

**AN EXAMINATION OF THE PREVALENCE AND  
EFFECTIVENESS OF ENVIRONMENTAL  
MANAGEMENT PLANS AS LEGAL REQUIREMENTS  
ON CONSTRUCTION PROJECTS IN THE AREA OF  
ETHEKWINI MUNICIPALITY KZN**

**By**

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**Submitted in fulfilment of the academic requirement of**

**Master of Science in Construction Management**

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## PREFACE

This research has not been previously accepted for any degree and is not currently being considered for any other degree at any other university.

I, Samson Henry Khoza, at this moment declare that this Dissertation contains my work except were explicitly acknowledged.

[REDACTED]

Date: 7-January-2022.....

As the Candidate's supervisor, I agree/disagree with the submission of this thesis

Signed [REDACTED]

Supervisor: Prof Theo C. Haupt.....

Date: 7-January-2022.....

## DECLARATION 1: PLAGIARISM

I am, Samson Henry Khoza, declare that:

- 1 The research reported in this dissertation, except where otherwise indicated is my original research.
- 2 This dissertation has not been submitted for any degree or examination to any other university.
- 3 This dissertation does not contain other persons' data, pictures, graphs, or other information unless specifically acknowledged as being sourced from other persons.
- 4 This dissertation does not contain other persons' writing unless specifically acknowledged as being sourced from other researchers where other written sources have been quoted, then:
  - a. Their words have been re-written, but the general information attributed to them has been referenced.
  - b. Where their exact words have been used, then their writing has been placed in italics and inside quotation marks and referenced.
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Date: 31 December 2021

## ACKNOWLEDGEMENTS

- Some special acknowledgments well earn a specific mention because of their contribution and assistance in the preparation of this dissertation:
- First, I would like to take this opportunity to thank Almighty God for his protection and guidance throughout my academic journey.
- I want to thank Professor Theodore Haupt for his confidence in me and his support, guidance, and encouragement. Thank UKZN and Stefanutti Stocks Coastal for the financial support. It would not have been possible.
- Special thanks to my family, dad, moms, brothers and sisters for your support and encouragement in my darkest moments.
- Thanks to my beautiful wife (Tenele) and our handsome little boy Bukhosi (BK) for bringing hope and happiness to our hearts.
- Thanks to my late childhood friend Jakkie (America) Shabangu and Jasi Shabangu for inspiring me.
- And many thanks to all the organizations and individual participants who responded to the questionnaires and the construction workers who work tirelessly in the construction industry.



## ABSTRACT

The construction sector is regarded as one of the fundamental causes of environmental pollution globally due to noise, water, air pollution from harmful gases, dust, solid and liquid waste. Furthermore, due to heavy machinery operations, oil spills occur frequently. Therefore, an environmental management plan was introduced as a document prepared during the environmental management process to guide the environmental impact mitigation through the entire construction project life cycle, from project initiation to decommissioning as a legal requirement for all contractors to comply. However, despite compliance in the form of an environmental management plan being a legal requirement for construction projects in South Africa, environmental management plans are not prevalent, pervasive, enforced on construction sites. Therefore, the study examines the prevalence and effectiveness of environmental management plans as legal requirements on construction projects in eThekweni Municipality of KwaZulu-Natal. A quantitative study was employed, and data were analyzed using IBM Statistical Package for Social Sciences (SPSS) version 27. Descriptive statistics was adopted for the data analysis. The technique used to collect data was convenience sampling based on proximity and familiarity and completed in close-ended questionnaires through google forms and completed questionnaires copies, 91 population participated in the study from different contractors. Cronbach's Alpha reliability test was used to determine the internal consistency of the constructs used to examine the prevalence and effectiveness of environmental management plans as legal requirements. Internal consistency of various scales was deemed acceptable for interpretation. The results revealed that contractors do not provide enough training and induction about environment management plans to staff and construction workers before the project starts. Therefore, this causes contractors to not fully comply with an environmental management plan because site managers and construction workers are not making a better-informed decision on protecting the environment when they are physically involved in the execution of activities on-site. The results further suggested that contractors see environmental management plans as a waste of time; they prefer to focus on production and profit maximization. Therefore, this has led to contractors not complying with construction projects' environmental management plans. The results also suggested that few contractors have environmental management plans on their daily site Instruction; not all contractors consider environmental management plans on their daily site instructions. The absence of environmental management plan on daily site instructions of contractors on-site is one of the factors causing contractors to continue harming and degrading the environment because site management and construction workers are not daily reminded about the environmental hazards on-site during the execution of activities. Therefore, contractors need to start considering environmental management plans on their daily site instruction to remind their

employees about expected and potential hazards because they are physically involved with execution on site. Therefore, it will benefit the effectiveness of environmental environment plans on construction projects.

**Keywords:** Environmental Management Plan, Environmental Impact Assessment, Green House gas, Environmental Management Systems, International standard organiza

# CHAPTER 1

## INTRODUCTION

### 1.1 BACKGROUND

Construction is widely regarded as one of the most polluting industries on the planet. Noise, water, and air pollution from toxic gases, dust, and solid and liquid waste make construction hostile to the environment (Jackson et al. 2001). As a result, environmental degradation has captivated the attention of the entire globe and has become one of the most debated topics locally, nationally, and worldwide (Bentivegna et al., 2002).

During the development cycle, construction activities have an impact on the environment. These effects occur at all stages of a building's life cycle, from the initial construction phase to the operational phase and finally demolition when the structure reaches the end of its useful life. Many ecosystems are lost at deserted natural places (Teixeira, 2005 and Du Plessis, 2002). In addition, construction sites are also susceptible to environmental danger, resulting in environmental incidents (Kim et al., 2012). Heavy gear and equipment are used in sensitive ground areas to conduct complex infrastructure projects, including bulk earthworks, pipe laying, and other procedures (Guerin, 2002). Oil leaks are expected to result from heavy machinery operations, posing direct or indirect harm to the environment (Guerin, 2015). In addition, the spilling of oil and chemicals on construction sites is a significant concern (Taylor, 2007).

Even though the construction phase of the building's life cycle is shorter than the other stages, it has a wide range of environmental impacts. As a result, the construction industry is one of the most polluting industries on the planet (Zolfagharian et al., 2012). The construction industry for a decade has been ranked top as a significant cause of pollution in the United States (Sharrard et al., 2007). Infrastructure and buildings consume a lot of energy and resources globally, contribute a lot of waste and resources globally, and contribute to waste and pollution (Ortiz et al., 2009). Furthermore, workers work in various injury-inducing hazardous situations in construction, and occupational accidents are more common than in other industries.

Specific actions are needed to ensure that construction activities and the built environment, in general, are more sustainable (Holmes et al., 2003). As a result, one of the most crucial goals is to meet present requirements without jeopardizing future generations' ability to meet their own (Brundtland, 1987). Sustainability is a method for fostering a thriving economy and high-quality life while also considering preserving natural resources and safeguarding the environment. It reflects the notion that future generations should live in a world that benefits and enjoys the same things as the current generation (Cough et al., 2006). Social and economic resources are

considered in addition to natural resources. Environmentalism is not the only aspect of sustainability. Instead, social considerations are emphasized in most definitions of sustainability. As a result, one of the essential sources of equity and economic development is the construction industry (Brundtland, 1987). By the end of the twentieth century, many of these ideas had come together in the global demand for “sustainable development.” The World Commission on Environment and Development (WCED, 1987) produced a study entitled “Our Common Future.” established in 1983. The Brundtland Report was named after the chairwoman of the Commission, Gro Harlem Brundtland. It established the guiding concepts for sustainable development as we know it today (Brundtland, 1987).

According to the Brundtland Report (1987), significant worldwide environmental problems are essentially the result of tremendous poverty in the South and non-sustainable consumption and production practices in the North. The UN General Assembly considered the report, which led to the UN Conference on Environment and Development (United Nations, 1989). However, sustainability motivations have frequently been complicated, personal, and diverse. Therefore, it is impossible to imagine why so many people, organizations, and communities work towards this goal. However, for most people, sustainability is defined by the kind of future that the following generation will have (Brundtland, 1987). Therefore, sustainability is a value shared by many individuals and organizations who display it in their policies, daily activities, and behaviours. As a result, individuals have had a considerable impact on the development of our contemporary environmental and social conditions (UN, 2013).

Construction activities must be sustainable during construction periods if they are to be completed on time to safeguard the environment and lives of people; using an appropriate environment management plan ensures that noise, waste, and air pollution from harmful gases, dust, and solid and liquid waste are controlled during construction. An environmental management plan should be updated regularly to synchronize with the project as it advances from construction to operation and finally decommissioning (DEAT, 2004). Construction projects have become a significant source of revenue for many countries' economies (Chang, 2011). However, the contractor's priority, on the other hand, is to complete the project on schedule while ignoring the environment (Poon, 2001). The environmental impact of construction activities has only lately been recognized globally. Therefore, many nations evaluate the environmental implications of construction activities, which is now required by law (Tam et al., 2006).

In South Africa, the National Environmental Management (NEMA) (Act No. 107 of 1998) mandates compliance from construction projects. NEMA encourages the use of integrated environmental management plans by ensuring that management concepts are fully integrated at

phases of the construction process. These plans include pollution management, noise reduction, and activities that may harm the environment. On the other hand, contractors appear to disregard EMPs as legal standards to be followed during daily construction activities. Furthermore, the lack of employees' environmental awareness training before the project starts (CSIR, 2002) and high implementation costs make managing effective EMPs on construction sites challenging (Tse, 2001).

Tse and Raymond argue that environmental protection is essential worldwide (Tse and Raymond, 2001). Construction is the largest polluter of the environment compared to other businesses (Shen, 2005). As a result of this problem, construction companies are attempting to mitigate the effects of their operations by implementing environmental management systems (Lam, 2011). Therefore, it is the responsibility of construction employers and the Department of Environmental Affairs to ensure that EMP's are followed throughout construction projects in the KZN province. Contractors and subcontractors must implement and adhere to EMPs. Awareness and knowledge are the significant variables that intensify the sustainability movement (Abidin, 2010). EMP's are widely regarded as a method for ensuring that the project proponent has made enough mitigation provisions (EMP, 2004). Methods and techniques for reducing and monitoring consequences are described in EMP's. They also include environmental objectives and targets that the project proponent or developer must meet to minimize or eliminate negative consequences. The EMP's can be deployed at any point in the project's life cycle. It should be updated regularly to stay current with the project as it moves from construction to operation and finally decommissioning (DEAT, 2004). Developing countries have been slow to effectively use and implement EMP's (George, 2008)

Attributes of the slow utilization of EMPs are the following:

- Environmental Impact Assessment (EIA) policy systems concentrate on the evaluation phase of the process that likely to evaluating impacts of a proposed project or development by scoping, assessment, decision, implementation, and stakeholder engagement.
- Lack of guidelines for the compilation and implementation of EMPs.
- EMPs are not legally enforced.
- Governments do not prioritize the development of the institutional capacity for
- monitoring and enforcing compliances (Ira, 2000; Parker, 2001)

## **1.2 PROBLEM STATEMENT**

Despite compliance in the form of EMP's being a legal requirement for construction projects in eThekweni Municipality, KZN EMP's are not prevalent or prominent enforced in compliance and implementation on construction sites. In a previous study, it appears to be a practical knowledge gap. There is a lack of rigorous research in the prior literature. Some of the unexplored literature appear to be lacking in the practice of EMP's in the field of construction. The field of EMP's is ripe for an investigation of practical focus research on prevalent, pervasive, or effectiveness of EMP's. However, there are very few practical studies or action research in the field of investigating the effectiveness of EMP's on construction on site as legal requirements. Therefore, it is a critical and worthy investigation for the prevalence and effectiveness of EMP's as legal requirements in eThekweni Municipality in KZN.

## **1.3 RESEARCH QUESTIONS**

The study research questions are:

- What factors and challenges cause contractors not to effectively used EMP's as legal requirements on construction projects in eThekweni Municipality KZN?
- What are the legal consequences of not complying with providing/developing and implementing environmental management plans on construction sites?
- What impact does non-compliance with the EMP's as legal requirements have on the environment in eThekweni Municipality KZN?

## **1.4 AIM AND OBJECTIVES**

### **1.4.1 AIM**

This study aims to examine the prevalence and effectiveness of environmental management plans as legal requirement on construction projects in eThekweni Municipality.

### **1.4.2 OBJECTIVES**

- To investigate the prevalence and effectiveness of EMP's as legal requirements on construction site in the area of a Thekweni Municipality KZN.
- To investigate if EMP's as legal requirements is effectively enforced and identify the legal consequences of not complying with EMPs on construction projects in eThekweni Municipality KZN.

- To examine the impact of non-compliance with EMP's by contractors in eThekwin Municipality KZN before, during, and after construction activities.
- 

## **1.4 METHODOLOGY**

The following research methodology was employed to achieve the objectives of the study:

- Conduct a thorough assessment of prior research on EMPs in construction projects and their influence on the environment before, during, and after construction activity.
- Conduct a questionnaire survey of a sample of contractors in the eThekwin Municipality KZN area, using an instrument created based on a literature review to obtain responses to the research questions.
- Conclude and formulate recommendations.

## **1.5 ASSUMPTIONS OF STUDY**

The following assumptions are made regarding this study:

- Assumed that respondents answered honest and truthfully.
- The respondents were competent to answer the questions in the instruments.

## **1.7 LIMITATIONS OF THE STUDY**

The following limitation was applied to this research project:

- The study was limited to the eThekwin Municipality in KwaZulu Natal province.
- The study was confined to a sample of contractors registered with the Construction Industry Development Board (CIDB) and Master Builders in eThekwin Municipality in KwaZulu Natal province.
- The duration of this study was 2years.

## **1.8 ETHICAL CONSIDERATIONS OF THE STUDY**

- The respondents voluntarily participated in the study. On the other hand, participants had the right to withdraw from the study at any time.
- Respondents gave their informed agreement to participate in the study. The notion of informed consent was to provide participants with enough knowledge and assurance

about participating in the study and understanding the implications of participation in the study.

- In creating the questionnaire survey, offensive, discriminatory, or objectionable language was avoided.
- According to the dissertation guideline, acknowledging other authors' works used in any part of the dissertation was done by employing the Harvard referencing system.

## **1.9 STRUCTURE OF THE STUDY**

Chapter 1: Introduction - This chapter discussed the research background and gave the problem statement, research questions, aim, and objectives of the study.

Chapter 2: Literature review - This chapter contains a comprehensive literature review of prior research on the subject issue and current environmental management trends.

Chapter 3: SA legislation requirements: This chapter will discuss acts and regulations that govern environmental management in terms of construction and ISO 14000

Chapter 4: Research Methodology- The research method used is described in this chapter. The method provides the required instruments for properly gathering data within the study's limits.

Chapter 5: Presentation and Discussion of results- This chapter presents data analysis from the field.

Chapter 6: Conclusion - Data was reviewed to draw conclusions and recommendations based on the findings. The study's conclusion decides if the study achieved the objectives mentioned in the background to address the issues found.

## **1.10 CHAPTER SUMMARY**

This chapter introduced the topic under investigation, outlining the research's principal goal, objective, and research question. The following chapter will undertake a full literature assessment on the contractor's role in project construction.



## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 INTRODUCTION

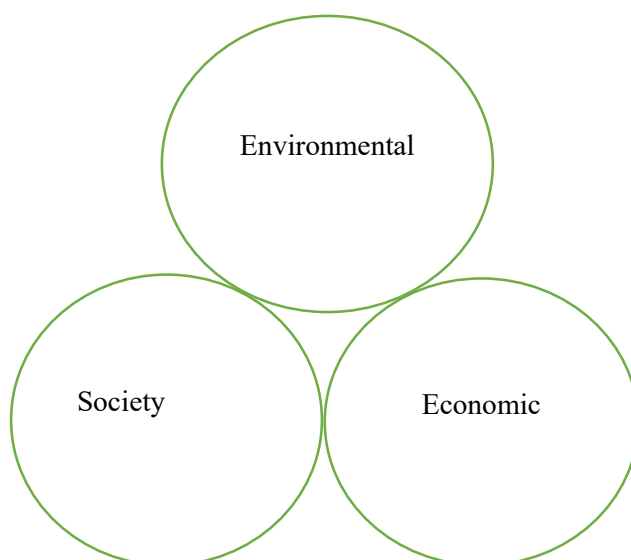
The theory of sustainable development is based on an economic field that has been developing for two centuries. In the early 1800s, the English political economist Thomas Malthus started debating whether Earth's limited natural resources would continue to provide life support for humanity's expanding population (Dixon and Fallon, 1989). On the other hand, economists have taken long developed economic models that properly account for resource scarcity and pollution. As a result, environmental issues have become global, both in their existence and impact and the socio-economic forces that cause them. Throughout history, humans have faced dire environmental circumstances, but environmental issues became more prevalent and visible with industrialization and urbanization. When people move from rural to urban areas in developing countries, this is known as urbanization. As a result, economic growth, prosperity, and technology all impact the decision of villages to relocate to cities. (Marshal et al., 2009). In developing countries, industrialization and urbanization have an enormous impact on the environment. Because of a lack of environmental development planning and management, pollution rises with the growth of cities, contaminating the air, water, and soil. (Ghasemian, 2012).

The urban population pattern and trend in 1960, the global urban population was 34% of the total. However, by 2014, the urban population has increased to 54% of the total and is still growing. The number of people living in cities will reach 66 percent by 2050. (UNDESA, 2014). Since the lifting of apartheid-era immigration limitations in 1980, the growth of South Africa's urban population has accelerated (Vacchian-Marcuzzo et al., 2005). Metros housed about two-thirds of South Africa's population, which grew from 2001 to 2011 (Saladin and Turok, 2014).

On the other hand, industrialization has serious negative consequences for the environment, causing immense stress on natural system components such as water, air, soil biodiversity, and the surrounding ecosystem; the effects of industrialization on the environment should be studied more thoroughly (<http://environmentinsider.com/impact-industrialization-environment>). The Stockholm United Nations Conference on the human environment (1972) aided in making environmental quality a primary international concern. The use of the global atmosphere as a waste store for greenhouse gases results in climate changes that endanger human habitats worldwide (Haberl et al. 2004; Kitzes et al. 2008). Although the issues are global and affect people worldwide, it was clear that some societies contribute to the current challenges and demands on the global ecosystem. However, in 1987, the Brundtland Report, titled "Our Common Future",

was issued. It became known as the Brundtland Report after the developed guiding principles for what is now commonly known as sustainable development (Brundtland, 1987). According to the Brundtland Report, massive poverty, non-sustainable patterns, and production were the primary causes of major worldwide environmental concerns (Brundtland, 1987). The Brundtland Report was a strategy that used the now-common term “sustainable development” to bring development and the environment together. Sustainable development is defined as development that meets current needs without jeopardizing future generations' ability to meet their own (United Conference on Environment Development, 1989).

Sustainability is a concept for fostering a thriving economy and a high-quality life while also considering conserving natural resources and safeguarding the environment. Furthermore, sustainability entails the idea that future generations should live in a beautiful and sustainable environment with the same benefits as the current generation (Cough et al., 2006). Therefore, all environmental systems are kept in balance to maintain the three pillars of sustainability and ecological integrity. But on the other hand, humans consume natural resources at a rate that exceeds their ability to restore them (Jour et al., 2018). As a result, to achieve sustainable development, there must be a reasonable balance of interaction that represents society, economy, and environment among various sectors (Barton & Du Plessis, 2000).



**Figure 2-1. Interaction between the main sectors of sustainable development**

Environmental, Economic, and Social Economics are the three pillars of sustainability. As a result, humans in communities worldwide can maintain their independence and access the

financial and other resources they require to meet their requirements (Jour et al., 2018). Each of the three pillars is treated as a separate and equal entity in this concept. The stool is designed so that if one leg is less important than the others, the stool will be imbalanced. For example, assume that all three legs are the same length and that each pillar is equally weighted. In that instance, the ‘‘three E balance rule’’ of Environment, Equity, and sustainability will result in a balanced stool that will promote sustainability (SOGESID,n.d.). Socially, economic, and environmental are the three pillars of sustainability; there must be a reasonable balance of interactions among these three pillars of sustainability (Barton & Du Plessis, 2000). Environmental sustainability enables human society to meet its demand by allowing the ecosystem to regenerate the services required (Morelli, 2013). Therefore, the three pillars of sustainability must be harmonized to balance sustainable development. Social sustainability promotes well-being by understanding what people need from their lives and work, maximizing human benefit without significant environmental costs or threatening economic growth.

According to Josh (2001), development allows people to live a healthy and creative life. The Brundtland Report, Agenda 21, and the 2002 World Summit on Sustainable Development have all been credited with the origins of the three pillars of the sustainability paradigm (Moldan et al., 2012). Social sustainability includes physical and social world infrastructure to enable social and cultural life, social amenities, a citizen engagement system, and space for people and places to participate (Woodcraft, 2011). Sustainable development is often presented as being divided into the economy, environment, and society (West Midlands Round Table, 2000)

Construction sites are frequently criticized for their harmful effects on the surrounding biophysical environment and residents (Fuertes et al., 2013). As a result, although construction activities are crucial for socioeconomic development, construction operations have a negative environmental impact (Thsiki, 2015). Furthermore, the lack of commitment to mitigation and monitoring consequences in environmental impact studies contributes to South Africa’s unsustainable development problems (Sandham et al., 2013). Therefore, the Environmental Management Plan (EMP) was created as a document during the environmental management process to guide environmental effect reduction and management across the whole construction project life cycle, from project inception to decommissioning (Baby, 2011). The purpose of the EMP document is to manage all aspects of a construction project, including planning, construction, operation, and decommissioning (Aucamp, 2009). On the other hand, contractors and subcontractors perceive no motivation to follow the environmental management plan during construction because there are no consequences for non-compliance (Ira, 2000; Parker, 2010). As a result, contractors and subcontractors pollute the soil water and cause deforestation.

## 2.2 BRUNDTLAND REPORT

The United Nations adopted a resolution establishing the World Commission on Environment and Development as an independent body. The commission's goal was to create a "global agenda for change" that would include long-term environmental measures for achieving sustainable development.

- To translate environmental concern into a set of measurable, mutually beneficial goals.
- To consider how the international community may address environmental challenges more effectively.
- Define the attitudes, objectives, and action plan required to successfully protect and improve the environment (World Commission on Environment and Development, 1985).

The United Nations General Council demanded comprehensive agenda that included long-term environmental policies, worldwide solidarity and cooperation, more efficient human acts concerning the environment, and global society's expectations and goals (UNWCED, 1987). The commission's final report was eventually established, "Our Common Future" (World Commission on Environment and Development, 1987). The Brundtland Report was named after the Commission chair, Gro Harlem Brundtland. According to the report, the time has come to break free from previous patterns—efforts to sustain social and ecological stability by repurposing old technologies. Aggressive development and environmental preservation strategies will exacerbate insecurity. Change must be made to achieve security (Brundtland, 1987). Sustainable development is required to meet current requirements without jeopardizing future generations' ability to meet their own (United Conference on Environment Development, 1989).

Environmental protection must be included in the development process (United Nations Conference on Environment Development, 1992). The ability to anticipate and mitigate environmental damage will necessitate the consideration of ecological dimensions policy alongside project design (Brundtland, 1987). The Brundtland Report recognized the conflict between economic expansion and environmental conservation, but it did not offer a solution. It was found that economic growth is necessary, particularly in developing countries, but that there should be a shift to ecologically friendly sustainable development (Sustainability Reporting

Program 2000; Euractiv 2002; Atmosphere, Climate and Environment Information Programme 2004; Columbia University Biosphere 2 Center 2004).

### **2.2.1 Rio Summit 1992**

The Brundtland report gave the 1992 Rio Summit the impetus it needed to lay the groundwork for long-term growth. As a result, The Earth Summit, also known as the United Nations Conference on Environment and Development, was held in Rio de Janeiro, Brazil, in June 1992 to secure some environmentally acceptable international agreements. The summit drew the most sizeable number of international leaders, with 118 heads of state and government and delegates from 178 countries in attendance. There were also 7000 ambassadors and their staff (UNCED, 1992). The Rio Summit process continued institutionalizing sustainable development by bringing together world political leaders to pledge their commitment to the principle of long-term development (Jordan and Voisey, 1998). The Rio Declaration on Environment and Development and Agenda 21 was adopted at the Earth Summit as a framework treaty on climate change (Grubb et al., 1993). In addition, the United Nations established the Commission on Sustainable Development at the Rio Summit in 1992 to advise and supervise the implementation of the Rio Declaration and Agenda 21.

The Rio Declaration featured 27 principles of sustainable development that were intended to steer countries' conduct towards more environmentally sustainable development patterns (UNCED, 1992). Agenda 21 was divided into chapters, each set of social and economic development goals, natural resource protection and management, and implementation. Hundreds of pages of recommended actions to solve the environmental issue and promotes sustainable development made up Agenda 21 established a route to sustainable development at the local level to improve the quality of life for all people by bolstering ecosystem capacity and safeguarding future generations rights (Emrealp, 2005). From a political standpoint, the Rio Summit was a tremendous success, and it captured the world's attention. A virtual national leader attended it.

