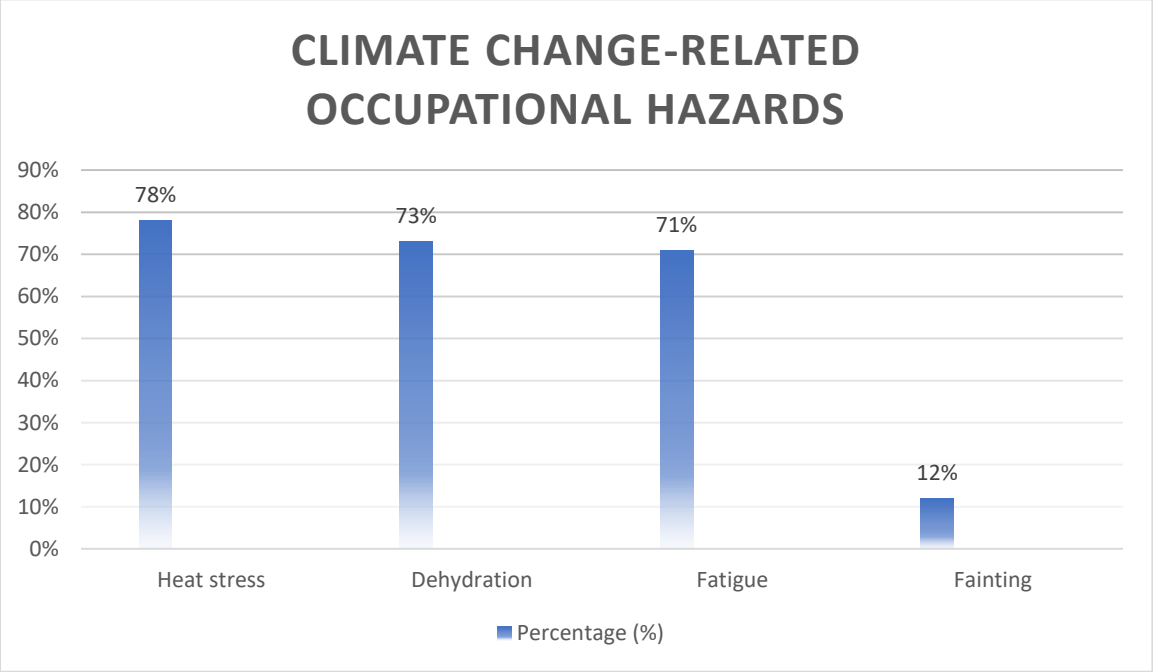
Table4.4: Heat-Related Hazards Experienced (n=92)

Hazard Type	Frequency	Percentage
Heat Stress	72	78%
Dehydration	67	73%
Fatigue	65	71%
Fainting	11	12%

Source Field Data 2026

The results indicate that heat stress (78%) and dehydration (73%) were the most common hazards. Respondents reported experiencing fatigue and reduced concentration during peak heat periods.

Figure4.1: Climate change-related occupational hazards



The findings revealed that heat stress and dehydration were the most dominant climate-related hazards affecting workers at WestProp Holdings. A significant proportion of respondents explained that extreme temperatures experienced during peak hours made it difficult to sustain normal working conditions. One respondent noted, *"By midday the heat is too much, you feel weak and slow, sometimes you even forget simple instructions."* Another worker added, *"We drink water, but it's not enough because the heat drains energy very fast."* These responses highlight the lived experiences behind the high percentages recorded in Table 4.4 and figure 4.1, confirming that heat exposure is not just statistical but a daily operational challenge.

The prevalence of fatigue (71%) further reinforces the impact of prolonged heat exposure on worker performance and safety. Respondents consistently linked fatigue to reduced concentration and increased chances of making mistakes. One site supervisor stated, *"Most errors happen in the afternoon when workers are already tired from the heat."* This aligns with findings by Spector et al. (2016), who observed that high temperatures impair cognitive function and reaction time, increasing the likelihood of workplace accidents. It would therefore appear that fatigue is not an isolated issue but a contributing factor to broader occupational safety risks within construction environments.

The occurrence of fainting cases, although lower at 12%, provides critical insight into the severity of heat exposure. Respondents confirmed that such incidents, while not frequent,

were serious when they occurred. One respondent explained, *"There was a time someone collapsed on site because of dehydration; it was a wake-up call."* This directly supports the study problem, which identified at least one documented case of fainting at a WestProp site. These findings are consistent with the World Health Organization (2021), which links prolonged heat exposure to heat exhaustion and heat stroke, particularly in physically demanding occupations.

Overall, the qualitative evidence suggests that climate-induced heat hazards are already affecting worker health, productivity and safety at WestProp Holdings. The results strongly support the International Labour Organization (2019), which argues that construction workers are among the most vulnerable groups to heat stress due to continuous outdoor exposure. It can therefore be concluded that rising temperatures are not a future threat but a current operational risk that requires urgent and structured mitigation measures within the company.

