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INTEGRATING SUSTAINABILITY PRINCIPLES IN CONSTRUCTION HEALTH AND SAFETY MANAGEMENT PRACTICES IN ZIMBABWE

BENVIOLENT CHIGARA

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A THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF PHILOSOPHIAE DOCTOR IN CONSTRUCTION MANAGEMENT IN THE FACULTY OF ENGINEERING, THE BUILT ENVIRONMENT AND INFORMATION TECHNOLOGY AT THE NELSON MANDELA UNIVERSITY

Promoter: Prof. J.J. Smallwood

DECLARATION OF AUTHORSHIP

I BENVIOLENT CHIGARA declare that the work contained in this thesis is my personal work and has not been submitted to another institution of higher learning for the award of an equivalent qualification. The sources used are appropriately referenced.

Signature  Date: 12.11.2018

ABSTRACT

The construction industry is an important industry to national development through the provision of infrastructure and creation of employment, and hence contributing to sustainable development. Nevertheless, the construction industry has a poor health and safety (H&S) and environmental record. Globally, the construction industry is a leading contributor to workplace fatalities, injuries, and disease. In Zimbabwe, the Millennium Towers accident, which resulted in 15 construction workers losing their lives, compromised the integrity of construction H&S management, and highlighted the need to improve H&S management in the sector. This study examined H&S management in Zimbabwe and developed a framework for integrating sustainability into H&S management practices.

The study employed a mixed method research design involving the use of interviews and questionnaires to collect primary data from contractors, consultants, government, clients, and workers in Harare and Bulawayo. A total of 101 questionnaires were successfully completed and analysed, representing a response rate of 55.6%. The data from questionnaires were analysed with the help of the SPSS software v.23 to produce descriptive and inferential statistics.

The results of the study suggest that H&S practices are inadequate as demonstrated by the extent to which workers are exposed to hazards and the occurrence of injuries, disease, and fatalities. The factors contributing to workers' exposure to hazards and the occurrence of injuries, disease, and fatalities include, *inter alia*, inadequate planning for H&S, inadequate hazard identification and risk assessments (HIRAs), inadequate management of hazards, inadequate occupational health (OH) surveillance, appointment of stakeholders who do not systematically manage H&S, inadequate design HIRAs, and unsafe work practices. The problem is amplified by inadequate integration of H&S within procurement systems, which limit the extent to which contractors make financial provision for H&S. Regrettably, workplace fatalities, injuries, and disease diminish the quality of life for the injured workers, increase project cost and delays project completion. Against this background, the study investigated the integration of sustainability principles in construction H&S as a strategy to improve H&S practices in Zimbabwe. The outcome of that investigation was a strategy and interventions, and a framework for improved practices in the form of a Sustainability Framework for Construction H&S (SFCHS). The validation of the SFCHS by construction practitioners confirms the importance of the recommended practices to reducing workplace fatalities, injuries, and disease in Zimbabwe and beyond.

The development of a SFCHS, as a strategy to improve H&S practices in Zimbabwe, and the validation thereof, resulted in a significant contribution to the related body of knowledge. Nevertheless, the transition to sustainable H&S practices require contractors, consultants, government, clients and workers to take a proactive role relative to the recommended practices in the SFCHS. Further studies can explore the responsiveness of sustainability factors relative to the occurrence of injuries, disease and fatalities based on selected case studies.

Keywords: construction industry, precautionary approach, sustainable health and safety, sustainability principles.

LIST OF PUBLICATIONS

Chigara, B. and Smallwood, J. (2017). Barriers to integrating sustainability principles in construction health and safety in Zimbabwe. In: Emuze, F. and Behm, M. (eds.) *Proceedings of the Joint CIB W099 and TG59 International Safety, Health and People in Construction Conference,* Cape Town, South Africa, 11-17 June 2017, 424-435.

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DEDICATION

To the construction workers who toil every day in hazardous work conditions.

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LIST OF ACRONYMS

AIHA	American Industrial Hygiene Association
AIZ	Architects Institute of Zimbabwe
ASCC	Australia Safety and Compensation Council
BE	Built Environment
BOQ	Bill of Quantities
cidb	Construction Industry Development Board
CIFOZ	Construction Industry Federation of Zimbabwe
CSR	Corporate Social Responsibility
DfS	Design for Safety
EMA	Environmental Management Agency
EMCOZ	Employers Confederation of Zimbabwe
EU	European Union
GoZ	Government of Zimbabwe
H&S	Health and Safety
HIRA	Hazard Identification and Risk Assessment
HSE	Health and Safety Executive
HSE	Health and Safety Executive
ILO	International Labour Organisation
JHA	Job Hazard Analysis
LEED	Leadership in Energy and Environmental Design
MDGs	Millennium Development Goals
MNC	Multinational Corporation
MS	Mean Score
NEC	National Employment Council
NIOSH	National Institute for Occupational Safety and Health
NMU	Nelson Mandela University
NMMU	Nelson Mandela Metropolitan University
NSSA	National Social Security Authority
OH	Occupational Health
OSH	Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
PPE	Personal Protective Equipment

PtD	Prevention through Design
QS	Quantity Surveyor
RGN	Rhodesia Notice Number
RTW	Return to Work
SADC	Southern Africa Development Community
SCHS	Sustainable Construction Health and Safety
SDG	Sustainable Development Goal
SFCHS	Sustainability Framework for Construction Health and Safety
SHE	Safety Health and Environment
SHP	Safety and Health Plan
SI	Statutory Instrument
SPSS	Statistical Package of Social Scientists
UK	United Kingdom
UNEP	United Nations Environment Programme
USA	United States of America
USGBC	United States Green Building Council
WCIF	Workers Compensation and Insurance Fund
WECD	World Commission on Environment and Development
WHO	World Health Organisation
ZACE	Zimbabwe Association of Consulting Engineers
ZBCA	Zimbabwe Building Contractors Association
ZCTU	Zimbabwe Congress of Trade Unions
ZFTU	Zimbabwe Federation of Trade Unions
ZIMSTAT	Zimbabwe National Statistics Agency
ZIQS	Zimbabwe Institute of Quantity Surveyors
ZNOSHP	Zimbabwe National Occupational Safety and Health Policy

1.0: THE PROBLEM AND ITS SETTING

1.1 INTRODUCTION

The construction industry is an important industry in most countries as it traditionally employs a significant proportion of the population and contributes to a nation's gross domestic product (GDP). In Zimbabwe, despite slow economic growth, the Zimbabwe National Statistics Agency (ZIMSTAT) (2014) estimates that the construction industry employs 2.6% of the total workforce and contributes 3.6% to GDP. Despite its importance, the construction industry is regarded as the most hazardous work sector around the world (Faical *et al.*, 2013; Mosanawe, 2013; Smallwood and Emuze, 2013; Walters, 2009) due to the high incidence of occupational accidents, illnesses, and above all, fatal injuries (Kayumba, 2013). Previous studies also indicate that every construction worker is likely to be temporarily unfit for work at some time because of moderately serious injuries or health problems after working on a construction site (Shakantu *et al.*, 2006). According to Walters (2009), construction is dangerous because of the intrinsically hazardous nature of the work, and the industry's structural and organisational challenges for risk management. These combined factors have created an industry culture in which poor health and safety (H&S) outcomes have long been the accepted norm (Walters, 2009).