On the other hand, the obstacles were an overemphasis on the environment pillar in the discussions and a lack of execution of Agenda 21 goals, particularly those connected to development aid and cooperation (Drexhage and Murphy, 2010). The progress made since the Rio Summit is organized around economic growth, social development, and environmental sustainability (UN, 1997). The construction industry has a significant role in the sustainable development of human settlement (CIB Report Publication 237). The Rio Declaration of 1992, according to Christopher Flavin et al. (2002), states that people are the foundation of concern for sustainable development and emphasizes how signified social matters are developed. The

underlying principle of sustainable development is to use economic and social factors to assess current and future prosperity and assure the sensible use of natural resources while increasing human efficiency (Rio, 1992).

### **2.2.2 Kyoto Protocol**

The 1992 Rio Conference set the stage for the Kyoto Protocol to be drafted and implemented in 1997. The global climate system has changed on both global and local scales since the Industrial Revolution; these changes are directly and indirectly the result of human activity. The combustion of fossil fuels has resulted in the highest greenhouse gas concentrations in the atmosphere (Climate Change, 2008). As a result, climate change has become a significant source of concern worldwide. While some countries devote resources to environmental protection and preservation, others fail to perceive the link between the benefits and costs of such initiatives. As a result, they would instead do nothing. The Kyoto Protocol adds new, more forceful, and legally enforceable measures to combat global warming. Emissions of greenhouse gases (United Nations Framework Convention on Climate Change: Essential Background, 2008). Under the Kyoto Protocol, South Africa is not compelled to satisfy any globally enforced carbon reduction objectives or deadlines (South Africa signed in July 2002).

On the other hand, South Africa has pledged to reduce greenhouse gas (GHG) emissions to 34% below projected levels by 2020 and 42% below current trends by 2025. This goal may not be met without financial and technological assistance from wealthy countries, and it has been suggested that the socioeconomic situation of South Africa takes precedence over its other promises. Despite its difficulties, South Africa recognizes that it contributes to CO<sub>2</sub> emissions (W. Beech et al., 2017).

In June 2002, Japan ratified the Kyoto Protocol, becoming the 73rd country. Japan was obligated to cut its emissions by 6% from 1990 levels. The government has pushed industries to reduce carbon dioxide emissions and boost local governments and individuals (Globalis, 2008). Floods in the Indian states of Bihar and Assam in 2008 displaced millions of people, demonstrating that until developing countries address climate change, their citizens will be subjected to the effects of such extreme weather (Flood Situation Improves Bihar, 2008). Although the Kyoto Protocol is both an environmental and an economic priority for the government, it provides an excellent chance for the government to encourage activities by enacting environmental rules and regulations (Environmental Performance Reviews, 2007). Several measures are needed to improve environmental quality and minimize emissions. Montenegro has amassed many carbon credits by leveraging investments in various industries, including energy, trash, forestry, and

agriculture. It was accomplished by reducing greenhouse gas emissions (Ministry of Tourism and Environmental Protection, 2008). Every country must set aside its desire to expand its economy at the expense of the environment. All governments must use resources sensibly, without jeopardizing future generations' ability to meet their own needs (WCED, 1987).

## **2.3 SUSTAINABILITY**

According to the Future Foundation (2002), "Sustainable Construction supports environmental, economic, and social balance to produce a better-quality life for present and future generations," When employing environmental, economic, and social resources, the notion of fairness among and between current and future generations should be recognized. Putting these needs into action necessitates comprehensive biodiversity protection in terms of ecosystem species and genetic diversity, which are all necessary underpinnings for existence (Monet project, 2001). The origin of sustainability in the modern period appears to be more explicitly anchored in biological and ecological conservation principles. Sustainable Economic efficiency had to be improved, ecological systems had to be protected and restored, and everyone's well-being had to be improved (IIS, 2003). Despite widespread agreement that sustainable development necessitates the convergence of economic growth, social equity, and environmental protection, the concept has remained elusive since the Brundtland report, and the Rio Summit; governments and organizations have adopted sustainable development as a desirable goal and developed sustainable development metrics, but implementation has proven difficult (Matthews and Hammill, 2009). In his report on the implementation of Agenda 21 at the 2002 World Summit on Sustainable Development in Johannesburg, United Nations Secretary-General Kofi Annan confirmed that "progress toward reaching the goals set at Rio Summit 1992 has been slower than anticipated, and there is undeniably a gap in implementation" (United Nations Economic and Social Council, 2002). Many people worldwide are concerned about sustainability and talk about it, but they are not acting on the ground. Drexhage and Murphy (2010) argue that fundamental structural changes are required in how societies manage their economic, social, and environmental concerns and challenging decisions to go from talking to action.

### **2.3.1 Challenges Negating Sustainable Development**

The problems of sustainable development are bringing environmental concerns, social needs, and economic imperatives under the same decision-making tent (Josh, 2001). There are numerous goals for sustainable development. It includes increasing everyone's opportunity to engage in public life, assisting in preserving the environment, encouraging intergenerational equity, and practices that are equally as vital as policy. Governance structures that incorporate a transparent

and inclusive process incorporating partnerships and other arrangements between the government and the private sector are required for long-term growth (Joshi, 2001). Developing countries are not adhering to the principles of sustainable development, and urbanization is causing environmental, economic, and social concerns. Implementing urban development concepts and environmental policies should result in long-term growth (Kalhor & Mahdisoltan, 2015). The efficiency of the program, on the other hand, is debatable. However, the effectiveness of the sustainable building method is limited due to issues such as profit-driven construction and a failure to identify and quantify the project's contribution to sustainable development, particularly during the feasibility study (Shen et al., 2010). Although the concept and idea of sustainable development are universally acknowledged, and significant work has been made on sustainable development measures, sustainable development implementation has mainly failed. The world has made little progress in putting policies and programs to help the impoverished (Moyo, 2009). Integrating the three pillars of sustainable development improvement is still a challenging task. It will take a significant amount of time and work. However, policies and proper environmental initiatives must be developed to achieve sustainable development: physical construction and planning stages (Begun al el., 2009). EMP is a part of the established policy's implementation approach, limiting negative environmental consequences during building activities. Using EMP during the construction stage will ensure that construction projects are well-developed more sustainably. Cities with integrated and balanced development of economic, social, and environmental aspects of urban life, on the other hand, can thrive in long-term sustainable development (Luděk Sýkora, 2001).

## **2.4 INTRODUCTION OF EMP ON CONSTRUCTION SITES**

In South Africa, the Environmental Management Plan (EMP) is a legal requirement and a mechanism for implementing environmental impact assessments (EIA) (DEA, 2004). EMP is utilized by DEA and relevant national and provisional agencies to monitor environmental impacts throughout project implementation (Campion and Essel, 2013). The Environmental Impact Assessment (EIA) is a systematic process of gathering information regarding development projects' environmental implications to reduce or mitigate those impacts (El Haggag and El-Azizy, 2003). EIA's most effective method helps identify environmental risks and conflicts by encouraging community participation, reducing adverse environmental effects, and laying the groundwork for environmentally viable projects. The Environmental Impact Assessment (EIA) was created to reduce the detrimental effects of human activities on the environment (Kominkova, 2016).

The EIA's goal is to:

- Evaluate the environmental impact of a proposed project.



- Develop and assess steps to avoid or minimize the impacts of proposed activities on the environment before choosing whether to carry them out; if it decides to carry them out,
- develop and assess methods to avoid or minimize such impacts (Kominkova, 2016).

The mitigation, monitoring, and management components receive less attention at EIA's formulation and implementation stages. However, impacts that can be monitored and managed are getting a lot of attention. During the EIA process, an EMP is created that outlines the strategies and procedures for mitigating and monitoring impacts. In addition, the EMP supports environmental management best practices awareness and implementation (Rizzolo, 2006). According to the study, an EMP is produced to define strategies to avoid severe environmental degradation connected with the construction and demolition of buildings. In addition, infrastructural improvement provides a framework for environmental monitoring during the development phase. Finally, it serves as a reference for the contractor and the workforce on their roles and responsibilities for environmental management on site (Saiccor, 2008).

The World Bank (1999) recommends that an EMP include the following elements:

- A summary of the projected negative environmental impacts that require mitigation should be
  - Mitigation measures should be detailed, including designs, equipment descriptions, and operating procedures. In addition, the technical aspects of putting mitigation measures in place should also be highlighted.
  - According to the description of the monitoring program, environmental performance monitoring should be planned to apply mitigation actions. Therefore, the monitoring plan should include links between impacts, measurement indicators, methodologies, and definitions. In addition, there will be a set of criteria that will indicate the necessity for corrective action.
  - Institutional arrangements: Mitigation and monitoring responsibilities should be specified
  - Legal enforceability: The legal framework for environmental protection and the legal basis for mitigation are essential legal concerns for EMP.
  - Timeline for implementation and reporting procedures: An implementation schedule with linkages to the overall project should be used to specify the timing, frequency, and duration of mitigating measures. Procedures for reporting the progress and outcomes of mitigating and monitoring measures should also be stated.
- Cost estimates: Costs for the initial investment and recurring expenses for adopting mitigation measures should be calculated.

The Environmental Management Plan (EMP) lays forth precise environmental rules for implementing and developing a project. Its goal is to make management and decision-making more straightforward mitigation of construction activities to avoid or reduce environmental impacts; thus, these impacts range from those incurred during the project's start-up, such as site clearing and erection of the construction camp, to those incurred during construction activities, such as erosion, water pollution, noise, and dust (DEA, 2004). Employers are accountable for effective management of environmental impacts, which they typically outsource to environmental specialists or consultants who furnish regulatory authorities with audit reports (Patel and Giodano, 2014). Furthermore, environmental specialists or consultants oversee ensuring that the EMP is conducted with caution. All conditions in the environment authorization or decision record are followed (Aucamp, 2009; Wesel et al., 2015). On the other hand, project managers and contractors have been chastised for putting too much emphasis on the time, cost, and quality while ignoring the project's environmental consequences (Mishra et al., 2015).

#### **2.4.1 Implementation of EMP's on Construction site**

The effectiveness of an EMP's implementation is critical to its success. An EMP is a document that describes the methods and procedures for mitigating and monitoring environmental impacts and environmental objectives and targets that the project Contractor must meet to eliminate negative impacts. It can be used throughout the project life cycle (DEAT IEM series 12, 2004).

The following are some guidelines for developing and implementing an EMP:

1. Gain a thorough understanding of all project stages' activities and consequences. After that, appropriate mitigation and monitoring measures can be put in place.
2. Recognize unique environmental dangers and concerns. It requires determining the environmental aspects that must be safeguarded and the spectrum of actions that may harm them.
- 3 Create an environmental control suite and, ideally, turn it into a set of requirements that can be incorporated into the construction tender or contract document. Mitigation methods, management controls, and environmental criteria to be satisfied will all be included in these environmental controls.
4. When creating an EMP, consider the following questions: • What is the scope of construction and operations activities?
  - What is the receiving environment's sensitivity?
  - What are the potential threats to the environment?
5. To be easily implemented, mitigating measures must be practical and cost-effective.
6. Method statements are useful tools for contractors to describe how mitigation actions will be conducted.
  - Construction and operational procedures.

- Materials and equipment to be utilized.
- How and where the material will be stored; and
- Action to contain leaks or spills.
- The time and location of construction and operational activities

7. For specific activities, identify and assign roles and responsibilities for mitigation, monitoring, and performance evaluation.

8. Create a monitoring system.

9. Outline the procedures for achieving compliance (i.e., rewards and penalties).

10. Create a program to raise environmental awareness (DEAT, 2004).

Adopting the ISO 14001 environmental management system can also help the construction industry improve its environmental performance (Ball, 2002). Sustainable businesses have realized that proper management of their natural resources and waste significantly impacts their economic and environmental performance. Certain firms have used SANS/ISO 14001 over the years to improve their chances of thriving in the worldwide competitive market (SANS/ISO 14001, 2015). SANS/ISO 14001 focuses on prevention and continuous improvement while balancing environmental protection and pollution prevention with socioeconomic requirements. Contractors will systematically manage their environmental issues by including the ISO system as part of the implementation (Addis and Talbot, 2001). As a result, the ISO system helps to improve environmental performance, particularly during the construction phase (Dasgupta, 2000).

The following are the fundamental aspects of an ISO 14001-compliant EMS, according to George (2000):

- a list of potential environmental impacts
- a set of operational processes for monitoring, regulating, and minimizing impacts, as well as recording the results
- Procedures for internal audits

EMS helps businesses improve their bottom line by decreasing environmental hazards and lowering their environmental footprint:

- Assist a corporation in building a healthy working environment to promote occupational health and safety.
- Assures customers that a company is committed to responsible environmental management and legal compliance

- Assists a company in maintaining good public and community relations • Improves cost control
- Demonstrates a responsible carrying attitude
- Conserves input material and energy
- Assists in the development and sharing of environmental solutions
- Assists in improving the relationship between government and industry (SA)

EMP is a valuable tool for assessing and reducing the environmental effect of construction projects. EMP serves as a link between the two; the EIA report's expected consequences and mitigation strategies are linked to the project's execution and operating activities through the EMP (Baby, 2011). EMP is a dynamic and adaptable document that must be reviewed and updated regularly; there is always the risk that unforeseen issues will occur during the implementation of a project. As a result, this EMP should be changed as needed to mitigate unforeseen consequences (Baby, 2011). Furthermore, it should be standard practice in an organization to identify and document the actual and possible environmental consequences of Project operations; this can be accomplished by conducting environmental audits regularly (Khanna et al., 2009).

## **2.5 BARRIERS TO EFFECTIVE EMP COMPLIANCE AMONG CONTRACTORS**

The most significant barrier to Contractors and their subcontractors fully complying with EMP is a lack of awareness and information about EMP (Nyihirani et al., 2014). It is necessary to improve project participants' understanding and awareness of the environmental implications of construction processes, particularly project managers (Zolfagharian, 2012). Politicians see EIA as a roadblock to society's essential social-economic growth. On the other hand, public and private developers see EIA as a roadblock, less important than profit, even after approval in South Africa (Sandham and Bond, 2015). Insufficient budget and understaffing at South Africa's provisional and municipal authorities jeopardize efficient monitoring and auditing enforcement (Sandham et al., 2005). It has been alleged that only a few contractors and private individuals are involved. Because most developers prioritize completion time and pay little attention to the environment, developers examine the environment (Poon et al., 2001). As a result, developing countries lack information regarding the environmental impacts of building materials and technology, making it difficult to make informed decisions about reducing environmental impacts (Pittet and Kotak, 2009). As a result, EMP implementation issues stem from EIA and EMS (J ha-Thakur and Fisher, 2016). As a result, developing countries have been hesitant to adopt and implement EMPs (George, 2008) adequately.

The following are the reasons for the slow application of EMP on construction projects:

- The lack of legal enforcement of EMPs by custodian of EMP's example Contractors, Employers and Government
- EIA policy systems often focus on the assessment part of the process. Because most developers and contractors prioritize completion time and pay little attention to the environment (Poon et al., 2001). As a result, developing countries lack information regarding the environmental repercussions of building materials and technology, making it difficult to make informed decisions that consider the cost implications of environmental regulations.
- Governments are not concentrating their efforts on strengthening institutional capacity for monitoring and enforcing compliance (Ira et al. 2000) and (Parkes et al. 2001).
- 

## **2.6 COMPLIANCE AND LEGAL ENFORCEABILITY OF EMP**

Most countries struggle to comply with environmental legislation since placing a limit on a firm's emissions does not guarantee a reduction in its emissions. However, the firm's activity must be controlled, and legal restrictions enforced (Botelho, 2003). Winter and May (2001) discovered five sets of variables to comply with environmental regulations by analyzing incentives.

- Normative motivation
- Social incentive
- Rule awareness
- Compliance capacity

The factors are determined by the firms, the community, and the government body in charge of developing regulations, assessing corporate performance, and enforcing them. According to Winter and May (2001), the higher the likelihood of detection, the higher the degree of compliance by businesses. If there is a reward for compliance, it is also more likely. Regulated businesses believe a greater chance of a fine being applied if they violate the rules. To make the most efficient use of environmental information as it flows through environmental management systems, government authorities at the local and provincial levels must coordinate their planning, development, monitoring, and enforcement operations (DEAT IEM series 20, 2004). South Africa is a country in Africa. EMP is becoming increasingly a component of the development approval process on the other hand, Individual Contractors cannot be held responsible for compliance by the Employer. Integrating the EMP as a collection of environmental specifications into the tender

and contract agreements is an ideal way to facilitate the legal enforceability of the EMP; thus, incorporating environmental considerations into the tender and contract documents is a crucial prerequisite for the EMP. EMP implementation that is effective (Barker and Hill, 2000). Identifying and documenting the actual and possible environmental implications of Project operations should be regular practice in any business; this can be accomplished through environmental audits (Khanna; Bhutiani and Matta; 2009). Staff should get environmental awareness training to familiarize themselves with their responsibilities for implementing the EMS following the environmental policy and Objectives; this will equip them with the required skills and drive to conduct the EMS effectively (Khanna; Bhutiani and Matta; 2009)

### **2.6.1 Impacts of non-compliance with EMP**

The EMP must be kept on-site during the construction time, made binding on all contractors working on the site, and incorporated into the Contractual Clauses. Construction and upgrading significantly impact the environment; during these activities, the earth's surface is opened, resulting in dust emissions and pollutants from the burning of fuels. Air pollution has been related to various health issues, such as cancer and bronchitis (South Africa Department of Transport, 1994). Most of the consequences are pollution, biodiversity loss, and natural resource depletion. Construction has a negative environmental impact since it fragments habitat and splits the ecosystem into smaller, partially isolated units (OECD), endangering the population's survival. Species by species Another harmful environmental consequence is soil contamination. Underground gasoline storage facilities are to blame (Gilbert & Perl, 2008). Human health, the natural environment, ecosystems, and natural resources are all negatively impacted by environmental factors (Sala et al., 2012). Climate change impacts the environment for people, wildlife species, and the populations that rely on these ecosystems (IPCC 2007, MEA 2005). Climate change poses the greatest threat to wildlife species. Because they rely on abiotic cues and natural resources, they are a vulnerable species (Robinson et al., 2009). Climate change impacts the temporal elements of resource usage and consumption by animal species that rely on it (Shafer et al., 2001).

### **2.6.2 Legal Consequences Of not Complying With EMP**

People should take responsibility for preventing pollution and environmental deterioration, reducing its impact, and correcting it where possible (Warren and Veltman, 2017).

- A fine of not more than ZAR5 million and a maximum sentence of five years in jail for a first offense. A fine of not more than R10 million or a term of imprisonment of not more than ten years for a second violation.

When deciding on a fine,

- The seriousness of the infraction and its impact on the environment, as well as any monetary or other benefits the offender gained because of the infringement, must be considered by the competent court.

For the duration of their validity, Environmental Authorisations (EAs) must ensure that compliance with the EA's requirements and the Environmental Management Program is audited, and an environmental audit report is produced to the competent authority (Regulation 34, Environmental Impact Assessment Regulations).

The environmental audit report must include the following information:

- Describe the results about the level of compliance with the EA/EMP/closure plan provisions, as well as the ability of the EMP/closure plan's measures to manage and mitigate environmental impacts.
- Include information from Appendix 7 of the 2014 Environmental Impact Assessment Regulations.
- Make a judgment about the ability of EMPs/closure plans to monitor and mitigate environmental impacts continuously, as well as the level of compliance with the provisions of an EA/EMP/closure plan.
- These environmental audits must be completed and filed according to the EA's schedule. There are flaws in either regulatory compliance or environmental impact reduction. In the report, a holder must make recommendations to change their EA/EMP/closure plan (Beech et al., 2017).

## **2.7 ENVIRONMENTAL MANAGEMENT PLAN AUDITING**

In the mid-1980s, the first documentation on environmental audits appeared (Greeno et al., 1988). Environmental audits were encouraged by management consulting firms to quantify their clients' environmental responsibilities. Around 1989, the first officially recognized environmental audits were conducted in South Africa. According to observers, ESKOM (South Africa's Electricity Supply Company) performed a massive environmental audit, met with mixed results. Nonetheless, it successfully persuaded several other businesses to consider environmental auditing. In South Africa, there are no explicit legislative obligations for conducting environmental audits. On the other hand, environmental auditing is the most reasonable way of

formally checking compliance with specific environmental legal requirements (DEAT, 2004). Environmental audits also detect existing, and future environmental issues decide what actions are required to meet legal obligations (DEAT, 2004c).

## **2.10 CHAPTER SUMMARY**

Construction sites activities although they are crucial for socio-economic development, activities of construction sites create negative impacts on the environment, seemingly contractors are not acknowledging EMP as a legal requirement for construction projects in South Africa. Contractors and Subcontractors perceive no motivation to follow the environmental management plan during construction because there are no consequences for non-compliance as a result, contractors and subcontractors pollute the soil water and cause deforestation. The most significant barrier to Contractors and their subcontractors fully complying with EMP is a lack of awareness and information about EMP it is clear from the literature review, the focus is on the profit margin of the project. These behaviour compromises the mitigation process of environmental impacts that have been identified at a documentation stage. Lack of awareness and training on construction workers and shortage of institutional capacity to enforce compliance are the main attributes of ineffective EMP; based on literature, many construction companies are not having ISO 140001 in their environmental management system. ISO 140001 is an internationally accepted environment system that helps companies comply with environmental protection without being forced to comply but taking the initiative to support the environmental protection program by being a member of ISO 140001 construction companies that are members of ISO are self-guiding themselves in complying with environmental protection. Therefore, effective private and public partnership collaboration is needed for prevalent and effective EMP on construction projects.



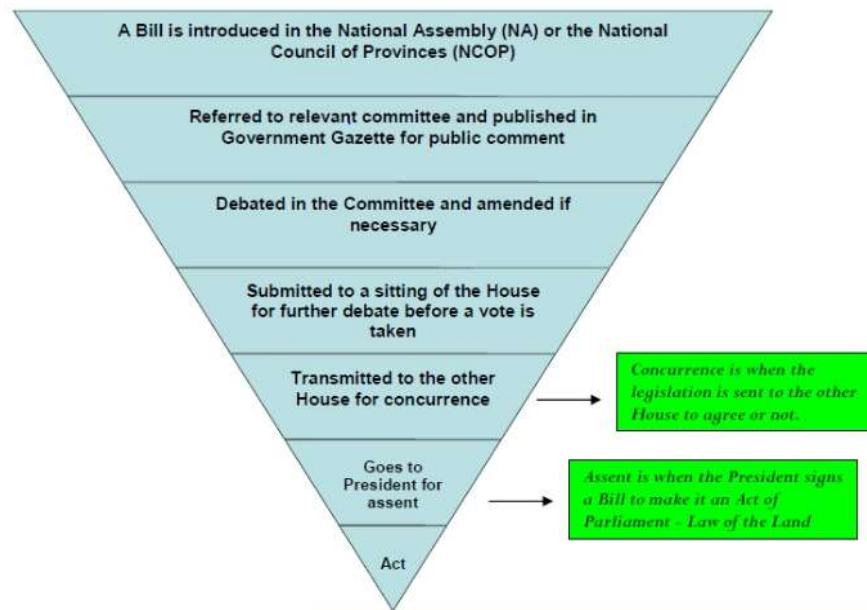
## **CHAPTER 3**

### **SOUTH AFRICAN LEGISLATIVE REQUIREMENTS AND FRAMEWORK**

#### **3.1 INTRODUCTION**

This chapter discusses the legislative requirement of environment management in South Africa. This chapter emphasizes construction legislation, acts, and regulations to direct the research study and resolve difficulties with the South African Environment Management Plan. The "development and enactment of laws by municipal, state, and national legislation," according to Encyclopedia Britannica (2018). A law-making process is a type of government activity that aims to establish legal standards (Legislation or acts adopted by the government bodies). Parliaments are an essential part of national governing structures. Legislation (creating laws), supervision, public involvement, and representation are the primary responsibilities of parliaments (Hudson, 2007). According to Hudson (2007), legislation comprises passing the laws that make up a country's legal structure. A system of regulations is referred to as law, which institutions usually impose to control human behaviour. In many ways, it influences politics, economics, and society. Parliament is South Africa's national legislature, and one of its key responsibilities is to pass new laws, amend current laws, and repeal old ones. The Constitution of South Africa governs and applies to all laws and conduct inside the country; both houses of parliament, the National Assembly, and the National Council of Provinces play a part in enacting legislation (<https://www.parliament.gov.za/how-law-made>).