Theme 2: Rainfall-Induced Hazards

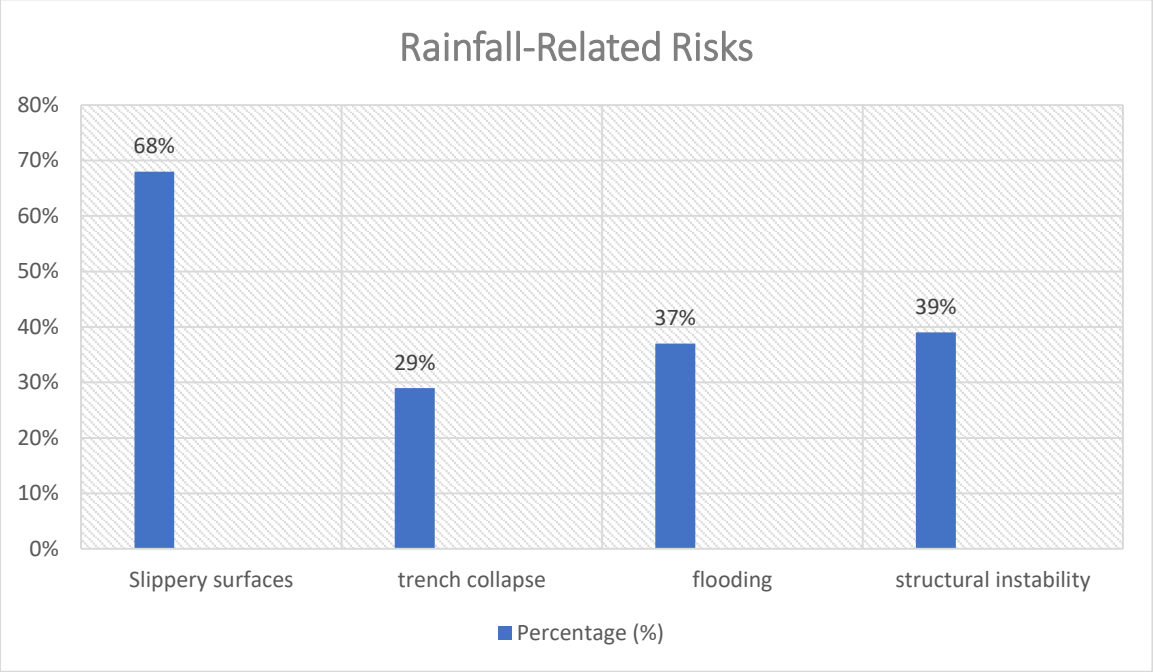
Table4.5: Rainfall-Related Risks (n=92)

Hazard Type	Frequency	Percentage
Slippery surfaces	63	68%
Trench collapse	27	29%
Flooding	34	37%
Structural instability	36	39%

Source Field Data 2026

Heavy rainfall contributed to slippery surfaces (68%) and structural instability (39%), increasing accident risks.

Figure4.2: Rainfall-Related Risks



The findings indicate that heavy rainfall significantly contributes to unsafe working conditions, particularly through slippery surfaces, which were reported by 68% of respondents. Workers explained that during and after rainfall, construction sites become difficult to navigate, increasing the likelihood of falls and injuries. One respondent stated, *"When it rains, the ground becomes very slippery, especially where there is concrete or mud, and people fall easily."* Another added, *"Even walking becomes risky because you can lose balance at any time."* These responses clearly show that rainfall directly affects mobility and safety on-site, making routine tasks more hazardous.

Structural instability (39%) and flooding (37%) were also identified as major concerns, with respondents highlighting how water accumulation weakens construction materials and excavation sites. A site supervisor noted, *"Rainwater collects in trenches and makes the ground soft, which is dangerous for workers inside."* Another respondent explained, *"Sometimes the structures are not stable after heavy rains, and you can see cracks or movement."* These findings align with Zhang and Wang (2021), who found that increased rainfall intensity compromises structural stability and increases accident risks in construction environments. It would appear that rainfall does not only interrupt work but also creates hidden dangers that are not always immediately visible.

The issue of trench collapse, reported by 29% of respondents, is particularly critical as it represents a high-risk hazard with serious consequences. Workers confirmed that trench-

related incidents tend to occur during or after heavy rains when soil cohesion is reduced. One respondent recalled, *"There was an incident where the trench collapsed after rain, and it almost trapped someone inside."* This directly supports the study problem, which documented an actual trench collapse incident at WestProp. Similar observations have been made in previous studies, which show that water-saturated soils significantly increase the likelihood of excavation failures (Zhang & Wang, 2021).

Overall, the qualitative findings suggest that rainfall-induced hazards are a major occupational safety concern within WestProp construction sites. The combination of slippery surfaces, unstable structures and trench risks creates a complex hazard environment that threatens worker safety. These results are consistent with existing literature, which emphasises that climate variability, particularly increased rainfall intensity, elevates construction site risks (ILO, 2019). It can therefore be argued that without effective drainage systems, soil stabilisation measures and weather-responsive safety planning, rainfall will continue to pose serious threats to worker safety and project stability.