In terms of the extent of the H&S management problem, the International Labour Organisation (ILO) (2012) estimates that 2.34 million people die each year from work-related accidents or diseases, and 317 million suffer from work-related injuries. Tentatively, 60 000 fatal accidents are recorded per year on construction sites worldwide (Phoya, 2012; ILO, 2009) translating to about one fatal accident every 9 minutes. In the United Kingdom (UK), the Health and Safety Executive (HSE) (2001) determined that one third of all work fatalities happen in construction, and its employees are six times more likely to be killed at work than employees in manufacturing. According to the World Health Organisation (WHO) (2004), the risks that foster ill-health are estimated to be 10-20 times higher in developing countries than in developed countries. The construction industry in Zimbabwe is not an exception to the global H&S problem. The Millennium Towers accident in 1999, which resulted in 15 construction workers losing their lives, compromised the integrity of construction H&S management, and highlighted the need to improve H&S management in the

sector. The construction industry has the highest non-compliance with H&S issues, which is estimated at approximately 80 % (NSSA, 2012). Against a background of non-compliance, the construction industry registered a 211% increase in occupational injuries between 2009 and 2012 and an average incidence rate of 4.34 per 1 000 workers (NSSA, 2012; Mutetwa, 2010). Regrettably, the workforce in the industry is still being injured, killed, and made sick by the same things that have characterised the industry for the past 100 years, namely falls from height, being struck by moving vehicles or by falling objects, and asbestos (HSE, 2004).

The workplace injuries exert an enormous burden on workers and their families, society and the economy. The ILO estimates that approximately 4% of Gross Domestic Product (GDP) is siphoned off by direct and indirect costs of occupational accidents and diseases annually. In Southern Africa, the cost of workplace accidents was estimated at approximately 3% of GDP in Zimbabwe (Loewenson, 1999b) and 3.5% of GDP in South Africa (Musonda *et al.*, 2013). Regrettably, workers and their families bear the greatest burden of the cost (HSE, 2015). The injuries curtail the working life of workers by several years, shorten life expectancy, increase temporary and permanent work disability, and premature death or retirement (WHO, 2002). Despite the economic and social costs of workplace injuries, investment decisions continue to be made with disregard of H&S and environmental considerations (Alli, 2008). In addition to inadequate investment in H&S, poor H&S performance in the construction is also a result of poor planning (Lopez-Valcracel, 2001), lack of management commitment, inadequate supervision, and inadequate or lack of H&S training, and a negligent attitude by management of contracting organisations (Chigara and Moyo, 2014; Windapo, 2012; cidb, 2009).

Although the interventions by government and construction stakeholders with regards to construction H&S produced some notable positive results, Reyes *et al.* (2013) argue that the results fall short of expectations. Workers continue to be exposed to conditions which systematically curtail their working life and their ability to meet current and future needs. Against that background, an alternative approach to reduce the accident rate and improve quality of life of construction workers is needed. In today's world, most organisations are leveraging sustainability (Boileau, 2016) to improve their economic and environmental outcomes. To achieve sustainability in H&S, the interventions to

prevent workplace injuries need to rely on a much broader perspective to ensure that their effects will be capable of providing a healthy and safe work environment (Boileau, 2016). Previous studies conducted by the OSHA (2016) and Boileau (2016) suggest that sustainability in H&S can be achieved through leveraging sustainable development principles. Rajendran and Gambatese (2009) define sustainable construction H&S as a concept, which aims to sustain workers' H&S from the commencement to the completion of a single project; for each future project the worker is involved in; and during the worker's remaining life time after retirement, without any injuries or illnesses as a result of the construction work. Thus, a sustainable approach to H&S should strive to remove all conditions, which curtail the ability of workers to meet their current and future needs.

Nevertheless, the synergy between H&S and sustainability has not been fully exploited. Limited studies have investigated the potential of leveraging sustainability to improve H&S outcomes (Bezalel and Issa, 2016). Previous studies with regards to H&S have been limited to exposing the influence that owners, designers, constructors, and subcontractors have individually on construction worker H&S (Rajendran and Gambatese, 2009). The few studies conducted with regards to sustainable H&S are limited to developed countries, and then mainly the United States of America (USA). According to Amponsah-Tawiah (2013), studies exploring the role of occupational H&S on sustainable development are either fragmented, or their relationships merely glossed over.

Against that background, Musonda *et al.* (2012) and Reyes *et al.* (2013) concur that alternative lines of research are needed to develop new tools and approaches to improve the H&S outcomes and quality of life of workers in the construction industry. Therefore, this research examined the H&S management practices in Zimbabwe and developed a framework for integrating sustainable development principles into H&S practices. The integration of sustainability principles in construction H&S will raise the H&S profile to a similar status to resonate with sustainability thereby increasing the likelihood of H&S making it onto more agendas and ultimately improve environmental, social and economic success of the construction industry in Zimbabwe and beyond.

1.2 BACKGROUND OF THE SUSTAINABLE H&S CONCEPT

There is a growing, but limited body of evidence demonstrating that aligning H&S with sustainability can improve H&S outcomes. The thesis surrounding the integration of sustainability into H&S practices arises from the realisation that the concepts of sustainable development and H&S are mutually related (Molamohamadi and Ismail, 2014; Schulte *et al.*, 2013; WHO, 2012) by their concern for human wellbeing. According to the WHO (2006), workers represent half of the world's population contributing greatly to the economic and social value of contemporary society. Nevertheless, the contribution of workers to sustainable development is curtailed by unhealthy and unsafe work environments, which suggests that addressing sustainability without addressing H&S, or the converse, will not produce the desired results.

The previous studies which investigated the relationship between H&S and sustainable development discussed the relationships along the three dimensions of sustainable development, namely social, economic and environmental sustainability. According to the WHO (2012), a healthy and safe workplace and a healthy and safe workforce are the prerequisites of productivity, social, economic, and sustainable development. The observations of the WHO corroborate a study by Chen (2004), which determined that economic effectiveness and H&S are inseparable. It is through the engagement of workers in the productive processes that the triple bottom line for sustainable development may be achieved. With regards to environmental sustainability, several studies (Hinze *et al.*, 2013; Schulte *et al.*, 2013; ILO, 2012a) determined that protection of workers' H&S and the protection of the environment are mutually reinforcing objectives. According to Molamohamadi and Ismail (2014), without healthy workers and safe working places, the environment and society would be exposed to danger.

Notwithstanding the above, the connection between H&S and sustainable development has not been fully appreciated by decision makers in the construction industry. Despite adopting sustainability as a development paradigm, most organisations rarely consider H&S issues (such as exposure to hazards, injuries, disease, and fatalities) as sustainability issues, but as 'ordinary' social issues. According to Hinze *et al.* (2013), despite significant changes to promote sustainability,

little has been done to evaluate the wellbeing of human resources at construction site level.

Nevertheless, the consequential effects of the failure to optimise the relationship between H&S and sustainability is that the H&S problem is underestimated and possibilities for 'root solutions' missed (Broman and Robert, 2015). A sustainable approach to H&S should strive to remove conditions (social, economic and environmental), which systematically diminish the capacity of workers to meet their present and future needs. According to Boileau (2016), the H&S community can leverage sustainability principles to realise better and sustainable H&S outcomes. Leveraging sustainability ensures that interventions in H&S take a much broader perspective to ensure that the impacts of such interventions are long-lasting and sustainable. According to Schulte *et al.* (2013), integrating H&S with sustainability practices is extremely important to the effective realisation of both objectives.