Diagram of How a Law is made in South Africa



*Figure 3.1 (Source [parliament.gov.za/how-law-made](http://parliament.gov.za/how-law-made), 2009)*

### 3.2 SOUTH AFRICA ENVIRONMENT MANAGEMENT REGULATORY FRAMEWORK

Regulations are tools for promoting good behaviour in activities that have been deemed undesirable or harmful. To characterize undesirable behaviour, governments must articulate policy goals. (<http://www.qp.gov.bc.ca/rcwc/research/intersol-frameworks>). Regulations are regulations established by the government or other authorities to regulate how something is done or how people act (<https://www.collinsdictionary.com/dictionary/english/regulation>). The environmental management framework (EMF) has legislative roots in section 24(3) of the NEMA, defining environmental attributes in a specific geographic area, including sensitivity. Every competent authority must think about the scope, interrelationships, and importance of such characteristics. The approach for investigating, assessing, and communicating the potential impact of operations must meet the requirements of section 24(4) I of the NEMA. As anticipated in subsection 24(3), applying the environment authorization and maps are deemed to contribute to environmentally sustainable development by anticipating future impacts, offering early warnings, and identifying already existing impacts that must be addressed. The Environmental Management Framework strives to enhance environmental sustainability, security, and cooperation in environmental governance (South African Regulatory Framework, Chapter 5)

### 3.3 THE CONSTITUTION OF THE REPUBLIC OF SOUTH AFRICA

The Constitution of the Republic of South Africa is the legal basis for all law in South Africa, including environmental law. Everyone has the right (a) to an environment that is not harmful to their health or well-being; and (b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation, promote conservation, and secure ecologically sustainable development, according to Section 24 of the Constitution of the Republic of South Africa (The Constitution of the Republic of South Africa Act 108 of 1998).

The Republic of South Africa established sustainable development, which was put into effect by NEMA. "1(29) Sustainable development involves integrating social, economic, and environmental issues into the planning, implementation, and decision-making process to ensure that development benefits current and future generations," according to Section 1 (29) of NEMA. 10 Similarly, Section 2 (3) of NEMA establishes the following guiding principles: "2(3) Development must be socially, environmentally, and economically sustainable. (4) (a) Sustainable development requires the consideration of all relevant factors, including the following:

- The disturbance of ecosystems and loss of biological diversity are avoided, or where they cannot be altogether avoided, are minimized and remedied.
- That pollution and degradation of the environment are avoided, or where they cannot be altogether avoided, are minimized, and remedied
- Conclusion: Negative impacts on the environment and people's environmental rights are anticipated and prevented, and where they cannot be altogether prevented, they are minimized and remedied.

In the Republic of South Africa, Section 24 of the Bill of Rights, South African citizens have environmental rights guaranteed by the Constitution.

According to Section 24, "Everyone has the right:

- (a) To an environment that is not harmful to their health or well-being; and
- (b) To have the environment protected for the benefit of present and future generations,
  - (i) Through reasonable legislative and other measures that prevent pollution and ecological degradation.

(ii) Promote conservation; and

(iii) Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development..." (Constitution of the Republic of South Africa Act 108 of 1996, Section 24)

The Constitution ensures that people live in a clean and healthy environment for present and future generations through legislation and measures that prevent pollution, ecological degradation, promote conservation and secure ecologically sustainable development and use of natural resources while promoting economic and social development (Constitution Environmental Right Chapter 8, Section 24). However, the challenge for South Africa and the rest of the globe is to improve the quality of life for current and future generations through sustainable development. As a result, the South African constitution serves as a foundation for several acts. The National Environment Act of 1998, as a result, establishes a broad commitment to environmental integration at all levels of the state (Hamann et al., 2000).

The constitution's section 24(b) ensures a balance of environmental, social, and economic issues. Economic inequities must be decreased to achieve long-term sustainability, and social welfare concerns must be addressed (Warnich, 2018). South African environmental law has been enhanced by including an environmental right in Section 24 of the Constitution, ensuring environmental protection and environmentally sustainable development. Laws and regulations can help achieve sustainable development; as a result, private individuals, business entities, and public authorities must comply with laws and regulations by implementing suitable measures and, where compliance is missing, enforcing them. The court and the judiciary oversee guaranteeing the implementation of environmental rights (South African Constitution). Section 24 of Act 108 of 1996). In general, is a person's action or a legislative plan passed by congress or legislature, which is a bill until it is implemented and becomes law, for the court to decide or rule on a motion or petition, such as a motion for a new trial (Collins Dictionary of law, 2006).

### **3.4 NATIONAL ENVIRONMENTAL MANAGEMENT ACT NO. 107 OF 1998 (NEMA)**

The Act provides standards for decision-making on topics impacting the environment; the Act aim is to create cooperative environmental governance for future generations to benefit from policies that avoid pollution and ecological degradation, encourage conservation, and ensure ecologically sustainable development and utilization of natural resources while fostering economic and social growth (National Environmental Management Act No. 107 of 1996, p2).

Contractors must submit an Environmental Management Plan (EMP) for construction and an operating phase development plan that must be set up, submitted to DEA, and approved before construction, including site preparation.

EMP must:

- Incorporate the condition of the authorization given authorization environment, including recommendation and mitigation measures contained in the assessment report prepared by the development planner
- The recommendation provided by the specialist must be included in all contractual documentation for the construction phase of the development
- Specify the persons responsible for ensuring that the individual's conduct is carried out as started in EMPr
- Specify the working hours for the project's construction phase to be implemented by the Contractor during the construction and operational phase of the development.
- EMP must include the following
  - Water quality monitoring and management plan for the canal system
  - Waste management plan
  - Stormwater management plan
  - Spoil management plan
  - Method statement for construction (Olifants River Bridge, 2015)

Failure to comply with the conditions of this environment is punishable under section 49A (1) (c) of the National Environmental Management Act 1998 (Act No. 107 of 1998), as modified. The crime punishable by a fine of up to R 10 million or a term of imprisonment of up to ten years if convicted. Failure to comply with the conditions of this authorization constitutes an offense under section 49A of the National Environment Management Act, 1998 (Act no. 107 of 1998), for which a convicted person may be liable to a fine not exceeding R 10 million or imprisonment for a period not exceeding ten years, or to both such fine and imprisonment such incarceration (National Environmental Management Act No. 107 of 1998).

### **3.4.1 National Environment Management Waste Act no. 59 of 2008**

The purpose of the Act is to protect public health and the environment by establishing measures to prevent pollution and ecological degradation and to ensure ecologically sustainable development for institutional arrangements and planning national norms and standards for regulating waste management by all levels of government, including licensing waste management

activity control, and remediation of contaminated land (National Environment Management Waste Act no. 59 2008, p -2).

In the case of the discharge or disposal of waste or water containing waste contemplated in sections 21 (l), (g). (i), the water user must comply with any applicable waster standards or management practices prescribed under section 26(1) and (i), unless the condition of the relevant authorization provided (National Environment Management Waste Act no.59 2008, Section 21 and 26)

According to the National Environment Waste Act 2008 (Act No. 59 of 2008), all materials on the construction site must be stored appropriately and confined. Remove any remaining construction items from the storage space and the construction site. The Contractor is responsible for ensuring that the materials are used correctly and do not harm the environment. Waste removal from the site should also be managed properly. Construction employees should have access to clean restrooms regularly at the construction site. These measures should be addressed, executed, and monitored in the EMP for the building phase. The contractors must provide a method statement for "solid waste management" must be provided and maintained. The technique statement must include information on the licensed facility used and the suggested record-keeping system for auditing purposes. All solid and chemical wastes must be collected and disposed of at a licensed waste disposal facility. The contractor must show the Environmental Office proof of this. Waste must be divided into recyclable and non-recyclable waste in the following manner

- Hazardous waste
- general waste: including (but not limited to) construction rubble
- Reusable construction material.
- Recyclable waste must preferably be deposited in separate bins.

Any illegal waste disposal by contractors and their subcontractors will not be tolerated; a fine will be imposed, and if necessary, further legal action will be pursued. As a result, this component must be properly monitored and reported on when the Contractor requests proof of legal dumping (National Environment Management Waste Act no. 59 of 2008).

### **3.4.2 Environment Conversation Act 73 of 1989**

The purpose of the Act is to provide adequate protection and utilization of the environment; although NEMA has replaced most of the Environment Conservation Act provisions, the following provisions are applicable

- Sections 21, 22, and 26 of Part V and Schedule 1 identify activities that are likely to negatively affect the environment, including transportation, land use, and land transformation. These sections also identify activities and projects in terms of which an Environmental Impact Assessment (EIA) is obligatory, namely road projects, airports, helipads, and maritime ports infrastructure
- Regulations regarding noise control, particularly road and aircraft noise
- Airfield. (Environmental Conservation Act 78 of 1989, Section 21, 22, 26)

The Act's purpose is to provide proper environmental preservation and exploitation; Although at the same time, most of the provisions of the Environment Conservation Act have been replaced by NEMA, the following provisions still apply.

- Part V and Schedule 1 sections 21, 22, and 26 highlight activities that are likely to harm the environment, such as transportation, land use, and land transformation. In addition, these sections indicate activities and projects that require an Environmental Impact Assessment (EIA), such as road developments, airports, helipads, and maritime port facilities.
- Regulations of noise, particularly in an airfield area, focus on traffic and airplane noise (Environmental Conservation Act 78 of 1989, Section 21, 22, 26).

Any person who violates or fails to comply with a condition of a permit, permission, authorization, or direction issued or granted under the said provisions is guilty of an offense and liable on conviction to a fine not exceeding R 5 million or imprisonment for a period not exceeding five years, or to a fine not exceeding R 10 million or imprisonment for a period not exceeding ten years in the case of a second conviction (Environment Conservation Act 73 of 1989).

### **3.4.3 National Water Act 36 of 1998**

The Act intends to provide guidance in the preservation, use, development, conservation, and control of water resources, with guiding principles that recognize present and future generations' basic human needs and foster social and economic development through water. The Act's key goals are to reduce pollution, prevent degrading water resources, and prevent pollution (Nation Water Act 36 1998, Chapter 1).

The requirement of the national water Act 1998 (Act No. 36 of 1998), particularly concerning the need for a water use license. The contractor must ensure that excessive quantities of sand, silt, and silt-laden water do not enter the stormwater system. Furthermore, the stormwater drainage system's design must ensure that the stormwater system is not harmed. Under Section 39 of the

National Water Act, 1998, any actions needing authorization must be approved by the Department of Water Affairs (Act No. 36 of 1998). In addition, the Department of Water Affairs (DWA) must be notified immediately if any surface or groundwater is contaminated. According to section 20 of the National Water Act, 1998 (Act No. 36 of 1998), the contractor is accountable for all costs incurred to help in pollution control and clean up contaminated regions if construction operations cause pollution.

#### **3.4.4 Atmospheric Pollution Act no. 45 of 1965**

The purpose of the Act is to regulate air quality to protect the environment by providing reasonable measures to prevent pollution and ecological degradation and ensure ecologically sustainable development while promoting justifiable economic and social development. It also establishes national norms and standards for air quality monitoring, management, and control for specific air quality measures (Atmospheric Pollution Act no.45 of 1965).

According to the Atmospheric Pollution Prevention Act of 1965(Act No. 45 of 1965), all types of dust pollution must be controlled, and the contractors must supply and maintain a method statement for dust control. The technique statement must include information on the intended water source to be used and the licenses that have been obtained for that purpose. Constant watering of roads and work areas are required to avoid dust spread. Concrete dust that has fallen or will infiltrate into the soil must not be disturbed. Concrete bags must not be blown around the construction site, as this will distribute cement dust. Typical dust suppression measures are insufficient. Key access roads and site camps must be used. A temporary surface such as gravel should be laid down (Olifants River Bridge, 2015). A person guilty of an offense listed in section 51 faces a fine, up to ten years in prison, or both fine and imprisonment. (Act No. 45 of 1965 on Atmospheric Pollution)

#### **3.4.5 National Environmental Management Biodiversity Act no. 10 of 2004**

The Act's goal is to offer biodiversity management and conservation within the National Environmental Management Act of 1998 and the protection of species and ecosystems that warrant national protection (National Environmental Management Biodiversity Act no. 10 of 2004). The contractor should keep riparian habitat to a minimum and rehabilitate damaged areas as soon as feasible after construction to avoid loss of aquatic biodiversity in-stream. After construction activities are completed, the habitat and vegetation should be repaired and planted with suitable indigenous plants if they have been disturbed by construction activity. Additionally, the building site should be maintained afterward to ensure that the damaged regions do not become infested with alien invasive plants (Olifants River Bridge EMP, 2015). A person who has



been convicted of a crime in words should be punished, fined, or imprisoned for not more than five years (National Environmental Management Biodiversity Act no. 10 of 2004).

#### **3.4.6 Hazardous Substances Act no. 15 of 1993**

The Act's purpose is to regulate substances that can harm or kill humans due to their poisonous, corrosive, irritating, sensitizing solid or explosive properties. On-site storage rooms must include the requisite safety warnings, such as "no smoking," "no naked lights," and "Danger." Containers must also be labelled with the contents and safety standards. The contractor must provide a method statement for storing hazardous materials at the tender stage. To avoid pollution, extreme caution must be exercised when handling these materials. Before work can begin, all employees must receive training on handling hazardous and poisonous chemicals. The contractors must provide and maintain a method statement for "Diesel tanks and refuelling procedure" must be provided and maintained. A permit is required for an explosive Liquid License of diesel volume greater than 200 litres. Bulk fuel storage tanks must be located on an impervious surface that is delimited and capable of containing at least 110 percent of the tanks' volume. If possible, the filler tap should be inside the bunded area, and the bund wall should not include a tap or valve (Olifants River Bridge EMP, 2015).

Subject to subsection (2), any person convicted of an offense under this Act is liable to the following penalties:

- First conviction, a fine not exceeding five hundred rands or imprisonment for a period not exceeding six months, or both.
- second conviction, a fine not exceeding one thousand rands or imprisonment for a period not exceeding twelve months, or both.
- third or subsequent convictions, a fine not exceeding one thousand rands or imprisonment for a period not exceeding twelve months, or both; third and subsequent convictions.

When regulation establishes punishment for a violation or failure to comply with a regulation, a person convicted of such a violation or failure is solely subject to the prescribed penalty (Hazardous Substances Act no. 15 of 1993).

### **3.4.7 Occupational Health and Safety Act 1993 (Act no. 85 1993)**

The act's goal is to safeguard people's health and safety at work, as well as their health and safety in connection with the use of plant and machinery, and to protect people's health and safety at work from hazards resulting from or in connection with their work activities (Occupational health and Safety Act no. 85 1993). The site and employees must be managed following the Occupational Health and Safety Act of 1993 (Act No. 85 of 1993) and the National Building Regulations. Before beginning work, the contractor must confirm that all emergency protocols are in place. Fire, spills, ground contamination, and the usage of hazardous substances and materials are all examples of emergency procedures that must be followed. Contractors are accountable and responsible for ensuring that only authorized personnel are always on the premises. Employees must be provided with adequate protective apparel, ablution facilities, and water, as well as designated smoking locations to avoid open fires (Olifant River Bridge EMP, 2015).

Any Contractor who commits an act that causes any person to be injured at a workplace, or any user of plant or machinery, thereby causing any person to be injured, shall be guilty of an offense if that Contractor found guilty of culpable homicide had that act or omission resulted in the death of that person and on conviction the contractor will be liable to a fine not exceeding R 100 000 or imprisonment of not more than two years (Occupational health and safety Act 1993 Act no. 85 1993).

### **3.5 ISO 14000 Framework**

ISO 14000 is a new international standard series that promotes environmental preservation and long-term development. The Business Council for Sustainable Development, which was present at the Rio de Janeiro Earth Summit, proposed that the International Organization for Standardization (ISO), which had already established standards for air, water, and soil quality, develop international standards for environmental performance based on the concept of sustainable development (Rio, 1992). Adopting ISO 14000 may improve their environmental performance and the built environment, contributing to sustainable development, according to a framework for implementing the standard in construction enterprises (Hui Zhang et al., 2000). The ISO 14000 framework assesses how an organization's environmental performance might be improved by implementing an EMS (Lee and Ling, 2015). According to ISO 14001, the company must describe the environmental impact of its operations before certification of the plans and procedures that make up the environmental management system (Darnall, 2006). The EMS

standard is built on the notion of continuous development, which encourages businesses to enhance their environmental management systems regularly (Darnall, 2006). According to Yiridoe and Marret (2004), the ISO 14001 standard's primary purpose is to improve and promote compliance and adherence to environmental laws and regulations. The overall goal of ISO 14001 is to promote environmental protection and pollution prevention. "An organization can use proof of effective implementation of this International Standard to satisfy interested parties that an acceptable environmental management system is in place" (ISO, 2004).

### **3.5.1 Importance of ISO 14000 Standard**

According to the British Standards Institution, the standard is designed to address or reduce environmental impact (BSI, 2010). The Contractors that are certified to ISO 14000 are committed to improving their environmental performance continually. ISO 14000 links an organization's activities to its environmental responsibilities. ISO14000 focuses on environmental management and supports contractors in reducing detrimental environmental consequences caused by their activities while continuously improving their environmental performance (ISO, 2008). Contractors must set environmental objectives to meet the environmental policy, monitor progress toward targets, resolve environmental issues, and amend the EMS regularly to ensure continuous improvement in environmental performance, according to ISO 14000. (Johansson al et., 2000). The adequacy of significant improvement that the organization may achieve on its different internal levels is the application of ISO 14001, aside from the internal transformation about environmental sustainability (Hawrock et al., 2009). The benefits of applying ISO 14001 certification, according to Escanciano et al. (2001), are not limited to enterprises and their staff but also extend to their customers.

### **3.5.2 Benefits of Implementing ISO 14000**

Construction operations have negative environmental consequences. The International Organization for Standardization (ISO 14000) has released a set of environmental management standards that have been introduced as a tool to help reduce these consequences. The goal of implementing these standards is to create an environmental management system that can help enterprises achieve their environmental objectives (Valdez and Chini, 2005). ISO 14001 is the most well-known of the ISO 14000 set of standards, and it provides the requirements for any organization, regardless of size or type, to adopt an EMS (Hikichi et al., 2016). The Environmental Management System is designed to decrease environmental consequences, yet

many contractors lack a comprehensive ISO 14000 certified environmental system. Contractors must comply with ISO standards.

Furthermore, few construction companies have fully adopted EMS systems, unlike manufacturing companies, according to worldwide trends. Therefore, they can be linked to the industrial industries' long-term stability (Christini al el., 2004). As a result, contractors should begin using ISO 14000 to improve their Environmental Management System to safeguard the environment without feeling compelled to do so.

### **3.5.3 Requirements of ISO 14001 to Contractors**

ISO 14001 certification is more widely used (Yiridoe et al., 2003). Africa has a small number of ISO 14001-certified contractors. However, the percentage of total certification is increasing. When it comes to implementing environmental management systems, contractors are behind the curve. Unlike the manufacturing industry, they have taken advantage of many EMS benefits, including increased regulatory compliance and improved stakeholder and client relationship (Johnstone and Labonne, 2009). However, in the context of South Africa, although all contractors in South Africa must adhere to the law's standards, only those having ISO 14001 certification are audited by certifying bodies regularly to ensure that their systems and processes are compatible with legislative, regulatory, and ISO 14001 criteria. Although certification to ISO 14001 is an option in South Africa in this legislative setting, legislation has been enacted to shift the burden of proof on environmental management to the business. Apart from that, one of the essential rights entrenched in Section 24 of the South African Bill of Rights is the right to privacy (Act 200 of 1993). One of the most important aspects of ISO 14001 is the demand that impacts be regulated and mitigated with specified measures. The operator sets the goals and action plans (George, 2000).

EMPs are used as part of a larger, more sophisticated project's overall environmental management plan. In addition, EMPs for specific sectors or management activities, such as solid waste management, may be prepared. However, using ISO 4001 certification body can assist Contractors in obtaining significant benefits (de Vries et al., 2012). The ISO 14001 standard considers that more significant environmental management increases operational performance, according to Curkovic et al. (2005). According to Singh, Brueckner, and Paddy (2015), it also leads to better organizational management, increased internal and external process communications, employee motivation, and a more productive workforce. A more positive picture of the company EMS also helps contractors reduce pollutants released by production activities and enhance waste management, resulting in improved overall management performance. Developing nations must accelerate the adoption of EMS (Massoud al el., 2010).

### **3.5.4 CHAPTER SUMMARY**

There are several laws governing the South African construction industry with the Constitution of South Africa being the supreme law. This chapter highlights the legislative requirements of environment management in South Africa. NEMA act 107 of 1998 being the main act that provides standards for decision-making on topics impacting the environment by creating cooperative environmental governance for future generations to benefit from policies that avoid pollution and ecological degradation, encourage conservation, and ensure ecologically sustainable development and utilization of natural resources while fostering economic and social growth. This chapter also emphasizes different construction legislations, acts, and regulations to direct the research study and resolve difficulties with the South African Environment Management Plan. Regulations tools are used to promote good behaviour in activities that have been deemed undesirable or harmful by enforcing fines for failure to comply legislative requirement of EMP.

## **CHAPTER 4**

### **RESEARCH METHODOLOGY**

#### **4.1 INTRODUCTION**

The research methodology used in this study described in this chapter. According to Rajasekar et al. (2006), research is the systematic and rational quest for new and valuable knowledge on a specific issue. It is a systematic inquiry of finding solutions to scientific and social problem theory objects. The study, experience, observation, analysis, comparison, and reasoning are all used in the investigation. The Oxford English Dictionary (OED), 2013 defines research as "the methodical examination into and analysis of materials and sources to establish facts and reach new conclusions."

The research design and methodology used in this study are described in this chapter. According to Rajasekar et al. (2006), research is the systematic and rational quest for new and valuable knowledge on a specific issue. It is a systematic inquiry of finding solutions to scientific and social problem theory objects. The study, experience, observation, analysis, comparison, and reasoning are all used in the investigation. The Oxford English Dictionary (OED), 2013 defines research as "the methodical examination into and analysis of materials and sources to establish facts and reach new conclusions."

#### **4.2 RESEARCH DESIGN**

A research design is a set of parameters for gathering and interpreting data to balance relevance to the study goal with efficiency and method (Ram, 2010). The research design establishes the procedure for collecting and analyzing the relevant data and how all of this will answer the research question (Grey, 2014). The research design aims to offer a suitable framework for a study. The research approach is crucial in the research design process since it dictates how relevant information for a study will be gathered (Aaker et al., 2000). The research procedure is divided into six stages:

A research design is the arrangement of conditions for collecting and analyzing data in a manner that aims to combine relevance to the research purpose with economy and procedure (Ram, 2010). Research design sets the procedure on the required data, the methods to be applied to collect and analyze this data, and how all of this will answer the research question (Grey, 2014). The research design is intended to provide an appropriate framework for a study. An important decision in the

research design process is the choice regarding the research approach since it determines how relevant information for a study will be obtained (Aaker et al., 2000). The Research process proceeds in six phases:

- Specifying the problem/topic to be studied
- Framing research design
- Planning a sample (probability or non-probability or combination of the two)
- Collecting data
- Analyzing data
- Writing report (Ram, 2010)

Robson (2002) distinguishes between three types of study designs: exploratory, descriptive, and explanatory (Robson, 2002). A descriptive study's goal is to paint a picture of a situation, person, or event or explain how objects are related to one another in the natural world (Blumberg, Cooper, and Schindler, 2005). Exploratory research sets the first research concept, sample methodology, and data gathering method, laying the groundwork for more decisive research (Singh, 2007). Finally, an explanatory study aims to explain and account for the descriptive data. On the other hand, explanatory studies seek to answer why and how questions, whereas descriptive studies, may address what kinds of inquiries (Grey, 2014).

#### **4.4.1. Qualitative Research Design**

Qualitative research design can be define as research about persons lives, lived experiences, behaviours, emotions, and feelings as well as about organizationaal functioning and interrraction between nations (Flicks, 2014). This model can be used to describe the "design-in-use" of a study, the actual links between the components of the research, as well as the planned design. It distinguishes between the "logic-in-use" and "reconstructed logic" of research (Maxwell & Loomis, 2002). Furthermore, certain research methods use in-depth interviews to accomplish their goal of learning about the underlying motivations and aspirations (Kothari, 2014)

#### **4.2.3 Quantitative Research Design**

Durrheim (2004) define research design as strategic framework for action that serve as a bridge between rearch questions and the execution or implementation of the research of the rearch strategy. Quantitative research design is mostly associated with deductive research approach (Saunder et al., 2012). According to Leedy & Ormrod (2001), research is independent of the researcher, therefore data is utilized to measure reality and produce meaning in an unbiased

manner. To ensure objectivity, generalizability, and dependability, the research design makes use of quantitative methodologies from the natural sciences, such as numerical or statistical analysis (Creswell, 2003; Weinreich, 2009). There four main types of quantitaitve research design in order to produce accurate results,

- Survey methodology collects data from a randomly sampled population using interviews, questionnaires, and sampling polls (Klazema, 2014).
- In a correlational method, the researcher uses statistical correlation to examine differences between variables or study groups (Leedy & Ormrod, 2001)
- Quasi-experimental also known as causal-comparative research seeks to examine the cause effect (Klazema, 2014)
- Experimental research is specifically focused on proving the hypothesis or several hypotheses (Klazen, 2014)

#### **4.3 RESEARCH PROCESS**

Bryman and Bell (2007) provide a schematic diagram depicting the main steps to be followed in quantitative research, see Figure 4.1. Bryman and Bell (2007) further acknowledge that research is rarely as linear and straightforward as depicted in Figure4.1 Nonetheless, the schematic depicted in Figure 4.1 is a valuable representation for the novice researcher to begin to understand what a quantitative research process would involve.