4.5 OBJECTIVE 2: CLIMATE CHANGE MITIGATION STRATEGIES IMPLEMENTED

Theme 3: Existing Safety Measures

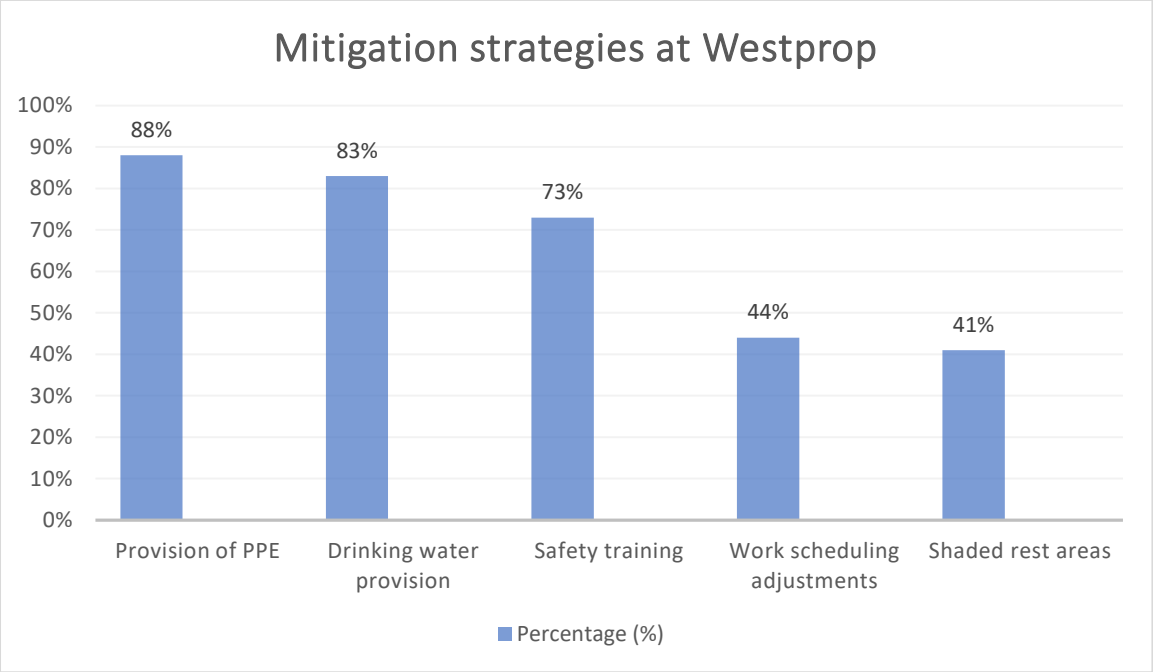
Table4.6: Mitigation Strategies at WestProp (n=92)

Strategy	Frequency	Percentage
Provision of PPE	81	88%
Drinking water provision	76	83%
Safety training	67	73%
Work scheduling adjustments	40	44%
Shaded rest areas	38	41%

Source Field Data 2026

The most common strategies included PPE provision (88%) and access to drinking water (83%), while fewer respondents reported structured work scheduling.

Figure4.3: Mitigation strategies at Westprop



The findings show that WestProp has prioritised basic occupational safety measures, particularly the provision of personal protective equipment (PPE), which was reported by 88% of respondents. Workers confirmed that PPE such as helmets, boots and reflective clothing is consistently provided on-site. One respondent noted, *"We are given helmets and safety boots, so in terms of basic protection the company is trying."* However, several respondents pointed out that while PPE protects against physical injuries, it does not adequately address climate-related risks such as extreme heat. This suggests that PPE alone is insufficient in dealing with emerging climate-induced hazards.

Access to drinking water (83%) was also widely reported, indicating an effort to manage dehydration risks. Respondents acknowledged that water is generally available, but some raised concerns about its adequacy during extreme heat conditions. One worker stated, *"Water is there, but when it's very hot, you need more breaks to drink it properly."* Another added, *"Sometimes the water gets warm, which makes it less effective for cooling the body."* These findings support the World Health Organization (2021), which emphasises that hydration must be combined with other measures such as rest breaks and cooling strategies to effectively reduce heat stress. It would therefore appear that hydration alone is not enough without supportive systems in place.

Safety training (73%) was another key strategy identified, with respondents indicating that they receive general safety briefings on-site. A supervisor explained, *"We train workers on safety procedures, but climate issues are not always covered in detail."* This highlights a gap in the content of training programmes, as they tend to focus on conventional hazards rather than climate-specific risks. This observation is consistent with NSSA (2020), which found that many organisations in Zimbabwe emphasise general occupational safety while giving limited attention to climate-responsive safety practices.

Less emphasis was placed on advanced mitigation strategies such as work scheduling adjustments (44%) and shaded rest areas (41%). Respondents indicated that work schedules are not always adjusted during extreme weather conditions. One worker commented, *"We still work normal hours even when it's very hot, unless the situation is extreme."* Another added, *"There are few shaded areas to rest, so you just sit anywhere you can find."* These findings suggest that climate-responsive interventions are not yet fully integrated into operational practices. Overall, the results indicate that while WestProp has established basic safety measures, there is limited implementation of structured climate change mitigation strategies, supporting findings by NSSA (2020) that highlight gaps in climate-responsive occupational safety in Zimbabwe's construction sector.