1.3 THE STATEMENT OF THE PROBLEM

The WHO (2006) asserts that despite the availability of effective interventions for occupational health (OH), too many workers are still exposed to unacceptable levels of occupational risks and fall victim to occupational diseases and work accidents, lose their working capacity and income potential, and still too few have access to occupational health services. Despite employing approximately 2.6% of the workforce, the construction industry is estimated to be the leading sector in terms of non-compliance with H&S provisions (NSSA, 2010; Mutetwa, 2010). The statistics courtesy of the Workers' Compensation and Insurance Fund (WCIF) for the period 2009 to 2012 show that the injury incidence rate increased from 1.44 to 6.93 injuries per 1 000 workers, with 36.4% of the injured experiencing disability between 20-49%, and an average of 2 fatalities being encountered per annum during the same period (NSSA, 2012). Although this information is limited to compensation claims in terms of the WCIF, it indicates the extent of the H&S problems in Zimbabwe's construction industry. The concomitant effects of occupational injuries, illnesses and fatalities are far reaching, manifesting in loss of productivity, project costs exceeding value, delayed completion of projects, and loss of income to injured workers and their families, and increased social benefits payouts at national level. The problem is compounded by lack of a holistic and long-term approach to H&S management on projects.

Considering this, the statement of the problem is as follows:

> Despite a declining contribution to employment, the construction industry in Zimbabwe is ranked among the top hazardous occupations accounting for a significant percentage of work-related accidents, injuries, illnesses and fatalities.

The statement of the problem is informed by the sub-problems presented in Table 1. The problem, sub-problems, and hypotheses were developed after an initial survey of the literature pertaining to H&S management in the construction industry. However, it is necessary to highlight the paucity of literature pertaining to this subject in Zimbabwe. Therefore, the problem was evolved from literature generated from other countries that have comparable conditions to that of Zimbabwe, and supplemented by the local available literature, mainly published by the NSSA, the H&S regulatory authority in Zimbabwe. This approach was successfully used by Takala (1999) when estimating global fatal occupational accidents. It is the submission of this research that the nature of the construction industry in Zimbabwe and its H&S performance are not substantially different from those of other developing countries.

1.4 THE SUB-PROBLEMS AND HYPOTHESES

The sub-problems and hypotheses are presented in Table 1.1 below.

Table 1.1 Sub-problems and hypotheses

Sub-Problems	Hypotheses
Sub-problem 1: Fatalities, injuries, and disease are generated on projects	**Hypothesis 1.1**: Inadequately managed hazards and poor occupational health (OH) surveillance result in workers being exposed to occupational hazards, and the occurrence of fatalities, injuries, and disease on projects **Hypothesis 1.2:** Inadequate design hazard identification and risk assessments (HIRAs) result in workers being exposed to hazards on projects and the occurrence of fatalities, injuries, and disease **Hypothesis 1.3:** Appointment of stakeholders that are not committed to construction H&S contributes to the occurrence of fatalities, injuries and disease
Sub-problem 2: Disabled workers cannot secure subsequent employment	**Hypothesis 2.1:** Injuries sustained at work prevent workers from securing subsequent employment **Hypothesis 2.2:**

	Labour productivity expectations set for workers by contractors reduces re-employability chances for injured and disabled workers **Hypothesis 2.3:** Inadequate policy and regulations on post injury return to work (RTW) result in injured workers failing to be reemployed
Sub-problem 3: Families of the deceased and injured experience financial difficulties	**Hypothesis 3.1:** Workers who are permanently absent from work due to death or injury results in their families experiencing financial difficulties **Hypothesis 3.2:** Poor compensation for injured or deceased workers result in their families experiencing financial difficulties **Hypothesis 3.3:** Increased cost of home care for injured workers result in their families experiencing financial difficulties
Sub-problem 4: Workers encounter hazards when executing work	**Hypothesis 4.1:** Lack of contractor H&S planning exposes workers to numerous hazards on projects **Hypothesis 4.2:** Inadequate designing for construction H&S results in workers being exposed to numerous hazards on projects **Hypothesis 4.3:** Inadequate project management results in workers being exposed to numerous hazards on projects **Hypothesis 4.5:** Lack of integration of H&S and environmental management systems expose workers and the general public to work-generated environmental hazards
Sub-problem 5: Projects experience delays, costs exceed value, and rework occurs	**Hypothesis 5.1:** Inadequate H&S is linked to occurrence of rework on construction projects **Hypothesis 5.2:** Accidents result in project costs exceeding value **Hypothesis 5.3:** Loss of output due to workers being absent, injured, or sick results in projects experiencing delays and or being completed late
Sub-problem 6: Contractors lack resources for construction H&S	**Hypothesis 6.1:** Non-facilitation of financial and other provision for H&S results in contractors lacking resources for construction H&S

1.5 THE AIM AND OBJECTIVES OF THE STUDY

Aim

The aim of the research is to examine construction H&S management in Zimbabwe and develop a framework for sustainable construction H&S management. This aim will be fulfilled through addressing the following objectives.

Specific Objectives:

- To investigate the factors contributing to workers' exposure to H&S hazards and the occurrence of fatalities, injuries, and disease;
- To establish the effects of occupational fatalities, injuries, and disease on workers and their families;

- To establish the impact of inadequate H&S on project cost, duration, productivity, and quality;
- To examine the factors that determine contractors' financial provisions for H&S;
- To assess the impact of procurement on H&S management on projects;
- To establish the interface between H&S and sustainable development, and
- To develop a model for integrating sustainability into H&S management on construction projects.

1.6 THE IMPORTANCE OF THE STUDY

The research contributes to the construction H&S body of knowledge as the literature review revealed paucity of research on construction H&S management in Zimbabwe. The available research on H&S management in Zimbabwe is either general (Masike *et al.*, 2013; Moyo, 2010; Mutetwa, 2010; Mutetwa, 2008) or addresses H&S in non-construction sectors such as manufacturing (Mukaro, 2008), and the wood industry (Jerie, 2012). While these studies portray the general state of H&S management in the country, however, the special characteristics of the construction industry, for example, the organisation of construction work, nature of hazards and risks, the temporary nature of construction, and the mobility of the labour force, make the planning for H&S in the industry unique, requiring a specific approach (Walters, 2009; Lopez-Valcracel, 2001). The need for a sector-based approach to H&S management is recommended through ILO Convention 167 (Safety and Health in Construction).

The research adopted a multi-stakeholder approach to examine H&S management in the construction industry, and to develop a framework for integrated and sustainable construction H&S management. The results of this research, which will be disseminated through seminars, conference presentations, and journal publications, are expected to provide an improved understanding of the economic, social, and environmental benefits of sustainable H&S management to business, workers, and society. Consequently, the results will influence policy direction, planning interventions, and setting priorities for action to improve construction H&S management. The ILO (2012), indicates that a careful analysis of H&S will help employers to realise how H&S investments can improve economic performance, and social partners can use the study as an opportunity to increase their understanding of the role of healthy work and the options for achieving it. A study that provides for sustainable H&S management will

benefit the industry through increased wellbeing and welfare of construction workers, saving lives, reduced illnesses and deaths, improved quality, cost reduction, and improved image for the industry. Through the development of a strategy for improved practices in the form of a Sustainability Framework for Construction H&S (SFCHS), the study makes a significant contribution to the related body of knowledge.

1.7 DEFINITION OF TERMS

Accident

An unexpected and unplanned occurrence, including acts of violence, arising out of or in connection with work which results in one or more workers incurring a personal injury, disease or death (ILO, 2008).