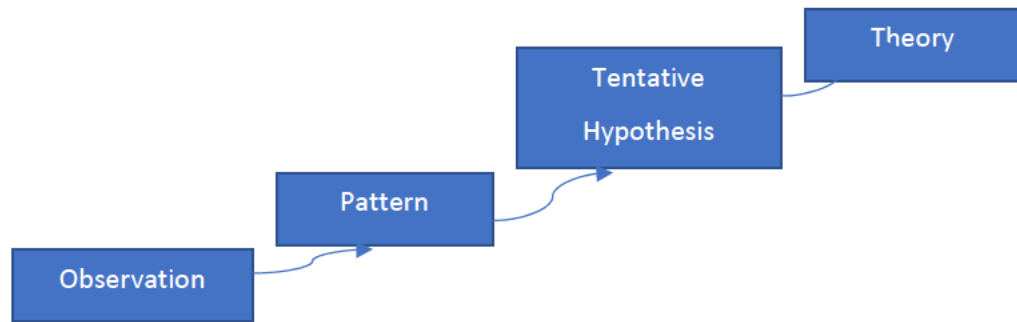




**Figure 4.1: The process of the research** Source: (Bryman and Bell, 2007)

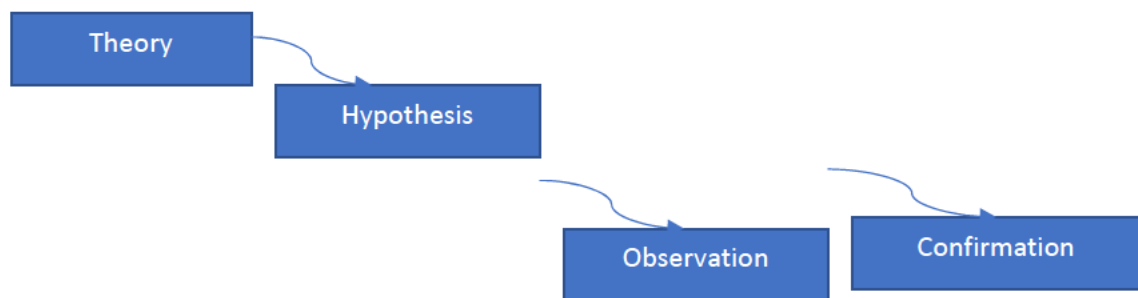
#### **4.4 RESEARCH APPROACH**

Inductive reasoning is used to move around the left side of the wheel, and deductive logic is used to circle the right side of the wheel (Rudestam and Newton, 2001). On the other hand, induction entails moving from the specific to the general, making empirical observations about a topic of interest, constructing induction, and developing conceptions and theories based on them (Locke, 2007). Moving from the specific to the observation is a "bottom-up" technique in inductive reasoning. Inductive reasoning starts with specific observations and measurements, then looks for patterns and regularities, formulates preliminary hypotheses to test, and develops broad conclusions or theories (Trochim, 2020).



**Figure 4.2 Inductive approach**

Starting with a theory, deducing hypotheses, testing those hypotheses, and modifying the theory are all examples of deductive reasoning (Locke et al., 2007). Top-down deductive reasoning starts with a theory, then narrows down to more precise hypotheses that may be tested, and finally narrows down to a collection of observations to address the hypothesis. Finally, the hypotheses are tested with data to confirm the original theory (Trochim, 2020)



**Figure 4.3 Deductive approach**

When it comes to research, these two reasoning techniques are vastly different. Inductive reasoning is more open-ended and exploratory, whereas deductive reasoning is more focused on hypothesis testing (Trochim, 2020)

#### **4.4.1 Qualitative Research Approach**

According to Rudestam and Newton (2001), qualitative research focuses on understanding the "socially constructed nature of reality," the nature of the "close interaction between the researcher and the object of study," and the context that influences the investigation. The qualitative technique differs from the quantitative approach in that it is entirely inductive; explanations and

hypotheses are derived from empirical observations of the natural world under study (Bryman and Bell, 2007). A qualitative method is also based on a subjective approach, frequently based on soft data. Qualitative researchers are mainly concerned with examining spoken and written representations of the human experience, and they employ various data gathering methods within a single study (Punch, 2005). Researchers that use this method are expected to have certain qualities or attributes. For example, researchers who use qualitative research methods are supposed to have qualities such as being a good listener, non-judgmental, friendly, honest, and adaptable, among others (Kothari, 2004).

**Table 4.1 Features of Qualitative Research**

<b>Advantages</b>	<b>Disadvantages</b>
It helps research a small number of cases in depth (Griffin, 2004)	The findings do not apply to large populations or in other scenarios (Atieno, 2009)
In qualitative research, data is frequently obtained in a naturalistic situation (Atieno, 2009, Creswell, 2009)	When opposed to quantitative research, data collection often takes longer (Creswell, 2009)
When conducting research, give the research a little leeway (Griffin, 2004)	Testing hypotheses and theories with large populations are more complicated.
Qualitative research is an interdisciplinary area that incorporates a wide range of philosophical perspectives, research methods, and interpretative tools for analyzing human experience (Denzin and Lincoln, 2002)	qualitative research methods often overlook contextual sensitivity to focus on meanings and experiences (Silverman, 2010).

#### **4.4.2 Quantitative Research approach**

A quantitative research approach is described as quantitatively oriented by Bryman and Bell (2007) and Punch (2005) since the data acquired about the world is numbers. Furthermore, the researcher can preserve objectivity when it comes to the subject of the study. Quantitative research methods are supposed to be reproducible and capable of being distinguished from reality while

being investigated (Rudestam and Newton, 2001). Quantitative research entails gathering information that will be quantified and statistically treated to support or refute alternative knowledge claims. According to Leedy & Ormrod (2001), research is conducted independently of the researcher, and as a result, data is used to objectively measure reality and produce meaning. To ensure objectivity, generalizability, and dependability, the research design makes use of quantitative techniques from the natural sciences, such as numerical or statistical analysis (Creswell, 2003; Weinreich, 2009).

**Table 4-2 Comparative analysis of Qualitative and Quantitative Research**

	<b>Qualitative Research</b>	<b>Quantitative Research</b>
Objective/ Purpose	To obtain a better understanding of the underlying reasons and motivations	To collect data and extrapolate outcomes from a sample to the target population.
	To provide insight into formulating problem concepts and hypotheses in preparation for a future quantitative study.	To determine the prevalence of diverse viewpoints and ideas in a sample of people.
	to learn about current thought and opinion trends	Qualitative research is sometimes utilized to go deeper into some of the findings.
Sample	A small number of non-representative cases are usually chosen to complete a specific quote.	Many instances usually represent the population of interest. Respondents were chosen at random
Data collection	Many instances usually represent the population of interest. Respondents were chosen at random	Online questionnaires or telephone interviews are examples of structured procedures.
Data analysis	Non-statistical	Tabulation is the most used format for statistical data because the findings are usually conclusive and descriptive.

Outcome	The exploratory and investigative research results are not definitive and cannot be applied to the entire population of interest. Instead, gain a basic comprehension and a solid foundation for future decision-making.	It is a phrase used to suggest a final course of action.
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(Neuman et al., 2007)

## **4.5 RESEARCH METHODS**

### **4.5.1 Qualitative research methods**

Qualitative researchers are mainly concerned with investigating oral and written accounts of the human experience, and they frequently employ numerous data gathering techniques within a single study (Punch, 2005). The following is a quick rundown of some of the most common data collection techniques used in qualitative research.

#### **4.5.1.1 Interviews**

The interview technique is considered the most generic form of data collection used in qualitative Research (Punch, 2005). Punch (2005) further argues that it is an effective way of accessing people's perceptions, meanings, and their worldviews. Three-way of identifying types of interviews these three types of interviews are structured, semi-structured, and unstructured. The structured interview is best suited to the qualitative paradigm. The semi-structured interview would have a set of predetermined questions, but the order or the wording of a question may be changed at the interviewer's discretion (Robson, 2002). Non-standardized, open-ended, and in-depth interviews are referred to as unstructured interviews. As a result, the interviewer usually has a basic concept of the topic of interest or concern, but they let the conversation flow naturally within it (Robson, 2002).

#### **4.5.1.2 Observation**

Observation allows the researcher to independently observe and record the actions and behaviours of people (Robson, 2002). There are two main fundamentally different approaches to using the observation research method: structured observation and participant observation. Structured observation means that the researcher adopts a detached stance (Robson, 2002). Structured observation is a way for systematically monitoring individual behaviour in terms of a specified coding scheme. It is a method for quantifying people's actions or groups of individuals (Bryman

and Bell, 2007). Participant observation requires the researcher to assimilate into the physical group being observed and share life experiences, learning their language and social conventions (Robson, 2002; Punch, 2005). Hence, this form of qualitative data collection is most used in an ethnographic study. Participant observation is seen to be a helpful tool where the researcher needs to be able to view the social world through the eyes of those being researched (Bryman and Bell, 2007)

#### **4.5.1.3 Focus groups**

A focus group is a "group interview on a specific topic" that is defined as a "group interview on a specific issue" (Robson, 2002). Allows the researcher to comprehend why people have certain feelings about a particular topic (Punch et al., 2007). The research uses the interaction amongst the group to produce the data via group interaction. The group situation stimulates the individuals to make a point of view. Sometimes, they are reluctant to do it in a one-on-one interview situation (Robson, 2002). Bryman and Bell (2007) provide a list of helpful, practical tips that need to be considered when using focus groups, namely:

- It works best from a data collection point of view if the group discussion is tape-recorded
- The number of focus group discussions needed in data collection must be carefully considered. For example, the norm in qualitative research is between 12 and 15 different focus group discussions on your topic.
- The role of the researcher needs to be carefully considered. The focus aims to obtain the perspective of the individuals within the focus group, and therefore research should not be structured or intrusive in any way.

#### **4.5.1.4 Case study**

The researcher needs to be clear about the case, as this clarity is critical. One of the significant challenges in using case studies is defining the analytical unit. The research issue and the unit of analysis are addressed at the same level (Yin, 2009). Robson (2002) argues that this difficulty in distinguishing between the case and the unit of analysis arises when the focus of the case moves away from a person to other forms of human interaction, e.g., a group of individuals and an organization

### **4.5.2 Quantitative Research Methods**

According to Leedy et al. (2001), a research technique is the set of steps before beginning a project to obtain results; a quantitative research method quantifies and analyzes factors. It's a type of

empirical investigation that's sometimes referred to as scientific research (Atieno, 2009). Quantitative research has a severe drawback: it focuses solely on statistics, and the results can be misleading because all other aspects are disregarded. Durrheim (2004) define research design as strategic framework for action that serve as a bridge between research questions and the execution or implementation of the research of the research strategy. Quantitative research design is mostly associated with deductive research approach (Saunders et al., 2012).

#### **4.5.2.1 Descriptive design**

This design aims to convey the current situation or a reality. The investigation does not begin with a hypothesis produced after the data has been acquired, and data acquisition is primarily observational.

#### **4.5.2.2 Correlational design**

Statistical analyses investigate the relationship between variables in this design type. In contrast, it does not look for cause and effect, and data collecting is primarily observational.

#### **4.5.2.3 Quasi-experimental**

A cause-effect relationship between two or more variables is the subject of the quasi-Experimental design. The independent variable cannot be changed, and groups can't be allocated. Instead, control groups are identified and exposed to the variable in this situation. The results are compared to those of groups not exposed to the variable.

#### **4.5.2.4 Experimental**

The scientific method establishes a cause-and-effect link among a group of variables in a research study using experimental, also known as actual experimentation. Except for the manipulated variable, all variables can be controlled (independent). The independent variable's impacts on the dependent variable are gathered and assessed to see a relationship.

#### **4.5.2.5 Questionnaire**

Data collection technique conducted by asking questions to those who are thought to have the desired information (Bhattacharyya, 2006). Questionnaires usually involve emailing or hand-delivering a carefully constructed questionnaire for the participants to respond to within a stipulated period. This method has proved to be highly effective in retrieving information (Kothari, 2004). Questionnaires are a familiar method of collecting data to get the required information related to the research question reasonably and efficiently. A well-designed questionnaire can provide an outcome that will reflect on the accuracy of the quality of information (Brace, 2008). Survey research designs provide flexibility and can be presented in

various forms like questionnaires. They can be administered electronically or personally. The advantage of using the questionnaire is that it has relatively comprehensive coverage, low cost, and the respondent's anonymity may allow disclosure of more confidential data.

Questioning persons assumed to hold the needed knowledge is gathering data (Bhattacharyya, 2006). Questionnaires usually entail sending an email or handing out a well-crafted questionnaire to participants who must respond within a certain amount of time. This technique has shown to be quite effective in extracting data (Kothari, 2004). Questionnaires are a common way of gathering data to gain the information needed to answer a research topic reasonably and efficiently. A well-designed questionnaire can yield a result that reflects the accuracy and quality of the data (Brace, 2008). Survey research designs are versatile and can be delivered in various formats, like questionnaires. They can be given out electronically or in person. The advantage of using the questionnaire is that it is quick and easy to complete. It offers a wide range of coverage and is inexpensive. In addition, the respondent's anonymity may allow for the revealing of more sensitive information.

### **The advantages of questionnaires**

- Practical
- Substantial amounts of information can be collected from many people in a brief period and in a relatively cost-effective way
- It can be conducted by the researcher or by any number of people with limited effect on its validity and reliability
- The results of the questionnaires can usually be quickly and easily quantified by either a researcher or with a software package
- It can be analyzed more 'scientifically' and objectively than other forms of research
- When data has been quantified, it can be used to compare other research and may be used to measure change
- Positivists believe that quantitative data can be used to create new theories and test existing hypotheses (Popper, 2004)

### **The disadvantages of questionnaires**

- It is argued to be inadequate to understand some forms of information - i.e., changes of emotions, behaviour, feelings, etc.
- Phenomenologists state that quantitative research is simply an artificial creation by the researcher, as it is asking only a limited amount of information without explanation



- Lacks validity
- There is no way to tell how truthful a respondent is being
- There is no way of telling how much thought a respondent has put in
- The respondent may be forgetful or not thinking within the full context of the situation
- People may read differently into each question and therefore reply based on their interpretation of the question - i.e., what is 'good' to someone may be 'poor' to someone else. Therefore, there is a level of subjectivity that is not acknowledged
- There is a level of researcher imposition, meaning that when developing the questionnaire, the researcher is making their own decisions and assumptions as to what is and is not essential; therefore, they may be missing something that is of importance (Popper, 2004)

In this study, the questionnaire was used to collect data since it allows for data quantification and makes data analysis easier in general. In addition, questionnaires provide some advantages, including saving time and money, covering a vast geographic area, permitting the collection of considerably more data on a condensed basis, processing findings quickly, and protecting anonymity (Popper, 2004).

#### **4.5.3 Mixed Method**

Mixed methods define as research that collect, analyses data, integrate the findings and draws inferences by combine both qualitative and quantitative approach in the one study (Tashakkori and Creswell, 2007). Mixed methods research is guided by theoretical assumption to combination of both qualitative and quantitative approach through research process (Hanson, et al., 2005). The qualitative data is derived from open ended without pre-design replies and whereas quantitative data comes from close end data like questionnaires(Creswell, 2007). The research should provide equal weight to both qualitative and quantitative data that are collected simultaneously. In order to create their three-dimensional typology of mixed methods design, Leech and Onwuegbuzie (2007) used three criteria: the degree of mixing, the emphasis of the approaches, and the time orientation. Even though it is obvious although a mixed methods approach has several benefits for researchers, there have been objections to its application. Several of these criticisms center on the thesis' incompatibility, or the idea that because quantitative and qualitative research methodologies have such dissimilar ontological and epistemological foundations (Creswell and Plano Clark, 2007). The third methodological approach that has a lot to offer in research is now considered to be mixed methods research. Combining techniques gives researchers the chance to comprehend research topics more thoroughly (Creswell and Plano Clark, 2007). According to Johnson and Onwuegbuzi (2004) the use of induction, which refers to the discovery of patterns,

deduction, which involves testing theories and hypotheses, and abduction, which refers to discovering and relying on the best set of explanations for understanding one's results, are all examples of mixed methods research. The following justifications for combining qualitative and quantitative approaches are identified by Onwuegbuzie and Leech (2006).

- *Participant enrichment* refers to increasing the number of participants in the research. Leech (2006) contends that the larger the sample, the more reliable and valid the research findings will be
- *Instrument fidelity* refers to maximizing the appropriateness and/or utility of the instruments used in the study
- *Treatment integrity* refers to mixing qualitative and quantitative research methods in order to assess the fidelity of interventions, treatments, or programmes; and significance enhancement refers to maximizing the researcher's interpretation of data.

#### **4.6 INSTRUMENT DESIGN**

Research instruments are fact-gathering tools, and every effort was taken to ensure that the survey was constructed so that participants could comprehend it and respond appropriately (Kothari, 2004). The questionnaire was created to be straightforward, brief, and to the point, as Marshall (2004) advised. The suitability of the instrument chosen has a significant impact on the reliability and validity of a research project; as a result, the process used to collect data must be assessed to see if it is likely to provide the intended results. Questionnaires were utilized to collect data pertinent to this investigation's aims and research questions.

##### **4.6.1 Questionnaires**

The questionnaire is an organized set of questions typed out in a particular order for gaining information related to the research problem (Kothari, 2014). Questionnaires are a familiar method of collecting data to get the required information related to the research question reasonably and efficiently. Furthermore, a well-designed questionnaire can provide an outcome that will reflect on the accuracy of the quality of information (Brace, 2008).

A questionnaire is used when resources are limited, as a questionnaire can be inexpensive to design and administer. Time is an essential resource that a questionnaire consumes to its maximum extent, protecting the participants' privacy as participants will respond

honestly only if their identity is confidential. Therefore, the first step in questionnaire development is determining the research goals (Burgess, 2001; Pope et al., 2005).

### **Open-ended questions**

Participants are asked to write their responses to open-ended questions (Thorndike & Thorndike-Christ, 2010). Because open-ended questions let respondents use their language, they can submit whatever response they like to a question (Fink, 2013). They help elicit opinions, such as the staff's feelings on a new reading program or specific teaching methods. Open-ended queries can elicit data without constraining responses, resulting in the omission of valuable information. On the other hand, open-ended questions take longer to code and analyze than closed-ended questions (Dillman, 2014; Fink, 2013). As a result, the processing time can be lengthy, especially when the responses are lengthy. One way to cut down on this time is to set a word or character restriction for responses, which can be enforced if the survey is completed online. (Source: Fink, 2013). Structured and unstructured open-ended queries are possible (Fink, 2013; Kline, 2005). Open-ended inquiries with a structure call for specific information. Open-ended, unstructured inquiries inspire more in-depth responses.

Every effort was made to ensure that it was structured so that participants could understand it and respond effectively (Kothari, 2004). According to Marshall's advice, the questionnaire should be simple, brief, and to the point (2004). The instrument's adequacy has a considerable impact on the research project's reliability and validity; as a result, the data collection procedure must be evaluated to see if it is likely to produce the desired results. In this investigation, questionnaires were used to collect data relevant to the study's goals and research questions (Source: Fink, 2013). Open-ended inquiries can be organized and unstructured (Fink, 2013; Kline, 2005). Inquiries with an open-ended answer structure necessitate specific data. Unstructured, open-ended questions elicit more detailed responses.

### **Closed-ended questions**

Closed-ended questions limit the number of possible responses (Thorndike & Thorndike-Christ, 2010). They're helpful when the information required is not exploratory, and the developer is looking for definite responses. The open-ended question "What do you believe are the strengths of the new reading program?" for example, allows employees to express a variety of opinions and attitudes. Closed-ended questions are popular because the data they create is more manageable to summarize and analyze than data from open-ended questions (Fink, 2013; Kline, 2005). When time and resources for analysis are limited, closed-ended questions are frequently used (Kline, 2005). However, they may limit the breadth and depth of responses and the range of alternative

responses respondents can provide (Dillman, 2014; Fink, 2013; Thorndike & Thorndike-Christ, 2010). An "alternative" solution to the problem Respondents may be given a chance to add items that do not show among the alternatives using the response option (Burgess, 2001).

### **Close Ended Questions**

In most cases, these are multiple-choice questions. Closed-ended inquiries allow a limited number of responses, obviating the need to provide further information; they require awareness and decision-making among answer options. They were used for more accuracy, consistency, and a less taxing evaluation for the respondent (Ibid).

### **Advantages of Open-Ended Questions.**

- Open-ended questions offer respondents an opportunity to provide a wide range of answers. Because some of these answers will be unexpected, they will suggest follow-up questions in person-to-person interviews (Hyman and Sierra, 2016).
- • Open-ended questions allow respondents to react with a variety of options. They will recommend follow-up questions in person-to-person interviews because some of these replies will be surprising (Hyman and Sierra, 2016).

### **Disadvantages of Open-Ended Questions**

- Biased by respondent articulateness to some extent, responses to open-ended questions are weighted unintentionally by respondent articulateness, as more articulate respondents will say more.
- Interviewer bias in open-ended questions does not lend to self-administered questionnaires. They are best used with a live interviewer either in person or via telephone, and interviewers are not alike.
- It is hard to record answers; although audio or video recording seems a wonderful way of collecting data, many people may be reluctant to allow themselves to be audio or video recorded. Therefore, it can result in the incomplete collection of data.
- Coding inconsistency and difficulty any post-data-collection numerical analysis requires examining every response to every question.
- Reduced cross-study comparability open-ended questions are more challenging to use for cross-study comparisons because choices and contexts change over time.

- Tabulating complexity and costliness in open-ended questions are more costly because their best use requires live and expensive interviewers and additional costly (Hyman and Sierra, 2016).

### **Close-ended Questions Advantages**

- Respondents' communication skills are less critical because they merely require respondents to select from a set of alternatives; relatively inarticulate people will not struggle to answer close-ended questions; there is a Speedy response.
- Respondents can answer close-ended questions quickly, giving them the sense, they are making good progress; speedy response time per question means you can ask more questions on a broader range of topics.
- Easier to answer by easing their task, you increase respondents' enthusiasm for returning a completed questionnaire.
- Data quickly coded, entered, and analyzed to close-ended questions are easily pre-coded, which means entering an answer into your response database merely requires you to type a number corresponding with the answer provided.
- Less-skilled or no interviewer needed either little or no interviewing skill is needed to administer close-ended questions, which is why such questions dominate self-administered surveys (Hyman and Sierra, 2016).

### **The disadvantages of closed-ended questions**

Cannot obtain in-depth response respondents merely read several options and pick the one most representative of their opinions and behaviours.

- Poor at providing new insights, the structure of the questions has the likely correct answers for respondents to pick.
- It is harder to write good close-ended questions because all possible answers must be anticipated.
- Answers may not fully reflect the respondent's attitude
- Categories hint at correct answers by providing possible responses hinting at the correct answer to respondents (Hyman and Sierra, 2016).

### **Things to be considered while preparing research design instrument:**

- Prepare a minimum number of questions.
- The question must be short.

- Negative questions and ambiguous language must be avoided
- Sequence the questions carefully with opening questions and closing questions.
- Assess the questionnaire in a pilot survey to ensure that the correct research instrument to obtain the needed data is in place (Bell et al., 2005).

Open-ended questions were not included in this study. Every response to each question must be examined in numerical analysis. This procedure needs more time and effort (Hyman and Sierra, 2016). As a result, in this study, a closed-ended question was used. It may take longer to write, but it makes data analysis much more manageable.

All questions are closed-ended and straightforward to read and comprehend; construction workers and site management teams were asked to score their knowledge on a Likert scale with 1 = strongly disagree, 2= disagree, 3=Seldom 4=agree, and 5 = strongly agree. For example, on An Examination and Prevalence of Environmental Managers Plans in eThekweni Municipality, how much did they agree with two questionnaire surveys created to cover construction employees and construction management on-site? Construction workers and the site management team included the gender, intended grade, and achievement and completed the measure. Annexure 1 contains a copy of this measure. Two questionnaires were prepared for construction employees and the site construction management team for various projects. Declarative questions are comparable to multiple-choice questions, but they have a different format. The respondent is asked to rate or rank a statement or a sequence of statements in response to the inquiry. These are simple questions to answer, and the data is simple to evaluate. Closed-ended questions are popular because the data they create is more manageable to summarize and analyze than data from open-ended questions (Fink, 2013; Kline, 2005). When time and resources for analysis are limited, closed-ended questions are frequently used (Kline, 2005). However, they may limit the breadth and depth of responses and the range of alternative responses respondents can provide (Thorndike-Christ et al., 2010). The surveys were semi-structured and featured closed questions with definite and pre-determined answers. Some demographic information about the participants was included in the first section of the questionnaire (questions 1.1–1.10), such as years of experience and the percentage of work typically performed by the respondent (whether private or public sector project), as well as the number of permanent and temporary staff. The second component of the Act focused on the level of understanding of the Environmental Management Regulatory Framework, the influence of the efficacy of the environment management plan on site, and the third section on construction project compliance with the environmental management plan.