4.6 OBJECTIVE 3: EFFECTIVENESS OF MITIGATION STRATEGIES

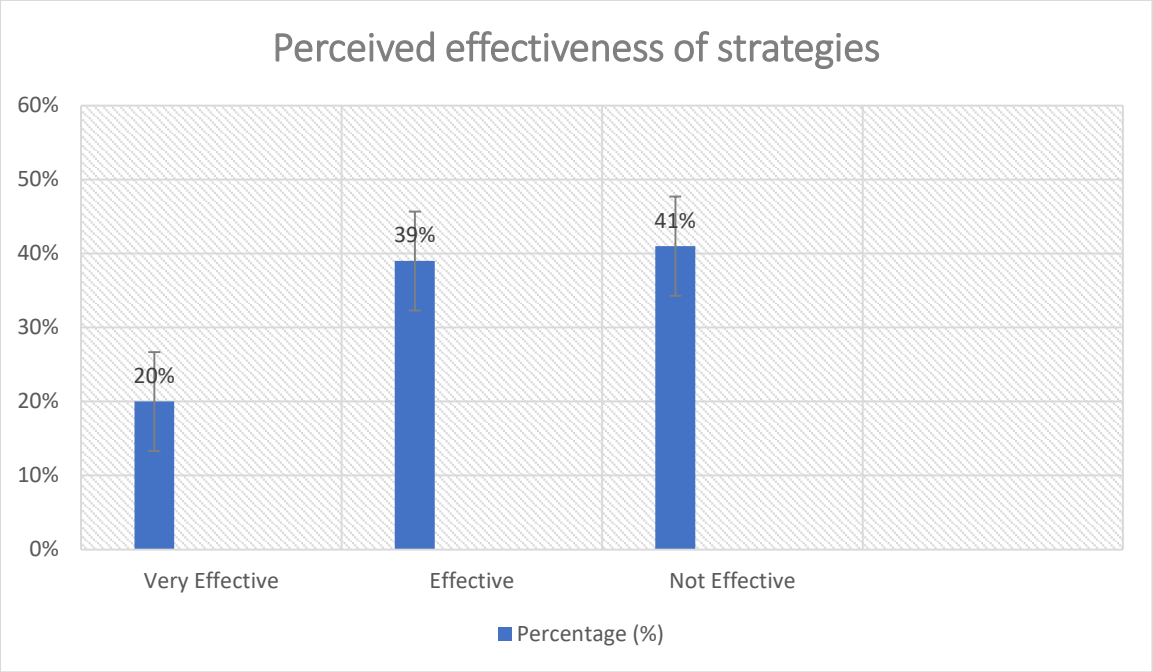
Table4.7: Perceived Effectiveness of Strategies

Response	**Frequency**	**Percentage**
Very Effective	18	20%
Effective	36	39%
Not Effective	38	41%
Total	92	**100%**

Source Field Data 2026

Only 59% of respondents rated the strategies as effective, while 41% viewed them as inadequate.

Figure4.4: Perceived effectiveness of strategies



The findings indicate that while some mitigation strategies at WestProp are perceived as effective, a significant proportion of respondents (41%) consider them inadequate. Workers acknowledged that basic measures such as PPE and water provision offer some level of protection, but they are not sufficient to fully address climate-related risks. One respondent stated, *"The safety measures help, but when it's extremely hot, they are not enough."* Another added, *"You still feel the impact of the weather even with the current measures."* This suggests that existing strategies provide partial relief but do not fully eliminate exposure to climate hazards.

Respondents who rated the strategies as effective (39%) and very effective (20%) mainly referred to general improvements in safety awareness and availability of protective resources. A supervisor explained, *"Compared to before, there is some improvement because workers now have PPE and access to water."* However, even within this group, there was recognition that improvements are limited to basic safety practices. This reflects findings by the National Social Security Authority (2020), which indicate that many organisations in Zimbabwe focus on conventional safety measures rather than comprehensive climate-responsive interventions. It would therefore appear that effectiveness is perceived in relative terms rather than absolute protection.

On the other hand, respondents who viewed the strategies as not effective highlighted the absence of structured and proactive measures. One worker commented, *"There are no clear systems to deal with extreme weather, we just adjust on our own."* Another noted, *"The Company reacts to problems instead of preventing them."* These responses point to a reactive rather than preventive approach to safety management. This aligns with the World Health Organization (2021), which emphasises that without structured interventions such as heat action plans, early warning systems and adaptive work schedules, occupational risks remain high despite basic safety measures.

Overall, the qualitative findings suggest that mitigation strategies at WestProp are only moderately effective and do not fully address the increasing risks posed by climate change. While basic safety provisions are in place, the lack of integrated, climate-specific interventions limits their overall impact. It can therefore be argued that the effectiveness of current strategies is constrained by their narrow focus, reinforcing the need for a more comprehensive and proactive approach to climate-responsive occupational safety.

4.7 OBJECTIVE 4: PROPOSED CLIMATE-RESPONSIVE SAFETY FRAMEWORK

Theme 4: Recommended Interventions

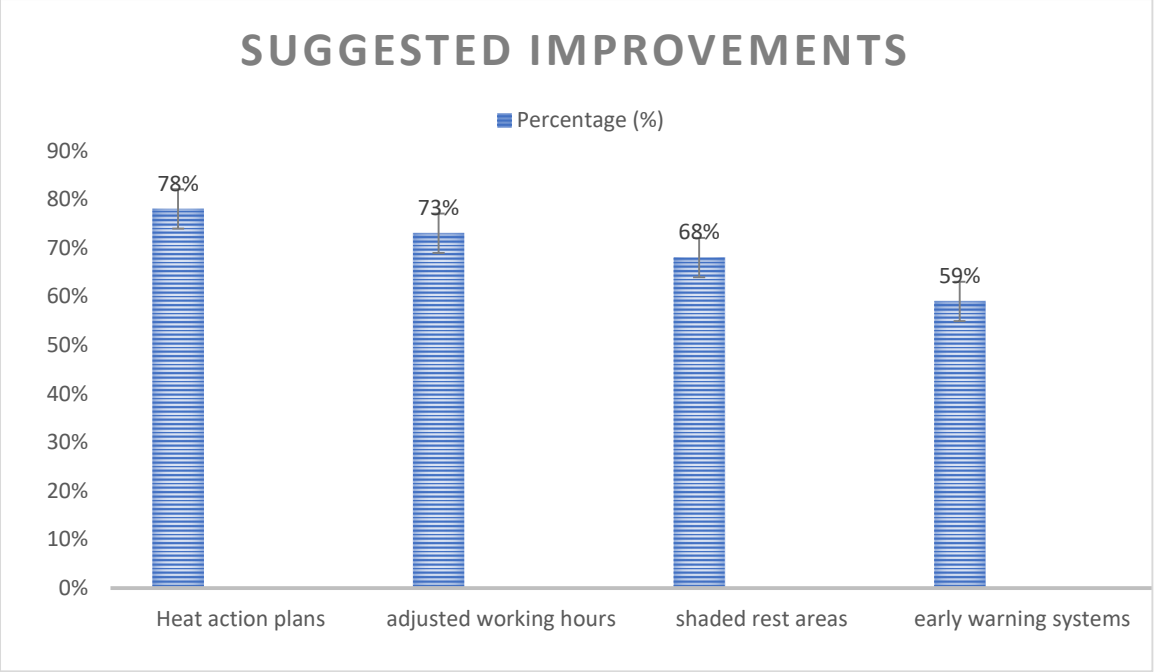
Table4.8: Suggested Improvements (n=92)