Occupational injury

It is defined as any personal injury, disease or death resulting from an accident; an occupational injury is therefore distinct from an occupational disease, which is a disease contracted as a result of an exposure over a period to OH risk factors arising from work activity (ILO, 2011). Occupational injuries include deaths, personal injuries and diseases resulting from work accidents (ILO, 1998).

Health and safety (H&S)

The promotion and maintenance of the highest degree of physical, mental and social wellbeing of workers in all occupations achieved through preventing ill-health, controlling risks, and adapting work to people and people to their jobs (WHO, 2004).

Incidence rate (IR)

Incidence rates relate the number of new cases of occupational injury to the number of workers exposed to the risk of occupational injury (ILO, 1998). In Zimbabwe, the incidence rate is defined as the number of injuries per 1 000 insured labour-force. The insured labour force being the population at risk (NSSA, 2010).

Injury frequency rate (IFR)

A frequency rate is intended to indicate the number of new cases of injury occurring in relation to the amount of time during which workers in the reference group were ‘exposed to the risk’ of being involved in an accident (ILO, 1998). In Zimbabwe, it is

defined as the number of injuries per one million hours of exposure (NSSA, 2010). A workplace with a high IFR (1 and above) is regarded as unsafe.

Sustainability

The World Commission on Environment and Development (WCED) defined sustainable development as development that meets the needs of the present without compromising the ability of future generations to meet their own (WCED, 1987).

1.8 THE ASSUMPTIONS

The assumptions are as follows:

- Accidents are occurring on construction projects;
- Workers lose earnings as a result of accident induced absenteeism / death;
- Projects experience delays and costs exceed value;
- Workers encounter hazards on projects resulting in injuries, diseases and deaths, and
- There is a policy and regulations with respect to post injury return-to-work.

1.9 THE DELIMITATIONS

This study will:

- be limited to two regions – Harare and Bulawayo. These two cities contain more than 80% of registered contractors and consultants and the two regions account for a significant share on construction works in the country (Chigara *et al.*, 2013; Saungweme, 2011);
- consider contractors and consultants (architects, engineers, quantity surveyors, and project managers) registered by respective associations and professional institutes;
- be limited to private and public-sector building construction projects, excepting houses, and
- consider clients from selected projects

1.10 OUTLINE OF THE THESIS

The thesis is organised into 9 chapters as follows:

Chapter 1 presents the problem under investigation, the aim and specific objectives of the study, and the justification of the study. In Chapter 2, the thesis provides an overview of the construction industry in Zimbabwe, regulatory and institutional framework for H&S management and the H&S issues in the industry. Chapter 3 discusses the H&S issues identified through the sub-problems. The key issues discussed in this chapter relates to the management of construction hazards, procurement and financial provisions for H&S, and the implications of inadequate H&S on workers and their families, and project parameters. This chapter also provides insights into the issues to be included in the research instruments. Chapter 4 discusses the relationship between sustainability and construction H&S, and explores opportunities of integration. In addition, the Chapter develops a framework of principles of sustainable development for construction H&S. Chapter 5 presents the philosophical paradigms, research methods and the research design adopted for this research. Furthermore, the chapter explains the process through which the respondents were selected, and the data collection procedure. Chapter 6 presents and discusses the research findings. The research findings are presented and discussed in accordance with the objectives of the study and the sub-problems. Chapter 6 is a precursor to Chapter 7, which will deal with the testing the hypothesis testing for the study. In Chapter 8, the processes followed to develop and validate the Sustainability Framework for Construction H&S (SFCHS) are described. Chapter 9 presents the major conclusions of the study and recommendations for further research.

2.0 : THE ZIMBABWEAN CONSTRUCTION INDUSTRY

2.1 INTRODUCTION

The construction industry in Zimbabwe is pivotal to ensure economic growth in the country. Nevertheless, despite a low contribution to employment creation, the industry contributes disproportionately to workplace injuries, disease and fatalities. This section will provide a discussion of the state of construction activity, structure of the construction industry, the H&S problem, and management in Zimbabwe.

2.2 THE CONSTRUCTION INDUSTRY AND THE ECONOMY IN ZIMBABWE

The construction industry is a key industry, providing shelter and infrastructure to facilitate commerce and socio-economic activities. The Minister of Finance and Economic Development states that construction is among the four sectors on which national economic growth is anchored (Chinamasa, 2015). However, the construction industry's contribution to the Gross Domestic Product (GDP) has declined due to a deteriorating macroeconomic environment since 2000. According to the Government of Zimbabwe GoZ (2013b), industrial capacity utilisation declined to less than 10%. However, with the inauguration of a government of national unity in 2009 and a cocktail of measures that followed, some modicum of economic stabilisation characterised by real GDP growth of 5.4% in 2009, 11.4% in 2010, reaching a peak of 11.9% in 2013 was achieved. However, the recovery remained fragile as growth declined to 10.6% in 2012, 3.4% in 2013 (GoZ, 2013b) and 1.5% (projected) for 2016 (Chinamasa, 2015).

There are, however, conflicting statistics with regards to the contribution of the construction industry to employment. According to the Ruzivo Trust (2013), employment in the construction industry declined from a peak of 20% of the national labour force in 1996, to 5% of the total labour force, mostly for short term contracts. The findings of the 2014 Labour Force Survey revealed that the construction industry employed 2.6% of the labour force (ZIMSTAT, 2015b). Against that background, statistics courtesy of the ZIMSTAT (2015b) suggests that the construction industry contributed 3% to GDP. These statistics are generally consistent with the declining construction capacity utilisation, which is estimated at between 20 and 30% (Nyoni, 2016; Nyoni, 2015).

The economic meltdown is exerting financial problems for the construction industry. According to Chinamasa (2014), the construction industry has failed to realise its full potential due to limited financing, low fiscal space for capital development programmes, and little external capital flows. Consequently, some private and public-sector projects were stalled and only a 'handful' of projects are being implemented. In addition to financial constraints, the construction industry has also been affected by skills flight (Chigara and Mangore, 2012; Saungweme, 2011), low uptake of technology and equipment (Ruzivo Trust, 2013), and declining productivity (Chigara and Moyo, 2014b).

Despite these challenges, some projects in the housing, aviation, water, power and road development sectors have been implemented throughout the country. These are financed by the public sector through loans, joint ventures, mortgages as well as direct budgetary support (Chinamasa, 2015).

2.3 STRUCTURE OF THE CONSTRUCTION INDUSTRY

The construction division is defined in the ZIMSTAT (2013) to include establishments whose predominant activity is the construction and / or repair of buildings, roads, bridges, sewers, railroads, dams, airports, swimming pools, communication systems and all other construction work; special trade contractors in the field of construction such as carpenters, plumbers, plasterers, and electricians, and own account construction undertaken as an ancillary activity by an establishment in another industry (ZIMSTAT, 2013). According to the Ruzivo Trust (2013), approximately 60% of the contractors in the construction sector are indigenous, most of which are small and unable to implement big contracts, while 40% are large non-indigenous and foreign contractors.