Lastly, practice and attitude toward the environmental management plan on the construction site. Respondents were asked to read and comprehend the questions and score their responses after

receiving the questionnaire by email (self-completion surveys), google forms, or physical delivery. The respondents were given instructions on how to react, i.e., how to tick the proper answers, and they were also asked to complete a questionnaire must complete the questionnaires and return them. The questionnaire survey took place between May and June 2021, and all research participants were given two weeks to complete the surveys to increase response rates. Follow-up phone calls were be made, and e-mail issued to the participants as a reminder. The advantage of emailing the questionnaires to the responders was that it reduced expenditures by eliminating travel fees. The disadvantage of employing questionnaires is that the researcher has no control over whether the best-qualified representative from each firm responds.

#### **4.7 POPULATION**

In both qualitative and quantitative investigations, population specification is required. Furthermore, both designs use generic, target, and accessible ideas. However, the same qualitative and quantitative investigations are not used to define the population (Creswell, 2003; Denzin & Lincoln, 2011). Qualitative studies, for example, focus on a small number of participants who express their experiences and expertise to specific study issues (Bakarada, 2014; Creswell, 2003). Furthermore, quantitative studies necessitate the participation of many people who are not expected to elaborate on their experiences in the study (Creswell, 2003; Williams, 2007).

As a result, various methods and criteria would be used in selecting population members in qualitative and quantitative designs. For qualitative and quantitative studies, the definitions of the broad, target, and accessible populations are not the same (Mahoney & Goetz et al., 2006). As a result, many qualitative researchers use quantitative methods to undertake sampling (Bakarada, 2014; William, 2007). The target population to participate in this study was construction workers and construction managers. The data was collected using large, medium, and small contractors and consultants in the eThekwin Municipality in Durban. Therefore, a research protocol of an environmental management plan study is essential to describe the population's demographic characteristics, including their years of experience for workers, position or skills, gender, and CIDB grading of contractors.

#### **4.8 SAMPLING**

The process of picking an individual from a large population and generalizing the results taken from the sample to the entire population is known as sampling (Bhattacharyya, 2006). As a result, a good sample should represent the population, allowing the results to be generalized to the entire population (Creswell, 2009).

**Table 4.3 Features of sampling techniques**

Technique	Descriptions	Advantages	Disadvantages
Simple random	A random sample from a population.	Highly representative if all subject participates in the ideal	Not possible without a complete list of population members potentially uneconomical to achieve can be disruptive to isolate members from a group timescale may be too long data/sample could change
Stratified random	A random sample from identifiable groups (strata) subgroups, etc.	Can ensure that specific groups are represented, even proportionally, in the sample(s) (e.g., by gender), by selecting individuals from strata list	More complex requires greater effort than simple random; strata must be carefully defined
Cluster	Random samples of successive clusters of subjects (e.g., by institution) until small groups are chosen as units	Possible to select randomly when no a single list of population members exist, but local lists do; data collected on groups may avoid introduction of confounding by isolating members	Clusters in a level must be equivalent and some natural ones are not for essential characteristics (e.g., geographic: numbers equal, but unemployment rates differ)
Stage	Combination of cluster (randomly selecting clusters) and random or stratified random	Can make up a probability sample by random at stages and within groups; possible to select random sample	Complex combines limitations of cluster and stratified random sampling



	sampling of individuals	when the population is local	
Purposive	Hand-pick subjects based on specific characteristics	Ensures balance of group sizes when multiple groups are to be selected	Samples are not easily defensible as being representative of populations due to potential subjectivity of researcher
Quota	Select individuals as they come to fill a quota by characteristics proportional to Ensures selection of adequate numbers of subjects with appropriate characteristic	Ensures selection of adequate numbers of subjects with appropriate characteristics	Not possible to prove that the sample is representative of designated population
Snowball	Subjects with desired traits or characteristics give names of further appropriate subjects	Possible to include members of groups where no lists or identifiable clusters even exist	No way of knowing whether the sample is representative of the population
Volunteer, accidental, convenience	Either asking for volunteers, or the consequence of not all those selected finally participating, or a set of subjects who just happen to be available	Inexpensive way of ensuring sufficient numbers of a study	Can be highly unrepresentative

(Black, 1999).

## 4.9 A SAMPLE SIZE

The sample size is the number of individuals chosen to represent the entire population (Molenberghs, 2007). In difficulties concerning the estimation of population percentages or proportions, researchers are frequently concerned with calculating sample size (Zikmund, 2002). The proportion of the research population sampled is not the most crucial factor here. Still, the absolute size of the sample chosen with the population's complexity, the researcher's goals, and the types of statistical manipulation utilized in data analysis are all factors to consider (Taherdoost, 2016). While the larger the sample the lesser the likelihood that findings will be biased does hold, diminishing returns can quickly set in when samples get over a specific size which needs to be balanced against the researcher's resources (Gill et al., 2010). Most of the time, the population is too large to handle. To generate a representative sample, researcher must apply appropriate sampling strategies in this scenario. According to Krieger (2012), a population is defined as all members of a well-defined group of people, events, or things. As a result, any entity, group, or set that makes up a population must share at least one property or trait with the rest of them. A sample size of Construction work and Construction Managers for 91 people was used in this study.

### 4.9.1 Types of Sample technique

- **Probability Sampling**

In probability sampling, each sample has an equal and known chance of being chosen from the sample or has a non-zero chance of being chosen (Wretman, 2010). There are a few standard methods for selection in probability sampling.

- **Random Sampling**

According to (Creswell 2009), Random sampling is a mechanism for ensuring a known probability of each elementary unit being chosen, such as in a lottery. The various kinds of random sampling

- *Simple random* sampling is a technique that ensures that each person in a population has an equal probability of being chosen (Molenberghs, 2007).
- Randomly selecting one unit and then randomly selecting other elementary units at equally spaced intervals until the needed units are attained is known as systematic random sampling. A systematic sample would typically choose one person from a list of probable responses (Molenberghs, 2007).

- *Stratified sampling* - This method entails selecting a distinct, simple random sample based on the fraction of the population (Ibid).
- **Non-probability sample**

Non-probability sampling is a technique in which sample units are chosen based on human judgment or convenience, with the chance of any population unit being chosen unknown (Wretman, 2010). The following are the several types of random sampling:

- *Convenience Sampling* is when elementary units are conveniently chosen from a population for observation (Creswell, 2009). Due to the study limitations such as time and cost, the study utilized this
- *Judgment Sampling* - Here, the researcher uses their discretion based on the population's characteristics to select a sample (Creswell, 2009).

#### 4.10 SAMPLE SELECTION BIAS

According to Grooves et al. (2000), sample bias “arises when some members of the sampling frame are given no chance (or reduced chance) of selection”. There is a systematic failure to correctly identify some elements to randomize the statistics (ibid). Therefore, incorrect inference from the data collected can be caused by systematic bias and sampling error. Systematic bias results from errors in the sampling procedures and cannot be decreased or diminished by an increased sample size. Systematic bias is frequently a result of one or more of the following:

According to Grooves et al. (2000), Sample bias “occurs when some members of the sampling frame are given no chance (or a reduced likelihood) of selection there is a pattern of incorrectly identifying some elements to randomize the statistics (ibid). As a result, systematic bias and sample error might lead to inaccurate inferences from the data acquired. Systematic bias is caused by sampling technique flaws and cannot be reduced or eliminated by increasing sample size. One or more of the following factors commonly contribute to systematic bias:

- Inappropriate sampling frame: a biased representation of the population will give rise to a systematic bias
- Defective measuring advice: if the instrument itself is biased, then the data collected and subsequent measuring will prove biased, i.e., if questionnaires or interviewers are biased, then the data collected will be biased.
- Non-respondents: if all the participants within the initial sample cannot be included, this may result in systematic bias.

- Indeterminacy principle: the participant may behave differently due to the knowledge of being observed instead of natural behaviour when not being under observation this may result in systematic bias.
- Natural bias in the reporting of data: the risk of participants providing responses which are the 'correct response,' as opposed to their own opinions or facts, could cause systematic bias (Kothari,2004).

#### Steps to avoid bias on sample selection on this study

- The research instrument or design will be clearly defined to avoid bias for the study's objective.
- Participants or defined targeted population of the study will be contractors construction workers and constructors managers.
- The participants will select answers based on their knowledge of the appropriate box in the survey.
- The participants have the right not to respond to any questions that may be inappropriate.
- Responding to the questionnaire is entirely voluntary.
- Define population or targeted population to participate in a research study will be selected randomly
- The study sample will be randomly selected to represent the target population: contractors, subcontractors, Consultants, and Employers in the Area of eThekweni Municipality.
- Data analysis by analyzing data in a way that gives preference to the conclusion or favour of the hypothesis and research Question will be avoided
- The fabrication and manipulation of data will be avoided; all the data will be a true reflection of the randomly selected population in the study
- It eliminated data that did not support the research question or hypothesis.
- A proper statistical test was used to interpret the results to ensure that the data were interpreted correctly to avoid bias.
- Data collection should be meticulous and appropriate software was used for data analysis (Simundic, 2017).

**Table 4.4 Sample Design and Procedures**

Sample Design/Procedure	Contractors workers	Construction	Contractors Managers

<b>Target Population</b>	Construction workers working for Contractors registered with CIDB in eThekweni Municipality Durban KZN	Construction Managers working for Contractors registered with CIDB in eThekweni Municipality Durban KZN
<b>Sample Technique</b>	Convenience sampling	Convenience sampling
<b>Sample size</b>	The sample size is based on 36 construction workers from different Contractors in eThekweni Municipality	The sample size is based on 55 construction Managers from different Contractors in eThekweni Municipality
<b>Conduct Fieldwork</b>	Questionnaires are distributed to Contractors for data collection through hard copies and emails	Questionnaires are distributed to Contractors for data collection through hard copies and emails

#### 4.11 VALIDITY

Validity refers to how well the information gathered is relevant to the investigation (Ghauri and Gronhaug, 2005). In research, 'validity,' according to Kothari (2004), refers to the amount to which an instrument measures what the researcher aims to measure. Validity and reliability are two critical features of a good measurement tool (Groth-Marnat, 2003). Validity refers to the process of analyzing a new survey instrument to ensure that it has all the necessary items and excludes any undesired ones from a construct domain (Lewis et al., 1995, Boudreau et al., 2001). Validity is at the forefront of those producing measures, and accurate scientific measurement is at the forefront of those seeking legitimate assessment outcomes (Bond, 2003). Validity is challenging to sum up in a single sentence. Linn and Gronlund (2000) defined it as an "issue of degree" rather than a numerical value. As a result, the validity of assessment results can be classified as high, medium, or poor, with weak to vigorous validity (Gregory, 2000).

To summarize, validity refers to the reasonableness of inferences drawn from assessment outcomes. First, "...conclusions developed from empirical evidence bearing on score meaning..." are inferences. Messick (Messick, 1989). Second, validity is a function of degree rather than absolute value. Finally, validity is applied to a specific purpose or application and is not universal. Fourth, validity is viewed as a single idea, although there are numerous types of validity. Finally,

validity is concerned with an assessment's evaluative judgment (Gregory, 2000). Finally, construct validity is the most important of the several types of validity. Construct validity is the foundation for all other types of validity, and it is considered the entirety of validity (Mislevy, 2007).

#### **4.12 RELIABILITY**

According to Trochim (2006), Reliability refers to the repeatability or consistency of a research study's measure quality. Reliability is “the extent to which measurements are repeatable when different people measure on a different occasion, under different conditions, supposedly with alternative instruments which measure the construct or skill (Drost, 2011). Reliability and validity form psychometric properties of measurement scales that are important in estimating scientific research's adequacy and accuracy procedures, as Bajpai and Bajpai (2014) mentioned. According to Drost (2011), the reliability of data from research instruments is affected by two errors: namely, random error and systematic error. Random error is attributed to a set of unknown and uncontrollable external factors that randomly influence some observations but not others. For example, respondents who might have more generous moods might respond positively to constructs like self-esteem, happiness, and satisfaction than respondents with a bad mood. Random error is seen as noise in measurement; hence it is usually ignored. Systematic error is introduced by factors that systematically affect all construct observations across the entire sample. Systematic error is considered a bias in measurement and should be corrected to yield better results for the sample. Bryman and Bell (2007) argue that most researchers use Cronbach's Alpha to evaluate the internal reliability of the data. Testing for reliability is essential as it refers to the consistency across the parts of a measuring instrument (Huck, 2007). Cronbach's Alpha measures the degree to which the items that make up a scale measure the same underlying attribute (Pallant, 2010). Cronbach's Alpha indicates the average Correlation among all the items that make up the scale. The alpha coefficient can range between 0 and 1, where 1 = perfect internal reliability and 0 = no internal reliability. Pallant (2010) argues that while various levels of reliability may be appropriate depending on the nature and purpose of the scale, Generally, a minimum level of 0.7 is typically seen to denote an acceptable level of internal reliability, with higher values in the alpha coefficient indicating more excellent reliability of the data. Although reliability is essential for study, it is not sufficient unless combined with validity. In other words, for a test to be reliable, it also needs to be valid (Wilson, 2010). Guidelines to interpret Cronbach's alpha reliability coefficient have been accepted by researchers (Vosloo, 2014).

#### **4.13 DATA ANALYSIS**

Data analysis systematically organizes data for analysis, describes data, and tests hypotheses and models (Trochim, 2006). Rudestam and Newton (2001) state that this is an opportunity to ‘move beyond the data’ and relate your findings to the literature that has been documented earlier in the report in the theoretical and conceptual framework. Mouton et al. (2006) defined a hypothesis as a testable statement. The researchers must test their hypotheses to determine whether they are. Should be accepted or rejected, as opposed to proven or not proven. Quantitative data requires appropriate statistical tools to test hypotheses. Babbie and Mouton (2005) state that the quantification of data is necessary when statistical analysis is desired.

Further, the observations describing each unit of analysis must be transformed into standardized, numerical codes for retrieval and manipulation by machine (e.g., computer). According to Babbie and Mouton (2005), data entry can be accomplished in several ways, and increasingly, data is keyed directly into the computer. Data processing involves the preparation of the raw data into a computer-readable form. Essentially, four main steps are involved in this process: editing, coding, data entry, and cleaning. The descriptive statistics technique is used in this study to organize, analyze and interpret the quantitative data and was derived from the Statistical Program for Social Science IBM SPSS version 27.

#### **4.13 MEASUREMENT & SCALES**

The scaling Method is divided into open questions and closed questions. An open question tends to generate lengthy answers. Often respondents see open questions as an opportunity to respond to a question in detail (Taherdoost, 2017). In addition, open questions can provide some exciting qualitative findings that may lead to new insights and help to develop future research ideas (Wilson, 2010). disadvantages associated with open questions too many open questions can make the analysis and interpretation of the findings time-consuming and make a comparative analysis of qualitative answers difficult. A closed question, usually a straightforward close question, may require the respondent to choose from multiple options such as multiple-choice and multiple-choice questions, Likert Scale, and semantic differential scale. Therefore, closed-ended questions were used to design this research instrument based on the following advantages of closed-end questions. Respondents' communication skills are less critical because they merely require respondents to select from a set of alternatives; relatively inarticulate people will not struggle to answer close-ended questions; there is a speedy response.

- Respondents can answer close-ended questions quickly, giving them the sense, they are making substantial progress; speedy response time per question means you can ask more questions on a broader range of topics.
- Easier to answer by easing their task, you increase respondents' enthusiasm for returning a completed questionnaire.
- Data quickly coded, entered, and analyzed to close-ended questions are easily pre-coded, which means entering an answer into your response database merely requires you to type a number corresponding with the answer provided.
- Less-skilled or no interviewer needed either little or no interviewing skill is needed to administer close-ended questions, which is why such questions dominate self-administered surveys (Hyman and Sierra, 2016).

#### **4.14 INSTRUMENT ADMINISTRATION**

Two sets of questionnaires were developed for Construction workers, and the Management for research instruments were closed-ended questions. Marshall (2004) suggested that the questionnaire was designed to be short and straightforward. A lengthy questionnaire considered a factor that affects the response rate may inhibit participants from responding (De Vaus, 2002). All the Questionnaires issued to each set of respondents were identical, with the exact wording and questions sequences.

#### **4.15 CHAPTER SUMMARY**

This chapter highlights the overall research methodology and design for the study. First, the research process was discussed from the research approach, design instrument, research methods, data collection methods, targetted population, sample technique, research questionnaire, validity, reliability, ethics employed, and location of the research where the study was conducted. The next chapter focuses on the discussion, data analysis, and research findings. Measurement procedures are explained as well as methods used for data analysis. Briefly, the chapter focuses on the approach to achieve the study objectives and provide answers to the research questions



## CHAPTER 5

### PRESENTATION AND DISCUSSION OF RESULTS

#### 5.1 INTRODUCTION

This chapter analyzes the information gathered and discusses the results. The IBM Statistical Package for Social Science (SPSS) version 27 was used to analyze the data and summarize information regarding the samples' characteristics. Finally, the results are displayed in tables.

#### 5.2 STATISTICAL ANALYSIS

##### 5.2.1 Descriptive Statistical Analysis

Descriptive statistics display numerical data in a table or a graph. It entails central computing tendency measurements like the mean and median and mode measures of dispersion like the standard deviation. Descriptive statistics is a valuable tool for quickly determining the distribution of sample data (Field, 2009).

#### 5.3 RESPONSE RATE

Data was collected from April to July 2021. The response rate based on the final sample of 91 respondents is shown in Table 5-1:

**Table 5-1: Shows the number of questionnaires that were returned**

	<b>Sample</b>	<b>The number of responses</b>	<b>Percentage of response rate</b>
Contractors (Construction workers)	49	36	73%
Contractor (Managers)	72	55	76%
<b>TOTAL</b>	<b>121</b>	<b>91</b>	<b>75.21%</b>

The sample was picked via convenience sampling, which involves selecting elementary units from a population for observation (Creswell, 2009). Due to time and expense constraints, the study used this sampling strategy to swiftly and cost-effectively gather a high number of

completed questionnaires. Furthermore, respondents were chosen based on their closeness and familiarity. Because the study was completed quickly, this sampling method increased the response rate. In addition, a variation of the snowballing sampling technique involves some respondent being referred by other participants. Finally, a Google form and self-administered surveys containing a series of closed-ended questions were emailed and handed out to respondents, who were then followed up with emails and phone calls to guarantee the study's response rate was met on time. However, challenges were encountered in obtaining desired results on time; most construction workers required translation into Zulu to improve their understanding of questions; more time was required for them to respond appropriately to obtain desired results, and another challenge was obtaining a quick response on google form questionnaires to send out follow-up reminder email.

#### 5.4 DATA INTERPRETATION:

The Likert scale, with its five points, is classified as an interval scale. From 1 to 1.8, the mean is quite significant, indicating an enormous disagreement. It indicates disagreement from 1.81 to 2.60, neutral from 2.61 to 3.40, agree from 3.41 to 4.20 and strongly agree from 4.21 to 5. The data range interpretation based on the 5-point and 3-point Likert scales employed in the study is presented in Table 5-4. For the 5-point Likert scale, the group interval coefficient was calculated as  $(5) / 3 = 1.67$ . In Tables 5-6 through 5-13, the range interpretations for the 5-point Likert scale were utilized. The mean values on the 5-point Likert scale were interpreted as a high, medium, and low for ease of understanding.

**Table 5-2 Data Interpretation Ranges**

Range	5-point Likert Scale		
	Frequency Scale	Important scale	Agreement Scale
4.21-5.00	Always	Most important	Strongly Agree
3.41-4.20	Often	Important	Agree
2.61-3.40	Sometimes	Neutral	Neutral/Unsure
1.81-2.60	Seldom	Somewhat important	Disagree
1.00-1.800	Never	Least important	Strongly Disagree

Source: (Kan, 2009)

## 5.5 RELIABILITY

The internal consistency of the various scales was deemed acceptable for further interpretation. The reliability and internal consistency of the scales used to examine the prevalence and effectiveness of EMPs as legal requirements on construction projects were determined using Cronbach's Alpha reliability test. Each Construct was subjected to a reliability test, as shown in Table 5.7. Cronbach's Alpha coefficients of 0.70 to 0.80 are considered 'acceptable,' while coefficients of 0.80 to 0.90 are considered 'good,' and coefficients of 0.9 are considered 'great' (Tavakol & Dennick, 2011). As a result, the various scales' internal coherence was deemed suitable for further interpretation.

**Table 5-3 Summary of Reliability Statistics**

<b>Construction Management and Labourers</b>	<b>Cronbach's Alpha</b>	<b>Reliability</b>
Knowledge of Environmental Management Regulation Framework	0.890	Good
Compliance with Environmental Management Plan	0.786	Acceptable
Legal requirements	0.940	Excellent
Non-Compliance with Environmental Management Plan	0.910	Excellent
Management Responsibility	0.953	Excellent
International Standard Organisation (ISO)	0.940	Excellent
Onsite Environmental Management Control	0.871	Good
Employer Responsibility	0.902	Excellent

Because Cronbach's alpha for all scales was greater than 0.7, the reliability was satisfactory across all scales, and the results were analysed. Further analysis of the results was conducted.

### 5.5.1 Knowledge of Environmental Management Regulatory Framework

Using a 5-point Likert scale, 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, and 5=Strongly Agree, respondents were asked to indicate their level of knowledge of the Environmental Management Regulatory framework. The participants were given five statements about the regulatory system in Table 5-3

**Table 5-4: Knowledge of Environmental Management Regulatory Framework**

Statement				
	Mean	SD	Ease of Interpretation.	Rank
Constitution of the Republic of South Africa	3.59	0.894	H	2
Environmental Management Plan as a legal requirement on Construction site	3.52	0.959	H	3
National Environmental Management Act no. 107 of 1998 (NEMA)	3.37	1.092	H	4
Occupational Health and Safety Act 1993 (Act 85 no. 1993)	3.71	1.047	H	1
International Standard Organization (ISO) 14000 Frameworks	3.09	1.186	M	5

The result in Table 5-4 shows that respondents know the South African Constitution (mean=3.56). The constitution protects the environment for current and future generations by enacting legislation and taking steps to prevent ecological pollution degradation, promote conservation, and ensure ecologically sustainable development and use of natural resources while promoting economic and social development (Constitution Environmental Right Chapter 8, Section 24). The finding suggested that Management and Construction workers are familiar with the functions of the constitution. It is also evident that the contractors know Environmental Management Plan as legal requirements on the Construction site (mean=3.52). Based on Table 5-6, Occupation Health and Safety Act 1993 (Act 85 no.1993) (mean=3.71), suggested that Management and Construction workers are familiar with the Occupational Health and Safety Act 1993; However, contractors had a medium degree of agreement they know National Environmental Management Act no. 107 of 1998 and Organization International Standard (ISO 14000) with (mean=3.37 and 3.09 respectively). Therefore, it may be concluded that although Contractors know the constitution of South Africa, familiar with environmental management plans as legal requirements on construction sites and the Occupation Health and Safety Act. However, contractors lack the required knowledge to implement National Environmental Management Act no. 107 of 1998 (NEMA) and the International Standard Organization (ISO) framework. The finding was supported by Massoud, who states developing countries need to implement an Environmental Management system like ISO 140000 to widen and maintain access to global markets and partnership and comprehensively comply with the Environmental Management Plan as legal requirements construction projects.

### 5.5.2 Compliance with Environmental Management Plan

On a 5-point Likert scale, 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, and 5=Strongly Agree, the respondents were asked to assess their level of compliance with the Environmental Management Plan as a legal obligation on building projects. The participants were given 15 statements about contractors' compliance with the Environment Management Plan in Table 5-7.