Strategy	Frequency	Percentage
Heat action plans	72	78%
Adjusted working hours	67	73%
Shaded rest areas	63	68%
Early warning systems	54	59%

Source Field Data 2026

Majority of respondents strongly recommended structured climate-responsive measures.

Figure4.5: Suggested Improvements



The findings show that the majority of respondents strongly support the introduction of structured climate-responsive interventions; particularly heat action plans (78%). Workers indicated that having clear guidelines on how to operate during extreme temperatures would significantly improve safety. One respondent stated, *"We need clear rules for when it gets too hot, not just guesswork."* Another added, *"If there was a proper heat plan, people wouldn't collapse on site."* These responses suggest that workers are not only aware of the risks but also recognise the importance of proactive planning. This aligns with EU-OSHA (2019), which emphasises that structured heat management systems are critical in reducing occupational heat stress.

Adjusted working hours (73%) were also widely recommended, with respondents highlighting the need to avoid peak heat periods. Many workers expressed frustration with fixed schedules that do not consider weather conditions. One respondent explained, *"Working in the afternoon heat is the hardest, we should start earlier or stop when it's too hot."* A supervisor added, *"If shifts are adjusted, productivity can actually improve because workers won't be exhausted."* These views are consistent with the International Labour Organization (2019), which found that flexible work scheduling significantly reduces heat exposure and improves overall worker performance. It would therefore appear that simple scheduling changes could have a major impact on safety outcomes.

The provision of shaded rest areas (68%) was another key recommendation, with respondents noting that recovery spaces are essential during extreme weather conditions. Workers

reported that current rest areas are either inadequate or unavailable. One worker commented, *"Sometimes you just sit anywhere because there is no proper shade."* Another added, *"Having proper shelters would help us cool down and continue working safely."* These findings support previous research by Bröde et al. (2018), which demonstrated that access to shaded rest areas and cooling spaces significantly reduces heat-related illnesses among construction workers.

Early warning systems (59%) were also identified as an important intervention, particularly for managing rainfall-related risks. Respondents emphasised the need for timely weather information to improve preparedness. One respondent stated, *"If we know the weather in advance, we can plan better and avoid dangerous situations."* Another added, *"Rain can catch us off guard, especially when working in trenches."* This aligns with UNEP (2020), which highlights the role of weather forecasting systems in enhancing climate resilience in vulnerable sectors. Overall, the findings suggest that workers possess practical knowledge of effective solutions, reinforcing the idea that the main gap lies not in awareness but in implementation of structured climate-responsive safety systems.

4.8 CHAPTER SUMMARY

This chapter presented, analysed and discussed the research findings on climate change mitigation strategies and worker safety at WestProp Holdings. The results showed that workers are highly exposed to climate-related hazards such as heat stress and rainfall-induced risks, while existing mitigation measures are mainly basic and only partially effective. The findings further revealed significant gaps in climate-specific safety systems, despite workers demonstrating clear awareness of practical solutions such as heat action plans and adjusted work schedules. Overall, the chapter established that there is a need for more structured and proactive climate-responsive safety frameworks to enhance worker protection and align with existing literature and policy expectations.

CHAPTER 5: DISCUSSION OF FINDINGS

5.0 INTRODUCTION

This chapter provides an in-depth discussion of the findings presented in Chapter Four. The discussion is organised according to the study objectives and themes, focusing on explaining the results rather than restating them. The findings are interpreted in relation to existing literature and comparable studies, with the aim of understanding why the observed patterns emerged. Evidence from both the study and prior research is used to support the arguments, ensuring a logical flow of ideas grounded in empirical data.

5.1 CLIMATE CHANGE-RELATED OCCUPATIONAL HAZARDS

The findings revealed that heat stress, dehydration and fatigue were the most dominant occupational hazards affecting workers. This pattern can be attributed to the outdoor nature of construction work, where prolonged exposure to high temperatures is unavoidable. The high prevalence of these hazards reflects the increasing intensity of heat conditions in Harare, where temperatures frequently exceed 30°C during peak seasons. These results are consistent with findings by the International Labour Organization (ILO, 2019), which established that construction workers are among the most vulnerable groups to heat stress due to continuous exposure to direct sunlight. The similarity between this study and global findings suggests that the challenges faced at WestProp are not isolated but part of a broader climate-related occupational trend.