Consistent with the government's 'Look East' policy after a diplomatic standoff with western countries, most government projects are executed by Chinese contractors. In addition to political connection, Chinese contractors also benefit from the use of low-cost tendering technologies. The weak government financial base has also resulted in major public-sector projects being procured through Public Private Partnership (PPP) arrangements. The resurfacing of Plumtree to Mutare road (794km) and the proposed dualisation of the Beitbridge to Chirundu road (897km) were awarded to foreign

contractors on a PPP arrangement. The Plumtree to Mutare road resurfacing project was awarded to Group Five (South Africa) and dualisation of the Beitbridge to Chirundu road was awarded to Geiger Pvt. Ltd. (Austria) and China Harbour (China). The international contractors have an advantage over local contractors due to technology and expertise needed to do the works. Nevertheless, the local building contractors perceive the foreign contractors as subjecting them to unfair tendering procedures (Kazunga, 2015). Therefore, the Construction Industry Federation of Zimbabwe (CIFOZ) and the Zimbabwe Building Contractors Association (ZBCA) are lobbying for a Contractors' Bill meant to regularise issues relating to contractor registration, tendering and procurement procedures consistent with the Indigenisation and Economic Empowerment Act (14:33). The harsh macroeconomic conditions reduced the financing of construction projects. The public sector, using the PPP, is the dominant financier of construction projects, contributing approximately 90% of projects implemented in 2012 (Ruzivo Trust, 2013).

The construction industry is made up of two contractor organisations, namely the CIFOZ and ZBCA, which represent the interests of contractors in Zimbabwe. The CIFOZ and ZBCA were established in 1915 and 1992 respectively as non-profit contractor associations. In addition to being registered with the CIFOZ or ZBCA, contractors who wish to tender for government projects also register with the Ministry of Local Government, Public Works and Urban Development. Table 2.1 presents the registration categories for contractors in Zimbabwe.

Table 2.1 Categories of building and civil engineering contractors

Category	Limit per contract US$
A	Unlimited
B	Up to $6 000 000
C	Up to $3 000 000
D	Up to $1 500 000
E	Up to $1 000 000
F	Up to $ 800 000
G	Up to $ 500 000
H	Up to $ 250 000

(Source: Ministry of Local Government, Public Works and Urban Development)

The Ministry of Local Government, Public Works and Urban Development provides the legislative and policy framework, which guides the professional conduct of built

environment organisations such as contractors and construction professionals in the country. It is also responsible for project management functions on government projects. On the other hand, professionals in the industry, except for project managers, are regulated by their professional Institutes and Acts of Parliament.

The lack of projects, weak macro-economic environment, appointment of foreign contractors (Chinese contractors), and the dominance of small firms have several ramifications for H&S. Several newspaper articles have published the poor H&S practices on projects implemented by the Chinese contractors. On the other hand, lack of projects and the weak economy have a strong effect with regards to financial provisions for H&S. The small to medium size contractors generally do not have proper H&S management systems.

2.4 AN OVERVIEW OF CONSTRUCTION H&S

According to Moyo *et al.* (2015), the organisation and implementation of H&S in Zimbabwe remained at suboptimal levels. The aforesaid is confirmed by statistics courtesy of the NSSA, which suggest that H&S performance in the country is poor. The workers are exposed to hazards and the occurrence of fatalities, injuries and disease. According to Jerie (2012), construction workers are exposed to various types of hazards. The NSSA statistics indicate that 20 641 non-fatal injuries and 401 fatal injuries were recorded between 2008 and 2013 (GoZ, 2014). The construction industry H&S statistics indicate that fatal and non-fatal injuries are increasing. Figure 2.1 shows the fatal and non-fatal incidence rate for 5 years from 2010-2014.

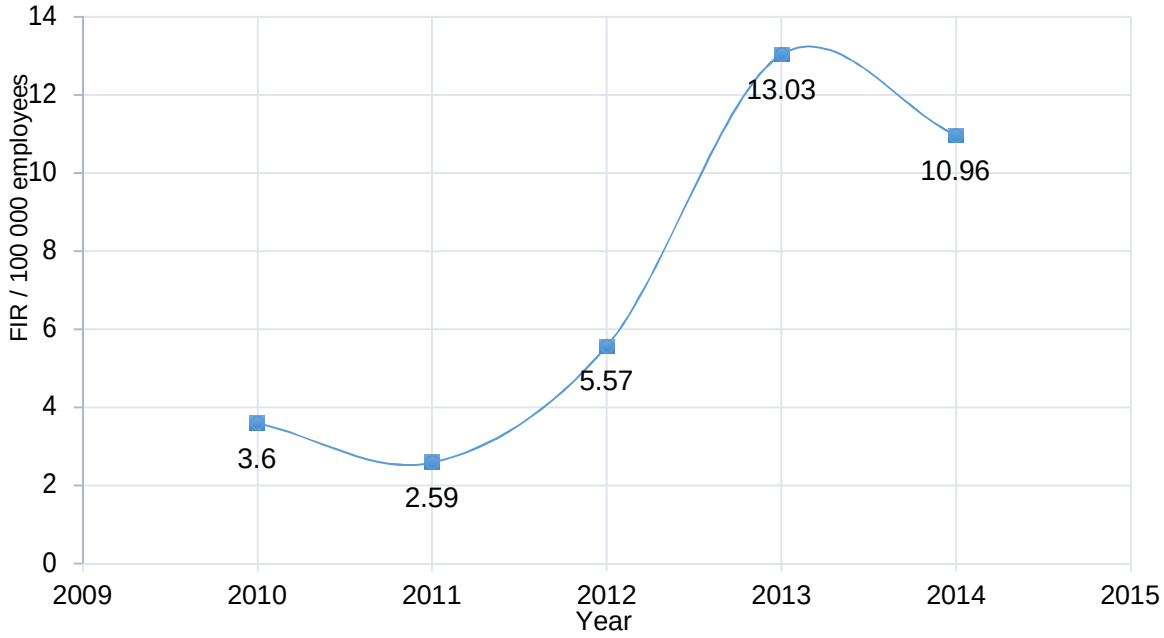

Figure 2.1 Fatal and non-fatal incidence rate for 5 years from 2010-2014.

(Source: compiled from the NSSA statistics)

The mean fatal incidence rate for the 5 years spanning 2010 to 2014 is 7.15 per 100 000 workers. In Zimbabwe, the fatal injury rate (FIR) is defined as the number of fatal injuries per 100 000 insured labour-force (NSSA, 2014). The rate depicts the risk that certain workers (such as those in an occupation or industry) have of incurring a fatal injury. The analysis of data with regards to fatalities reveal that motor vehicle accident (MVA) is the major cause of fatal accidents on construction projects in Zimbabwe contributing 75% and 88% of fatalities in 2014 and for the period 2009 to 2012 respectively.

The analysis of incidence rates (IR) for the period spanning 2010 to 2014 determined that the construction industry has a high IR of 5.7 against an all-sector IR of 4.7 per 1000 insured workers. The NSSA (2014) defines IR as the number of injuries per 1 000 insured labour-force. It is notable that the industry recorded a 41.3% decrease in the IR between 2013 and 2014. Despite registering a decrease in the IR, the achieved IR of 4.7 per 1 000 workers as recorded in 2014 is far above the ILO recommended IR of less than 1. This confirms that that the industry is still risky. It is also notable that the decline in IR coincides with the beginning of another phase of economic meltdown after

the disputed 2013 general elections. Figure 2.2 presents the construction industry IR and an all-sector IR from 2010 to 2014.