**Table 5-5**

**Table 5-5: Compliance with Environmental Management Plan**

Statements	Management and Construction Work			
	Mean	SD	Intr.	Rank
Contractors Comply with Environmental Management Plan	3.66	1.062	H	6
Contractors know the Environmental Management Plan as legal requirements on construction projects.	3.79	1.055	H	5

The application of the Environmental Management Plan on-site has a positive impact on the protection of the environment	4.04	0.953	H	2
National Environmental Management Plan Act no. 107 of 1998 (NEMA) positively impacts the overall protection of the environment.	4.03	0.900	H	3
Contractors are fully committed to effective environmental Management plans on site	3.66	1.128	H	6
Contractors are fully committed to effective environmental management plan because it is a legal requirement	4.09	1.050	H	1
Contractors are complying with the environmental management plan because it is a legal requirement	2.51	2.078	M	14
Contractors have ISO 14000 in place an Environmental Management system to regulate and monitor their environmental performance	3.48	1.144	H	8
The Employer Agent/Environmental Control Office/Environmental Practitioner or Departmental Affairs (DEA) ensures that contractors are fully compliant with EMP's	3.84	0.922	H	4
Contractors and their subcontractors understand how Environmental Management Plan work on Construction	3.40	1.173	H	9
There are enough institutions to enforce the compliance of environmental Management plans on construction.	3.22	1.191	M	13
Contractors and their Subcontractors are not fully complying with the Environmental Management Plan on-site as legal requirements	3.34	1.231	H	11
Contractors do not understand the environmental specification and environmental requirements during construction on site.	3.32	1.191	M	12
Contractors see Environmental Management as a waste of time rather than focus on production	3.64	1.465	H	7

Department of Environmental Affairs/Employers' / Environmental Control Office is not doing enough to ensure that contractors comply with the Environmental Management Plan as a legal requirement on site.	3.37	1.2078	M	10
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## Contractors

Table 5-5 The findings suggested that contractors are fully committed to effective environmental Management as legal requirements (means =4.09); it is evident that the existence of environmental management plan as legal requirements for construction projects is crucial to ensure the protection of the environment by Contractors. However, it could be argued that contractors would not protect the environment if the Environment Management Plan were not legal enforced to contractors to comply with by Employer. There was also a lot of consensuses on the fact that applying the Environmental Management plan on-site positively impacts the protection of the environment (mean=4.04); (DEAT IEM series 12, 2004) stated that effective implementation is the key to EMP's success as documents that describe the methods and procedures for mitigating and monitoring environmental impacts. The finding suggested that contractors agreed that applying EMP's efficiency would protect the environment during construction. Furthermore, the finding suggested contractors agreed that National Environmental Management Plan Act no 107 of 1998 (NEMA) has a positive impact on the overall protection of the environment (mean=4.03); it is evident that NEMA has a positive impact on the protection of the environment on construction projects. However, considering the importance of NEMA Act 107 of 1998 in this research, responses would have been reflected by response rate and not merely a good response as indicated by the mean value. There was also a high level of agreement that the Employer Agent/Environment Control Office ensure that contractors fully comply with EMP's (mean=3.84) by conducting a weekly site visit is evident that the Employer is also contributing or involved in construction projects to ensure that contractors comply with EMP's as legal requirements on construction projects (DEAT information series 12, 2004) stated that environmental auditing is the most logical means of formal checking compliance to comply with specific environmental legal requirements. There is also a high level of agreement on contractors knowing EMP's as legal requirements on construction projects (mean=3.79); this suggested that contractors know EMP's as legal requirements and must comply with them.

Although there is a high level of agreement on statements if contractors comply with EMP's as legal requirement and Contractors are fully committed to effective environmental Management Plan on-site respectively, the statements were not highest-ranking as it would have been expected (mean=3.66) for both statements, respectively suggested that contractors were not as positive as it was expected on this regard. The finding suggested a high level of agreement that contractors see EMP's as a waste of time

rather than focus on production (mean=3.64). However, based on findings, it is evidence that contractors see EMP's as a waste of time; they prefer to focus on production and maximize the profit; this led to contractors not fully complying with EMP's on construction projects (Mishra 2015) stated that Project and Contractors are to be blamed for focusing more on time, cost, and quality while neglecting environmental impacts on the project. The finding suggested that contractors have ISO 14000 in place or familiar with them as an Environmental Management system to regulate and monitor their environmental performance (mean=3.48) even though it is not a Mandatory or legal requirement for contractors to have it in place in the South African context; however, findings did not reflect convincing response about many contractors having ISO in place. However, Hawrock (2009) stated that implementing ISO 140001, besides the internal change regarding environmental sustainability, is the adequacy of substantial improvement that the organization could achieve on its various levels. The finding further suggested that there is a partial level of agreement on Contractors and their subcontractors on understanding how Environmental Management plans work on a Construction project (mean=3.40); it is evident that Contractors and their subcontractors have the slightest knowledge on how EMP's work this could be caused by lack of proper clarification and necessary training to ensure understanding of EMP's on Contractors and their subcontractors before the start of the projects.

The finding suggested a partial response if the Employer or Environmental control office is not doing enough to ensure that contractors comply with the Environmental Management plan as a legal requirement on-site (mean=3.37). The respondents are also not sure if Contractors and their subcontractors are not fully complying with the environmental management plan on-site as a legal requirement (mean 3.34). However, this could lead to a lack of proper communication on the feedback of environmental issues on weekly site visits and monthly audits on environmental by Employer Agent or contractor's management. The feedback needs to be distributed to everyone to know their performance or monthly on-site noticeboard updates to become available to everyone on site. Contractors do not understand the environmental specification and environmental requirement during construction (mean=3.32); however, management and construction workers gave a medium response on whether contractors understand the environmental specification and environmental this could lead by communication process to ensure that everyone on site understands environmental protection and their role and responsibility to ensure that environment is protected. The respondents are not sure if there is enough institution to enforce the compliance of environmental Management plans on construction sites (mean=3.22); it is evident that there is a lack of institutions or bodies responsible for regulating and monitoring EMP's or the current Environmental Control offices are not enough to ensure compliance on contractors. A study conducted by Sandham (2005) confirmed that the shortage of funding and understaffing at South Africa provisional and local authorities compromised effective enforcement of monitoring and auditing. Management and construction workers also responded that



contractors comply with the environmental management plan because it is a legal requirement (mean=2.51) and disagreed that contractors are not only complying because it is a legal requirement.

The finding in Table 5-5 shows that an Environmental Management Plan as a legal requirement to construction projects is crucial to protect the environment by Contractors. However, it could be argued that contractors would not protect the environment if the Environment Management Plan as legal requirements were not in place and enforced to contractors. The finding suggested that management and construction workers agreed that applying EMP's efficiently and effectively will protect the environment during construction. NEMA Act has a positive impact on protecting the environment on construction projects. However, considering the importance of NEMA in this research, responses would have been reflected by an excellent response rate and not merely a good response as indicated by the mean value. Conducting weekly site visits and monthly audits shows that the Employer contributes or engages in construction projects to ensure that contractors comply with EMP's legal requirements. However, based on this statement, it is clear evidence that contractors see EMP's as a waste of time; they prefer to focus on production and maximize the profit; this led to partial compliance with EMP's on construction projects. Contractors and their subcontractors are not sure how EMP's work; this could be caused by a lack of proper clarification and necessary training to ensure understanding of EMP's on Contractors and their subcontractors before the start of the projects.

### 5.5.3 Commitment to EMP's as Legal compliance

On a 5-point Likert scale, 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, and 5=Strongly Agree, respondents were asked to identify their level of agreement on commitment and attitude toward EMPs as a legal obligation. Participants in grades 5-6 were given two Statements of Commitment to EMPs as legal requirements.

**Table 5-6: Legal Consequences.**

Statements	Management and Construction workers			
	Mean	SD	Ease of Interpretation	Rank
Contractors are facing legal fines for degradation of the environment	3.46	1.036	H	1
Contractors are facing a legal fine for failing to implement EMP's on Construction Projects	3.44	1.035	H	2

The finding in Table 5-6 contractors face legal fines for environmental degradation (mean=3.46). The Department of Environmental Affairs or Employers Agent is issuing legal fines to contractors who fail to protect the environment during the construction of projects. There is also a high agreement that contractors face a legal fine for failing to implement EMP's on construction projects (mean=3.44); The findings suggest that contractors are implementing EMP's on the construction project. However, the response rate is not as good as it should, considering that all construction projects must have EMP in place; it is evidence that some contractors might not be implementing it accordingly. However, the results for both statements indicate that the contractors are least facing legal fines, which could be one of the reasons leading to the slight effectiveness of EMP's. These statements are essential to investigate and identify any legal consequences of not complying with EMP's on construction projects. (Section 28 NEMA) stated that Offenders may be obliged to clean up and make amends for their role in causing environmental damage. It may be concluded that there are legal consequences of degrading the environment and not implementing EMP's on construction projects. However, considering that EMP's is legal requirements for all contractors, it was expected that the means should be greater than >4; both statements indicate that contractors are least facing fines.

#### 5.5.4 Non-Compliance with EMP's

On a 5-point Likert scale, 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, and 5=Strongly Agree, respondents were asked to express their level of agreement on the implications of contractors' non-compliance with EMPs. Two statements about non-compliance with EMPs were offered to the participants in Table 5-9.

**Table 5-7 Non-Compliance with EMP's**

Statements	Management and Construction Workers			
	Median	SD	Ease of Interpretation	Rank
Lack of an effective environmental management plan or non-compliance on construction projects poses a threat to the environment	4.22	1.099	H	1
Non-Compliance with environmental Management plans by Contractors on-site will degrade the environment	4.13	1.114	H	2

The finding in Table 5-7 suggested that lack of an effective environmental management plan or non-compliance on construction projects poses a threat to the environment (mean=4.22). Sala (2021) stated that environmental impacts negatively affect human health, the natural environment, ecosystems, and natural resources. The finding suggests that contractors agreed that if there is a lack of adequate or Non-compliance with EMP's on construction projects, it will pose damage or harm to the environment and human life; this finding suggests that there is a need for compliance EMP's on construction projects to monitor and regulate environmental to reduce the hazards that can cause threat and harm to the environment. There is also a convincing high level of agreement that Non-compliance with environmental Management plan by contractors on site will degrade the environment (mean=4.13); participants agreed that non-compliance with EMP' will degrade the environment; it is evident that participants have confidence in the existence of EMP's as a tool to monitor and regulate hazard on-site to ensure the protection of the environment. Therefore, it may be concluded that non-compliance with EMP's will pose a threat, harm, and degradation to the environment. Additionally, compliance with EMP's must be ensured all the time on the construction projects.

### 5.5.5 Management Responsibility

The respondents were asked to express their level of agreement with Management's commitment. Based on a 5-point Likert scale, 1=Strongly Disagree, 2=Disagree, 3 Neutral, 4=Agree, and 5=Strongly Agree, their obligation towards EMPs as a legal requirement Under the age of ten, 9 Statements on Management Responsibilities were delivered to the participants.

**Table 5.8 Management Responsibility**

Statements	Management and Construction Workers			
	Mean	SD	Ease of Interpretation	Rank
Contractors Management are committed to preserving the environment on Construction projects	3.52	1.168	H	3
Contractors are providing the training and induction on Environment Management plan to staff and labour before the project start	3.18	1.442	M	6
Contractors have an environmental Management plan program to monitor and control environmental hazards	3.43	1.292	H	4

Awareness of environmental protection is ensured regularly by Contractors Management to staff.	3.13	1.327	M	7
Contractors Management conduct internal audit monthly to monitor and regulate the Environmental Management system of the contractor	3.65	1.068	H	1
Contractor Management are complying with the environmental management plan on the construction project as the specification of the client	3.56	1.056	H	2
Environmental Management Plan is part of the Daily site instruction (DSI) of Contractors on site	3.23	1.334	M	5
Regular Environmental meetings are held by Contractors internally	3.09	1.322	H	8
Contractors are allocating enough budget to address environmental requirements on site	2.89	1.303	H	9

The finding in Table 5-8 suggested a high level of agreement on contractor's management conducting internal audits monthly to monitor and regulate the environment (mean=3.65); DEAT (2004) stated that environmental audits assess existing and future environmental issues and establish what action is required to meet a legal obligation. Therefore, it is evident that contractors audit themselves and correct flaws before the external auditors audit them. However, the response is not as good as it should be; it suggested that few contractors audit themselves before getting audited. The contractors' management is complying with the environmental management plan on the construction project as per the client's specification (mean=3.56). It is evident that the contractor's management does implement EMP's on the construction projects as a mitigation tool to monitor environmental hazards; however, the response is not good as it expected looking at the importance of complying with EMP's as a legal requirement on construction projects the problem it could be to ensure that contractors play their role to ensure that environment is protected at cost.

On the other hand, management construction workers gave high responses to contractors. Management is committed to preserving the environment on Construction projects (mean=3.52); it is evident that contractors are doing their best to protect the environment. There is also a high level of agreement that contractors have an environmental management plan program to monitor and control environmental hazards (mean=3.42); based on these responses, not all contractors have a program to monitor and

control hazards in construction projects. Management and construction workers also gave a medium response on Contractors having an environmental management plan as part of the Daily site instruction (DSI) on-site (mean=3.23); the finding suggested that most minor contractors have EMP's on their daily site Instruction based on the mean value it is evident that not all contractors are considering EMP's on their daily site instructions this could conclude that absence of EMP's on daily site instruction of contractors on-site is one of the factors causing contractors not to comply with EMP's fully. The finding on contractors is providing the training and induction on Environment Management plan to staff and construction workers before the project start (mean=3.18); there is a medium response about contractors providing training and induction on EMP's. The responses suggested that not all contractors provide training and induction to all their employees; this causes contractors not to comply with EMP's on-site fully. However, there is a medium response on whether management regularly conducts awareness on environmental protection by contractors' management to staff (mean=3.13). The findings could further implicate the Management's lack of support on environmental protection awareness to its employees. Findings on regular environmental meetings are held by Contractors internally (mean=3.09); there was also a medium response; it suggested that not all contractors have regular meetings to discuss environmental issues on site based mean value it evident that a lack of regular internal meeting to discuss environmental issues causes contractors not fully comply with EMP's. Further finding on Contractors are allocating enough budget to address environmental requirements on-site (mean=2.89) but gave a medium response about contractors allocating enough budget response suggested that contractors are not allocating enough budget to control and monitor environmental hazard on site, and this raises concern on whether contractors to take environmental protection as a priority.

### 5.5.6 International Organization Standard 14000

On a five-point Likert scale, 1=Strongly Disagree, 2=Disagree, 3 Neutral, 4=Agree, and 5=Strongly Agree, respondents were asked to express their level of agreement with International Organization Standard 14000 as an environmental management system. In addition, the participants were given four statements on management responsibility when they were in the age group of 5-11.

**Table 5-9 International Organization Standard**

Statements	Management and Construction workers			
	Mean	SD	Ease of Interpretation	Rank
Contractors know ISO 14000	3.04	1.429	M	4
Contractors have an environmental Management system in place example, ISO 14000 to promote	3.15	1.349	M	3

environmental protection and sustainable development				
Contractors are implementing ISO 14000 to promote environmental performance to contribute to environmental protection.	3.19	1.280	M	2
Contractors are implementing ISO 14000 to comply with international standard	3.30	1.304	M	1

The findings in Table 5-9 indicate an inadequate level of agreement that the contractors are implementing ISO 14000 as mitigation to comply with international standards (mean=3.30). ISO 14000 is the Environmental Management system intended to reduce environmental impacts; however, there were medium responses on management and construction if contractors are implementing ISO 14000 to comply with the international standard the finding suggested that not all contractors do seem to have a comprehensive and certified environmental system concerning ISO 14000 in place to assist them in regulating themselves order to keep track of environmental hazards on construction projects and also to be relevant with the rest of the world. Contractors are implementing ISO 14000 to promote environmental performance to contribute to environmental protection (mean=3.19). Medium response on whether contractors are implementing ISO 14000 to promote environmental protection; it is evident that some contractors have no idea about the purpose and functions of ISO 14000 on reducing environmental impacts. Contractors have an environmental Management system in place, ISO 14000, to promote environmental protection and sustainable development =(mean=3.15); however, the was a medium response among Management and construction workers, whether contractors have an environmental management system ISO 14000 to encourage environmental protection the finding suggested some contractors do not have or heard about ISO 140000. Further, the was also a medium response on whether contractors know ISO 14000 (mean=3.04). The finding suggested that not all contractors are familiar with ISO 14000; this causes contractors not fully comply with EMP's.

The findings in Table 5-9 could be used to support this claim that some contractors do not have environmental management system or implemented ISO 14000 in place to reduce environmental impacts on construction projects even though having ISO is not a prerequisite for contractors in the South Africa context; however, contractors should have it a place. Furthermore, according to Yiridoe and Marret (2004), the ISO 140001 standard's primary purpose is to strengthen and develop compliance and adherence to environmental laws and regulations. Therefore, using ISO as a guide can help an organization achieve its environmental objectives (Valdez and Chini, 2005). It helps contractors fully comply

### 5.5.7 On-site Environmental Control

On a 5-point Likert scale, 1=Strongly Disagree, 2=Disagree, 3 Neutral, 4=Agree, and 5-Strongly Agree Under 5-12, respondents were asked to identify their level of agreement with onsite environmental control. In addition, the participants were presented with 4 Statements on Management responsibility.

**Table-5-10 On-site Environmental Control**

Statements	Management and Construction Workers			
	Mean	SD	Ease of Interpretation	Rank
There is the availability of bins and skip to control littering everywhere on site	4.02	0.954	H	2
There is the protection of soil contamination by providing a drip tray for a plant on-site and other hazardous chemicals	4.02	0.966	H	2
Water is protected from contamination by construction by activities	4.41	5.456	H	1

Table 5-10 there is an excellent level of consensus on the availability of bins and skip to control littering everywhere on site and protection of soil contamination by providing drip tray for a plant on-site (mean=4.02 & 4.02 respectively), it is evident that there is the availability of bins on-site to control littering everywhere on-site and also soil protection from contamination the responses rate is quite convincing that management and construction workers agree. There is also a high agreement on water protection from contamination (mean=4.41). The response suggested that contractors are protecting the water from contamination during construction.

### 5.5.8 Employer Responsibility

On a 5-point Likert scale, 1=Strongly Disagree, 2=Disagree, 3 Neutral, 4=Agree, and 5-Strongly Agree Under 5-12, respondents were asked to identify their level of agreement on Employer responsibility. In addition, the participants were given four Management Responsibility Statements.

**Table 5-11 Employer Responsibility**

Statements	Management and Construction workers			
	Mean	SD	Ease of Interpretation	Rank
Employer/Client implement environmental management plan from the tender stage as a specification of the project to monitor and mitigate environmental hazard of the project.	3.90	0.943	H	3
Employers/Client enforce environmental compliance by appointing the Environmental Control Office/Environmental Practitioner to monitor compliance	3.86	0.978	H	4
Environmental Control Office conduct Monthly Environmental audit to monitor the performance of the contractor on site	3.92	0.946	H	1
Employer/Client are committed to preserving the environment on construction projects	3.91	1.013	H	2
Employers/Client allocating enough budget to address environmental requirements on site	3.02	1.145	M	6
Employer/Client poses fines as legal consequences to contractors who fail to comply or implement EMP's on-site	3.62	1.071	H	5

The data in Table 5.11 suggests that Employers are implementing an environmental management plan from the tender stage as the project's specification to monitor and mitigate environmental hazards of the project (mean=3.90). However, Barker and Hill (2000) stated that an excellent Integrating of the EMP into the tender and contract agreement as environmental standards is one way to make the EMP more legally enforceable. The findings suggest that employers take responsibility for ensuring that EMP's are implemented to control environmental hazards during construction projects. There is also a high agreement that Employers in the construction industry are enforcing environmental compliance by appointing the Environmental Control Office to monitor compliance during construction (mean=3.89). the statement suggested that employers are taking responsibility to appoint Environmental Control Office to monitor contractors during the construction period. The finding suggested that the



Environmental Control Office conduct a Monthly Environmental audit to monitor the contractor's performance on-site (mean=3.92). Environmental Control Offices are visiting the construction site to monitor the performance of contractors by conducting a monthly audit. Employers are committed to preserving the environment on construction projects (mean=3.91); there is an important level of agreement. It suggests that employers are committed to conserving the environment by implementing EMP's at the tender stage and appointing Environmental control office is evidence of commitment from the employer. There is, however, was a medium response whether the Employer allocates enough budget to address environmental requirements on-site (mean=3.02); less than satisfactory in this regard; this finding suggests that employers are not allocating enough budget to contractors to address environmental hazards during the construction of projects this could cause contractors not fully comply with EMP's. There is a high level of agreement on Employer poses fines as legal consequences to contractors who fail to comply or implement EMP's on-site (mean=3.62); it is evident that Employer punished contractors who fail to comply with EMP's as legal requirements in the construction of projects.

## 5.6 Analysis of composite mean of various constructs

**Table 5.12**

### Descriptive Statistics

Variables	N	Means	SD	Maximum	Minimum
KEMF	90	3.45	.87515	1.40	5.00
Compliance with EMP	90	3.57	.60404	1.80	5.00
Legal requirement s	91	3.45	1.00569	1.00	5.00
Non -compliance with EMP	89	4.19	1.05632	1.00	5.00
Management Responsibility	91	3.30	1.07803	1.22	5.00
International Standard Organization	90	3.17	1.23956	1.00	5.00
On site Environmental Control	91	4.15	2.05676	1.00	21.67
Employer Responsibility	89	3.71	0.83425	1.17	5.00

The Composite means of the various constructs employed in the study are represented in Table 5.12. A composite mean of management and construction workers was calculated to determine the constructs' independence from one another. An emergent variable is a group of variables whose correlations with other variables in the model are proportionate (Benitez et al., 2017). In addition, to establish the statistical significance of the constructs, hierarchical multiple regression analysis was used in Tables 5.17 to 5.23. The composite mean of constructs suggests the conclusions as follows.

- **Knowledge of Environmental Management Plan**

The finding suggests that is a high level of agreement on Knowledge of Environmental Management Framework among management and construction workers (mean=3.45, SD=0.87) regarding knowledge of environmental management framework; there was a statistically significant knowledge between of environmental management framework and compliance with Environmental Management Plan  $F(1.84) = 41.430, p < 0.05$ . Therefore, the results suggest that high Knowledge in the Environmental Management Framework on EMP will improve EMP effectiveness on construction projects. Therefore, it may be concluded that, while Contractors know the constitution of South Africa and are familiar with environmental management plans as legal requirements on construction sites and the Occupation Health and Safety Act, they lack the required knowledge to implement National Environmental Management Act no. 107 of 1998 (NEMA) and the International Standard Organization (ISO) framework. The finding was supported by Massoud (2010), who stated that developing countries need to establish an ISO 14000-compliant environmental management system to widen and maintain access to global markets and partnership and comprehensively comply with the Environmental Management Plan as legal requirements construction projects.

- **Compliance with Environment Management Plan**

There was a significant level of consensus on Compliance with Environment Management plan (mean=3.57, SD=0.60) additionally statistical significance on Management and construction worker regarding Contractors compliance with Environmental Management Plan  $F(2.83) = 29.960, p < 0.05$  The finding in Table 5-7 shows that an Environmental Management Plan as a legal requirement to construction projects is crucial to protect the environment by Contractors. However, it could be argued that contractors would not protect the environment if the Environment Management Plan's as legal requirements were not in place and forced to contractors. The finding suggested that management and construction workers agreed that applying EMP's efficiently and effectively will protect the environment during construction. Therefore, NEMA Act has a positive impact on the protection of the environment on construction projects. However, considering the importance of NEMA in this research, responses would have been reflected by an excellent response rate and not merely a good response as indicated by the mean value.

- **Legal Compliance**

Finding suggests that there is a high level of agreement on legal compliance with the Environmental Management Plan between Management and construction workers (mean=3.45, SD=1.00), there was significant statistical  $F(3.80) = 29.484, p < 0.05$ . between legal compliance and compliance with Environmental Management Plan. The findings suggest that contractors are implementing EMP's on

the construction project. However, the response rate is not as good as it should, considering that all construction projects must have EMP in place; it is evidence that some contractors might not be implementing it accordingly. However, the results indicate that the contractors are least facing legal fines, which could lead to the slight effectiveness of EMP's. These statements are essential to investigate and identify any legal consequences of not complying with EMP's on construction projects. (Section 28 NEMA) stated that those who have committed environmental crimes must clean up and compensate for their role in damaging the environment. Therefore, it may be concluded that there are legal consequences of degrading the environment and not implementing EMP's on construction projects. However, considering that EMP's are a legal requirement for all contractors, it was expected that the means should be greater than 4; both statements indicate that contractors are least facing fines.

- **Non-Compliance with Environmental Management Plan**

The finding suggests a high level of agreement on Non-compliance with the Environmental Management Plan (mean=4.19, SD=1.06). Additionally, there was the statistical significance of Non-compliance with the Environmental Management Plan. The finding suggested that lack of an effective environmental management plan or non-compliance on construction projects poses a threat to the environment (mean=4.22). Sala (2021) stated that environmental degradation negatively affects human health, the natural environment, ecosystems, and natural resources. The finding suggests that if there is a lack of adequate or Non-compliance with EMP's on construction projects, it will pose damage or harm to the environment and human life; finding further suggests that there is a need for compliance EMP's on construction projects to monitor and regulate environmental to reduce the hazards that can cause threat and harm to the environment construction projects.

- **Management Responsibility**

The finding suggests a neutral agreement on Management responsibility on Environmental Management plans between Management and construction workers (mean=3.30, SD=1.08). There was statistical significance  $F(4.81) = 28.354, p < 0.05$ . on management responsibility and compliance with environmental management, plan finding suggests that not all contractors provide the training and induction about Environment Management Plan to staff and construction before the project starts. It results in contractors not complying with EMP's on-site fully. However, there is a medium response on whether management regularly conducts awareness on environmental protection by contractor's management to staff. The finding could further implicate Management's lack of support on environmental protection awareness to its employees. The finding further suggested that not all contractors have regular meetings to discuss environmental issues on site. Lastly, the finding further

suggests that contractors are not allocating enough budget to control and monitor environmental hazards on-site, raising concern about whether contractors take environmental protection as a priority.