The occurrence of fatigue and reduced concentration among workers further explains the increased risk of accidents under high temperatures. According to Spector et al. (2016), elevated temperatures impair cognitive function and reaction time, making workers more prone to errors. This supports the responses obtained in this study, where workers indicated that extreme heat affected their performance and alertness. The reported cases of fainting, although relatively low in percentage, provide strong evidence of severe heat exposure, reinforcing the argument that current working conditions pose significant health risks.

Rainfall-related hazards such as slippery surfaces, trench collapse and structural instability were also identified as major risks. These findings can be explained by the nature of construction environments, where soil stability and surface conditions are directly influenced by weather patterns. Heavy rainfall increases soil saturation, weakening trench walls and increasing the likelihood of collapse. This aligns with Zhang and Wang (2021), who found that rainfall significantly increases structural risks at construction sites. The presence of these

hazards in this study confirms that climate variability is already affecting construction safety at an operational level.

The combination of heat-related and rainfall-induced hazards indicates that workers are exposed to multiple climate risks simultaneously. This dual exposure increases overall vulnerability and complicates safety management. Similar observations have been made in Southern Africa, where climate change has intensified both heat waves and extreme rainfall events, leading to increased occupational risks (IPCC, 2022). The consistency between this study and regional findings suggests that the observed hazards are driven by broader climatic changes rather than isolated workplace conditions.

5.2 CLIMATE CHANGE MITIGATION STRATEGIES IMPLEMENTED

The study found that basic safety measures such as provision of personal protective equipment (PPE), access to drinking water and safety training were widely implemented. These measures are likely in place because they are part of standard occupational safety requirements under existing regulations. However, their dominance in the findings suggests that the company prioritises conventional safety practices over climate-specific interventions. This observation aligns with the National Social Security Authority (NSSA, 2020), which noted that many organisations in Zimbabwe focus on general safety compliance rather than adapting to emerging climate risks.

The relatively low implementation of strategies such as adjusted working hours and provision of shaded rest areas indicates a gap in climate-responsive safety planning. This can be explained by the fact that traditional safety frameworks, such as those outlined in the Factories and Works Act, were not designed to address climate-induced hazards. As a result, companies may lack clear guidelines on how to integrate climate considerations into their safety systems. Similar findings were reported by Bröde et al. (2018), who observed that climate adaptation measures are often underutilised despite their proven effectiveness in reducing heat-related risks.

The absence of structured interventions such as heat action plans and weather-based scheduling further highlights limitations in organisational response to climate change. These strategies require proactive planning and monitoring, which may not be prioritised in environments where safety management is largely reactive. The findings suggest that while the company acknowledges general safety risks, it has not fully transitioned towards climate-

responsive practices. This supports the argument that there is a lag between awareness of climate risks and implementation of appropriate mitigation measures.

5.3 EFFECTIVENESS OF MITIGATION STRATEGIES

The findings indicated that existing mitigation strategies were perceived as only partially effective, with a significant proportion of respondents rating them as inadequate. This perception can be explained by the mismatch between the nature of the hazards and the type of interventions implemented. While PPE and water provision address immediate safety needs, they do not fully mitigate the effects of prolonged heat exposure or extreme weather conditions. According to the World Health Organization (WHO, 2021), effective management of heat-related risks requires structured interventions such as work-rest cycles and environmental modifications, which were found to be limited in this study.

The moderate effectiveness reported by some respondents suggests that existing measures do provide some level of protection, but not enough to fully address the risks. This partial effectiveness is consistent with findings by EU-OSHA (2019), which emphasised that basic safety measures must be complemented by adaptive strategies to achieve meaningful risk reduction. The lack of comprehensive interventions in this study explains why a substantial proportion of workers still perceive safety measures as insufficient.

The variation in responses regarding effectiveness may also reflect differences in exposure levels among workers. Construction workers, who are directly exposed to environmental conditions, are likely to experience greater risks compared to supervisors or administrative staff. This could explain why some respondents rated the strategies as effective while others did not. The findings therefore highlight the importance of context-specific interventions that address the unique risks faced by different categories of workers.

5.4 PROPOSED CLIMATE-RESPONSIVE SAFETY FRAMEWORK

The study found strong support for the introduction of structured climate-responsive interventions such as heat action plans, adjusted working hours, shaded rest areas and early warning systems. These recommendations reflect practical solutions based on workers' direct experiences of climate-related hazards. The preference for these strategies suggests that workers are aware of the limitations of existing measures and recognise the need for more targeted interventions.

The emphasis on heat action plans and adjusted working hours can be explained by the direct impact of temperature on worker health and productivity. Studies by the International Labour

Organization (2019) show adjusting work schedules to avoid peak heat periods significantly reduces heat stress and improves performance. The alignment between worker recommendations and existing literature indicates that these strategies are both practical and evidence-based.

The recommendation for early warning systems highlights the need for proactive risk management. Such systems enable organisations to anticipate extreme weather events and take preventive action, reducing the likelihood of accidents. This is consistent with findings by EU-OSHA (2019), which identified early warning mechanisms as critical components of climate adaptation in the workplace. The absence of these systems in the current study explains the reactive nature of safety management observed.

Overall, the proposed framework reflects a shift from traditional safety practices to a more integrated approach that considers climate variability. The consistency between these recommendations and international best practices suggests that their implementation could significantly enhance worker safety. The findings therefore provide a clear direction for improving occupational safety in the context of climate change.