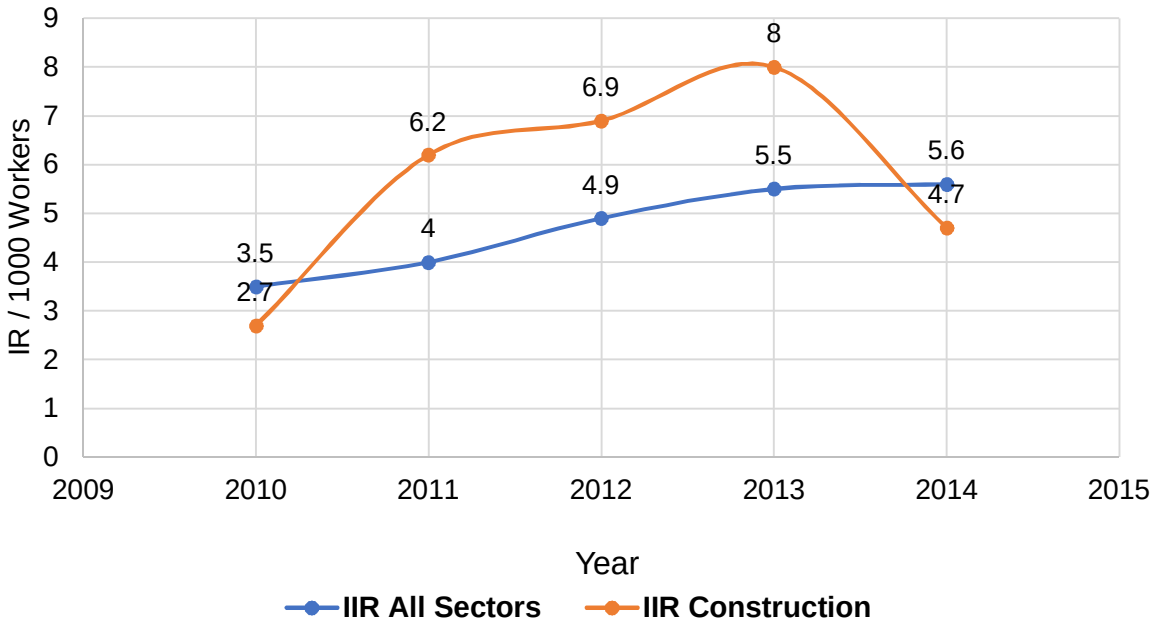

Figure 2.2 Incidence rate for 2010 – 2014.

(Source: compiled from the NSSA statistics)

The top five types of non-fatal accidents for 2014 are, in descending order, struck against a stationery object (13.5%); collapse or fall of platform, lift or scaffold (8.8%); collision with, struck by sliding or slipping objects (7.6%); contact with (in motion circulating, vibrating, revolving) (7.6%) and falls of persons from height e.g. scaffold, platform ladder (5.3%). These results are consistent with Table 2 covering the period from 2009 to 2012.

An analysis of fatal and non-fatal injuries also revealed the major types of accidents, in descending order, include: contact with objectives (28%); fall of material objects (14.4%); fall of persons (13.9%); overexertion when lifting, pushing or pulling heavy object (10.7%); road traffic accidents (9.78%) and caught in or between objects (8.68%). Table 2.2 presents the types of injuries / accident.

Table 2.2 Fatal and non-fatal injuries by type of accident

Type of accident	2009		2010		2011		2012		Total	Percent
	Non-fatal	Fatal	Non-fatal	Fatal	Non-fatal	Fatal	Non-fatal	Fatal		
Contact with objects	22		44		71		66		203	28.0
Falls of materials or objects	15		16		40		34		105	14.5
Falls of persons	13		17		44		27		101	13.9
Overexertion when lifting, pushing or pulling heavy object	5		29		23		21		78	10.7
Road Traffic accidents	10	2	17	2	19	1	18	2	71	9.8
Caught in or between objects	5	1	9		24		24		63	8.7
Exposure to extreme temperatures, radiation or bacteria/virus	2		8		7		16		33	4.6
Contact with electric current, lightning, fire and chemicals	1		4		5		17		27	3.7
Power Motivated Accidents (not road accidents)	2						7		9	1.2
Acts of violence					4		2		6	0.8
Explosives	1						3		4	0.6
Others	6		5		3		12		26	3.6
Total	**82**	**3**	**149**	**2**	**240**	**1**	**247**	**2**	**726**	**100**

(Source: compiled from the NSSA statistics)

The statistics presented in the preceding paragraphs corroborate the NSSA (2012) and Mutetwa (2010) that the construction industry in Zimbabwe is the sector with the highest non-compliance with H&S provisions. Previous studies estimate that non-compliance with H&S issues in the construction industry is approximately 80 % (NSSA, 2012; Mutetwa, 2010). Nevertheless, given the high level of underreporting of H&S incidents and the low capacity utilisation in the industry as a result of the economic meltdown, the statistics above present a conservative assessment of the extent of the construction H&S problem in Zimbabwe.

The results presented in Table 2.2 confirm that workers are exposed to various types of hazards on projects. This is consistent with Jerie (2012) who determined that construction workers in Zimbabwe are exposed to several hazards resulting in the occurrence of fatalities, injuries or disease. There are several factors contributing to poor H&S performance in Zimbabwe. The results of studies conducted by Chigara and

Moyo (2014) and Moyo (2010) suggest that inadequate H&S surveillance, enforcement bottlenecks, disjointed legislation, economic challenges and lack of commitment are among the factors leading to inadequate implementation of H&S provisions. These results are confirmed by the statement of the Minister of Public Service, Labour and Social Welfare (Goche, 2014) and the Director of Occupational Safety and Health who highlighted that the poor H&S performance in the country is a result of lack of a systems approach to H&S management and inadequate investment in H&S (Katongomara, 2015).

2.5 INSTITUTIONAL FRAMEWORK FOR H&S MANAGEMENT

The development of an institutional framework for H&S management represents a clear demonstration of commitment to H&S by the Government of Zimbabwe (GoZ). In Zimbabwe, the institutional framework for H&S management follows a top-down approach. The government assigned H&S management to key institutions, namely the Ministry responsible for Labour acting through the NSSA division of Occupational Safety and Health (OSH). In addition, the government, working with social partners, developed and ratified the Zimbabwe National Occupational Safety and Health Policy (ZNOSHP) in 2014 to define the operational framework for implementing H&S.

To align H&S management with international practice, the government ratified several ILO Conventions, namely, Occupational Safety and Health Convention, 1981 (no. 155), Occupational Health Services Convention, 1995 (No. 161), Safety and Health in the use of Asbestos, 1986 (No. 162), Safety and Health in the use of Chemicals, 1990 (No. 170), Prevention of Major Industrial Accidents Convention, 1993 (No. 174), and Safety and Health in Mines Convention, 1995 (No. 176), ratified in 2003. The ratifications of ILO Conventions, among other factors, had a strong effect with regards to the development of H&S infrastructure in the country. Figure 2.3 shows the schematic layout of the Institutional Framework for construction H&S.