- **International Standard Organization 14000**

There was a moderate level of agreement on International Standard Organization 14000 (mean=3.17, SD=1.24); there was no statistical significance  $F(5.80) = 22.942, p > 0.05$  on implementation of ISO 14000 as an environmental management system for compliance with Environmental Management Plan on-site. It could be argued from the findings that some contractors do not have environmental management system or implemented ISO 14000 in place to reduce environmental impacts on construction projects even though having ISO is not a prerequisite for contractors in the South Africa context; however, contractors should have it a place to regulate themselves. Yiridoe & Marret (2004) say that ISO 14001 standard's primary purpose is to strengthen and develop environmental law and regulatory compliance and adherence. ISO can assist an organization in reaching its environmental objectives (Valdez and Chini, 2005). It helps contractors fully comply

- **On-site Environmental Control**

Although management and construction workers expressed an outstanding level of agreement that on-site Environment Control improves compliance with the Environmental Management Plan (mean=4.15, SD=2.06), there was no statistical significance  $F(6.79) = 18.893, p > 0.05$  between On-site Environmental Control and compliance to Environmental Management Plan. However, the finding suggested that many contractors protect water and soil from contamination during construction. However, to protect the environment to the fullest, all the contractors must guarantee that water and soil are protected from contamination to ensure sustainable development during construction.

- **Employer Responsibility**

There was a high level of agreement on Employer responsibility on EMP (mean 3.71, SD=0.83), there was no statistical significance  $F(7.78) = 16.837, p > 0.05$  between Employer responsibility and compliance with EMP. However, the findings suggest that employers take responsibility for ensuring that EMP's is implemented as a tool to control environmental hazards during construction projects. Furthermore, it suggests that employers are committed to conserving the environment by implementing EMP's at the tender stage and appointing an Environmental control office is evidence of commitment from the employer. However, the finding suggests medium response whether the Employer allocates enough budget to address environmental requirements on-site less than satisfactory in this regard; this could cause contractors not fully comply with EMP's.

## 5.7 SPEARMAN'S CORRELATION TEST FOR INDEPENDENT VARIABLES

### Correlation Matrix

Individual variables were computed under each construct to determine the composite variables; the correlation was commonly employed to study the relationship among a collection of variables rather than two to assess the strength of the link between the constructs. Participants' responses were used to measure the constructs in Table 5-14. As shown in Table 5-13, the interpretation of the intensity of correlation was determined.

**Table-5-13: Strength of Association (Adapted from Cohen, 1988)**

Coefficient Value	Strength of Association
$0.1 < r < 0.3$	Small Correlation
$0.3 < r < 0.5$	Medium/moderate Correlation
$r > 0.5$	Large/strong correlation

**Table 5-14 Correlation of Constructs**

	Compliance with EMP's	KEMF	Legal Compliance	Noncompliance with EMP's	Management Responsibility	ISO	On-site Environmental Control	Employer Responsibility
Compliance with EMP's	1							
KEMF	.563**	1						
Legal requirements	.285**	.472*	1					
Non-compliance with EMP's	.145	.529**	.325**	1				
Management Responsibility	.515**	.460**	.414**	.083	1			
ISO	.530**	.500**	.415**	.122	.847**	1		
On site Environmental Control	.471**	.474**	.298	.103	.757**	.691**	1	
Employer Responsibility	.483**	.501**	.328**	.149	.647**	.635**	.738**	1

\*\* Correlation is significant at the 0.01 level (2-tailed)

1. Compliance with EMP correlates with the following constructs\*\*  KEMF  Legal requirements  Management Responsibility  On-site Environmental Control  Employers Responsibility.

2. Knowledge of Environmental Management Plan correlates with following constructs\*\* → Legal requirement → Non-compliance with EMP's → Management Responsibility → International Standard Organization → On-site Environmental Control → Employer Responsibility.
3. Legal Compliance correlates with the following constructs\*\* → Non-compliance with EMP's → Management Responsibility → International Standard Organization → On-site Environmental Control → Employer Responsibility.
4. Non-compliance with EMP's does correlate with the following constructs → Management Responsibility → International Standard Organization → On-site Management Control → Employer Responsibility.
5. Management Responsibility correlates with the following constructs\*\* → International Standard Organization → On-site Environmental Control → Employer Responsibility.
6. International Standard Organization correlates with the following constructs\*\* → On-site Environmental Control → Employer Responsibility On-site
7. On-site Environmental Control correlates with the following constructs\*\* → Employer Responsibility.

### 5.7.1 Interpretation of the results in Table 5.14

Spearman's correlation between the two variables (X and Y) is seen in Table 5-8. ( $\rho$ ). The intensity and direction of two ordinal variables were expressed using bivariate correlation analysis (Akonglu, 2018). A negative correlation expresses a negative link between the variables; as one variable (X-independent variable) increases, the other variable (Y-dependent variable) decreases (Field, 2017; Akonglu, 2018). A positive correlation shows that the two variables have a positive relationship and that as one variable (Y-the independent variable) increases, the other value (Y-dependent variable) decreases (ibid). When X increases, a Spearman correlation of 0 shows that Y has no propensity to increase or decrease. As the intensity of the link varies, it might range from a weak to a strong correlation as seen in Table 5-9. A correlation value of 0 shows that the variables have no relationship. The Spearman correlation coefficient becomes 1 when X and Y are perfectly monotonically connected. Furthermore, the Spearman correlation makes no assumptions about the distribution of the variables. The three assumptions dependent variables) decrease (Spearman's correlation) (Field, 2017; Akonglu, 2018). The intensity and direction of two ordinal variables were expressed using bivariate correlation analysis (Akonglu, 2018). Table 5-15 displays the correlations.

- **Knowledge in Environmental Management framework**

There was a strong positive correlation between understanding the Environmental Management Framework and compliance with the environmental management plan that was statistically significant. ( $r=0.563$ ,  $p<0.001$ ), suggesting that if Knowledge in Environmental Management Framework increases, there would be an increase in compliance with the Environmental Management Plan. Furthermore, knowledge in environmental management framework and legal compliance with a weak positive correlation showed statistical significance ( $r=0.285$ ,  $p<0.001$ ). Therefore, the results suggest that if knowledge of the environmental management framework increases, it will slightly improve legal compliance of the Environmental Management Plan on contractors on site. Knowledge of environmental management framework and Management responsibility with a strong positive correlation showed statistical significance ( $r=0.515$ ,  $p<0.001$ ), suggesting that if Knowledge Environmental Management Framework increase, would be an increase in the level of Management responsibility. Knowledge of environmental management framework and International Standard Organization 14000 with a strong positive correlation showed statistical significance ( $r=0.530$ ,  $p<0.001$ ), suggesting that if knowledge of environmental management framework increases, the would-be an increase in the level of International Standard Organization because managers will be well informed about the environmental management plan. There was a statistical significance with a moderate positive correlation between knowledge of environmental management framework and On-



site Environmental Control. A moderate positive correlation showed statistical significance ( $r=0.471$ ,  $r < 0.001$ ), suggesting that if Knowledge of Environmental Management Framework increases, On-site Environmental Control will also moderately. Knowledge of environmental management framework and Employer responsibility with a moderate positive correlation showed a statistical significance ( $r=0.483$ ,  $r < 0.001$ ), suggesting that if Knowledge of Environmental Management Framework increase, Employer Responsibility will also moderately.

- **Compliance with Environmental Management Plan**

There was a statistical significance with a moderate positive correlation between Compliance with Environmental Management Plan and Legal Compliance with Environmental Management with a moderate positive correlation showed that there is a statistical significance ( $r=0.472$ ,  $p < 0.001$ ), suggesting that if Compliance with Environmental Management Plan increase, the level of legal compliance with environmental compliance will also moderately increase. Compliance with Environmental Management Plan and Management Responsibility with a moderate positive correlation showed statistical significance ( $r=0.460$ ,  $p < 0.001$ ), suggesting that if Compliance in Environmental Management Plan increase, the level of Management responsibility will also increase moderately. Compliance with Environmental Management Plan and International Standard Organization with a moderate correlation showed statistical significance ( $r=0.500$ ,  $p < 0.001$ ), suggesting that if Compliance with Environmental Management Plan increase, the level of international Standard Organization 14000 compliance will also increase moderately. There is a statistical significance with a moderate correlation between Compliance with Environmental Management Plan and On-site Environmental Control ( $r=0.474$ ,  $p < 0.001$ ), suggesting that if Compliance with Environmental Management plan increase, the level of on-site control environmental will also increase moderately. Compliance with Environmental Management Plan and Employer responsibility with a moderate correlation show statistical significance ( $r=0.501$ ,  $p < 0.001$ ), suggesting that if Compliance with Environmental Management Plan increase, the level of Employer responsibility will also increase moderately.

- **Legal Compliance with Environment Management Plan**

Legal Compliance with Environmental Management Plan and Non-Compliance Environmental Management Plan with a moderate positive relationship showed statistical significance ( $r=0.325$ ,  $p < 0.001$ ), suggesting that if Legal Compliance with Environmental Management Plan increase, the level of Non- Compliance with Environmental Management Plan will also increase slightly. Legal Compliance with Environment Management Plan and Management responsibility with moderate positive correlation showed statistical significance. ( $r=0.414$ ,  $p < 0.001$ ), suggesting that if Legal Compliance in the Environmental Management Plan increase, the level of Management responsibility

will also increase moderately. Legal Compliance with Environmental Management Plan and International Standard Organization 14000 with a moderate positive correlation showed statistical significance ( $r=0.415$ ,  $p<0.001$ ), suggesting that if Legal Compliance with Environmental Management Plan increase, the level of standard International Organization 14000 will also increase moderately. Legal Compliance with Environmental Management Plan and On-site Environmental Control with a weak correlation showed statistical significance ( $r=0.298$ ,  $p<0.001$ ), suggesting that if Legal Compliance with Environmental Management Plan increases, the level of On-site Environmental Control increases very slightly. Legal Compliance with Environmental Management Plan and Employer responsibility with a moderate correlation showed statistical significance ( $r=0.328$ ,  $p<0.001$ ), suggesting that if Legal Compliance with Environmental Management plan increase, the level of Employer responsibility will also increase moderately.

- **Management Responsibility**

Management responsibility and International Standard Organization 14000 with a strong positive correlation showed statistical significance ( $r=0.847$ ,  $p<0.001$ ), suggesting that if Management responsibility increases, the level of International Standard Organization 14000 will also increase strong. Management responsibility and on-site environmental control with a solid positive correlation showed statistical significance ( $r=0.757$ ,  $p<0.001$ ), suggesting that if Management responsibility increases, the level of on-site environmental control will also increase enormously. Management responsibility and Employer responsibility with a strong positive correlation showed statistical significance ( $r=0.637$ ,  $p<0.001$ ), suggesting that if Management responsibility increases, the level of Employer responsibility will also increase enormously.

- **International Standard Organization 14000**

International Standard Organization 14000 and on-site environmental control with a strong positive correlation showed statistical significance ( $r=0.691$ ,  $p<0.001$ ), suggesting that if International Standard Organization increases, the level of on-site environmental control will also increase strong. Furthermore, International Standard Organization and Employer responsibility with a strong positive correlation showed statistical significance ( $r=0.635$ ,  $p<0.001$ ), suggesting that International Standard Organization increase, the level of Employer responsibility will also increase strength.

- **On-site Environmental Control**

On-site environmental control and employer responsibility showed statistical significance with a strong positive correlation. ( $r=0.738$ ,  $p<0.001$ ), suggesting that if On-site Environmental Control increases, the level of on-site environmental control will also increase very strongly.

- **Management Responsibility**

The high level of agreement on Employer responsibility regarding compliance with EMP (mean=3.71, SD=0.83), The was no statistical significance  $F(7.78) = 16.837, p > 0.05$  on Management responsibility regarding compliance with EMP. The finding suggests that Employers are implementing an environmental management plan from the tender stage as the project's specification to monitor and mitigate environmental hazards of the project (mean=3.90). However, Barker and Hill (2000) stated that incorporating the EMP within the tender and contract agreement as environmental criteria is an effective way to improve the legal enforceability of the EMP. The findings suggest that employers take responsibility for ensuring that EMPs are implemented to control environmental hazards during construction projects. There is also a high agreement that Employers in the construction industry are enforcing environmental compliance by appointing the Environmental Control Office to monitor compliance during construction (mean=3.89). The statement suggested that employers are taking responsibility to appoint Environmental Control Office to monitor contractors during the construction period. The finding suggested that the Environmental Control Office conduct a Monthly Environmental audit to monitor the contractor's performance on-site (mean=3.92). Environmental Control Offices are visiting the construction site to monitor the performance of contractors by conducting a monthly audit.

## **5.8 HIERARCHICAL MULTIPLE REGRESSION ANALYSIS**

Multiple regression analysis is a test that examines how much multiple predictor variables explain variance in a dependent variable (Ross and Wilsons, 2017). Hierarchical Multiple Regression Analysis for Compliance with EMP as a dependent variable for Knowledge of Environmental Management framework, legal compliance, Non-compliance with Environmental Management plan, Management Responsibility, International Standard Organization 14000, On-site Environmental Control and Employer Responsibility in EMP's. There are many reasons for using a hierarchical regression model to see the change and variability, which is explained by a change in  $r^2$  as we move from one model to another (Gerald Babo, 2021 YouTube). A hierarchical design was employed using seven models: 1) model 1 predicted Compliance with Environmental Management Plan from Knowledge Environmental Management Framework, 2) Model 2 added Legal requirement 3) Model 3 added Non-compliance with Environmental Management Plan, 4) Model 4 added Management Responsibility, 5) Model 5 added International standard organization, 6) Model 6 On-site Environmental Control, 7) Model 7 added Employer Responsibility, 8) see the tables 5.15 to 5.21.

### 5.8.1 Coefficient of the Constructs

**Table 5.15**

**Model 1 with Knowledge Environmental Management Framework as Predictor**

Coefficient	Estimate	SE	<i>p</i> -value
Intercept	2.240	0.215	<0.05
b1	0.390	0.61	<0.05

Note:  $F(1.84) = 41.530, p < 0.05, R^2 = 0.331$  Adj=0.323

The goal of the conceptual model was to see if the relationship between the independent and dependent variables contributed to the significance. As a result, the Model predicting Compliance with Environmental Management Plan from Knowledge Environmental Management Plan accounted for significant variance,  $F(1.84) = 41.430, p < 0.05$ . Therefore, the results imply sufficient evidence of a significant relationship between EMP's compliance with knowledge of the environmental management framework.

**Table 5.16**

**Model 2 Knowledge Environmental Management Framework and Legal requirements as Predictors**

Coefficient	Estimate	SE	<i>p</i> -value
Intercept	1.738	0.246	<0.05
b1	0.350	0.058	<0.05
b2	0.184	0.052	<0.05

Note:  $F(2.81) = 25.987, p < 0.05, R^2 = 0.419, R^2 \text{ adj} = 0.405$

The addition of Legal requirements significantly increased the variance accounted for in Compliance with EMP's,  $F(1.83) = 12.637, p < 0.05$ . In addition, this new model accounted for significant variance in Compliance with Environmental Management Plan,  $F(2.83) = 29.960, p < 0.05$ . Therefore, the results imply sufficient evidence of a significant relationship between EMP's compliance with knowledge with environmental management plans.

**Table 5.17**

**Model 3 Knowledge Environmental Management Framework, Legal requirement, and Non-compliance with EMP's as Predictors.**

Coefficient	Estimate	SE	<i>p</i> -value
Intercept	1.062	0.260	<0.05
b1	0.340	0.051	<0.05
b2	0.114	0.048	<0.05
b3	0.226	0.047	<0.05
Note: $F(3.82) = 32.895$ , $p < 0.05$ , $R^2 = 0.583$ , $R^2_{adj} = 0.530$			

The additional Non-compliance with the Environmental Management Plan significantly increased the variance accounted for in Compliance with Environmental Management Plan,  $F(1.82) = 22.932$ ,  $p < 0.05$ . In addition, this new model accounted for significant variance in Compliance with Environmental Management Plan,  $F(3.80) = 29.484$ ,  $p < 0.05$ . As a result, it implies sufficient evidence of a significant relationship between compliance with EMP's to Non-compliance with EMP's.

**Table 5.18**

**Model 4 Knowledge Environmental Management Framework, Legal Requirement, Non-compliance with EMP's and Management Responsibility as Predictors.**

Coefficient	Estimate	SE	<i>p</i> -value
Intercept	0.948	0.254	<0.05
b1	0.273	0.056	<0.05
b2	0.065	0.050	>0.05
b3	0.248	0.046	<0.05
b4	0.128	0.048	<0.05
Note: $F(4.81) = 28.354$ , $p < 0.05$ , $R^2 = 0.583$ , $R^2_{adj} = 0.563$			

Management Responsibility significantly increased the Compliance with Environmental Management Plan variance,  $F(1.81) = 6.762$ ,  $p < 0.05$ . In addition, this new model accounted for significant variance in Compliance with Environmental Management Plan,  $F(4.81) = 28.354$ ,  $p < 0.05$ . Therefore, it implies sufficient evidence of a significant relationship between compliance with EMP's to Management responsibility.

**Table 5.19**

Model 5 with Knowledge Environmental Management Framework, Legal requirements, Non-conformance with EMPs, Management Responsibility, and International Standard Organization as Predictors

coefficient	Estimate	SE	<i>p</i> -value
intercept	0.988	0.257	<0.05
b1	0.262	0.056	<0.05
b2	0.063	0.050	>0.05
b3	0.245	0.046	<0.05
b4	0.065	0.077	>0.05
b5	0.070	0.066	>0.05
Note: $F(5.78) = 20.591$ , $p > 0.05$ , $R^2 = 0.589$ , $R^2 \text{ adj} = 0.563$			

The addition of the International Standard Organisation did not significantly increase the variance accounted for in Compliance with Environmental Management Plan,  $F(1.80) = 1.123$ ,  $p > 0.05$ . This new model did not account for a significant amount of variance in Compliance with Environmental Management Plan,  $F(5.80) = 22.942$ ,  $p > 0.05$ ; therefore, it is insignificant F statistics ( $p > 0.05$ ). It means that there is insufficient evidence of a meaningful association between compliance with EMPs and the International Standard Organization.

**Table 5.20**

Model 6 with Knowledge in Environmental Management Plan, Legal requirements, Non-compliance with EMPs, Management Responsibility, ISO, and on-site Environmental Control as predictors

Coefficient	Estimate	SE	<i>p</i> -value
Intercept	0.990	0.259	<0.05
b1	0.262	0.057	<0.05
b2	0.061	0.051	>0.05
b3	0.247	0.047	<0.05
b4	0.068	0.078	>0.05
b5	0.072	0.067	>0.05
b6	-0.004	0.023	>0.05
Note: $F(6.79) = 18.893$ , $p > 0.05$ , $R^2 = 0.589$ , $R^2 \text{ adj} = 0.558$			

The additional Onsite Environmental Control did not significantly increase the variance accounted for in Compliance with Environmental Management Plan,  $F(1.79) = 0.033$ ,  $p > 0.05$ . This new model did not account for a significant amount of variance in Compliance with Environmental Management Plan,

$F(6.79) = 18.893$ ,  $p > 0.05$ . It means that there is insufficient evidence of a meaningful association between compliance EMPs and on-site environmental control.

**Table 5.21**

Model 7 with Knowledge in Environmental Management Plan, Legal requirements, Non-compliance with EMPs, Management Responsibility, ISO, On-site Environmental Control and Employer Responsibility as predictors

Coefficient	Estimate	SE	<i>p</i> -value
Intercept	0.846	0.273	<0.05
b1	0.249	0.057	<0.05
b2	0.057	0.51	>0.05
b3	0.238	0.047	<0.05
b4	0.046	0.079	>0.05
b5	0.051	0.068	>0.05
b6	-0.014	0.024	>0.05
b7	0.113	0.073	>0.05

Note:  $F(7.78) = 16.837$ ,  $p > 0.05$ ,  $R^2 = 0.602$ ,  $R^2 \text{ adj} = 0.566$

The final addition of Management Responsibility to the model did not significantly increase the variance accounted for in Compliance with Environmental Management Plan,  $F(7.78) = 16.837$ ,  $p > 0.05$ . However, it implies no sufficient evidence of a significant relationship between compliance with an environmental management plan and employer responsibility.

**Table 5.22**

***Summary of  $R^2\Delta$***

Set 1	Predictors	<i>p</i> -value
1	Knowledge Environmental Management Framework	<0.05
2	Legal Requirements	<0.05
3	Non-compliance with EMPs	<0.05
4	Management Responsibility	<0.05
5	International Standard Organization	>0.05
6	On site Environmental Control	>0.05
7	Employer Responsibility	>0.05

The final model includes all seven predictors-Knowledge Environmental Management Plan, Legal compliance, Non-compliance with environmental Management Plan, Management responsibility, ISO, Onsite Environmental Control, and Employer responsibility. Overall, the final Model counted for approximately 58% of the Compliance with Environmental Management Plan variance. Only the first four predictors are significant Compliance with Environmental Management Plan predictors, independent of one another,  $p < 0.05$ . the last three are not significant predictors of compliance with the Environmental Management Plan not independent of one another,  $p > 0.05$ .

## **5.9 Chapter Summary**

This chapter examined the questionnaire survey results to reach a reliable conclusion on examining the prevalence and effectiveness of environmental management plans as legal requirements for construction projects. The data were analyzed using IBM Statistical Package for Social Science (SPSS) v 27 and the Questionnaire. The significant correlation of the constructs was assessed using hierarchical multiple regression analysis. Dependent and independent variables are used in constructs and analysis. Cronbach's Alpha was used to establish the internal consistency of the constructs with a range of 0.81 to 0.953, and the coefficients were deemed acceptable. The results were then compared to the findings of the literature review. As a results, the final model includes that Knowledge Environmental Management Plan, Legal Compliance, Non-compliance with Environmental Management Plan, Management Responsibility are significant Compliance with Environmental Management Plan predictors, independent of one another,  $p < 0.05$ . while International Standard Organisation, Onsite Environmental Control, and Employer Responsibility are not significant predictors of compliance with the Environmental Management Plan not independent of one another,  $p > 0.05$ .



## **CHAPTER 6**

### **CONCLUSIONS AND RECOMMENDATIONS**

#### **6.1 INTRODUCTION**

This chapter outlines the study's key results and conclusions. This section will also assess the study's research question. The chapter also makes recommendations for future research based on the study's goals. Using the constructs Knowledge Environmental Management Plan, Legal requirements, Non-compliance with Environmental Management Plan, Management Responsibility, ISO, Onsite Environmental Control, and Employer Responsibility, the study investigates the prevalence and effectiveness of environmental management plans as legal compliance on construction projects.

#### **6.2 PROBLEM STATEMENT**

Although compliance in the form of EMPs is a legal requirement for construction projects in the eThekweni Municipality, EMPs are not widely used, widely enforced, or effectively enforced on construction sites. In a previous study, it appears to be a practical knowledge gap. In the literature, there is a shortage of rigorous studies. In the realm of construction, some unexplored literature appears to be absent in the practice of EMPs. Many of the prior studies focus on the theoretical aspects of the field environment in general rather than the effectiveness of EMP's in construction; the field of EMP's is ripe for an investigation of practical focus research on prevalent, pervasive, or influential EMP's; many of the prior studies focus on the theoretical aspects of the field environment in general rather than the effectiveness of EMP's in construction. However, there are a few actual studies or action research on the effectiveness of EMPs on construction sites as legal requirements. In the context of EMP's legal requirements in the eThekweni Municipality in KZN, this is a critical and worthwhile investigation.

#### **6.3 RESEARCH QUESTION OF THE STUDY**

The research questions were tested:

- What factors and challenges cause contractors not to effectively used EMP's as legal requirements on construction projects in eThekweni Municipality KZN?
- What are the legal consequences of not complying with providing/developing and implementing environmental management plans on construction sites?
- What impact does non-compliance with the EMP's as legal requirements have on the environment in eThekweni Municipality KZN?

## **6.4 OBJECTIVES OF THE STUDY**

The following are the critical study objectives that must be met:

- To investigate the effectiveness of EMP's as legal requirements on construction site in the area of a Thekweni Municipality KZN.
- To investigate if EMP's as legal requirements is effectively enforced and identify the legal consequences of not complying with EMPs on construction projects in eThekweni Municipality KZN.
- To examine the impact of non-compliance with EMP's by contractors in eThekweni Municipality KZN before, during, and after construction activities.

## **6.5 RESEARCH QUESTION TESTING**

### **6.5.1 Research Question One:**

- What factors and challenges cause contractors not to effectively used EMP's as legal requirements on construction projects in eThekweni Municipality KZN?

Contractors lack the required knowledge to implement National Environmental Management Act no. 107 of 1998 (NEMA) and the International Standard Organization (ISO) framework. The finding was supported by (Massoud, 2010), who stated that developing countries need to implement an Environmental Management system like ISO 140000 to widen and maintain access to global markets and partnership and comprehensively comply with the Environmental Management Plan as legal requirements construction projects.