5.5 CHAPTER SUMMARY

This chapter discussed the findings of the study in relation to existing literature and comparable research. The discussion demonstrated that climate change is already influencing occupational hazards at WestProp Holdings, with heat stress and rainfall-related risks emerging as key challenges. While basic safety measures are in place, their effectiveness is limited due to the absence of climate-specific interventions. The study also showed that workers are aware of practical solutions, highlighting the need for a more structured and proactive approach to safety management.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.0 INTRODUCTION

This chapter presents a synthesis of the entire study by outlining the key findings, drawing conclusions based on the research objectives, and providing practical recommendations. It reflects on the problem of climate-induced occupational hazards at WestProp Holdings, the methodology used to investigate the issue, and the implications of the findings for policy and practice. The chapter also highlights how the study contributes to existing knowledge on climate change and worker safety within the property development sector.

6.1 CONCLUSIONS

The study concluded that climate change has significantly increased occupational hazards within the property development industry, particularly at WestProp Holdings. Heat-related risks such as dehydration, fatigue, and fainting were found to be widespread, confirming that rising temperatures directly affect worker health and productivity. This supports existing literature which indicates that prolonged exposure to high temperatures reduces physical and cognitive performance among construction workers (WHO, 2021).

It was also concluded that rainfall variability contributes to serious safety risks, including trench collapse and structural instability. These hazards not only threaten worker safety but also increase project delays and financial costs. The findings align with previous studies which show that extreme weather conditions compromise construction site stability and increase accident rates (Zhang & Wang, 2021).

Although WestProp has implemented general safety measures, the study found that these are not sufficiently tailored to address climate-specific risks. The absence of structured Hazard Identification and Risk Assessment (HIRA) frameworks that incorporate climate variables indicates a major gap in safety management. This confirms observations by NSSA (2020) that many organisations focus on traditional hazards while neglecting emerging climate-related risks.

Finally, the study concluded that there is a significant gap between national climate policies and actual implementation at company level. While frameworks such as the National Development Strategy 1 emphasise climate resilience, their translation into practical workplace safety systems remains limited. Without deliberate integration of climate-responsive strategies, worker safety will continue to be compromised.

6.2 RECOMMENDATIONS

Based on the findings of the study, several recommendations are proposed to improve worker safety in the context of climate change. First, it is recommended that WestProp Holdings develops and implements comprehensive heat action plans. These should include temperature thresholds for work stoppage, mandatory hydration schedules, and monitoring systems to prevent heat-related illnesses. Evidence from EU-OSHA (2019) shows such measures significantly reduces occupational risks.

Secondly, the company should adopt climate-responsive work scheduling. This includes shifting working hours to cooler periods of the day and reducing exposure during peak heat conditions. Flexible scheduling has been proven to enhance productivity while protecting worker health, particularly in hot climates (ILO, 2019).

Thirdly, there is a need to strengthen Hazard Identification and Risk Assessment (HIRA) systems by integrating climate variables such as temperature extremes and rainfall patterns. Safety protocols should be updated to include early warning systems for extreme weather events, enabling proactive risk management rather than reactive responses.

Additionally, the provision of shaded rest areas and improved on-site infrastructure should be prioritised. Access to shelter and rest reduces fatigue and heat exposure, which are major contributors to workplace accidents. This aligns with WHO (2021) recommendations on occupational health under climate change conditions.

From a policy perspective, regulatory bodies such as the National Social Security Authority should revise occupational safety guidelines to explicitly incorporate climate-related risks. Stronger enforcement mechanisms are also required to ensure compliance within the construction sector.

Finally, further research is recommended to explore climate change impacts across multiple property development companies in Zimbabwe. Expanding the scope beyond a single case study will provide broader insights and enhance generalizability of findings. Longitudinal studies are also necessary to track the evolving nature of climate-related occupational hazards over time.

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APPENDIX 1: FIELD PHOTOGRAPHS

The photographs in the appendix show workers operating under extreme weather conditions at construction sites managed by WestProp Holdings Private Limited. Some images show workers exposed to intense heat and direct sunlight while carrying out construction activities, highlighting risks of heat stress, dehydration and fatigue. Other photographs show slippery working surfaces and waterlogged areas caused by heavy rainfall, which increase the risk of falls and workplace accidents. Additional images of trenches and excavation sites demonstrate the dangers associated with unstable soil conditions and trench collapse during rainy periods. These photographs provide visual evidence of the climate-related occupational hazards affecting workers within the property development industry.