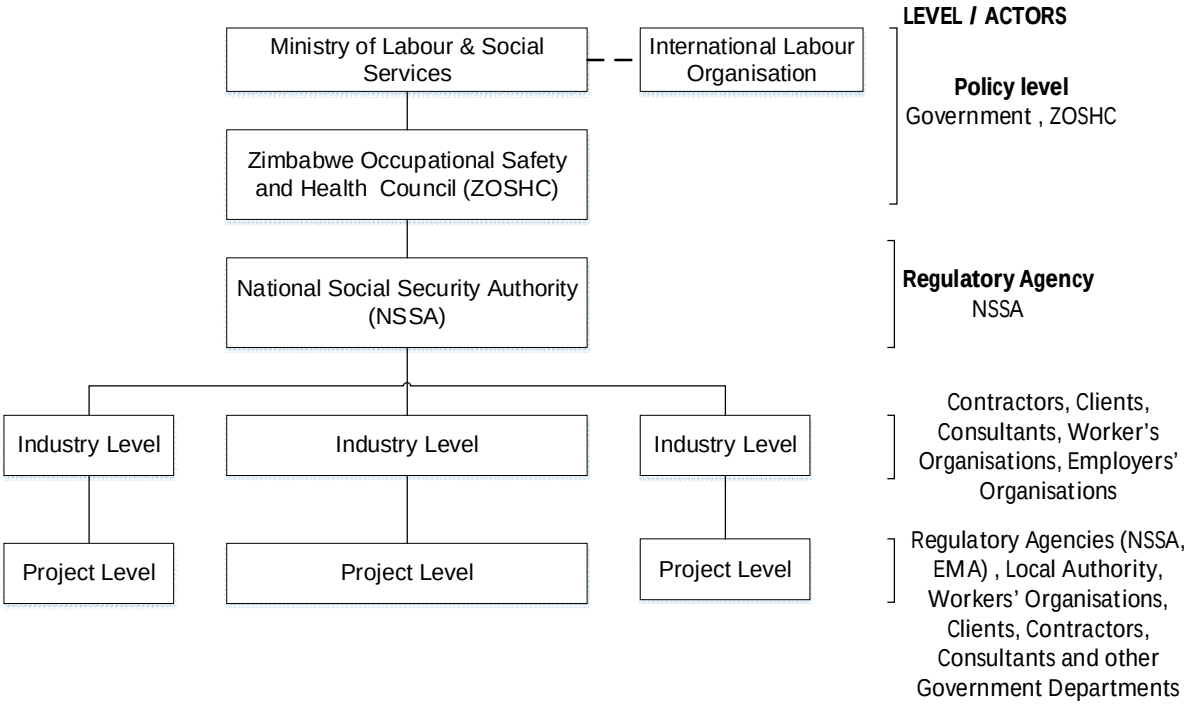

Figure 2.3 Institutional framework for H&S management in Zimbabwe

(Source: developed by the author)

The ZNOSHP identifies key institutions with responsibility for H&S. Another key institution for the management of H&S is the Zimbabwe Occupational Safety and Health Council (ZOSHC). The ZOSHC is responsible for ensuring a national consensus with regards to H&S issues in the country through dialogue. The ZOSHC advises the Minister responsible for labour with regards to H&S policy, law and standards (GoZ, 2014) and formulating and propagating national policy with respect to H&S. The ZOSHC is composed of members from some government ministries closely linked to H&S, the Employers' Confederation of Zimbabwe and workers represented by the Zimbabwe Congress of Trade Unions (ZCTU) and Zimbabwe Federation of Trade Unions (ZFTU).

In terms of H&S operational responsibility, the GoZ delegated the responsibility for the national planning, development and implementation of H&S programmes to the NSSA. The NSSA operates two schemes, namely the National Pension Scheme and the Accident Prevention and Workers Compensation Scheme. The Accident Prevention and Workers Compensation Scheme, commonly known as the Workers Compensation and Insurance Fund (WCIF), is a scheme, which was established and administered in terms of Statutory Instrument 68 of 1990. The main objective of the scheme is to

provide relief to employees and their families when an employee is injured or killed in work related accidents or suffers from a work disease or dies thereof (Moyo *et al*., 2015; NSSA, 2014). The WCIF is employer funded and the premiums are benchmarked on industry performance. In addition to compensation, the NSSA provides full rehabilitation services for injured employees at Workers' Compensation Rehabilitation Centre in Bulawayo. The rehabilitees are offered vocational training in carpentry, leather craft, poultry, market gardening, metalwork and tailoring (NSSA, 2014).

The OSH division under the WCIF section is responsible for ensuring the creation and maintenance of healthy and safe work environments (NSSA, 2016) through promotion and training, inspection of workplaces, OH surveillance and research and development. The OSH Division is responsible for the initiatives focused on accident prevention.

At project level, contractors promote H&S through the development of H&S policy, the establishment functional H&S committees, hazard monitoring and control programmes, accident investigation, H&S training and awareness programmes and the adoption and implementation of a recognised H&S management system. The National Employment Council (NEC) for the construction industry is also mandated to appoint H&S officers from amongst its designated agents for monitoring and surveillance of its members. The preceding presentation confirms that construction H&S responsibility is shared among several stakeholders.

In a previous study Moyo *et al.* (2015) determined that the H&S responsibility is shared between the Ministry of Labour, Ministry of Health and Childcare and Ministry of Environment. The Ministry of Health and Childcare is responsible for diagnosing and managing workplace-related occupational conditions (Moyo *et al.*, 2015). The Ministry of Environment through the Radiation Protection Authority and Environmental Management Agency (EMA) are charged with specific OHS functions.

The H&S regulations also specify responsibilities with regards to H&S on project stakeholders, namely clients, suppliers, and contractors. The institutional framework for H&S presented in Figure 2.3 indicates that there are several stakeholders with H&S

responsibility in the construction industry in Zimbabwe. However, the lack of integration of the H&S responsibilities of the several stakeholders may contribute to problems related to duplication of efforts. Anecdotal evidence indicates that, with exception of some H&S 'better practice' international and mining sector clients, H&S is perceived to be the responsibility of contractors and the NSSA.

2.6 CONSTRUCTION H&S LEGISLATION IN ZIMBABWE

The H&S laws and regulations are highly fragmented. The efforts to harmonise the legislation, which date back to more than 20 years are yet to materialise. Despite the draft Occupational Safety and Health (OSH) Bill having gone through a consultative stage in 2017, it has not been ratified into an Act of Parliament. Although the available legal instruments address most aspects with respect to H&S management, however, the fragmentation of the H&S regulations contribute to administrative problems relative to H&S management due to the existence of several agencies involved in the implementation of the instruments. Some of the administrative challenges created by lack of a harmonisation H&S legislation include: duplication of effort, overstepping and the creation of 'grey' areas, which may remain un addressed.

The following section presents an analysis of the H&S provisions of some of the H&S legal instruments.

The Constitution of Zimbabwe (Amendment No 20 of 2013)

The Constitution is the supreme law in the country. Section 65 of the Constitution confers a constitutional right to fair and safe labour practices to all workers. In addition, Section 65(4) of the Constitution bestows rights to workers to just, equitable, and satisfactory conditions of work.

Labour Act (Chapter 28:01)

This is the central legal instrument with regards to labour relations and practices. The Act defines fundamental rights of employees, unfair labour practices and regulate conditions of employment. Workers are empowered through this Act not undertake work in an unsafe environment. With regards to construction H&S, Statutory Instrument (SI) 45 of 2013 (Collective Bargaining Agreement: Construction Industry) sets out the H&S standards in relating to sanitation, industrial hygiene, use of PPE, and the

establishment of H&S committees. The Act and its subsequent statutory instruments are administered by the Ministry responsible for Labour.

Factories and Works Act (Chapter 14:08).