From the study's results, contractors do not provide the training and induction on Environment Management plan to staff and Construction workers before the project starts; there is a medium response about contractors providing training and induction on EMP's. However, the responses suggested that not all contractors provide training and induction to all their employees; this causes contractors not to comply with EMP's on-site fully. This finding was supported by (CSIR 2002). CSIR stated that difficulties in managing effective EMP's are caused by the lack of environmental awareness training before commencement.

The finding suggested that contractors see EMP's as a waste of time; they prefer to focus on production and maximize the profit; this led to contractors not fully complying with EMP's on construction projects supported by (Mishra 2015) stated that Project and Contractors had been blamed for focusing more on time, cost, and quality while neglecting environmental impacts on the project.

The finding suggested that most minor contractors have EMP's on their daily site Instruction based on the results, it is evident that not all contractors are considering EMP's on their daily site instructions this could conclude that absence of EMP's on daily site instruction for some contractors on-site is one of the factors causing contractors not to comply with EMP's fully. The finding suggested that contractors are not allocating enough budget to control and monitor environmental hazards, which raises concern whether contractors from; the finding suggests that not all contractors management are regularly conducting awareness about the environment this result could further implicate Management's lack of support on awareness about environmental protection to its employees.

The findings suggest that contractors do not have an environmental management system or implemented ISO 14000 to reduce environmental impacts on construction projects. Even though having ISO is not a prerequisite for contractors in the South Africa context; however, contractors should have it in place. Yiridoe & Marret (2004) say that the principal goal of the ISO 140001 standard is to improve and develop compliance and adherence to environmental laws and regulations. Therefore, implementing ISO can guide the organization towards achieving its own environmental goals (Valdez and Chini, 2005). In addition, it helps contractors fully comply with EMP.

### **6.5.2 Research Question Two**

- What are the legal consequences of not complying with providing/developing and implementing environmental management plans on construction sites?

The findings suggest that contractors who are not implementing EMP's are facing legal fines. Therefore, it may be concluded that there are legal consequences of degrading the environment and not implementing EMP's on construction projects. In addition, Section 28 of the National Environmental Policy Act (NEMA) backed the conclusion, stating that offending parties may be obliged to clean up and compensate for their role in environmental damage.

### **6.5.3 Research Question Three**

- What impact does non-compliance with the EMP's as legal requirements have on the environment in eThekweni Municipality KZN?

The finding suggests that lack of adequate or Non-compliance with EMP's on construction projects will damage, harm, and degrade the environment; the finding is supported by Sala (2012), who stated that environmental factors harm human health and the natural environment ecosystems, and natural resources. Therefore, there is a need for compliance with EMP's on construction projects to monitor and regulate the environment to reduce the hazards that can cause threats and harm to the environment and human life. Therefore, it may be concluded that non-compliance with EMP's must be strongly condemned at all costs from construction projects, and compliance with EMP's must be strengthened all the time on the construction projects.

## **6.6 RECOMMENDATION**

The following are recommended based on the finding of the study:

- Site management and construction workers lack the necessary training about EMP. Therefore, necessary training and education must be provided about environmental management plans before the project start knowing their role and responsibility during the construction period, in turn, could assist site management and construction workers on-site to make a better-informed decision on protecting the environment since site management and construction workers are participating in the execution of operations on-site.
- Many contractors do not have an environmental management system in place. Therefore, Contractors should adopt and implement an environmental management system like International System Organization 14000 even though it is not a prerequisite in the South African context. The adoption and implementation of the standard in construction companies may improve their environmental performance and contribute to sustainable development on a construction project at large.
- Some contractors do not have EMP in their daily site instructions (DSTI). Therefore, an environmental management plan should be included in their daily site instruction as standard requirements to remind construction workers since they are physically involved with the

construction activities daily about environmental hazards, they might encounter during the construction on-site. Such inclusion of environmental management plan on daily site instruction could benefit the protection of the environment, improve the effectiveness of the environmental management plan, and contribute to sustainable development.

- Contractors do not have enough budget to address environmental hazards on-site the employer should allocate enough budget and support from the tender stage to address environmental hazards on-site to ensure that contractors and their subcontractors have enough resources to protect the environment and avoid excuses from not adhering to the environmental protection, instead of focusing on production, profit, quality, and achieving practical completion to avoid penalties.

## **6.6 LIMITATION OF THE STUDY**

While the study made several valuable theoretical advances, it had certain limitations. For example, only contractors working on construction projects in the eThekweni Municipality KZN sample size of 91 participants from various contractors was collected. As a result, the study proposes that future research be expanded to the rest of the country, including other South African provinces, to determine whether the study's findings in this research are applicable nationally. It could also assist in determining and gaining a thorough grasp of the present state of environmental management plans as a legal requirement for construction projects.

## **6.7 CONCLUSIONS/ FINDINGS**

From the study's findings, it may be concluded that there was a lack of the expected knowledge about National Environmental Management Act no. 107 of 1998 (NEMA) as legislation for management and construction. However, the expectation would have been that contractors need to acquire more knowledge about NEMA as legislation and understand the critical success of protecting the environment, which lies in implementing the EMP by monitoring and mitigating environmental hazards during construction. The finding of the studies by (Begun al el., 2009) confirmed that EMP is part of the implementation approach to limit adverse impacts on the environment during construction of activities through EMP implementation will guarantee that construction projects are well developed more sustainably. Furthermore, knowledge and implementing ISO 14000 as an environmental management system would benefit the contractors by improving their environmental goal, performance, compliance, and contributing to the sustainable development of construction projects. The finding of

Yiridoe and Marret (2004) studies stated that the primary purpose of the ISO 14001 standard is to develop compliance and adherence to environmental laws and regulations. The study's finding suggests that some contractors are not providing the training, education, awareness, and induction about environment management plan to staff and construction workers before the project starts; providing training, awareness, education, and induction to employees will benefit the protection of the environment, and sustainable development Khanna supported this finding; Bhutiani & Matta (2009) Confirmed that employees should receive environmental awareness training to familiarize themselves with their responsibilities for implementing the environmental management system by the environmental policy and objectives; this provides employees with the necessary skills and motivation for effective environmental management implementation

The results suggested that the lack of an effective environmental management plan or non-compliance on construction projects poses a threat to the environment and affects human health, the natural environment, ecosystems, and natural resources. this finding suggests that there is an urgent need for compliance with EMPs on construction projects to monitor and regulate the environment to reduce the hazards that can cause threats and harm to the environment. compliance with EMPs must be ensured all the time on construction projects. The finding study by Sala (2021) confirmed that environmental impacts negatively affect human health, the natural environment, ecosystems, and natural resources. The results suggested that only a few contractors auditing themselves internally before getting audited externally. DEAT (2004) confirmed that environmental audits assess existing and future environmental issues and establish what action is required to meet a legal obligation. The results also suggest that there is a lack of proper communication regarding the feedback on environmental issues on weekly and monthly audits on projects by the Employer agents or contractor's management.. Furthermore, the feedback needs to be distributed to everyone on site to know their performance monthly on-site noticeboard or site meetings. The results suggest that not enough institutions to enforce the compliance of environmental Management plans on construction sites effectively it is evident that there is a lack of institutions or bodies responsible for regulating and monitoring EMP's or Environmental Control offices are not enough to ensure compliance on contractors. A study conducted by Sandham (2005) confirmed that the shortage of funding and understaffing at South Africa's provisional and local authorities compromised the effective enforcement of monitoring and auditing. The results indicate that there are insufficient institutions to effectively enforce the adherence to environmental management plans on construction sites. It is also clear that the environmental control offices or EMPs themselves are insufficient to assure contractor compliance. Sandham (2005) confirmed that Insufficient financing and staffing at South Africa's local and provisional authorities made monitoring and auditing less effective,

The results also suggested that some contractors see environmental management plans as a waste of time; they prefer to focus on production and maximize the profit; this led to contractors not fully complying with EMP's on construction projects; Poon (2001) supported this finding. Poon stated that few contractors and private developers consider environmental protection because most prioritize completion time and pay little attention to environmental protection. Therefore, employers need to start compensating contractors to address environmental protection; it will motivate contractors not to neglect environmental protection because they are compensated. According to the findings, most minor contractors have EMPs on their daily site instructions (DSTI). However, not all contractors are considering EMPs on their daily site instructions. The finding could conclude that one of the issues driving contractors not to comply with environmental management plans entirely is the absence of EMPs on daily site instructions for some contractors on-site. Therefore, contractors need to start considering environmental management plans on their daily site instruction to remind their employees about expected and potential hazards because they are physically involved with execution on site. Thus, it will benefit the effectiveness of environmental environment plans on construction projects.

According to Spearman's correlation, more knowledge of the Environmental Management Plan, legal compliance, management responsibility, International Standard Organization 14000, and on-site environmental control could significantly improve compliance with the Environment Management Plan. As a result, adhering to the Environmental Management Plan will increase the plan's visibility and efficacy on site.

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**APPENDICES**  
**APPENDIX A - INFORMED CONSENT**

**Information Sheet and Consent to Participate in Research**

Date: 17/8/2020

To whom it may concern

I, \_\_\_\_\_ from \_\_\_\_\_  
construction company allow Samson Henry Khoza to conduct a questionnaire survey at our Company  
as a requirement to fulfil his research study for MSc Construction Management at UKZN titled: An  
examination of the prevalence and effectiveness of environment management plans on construction  
projects in area of eThekwin Municipality KZN

I understand that my participation in this study is entirely voluntary and that I may withdraw at any time  
without affecting any of the benefits that I usually am entitled to.

\_\_\_\_\_  
Signature of Participant

\_\_\_\_\_  
Date

## APPENDIX B - MANAGEMENT QUESTIONNAIRES

University of KwaZulu-Natal  
School of Engineering  
Department of Construction Studies  
Howard College Campus  
Durban 4041  
South Africa

August 2020

To whom it may concern

Re: Questionnaire for a MSc An Examination of the Prevalence and Effectiveness of Environment Management Plans as Legal Requirement on Construction Projects in Area of eThekwin Municipality in KZN.

We are conducting MSc research study that looks to examine factors and Challenges that causes Contractors to not fully comply with EMP's as legal requirement and the Impact of Non-compliance with EMP's on Construction Projects eThekwin Municipality KZN.

Being Construction Employee, you are invited to take part in this research study by completing the attached questionnaire, which only requires you to check the appropriate box after reading the accompanying statement. The exercise takes only 15 minutes to complete. Your participation is vital to the success of this study, and we cordially ask that you treat the exercise with the importance it deserves of this statement.

Responding to the questionnaire is entirely voluntary. You are guaranteed complete confidentiality in treating your responses; you have the right not to respond to any questions you may consider inappropriate. You are assured that the information collected will be used for academic purposes only. Should you wish to know the research findings, note that publications arising from the study will be sent to the contact person at your organization for onward circulation to all participants.

Please check the box below to show that; a) you have read the above information; b) you are over 18 years old) you voluntarily agree to participate. I Agree. ☐ **If you do not agree**, please do not fill in the questionnaire. Thanking you in advance,

Mr. Samson Khoza

MSc Scholar

Mobile: +27 79 309 4864

E-mail: [hskhoza@gmail.com](mailto:hskhoza@gmail.com)

Prof. Theo C. Haupt

Professor, Construction Studies

Mobile: +27 82 686-3457

E-mail: [pinnacle.haupt@gmail.com](mailto:pinnacle.haupt@gmail.com) and [theo.haupt@mut.ac.za](mailto:theo.haupt@mut.ac.za)

Humanities and Social Sciences Research Ethics Committee

Research Ethics Office

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UKZN: MSc Online Survey Questionnaire for Management

Topic: An Examination of the Prevalence and effectiveness of Environment Management Plans as legal requirement on Construction Projects in the Area of eThekweni Metropolitan Municipality

Section A: Biographical Information

1.1 How many employees on average employed in your company \_\_\_\_\_

1.2 Length of your experience? \_\_\_\_\_

1.3 When was your company established? \_\_\_\_\_

1.4 Please indicate your gender? \_\_\_\_\_

1.5 Please Indicate your Age \_\_\_\_\_

1.6 Please Indicate your Primary sector of Employment \_\_\_\_\_

1	Private	
2	Public	
3	Other	

1.7 Have you conducted work in eThekweni Municipality for Building or Engineering Sector

1	Yes	
2	No	
3	May be	

1.8 Employment Category

1	Main Contractor	
2	Property Developer	
3	Engineering Consultant	
4	Project Manager	
5	Architect	
6	Quantity Surveyor Consultant	
7	Health and Safety Consultant	
8	Subcontractor	

9	Environmental Consultant/Specialist	
10	Environmental Control Office	
11	Other	

1.9 Please indicate your position

1	CEO	
2	Director	
3	Senior Manager	
4	Supervisor	
5	Employee	
6	Trainee	
7	Other	
8		

1.10 In which region do you execute most of your projects

1	Eastern Cape	
2	Free State	
3	Gauteng	
4	KwaZulu Natal	
5	Limpopo	
6	Mpumalanga	
7	Northwest	
8	Northern Cape	
9	Western Cape	

## Section B-Structured Questions

Part 1- Knowledge of environmental Management Regulatory framework rate your knowledge of the following where 1= No knowledge, 2=Poor, 3=Average 4=Good, and 5=Excellent Knowledge.

Legislation	1	2	3	4	5
Constitution of the Republic of South Africa					
Environmental Management Plan as a legal requirement on Construction site.					
National Environmental Management Act no. 107 of 1998 (NEMA)					

Occupational Health and Safety Act 1993 (Act 85 no.1993)					
International Standard Organization (ISO) 14000 frameworks					

## SECTION C STRUCTURED QUESTION

Part 2-Compliance with Environment Management Plan Please consider the following statement and indicate your level of agreement where 1= Strongly disagree, 2=Disagree, 3=Seldom, 4=Agree & 5=Strongly agree.

	1	2	3	4	5
Contractors Comply with Environmental Management Plan					
Contractors know the Environmental Management Plan as legal requirements on construction projects.					
The application of the Environmental Management Plan on-site has a positive impact on protecting the environment.					
National Environmental Management Plan Act, no 107 of 1998 (NEMA), has a positive impact on the overall protection of the environment.					
Contractors are fully committed to effective environmental Management plans on site					
Contractors are fully committed to an effective environment Management Plan because it is a legal requirement					
Contractors comply with the environmental management plan because it is a legal requirement?					
Contractors have ISO 14000 in place and Environmental Management systems to regulate and monitor their environmental performance.					
The Employer Agent/Environmental Control Office/Environmental Practitioner or					



Department of Environmental Affairs (DEA) ensures that contractors are fully compliant with EMP's.					
Contractors and their subcontractors understand how Environmental Management Plan work on Construction Projects					
Contractors are facing legal fines for degradation of the environment					
Contractors are facing legal fines for failing to implement EMP's on Construction Projects					
There are enough institutions to enforce the compliance of environmental Management plans on the construction site					
Lack of an effective environmental management plan or Non-compliance on Construction projects poses a threat to the environment.					
Non- Compliance with environmental Management plan by Contractors on-site will degrade the environment.					
Contractors and their Subcontractors are not fully complying with the Environmental Management Plan on-site as a legal requirement					
Contractors do not understand the environmental specification and environmental requirements during construction on site					
Contractors see Environmental Management as a waste of time rather than focus on production.					
Department of Environmental Affairs/ Employers' /Environmental Control Office are not doing enough to ensure that contractors comply with the Environmental					

Management Plan as a legal requirement on site.					
---	--	--	--	--	--

## SECTION D STRUCTURED QUESTIONS

Part 3- Practice and attitude towards Environmental Management Plan on Construction site Please consider the following statement and rate your answer (1=Strongly Disagree, 2= Disagree 3= Neutral, 4= Agree, and 5= Strongly Agree

<b>Contractors Management Responsibility</b>	1	2	3	4	5
Contractors Management are committed to preserving the environment on construction projects.					
Contractors are providing the training and Induction on Environment Management Plan to staff and laborers prior to the project's start.					
Contractors are having environmental Management plan program to monitor and control environmental hazards					
Awareness on environmental protection is ensured regularly by Contractors Management to staff.					
Contractors Management conduct Internal audit monthly to monitor and regulate Environmental management system of the contractor					
Contractors Management are complying with the environmental management plan on construction <u>project</u> as specification of the client.					

Environmental Management Plan is part of the Daily site instruction (DSI) of Contractors on site					
Contractors hold Regular Environmental meetings internal					
Contractors are allocating enough budget to address environmental requirement on site					
<b>ISO 14000</b>					

Contractors know ISO 14000					
Contractors are having an environmental Management system in place example ISO 14000 to promote environmental protection and sustainable development.					
Contractors are implementing ISO 14000 to promote environmental performance to contribute to environmental protection					
Contractors are implementing ISO 14000 to comply with international standard					
<b>Onsite Environmental control</b>					
There is availability of bins and skip to control littering everywhere on site					
There is Protection of soil contamination by providing drip tray for plant on site and other hazardous chemicals					
Water is protected from contamination by Construction activities					
<b>Employer/ Client/Department Environmental Affairs</b>					
Employer/Client implement environmental management plan from tender stage as specification of the project to monitor and mitigate environmental hazard of the project.					
Employers/Client enforce environmental compliance by appointing the Environmental Control Office/Environmental Practitioner to monitor compliance.					
Environmental Control Office conduct Monthly Environmental audit to monitor the performance of the contractor on site					
Employer/Client are committed to preserve the environment on construction projects.					

Employers/Client allocating enough budget to address environmental requirements on site					
Employer/Client poses fines as legal consequences to contractors who fail to comply or implement EMP's on site					

## APPENDIX C-CONSTRUCTION WORKERS QUESTIONNAIRES

University of KwaZulu-Natal  
School of Engineering  
Department of Construction Studies  
Howard College Campus  
Durban 4041  
South Africa

August 2020

To whom it may concern

Re: Questionnaire for a MSc An Examination of the Prevalence and Effectiveness of Environment Management Plans as Legal Requirement on Construction Projects in Area of eThekweni Municipality in KZN.

We are conducting an MSc research study that seeks to examine factors and Challenges that cause Contractors not fully comply with EMP's as legal requirements and the impact of Non-compliance with EMP's on Construction Projects eThekweni Municipality KZN.

Being Construction Employee, you are invited to participate in this research study by completing the attached questionnaire, which only requires you to check the appropriate box after reading the accompanying statement. The exercise takes only 20 minutes to complete. Your participation is vital to the success of this study, and we cordially request that you treat the exercise with the importance it deserves of this statement.

Responding to the questionnaire is entirely voluntary. You are guaranteed complete confidentiality in treating your responses; you have the right not to respond to any questions you may deem inappropriate. You are assured that the information collected will be used for academic purposes only. Should you wish to know the research findings, note that publications arising from the study will be sent to the contact person at your organization for onward circulation to all participants.

Please check the box below to indicate that; a) you have read the above information; b) you are over 18 years old and c) you voluntarily agree to participate. I Agree. **If you do not agree**, please do not fill in the questionnaire. Thanking you in advance,

Mr. Samson Khoza

MSc Scholar

Mobile: +27 79 309 4864

E-mail: [hskhoza@gmail.com](mailto:hskhoza@gmail.com)

Prof. Theo C. Haupt

Professor, Construction Studies

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E-mail: [mohunp@ukzn.ac.za](mailto:mohunp@ukzn.ac.za)

UKZN: MSc Online Survey Questionnaire for Construction Workers

AN EXAMINATION OF THE PREVALENCE AND EFFECTIVENESS OF ENVIRONMENTAL  
MANAGEMENT PLANS AS A LEGAL REQUIREMENT ON CONSTRUCTION PROJECTS IN THE AREA  
OF ETHEKWINI METROPOLITAN MUNICIPALITY KZN.

**Section A:**

**Instructions:** Please use cross (X) to select the category for your answer below:

1.1 Length of your experience? \_\_\_\_\_

1.2 When was your company established \_\_\_\_\_

1.3 Please indicate your Gender

Female	
Male	
Other	

1.4 Please indicate your Age -----

1.5 Please indicate your Primary sector of Employment

Private	
Public	
Other	

1.6 Have you conducted work in eThekwin Municipality for Building or Engineering Sector

Yes	
No	
May be	

1.7 Please indicate your highest formal qualification or level of schooling?

No formal education	
---------------------	--

Primary/elementary school education	
Junior High School (Grade 10)	
Senior Certificate/Matric (Grade 12)	
Technical/Vocational certificate/diploma	
University Diploma or degree	

1.8 Please indicate your position

<b>Discipline</b>	
General Worker	
Semi-skilled labor (Operator)	
Skilled Labor (Artisan)	
Leading hand	
Foreman/supervisor	
Other (Please indicate)	

1.9 In Which region do you execute most of your Project?

Eastern Cape	
Free State	
Gauteng	
KwaZulu Natal	
Limpopo	
Mpumalanga	
Northwest	
Northern Cape	
Western Cape	

## Section B-STRUCTURED QUESTIONS

Part 1-knowledge of Environment Management Regulatory Framework Rate your knowledge of the following where 1= No knowledge, 2=Poor, 3=Average 4= Good, and 5 =Excellent knowledge



Legislation	1	2	3	4	5
Constitution of the Republic of South Africa					
Environmental Management Plan as a legal requirement on Construction sites.					
National Environmental Management Act no. 107 of 1998 (NEMA)					
Occupational Health and Safety Act 1993 (Act 85 no.1993)					
International Standard Organization (ISO) 14000 framework					

### Section C Structured Question

Part- Compliance with Environment Management Plan Please consider the following statement and indicate your level of agreement where 1 =Strongly disagree, 2 = disagree, 3=seldom, 4= Agree & 5=strongly agree.

	1	2	3	4	5
Contractors Complying with the Environmental Management Plan					
Contractors know the Environmental Management Plan as legal requirements on construction projects.					
Contractors understand that the application of the Environmental Management Plan on-site has a positive impact on the protection of the environment.					
National Environmental Management Plan Act, no 107 of 1998 (NEMA), has a positive impact on the overall protection of the environment.					
Contractors are fully committed to effective the environmental management plan on site					

Contractors are fully committed to effective environmental management plan because it is a legal requirement					
Contractors have ISO 14000 in place as an Environmental Management system to regulate and monitor their environmental performance.					
The Employer Agent/Environmental Control Office/Environmental Practitioner or Department of Environmental Affairs (DEA) ensures that contractors are fully compliant with EMP's.					
Contractors and their subcontractors understand how Environmental Management Plan work on Construction Projects					
Contractors are facing legal fines for degradation of the Environment					
Contractors are facing legal fined for failing to implement EMP's on Construction Projects					
There is enough institution to enforce the compliance of environmental Management plan on the construction site					
Lack of an effective Management Plan or Non-compliance on Construction projects poses a threat to the environment					
Non-Compliance with environmental Management Plan by contractors on site will degrade the environment					
Contractors and their subcontractors do not fully comply with the environmental Management plan on-site as a legal requirement.					
Contractors do not understand environmental specifications and environmental requirements during construction on site.					

Contractors see Environmental Management Plan as a waste of time rather than focus on production					
Department of Environmental Affairs/Employer's/Environmental Control Office is not doing enough to ensure that contractors complying with the Environmental Management Plan as a legal requirement on site					

#### SECTION D STRUCTURED QUESTIONS

Part 2- Practice and attitude towards Environmental Management Plan on Construction site Please consider the following statement and rate your answer (1= Strongly disagree, 2=Disagree, 3 =Neutral, 4= Agree, and 5= Strongly Agree.

<b>Involvement of construction workers</b>	1	2	3	4	5
Contractors are committed to preserving the environment on construction projects.					
Contractors are providing the training and Induction on Environment Management Plan to Staff and laborers prior to the project start					
Contractors have an environmental Management plan program to monitor and control environmental hazards					
Awareness of environmental protection is ensured regularly by Contractors Management to Construction workers.					
Contractor Management conducts an Internal audit monthly to monitor and regulate the Environmental management system of the Contractor.					

Contractors comply with the environmental management plan on construction projects as per the client's specifications.					
--	--	--	--	--	--

Environmental Management Plan is part of the Daily site instruction (DSI) on the construction projects.					
Regular Environmental meetings are held internal					
Contractors are allocating enough budget to address environmental requirements on site					
Contractors know ISO 14000					
Contractors have an environmental Management system in place, for example, ISO 14000, to promote environmental protection and sustainable development.					
Contractors are implementing ISO 14000 to promote environmental performance to contribute to environmental protection					
Contractors are implementing ISO 14000 to comply with international standard					
There is the availability of bins and skip to control littering everywhere on site					
There is Protection from soil contamination by providing a drip tray for the plant on-site and other hazardous chemicals					
Water is protected from contamination by Construction activities					
Employers/Clients implement an environmental management plan from the tender stage as the project's specification to monitor and mitigate the environmental hazard of the project.					
Employers/Clients enforce environmental compliance by appointing the Environmental Control Office to monitor compliance.					

Environmental Control Office conduct Monthly Environmental audit to monitor the performance of the contractor on site					
Employer/Client are committed to preserving the environment on construction projects.					
Employer/Client allocating enough budget to address environmental requirement on site					
Employer/Client poses fines as legal consequences to contractors who fail to comply or implement Environmental Management Plan on site					