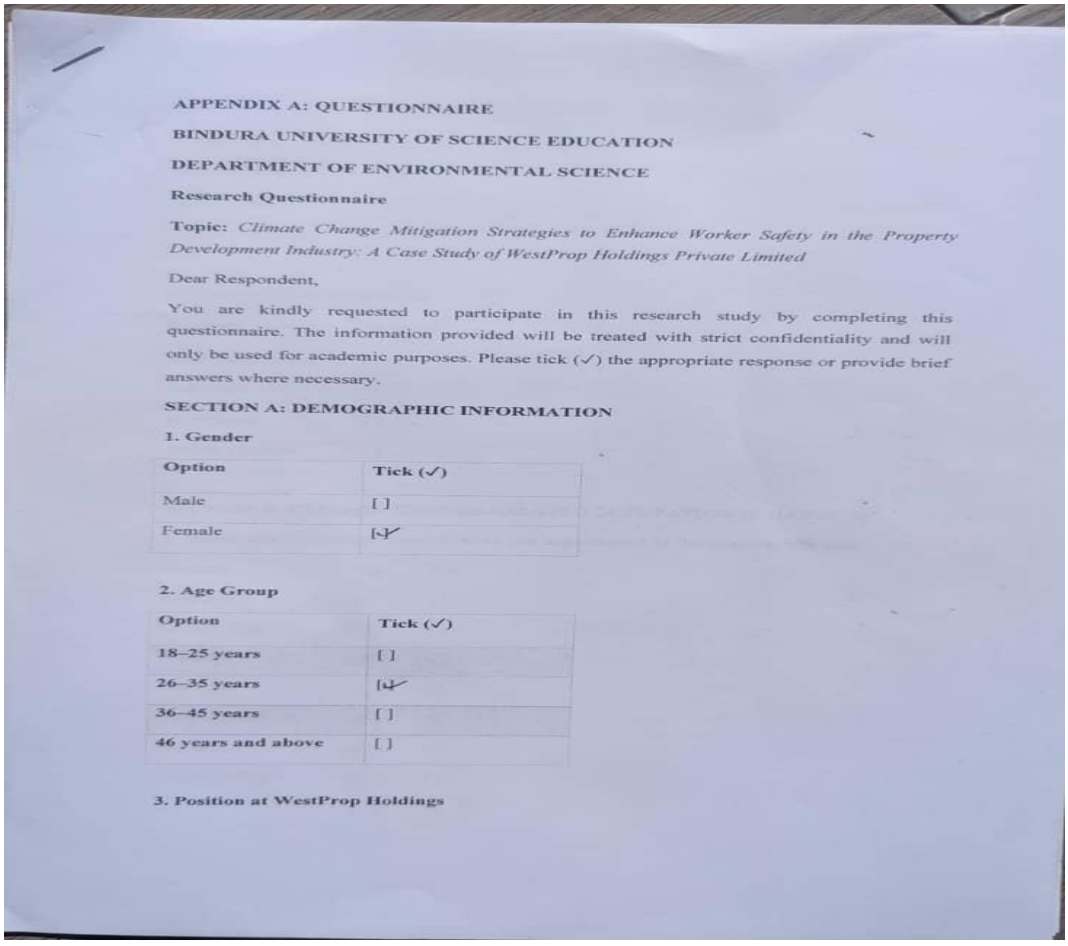






APPENDIX 2: EVIDENCE OF DATA COLLECTION (PHOTOS)

The photographs presented in this appendix provide evidence of the data collection process undertaken during the study at WestProp Holdings Private Limited. The images show the researcher administering questionnaires to employees and conducting face-to-face interviews with construction workers, site supervisors and safety personnel at various construction sites. These activities were carried out to gather both quantitative and qualitative data on climate change-related occupational hazards and mitigation strategies implemented within the company. The photographs serve as proof that primary data were collected directly from respondents in their actual working environment, thereby enhancing the credibility and authenticity of the research findings.



APPENDIX A: QUESTIONNAIRE

BINDURA UNIVERSITY OF SCIENCE EDUCATION

DEPARTMENT OF ENVIRONMENTAL SCIENCE

Research Questionnaire

Topic: *Climate Change Mitigation Strategies to Enhance Worker Safety in the Property Development Industry: A Case Study of WestProp Holdings Private Limited*

Dear Respondent,

You are kindly requested to participate in this research study by completing this questionnaire. The information provided will be treated with strict confidentiality and will only be used for academic purposes. Please tick (✓) the appropriate response or provide brief answers where necessary.

SECTION A: DEMOGRAPHIC INFORMATION

1. Gender

Option	Tick (✓)
Male	[ ]
Female	[✓]

2. Age Group

Option	Tick (✓)
18–25 years	[ ]
26–35 years	[✓]
36–45 years	[ ]
46 years and above	[ ]

3. Position at WestProp Holdings







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SECTION A: DEMOGRAPHIC INFORMATION

1. Gender

Option	Tick (✓)
Male	[✓]
Female	[ ]

2. Age Group

Option	Tick (✓)
18–25 years	[✓]
26–35 years	[ ]
36–45 years	[ ]
46 years and above	[ ]

3. Position at WestProp Holdings

APPENDIX 3: DATA COLLECTION LETTER

FACULTY OF AGRICULTURE AND ENVIRONMENTAL SCIENCE
DEPARTMENT OF ENVIRONMENTAL SCIENCE

P. Bag 1020
BINDURA, Zimbabwe
Tel: 263 - 71 – 6505
Cell : 0778371588
Email: tnyamugure@buse.ac.zw

BINDURA UNIVERSITY OF SCIENCE EDUCATION

5 May 2026

Dear Sir/Madam

REQUEST FOR PERMISSION TO COLLECT DATA FOR ACADEMIC RESEARCH PROJECT

This letter serves to inform you that Pamela Nyabunze **(registration number B221943B)** is a fourth year student at Bindura University of Science Education, in the Department of Environmental Science. During his/her fourth year of study he/she is supposed to do a research project in her area of specialisation.

Please assist in any possible way. Data collected will be used for academic purposes only and will not be published without your prior consent.

Thank you for your assistance.

Yours faithfully.



Mr. .T .Nyamugure
Chairperson - Department of Environmental Science

APPENDIX 4: TURNITIN REPORT



Pamela Nyabunze
(B221943B).pdf