This is the primary legal instrument in terms of H&S management. The Act is structured along the precautionary principle of sustainable development relative to the use construction plant and equipment. The Act also addresses administration issues with regards to H&S such as maintaining of the registration of workplaces, maintaining the accident registers, reporting of accidents, and accident investigation. The factory inspector is mandated by the Act to inspect any workplace, plant / equipment, excavations before they are used and during use. The Act bestows a duty of care on both the employer and the employee. With regards to construction H&S, the Factories and Works Act is supplemented by the Rhodesia Government Notice (RGN) 264 of 1976 (Building, Structural and Excavation Works) Regulations. The RGN 264 of 1976 sets out H&S standards with regards to building and structural works. The Factories and Works Act is administered by the NSSA.

Accident Prevention and Workers Compensation Scheme Notice, S.I. 68 of 1990.

The regulations provide for the right to compensation for employees who are injured or die as a result of work-related accidents or diseases. It also defines various degrees of disablement as a result of a workplace accident. Although the Regulations place the responsibility for H&S on several duty holders, the WCIF is employer funded. In addition, S.I. 68 of 1990 makes it mandatory for employers to provide and maintain appliances for rendering of first aid to workers in the case of accidents, and to provide the necessary means of transportation of the injured employee. It is also mandatory under these regulations for employers, employees, manufacturers or suppliers, and supervisors or H&S representative to perform their duties (as defined by the Third Schedule of the Notice) in relation to accident prevention. The S.I. 68 of 1990 is administered by the NSSA.

Pneumoconiosis Act (Chapter 15:08)

The Pneumoconiosis Act provides for the control and administration of persons employed in dusty occupations. The construction sector is classified as a dust work sector. The Act prohibits the employment of persons suffering from pneumoconiosis in

dusty conditions. It is also a requirement under this Act for persons employed in dusty conditions to be holders of current medical certificates and standards of fitness. The Pneumoconiosis Act is administered by the NSSA on behalf of the Minister responsible for Public Service, Labour and Social Welfare.

Environmental Management Act (Chapter 20:27).

The Environmental Management Act was promulgated to provide for sustainable management of natural resources and protection of the environment; the prevention of pollution and environmental degradation. The Act mandates the Standards Enforcement Committee to recommend to the Environmental Management Board minimum standards with respect to noise, noxious smells, and hazardous substances / materials. The Act prohibits the disposal of waste, hazardous substances / materials, and littering in such a manner as to cause pollution. The Act integrates the 'polluter pays principle' to ensure that those responsible for polluting the environment pay for the damage caused. This is an Act administered by the Environmental Management Agency (EMA).

2.7 SUMMARY

This presentation in this Section suggests that despite a low economic activity due to the economic meltdown, shortage of construction finance and political uncertainty, the construction industry contributes disproportionately to workplace injuries, disease and fatalities. The factors contributing to the poor H&S performance include, *inter alia*, inadequate investment in H&S (Katongomara, 2015), the lack of a systems approach to H&S (Goche, 2014), poor commitment and planning for H&S (Chigara and Moyo, 2014). The problem is amplified by the fragmentation of H&S regulations, appointment of contractors who are not commuted to H&S, macro-economic meltdown, and the informalisation of the economy. The fragmentation of H&S regulations increases administrative challenges as a result of the increasing number of agencies responsible for implementing various elements of H&S.

3.0 : CONSTRUCTION H&S MANAGEMENT PRACTICES AND ISSUES

3.1 INTRODUCTION

The global statistics relative to construction H&S incidents suggests that the construction industry is a hazardous work sector. However, to design an intervention strategy to address the H&S problem, the sources of the problem and the impacts should be investigated in detail. This section will, therefore, discuss the magnitude of the construction H&S problem, manifestations of the construction H&S problem, the factors contributing to the H&S problem and the impacts of this problem to workers and their families, society and project parameters.

3.2 THE GLOBAL PICTURE OF THE CONSTRUCTION H&S PROBLEM

There is an extensive body of literature suggesting that the construction industry is the most hazardous work sector. According to Opaleye and Talukhaba (2014), the construction industry`s H&S record is undesirable. The construction industry has a higher rate of fatal accidents compared to other industries in most countries. Despite several interventions by governments and construction industry practitioners, there is no corresponding decline in incidents (Aslesen *et al.*, 2013; cidb, 2009; Ahmed *et al.*, 2006).

According to Takala *et al.* (2012), 2.0 million of the fatal workplace injuries are caused by work-related diseases, and 0.3 million by occupational injuries. Globally, workplace accidents account for 19% of work-related deaths and the remainder is due to illnesses (Pearson, 2009). During another study, the WHO (2004) determined that 160 million new cases and 1.1 million deaths are associated with work-related diseases and injuries worldwide annually. The ILO also estimates that there are 264 million non-fatal accidents each year that result in 3 days or more absence from work (Pearson, 2009).

Statistically, the construction industry is one of the sectors with the highest number of accidents at work (Villa *et al.*, 2014; Ahmed *et al.*, 2006). In the USA, construction workers accounted for 1 in 5 on-the-job fatalities, and 1 in 10 non-fatal workplace injuries and illnesses in 2004 (Meyer and Pegula, 2006). According to the BLS (2006), the fatality rate in the USA construction industry was 12.9 per 100 000 employed workers in 2005. In Europe, work-related accidents are still a major H&S problem

(Mossink and de Greef, 2002). According to Gottfried *et al.* (2012), approximately 100 000 construction accidents are recorded in a year in Italy. In Norway, one out of five of all work fatalities occurred in the construction industry, and one out of ten of all construction workers was injured on the job in 2012 (Aslesen *et al.*, 2013). In the UK, one third of all work fatalities occur in construction, and its employees are six times more likely to be killed at work than employees in manufacturing (McKay *et al.*, 2005). The statistics suggest that the construction sector remains a high-risk area even in developed countries.

In Sub-Saharan Africa countries, Hämäläinen *et al.* (2006) determined that approximately 42 million work-related accidents took place that caused at least 3 days' absence from work and slightly more than 54 000 fatal occupational accidents happen annually. The fatality rate was estimated to be 21 per 100 000 workers (Hämäläinen *et al.*, 2006). In the SADC region, Loewenson (1999b) reported that the annual injury rate and fatality rate ranged widely between 0.35 to 49.42 per 1 000 workers and 0.85 to 21.6 per 100 000 workers respectively. The study conducted by Loewenson (1999b) acknowledged that construction is among the high-risk occupational sectors in the region. In South Africa, the construction industry was ranked first in terms of an industry with the most accidents between 2004 to 2008 (cidb, 2009). The aforementioned confirm a report by the Department of Labour, cited by Smallwood (2014), which determined that approximately 50% of contractors were not complying with H&S legislation and regulations in South Africa. In another study, Smallwood and Emuze (2013) determined that the construction industry contributes a disproportionate number of accidents, fatalities and work-induced illnesses. In Botswana, van Ooteghem (2006) determined that the construction industry ranks among the worst performing industries. The results of an all sector national survey in Zambia suggest that 20.6% of employed persons reported work-related injury (Siziya *et al.*, 2010).

The above statistics demonstrate the extent of the H&S problem in both the developed and developing countries. Nevertheless, due to the problem of non-availability of information regarding occupational injuries and illnesses (ILO, 2012; Siziya *et al.*, 2010) and the underreporting of accidents and work-related diseases in developing (Pearson, 2009), the above presentation is a conservative estimate of the H&S problem. However, the absence of accurate statistics inhibits effective implementation

of H&S in most construction businesses in most developing countries (Agumba and Haupt, 2009). In Kenya, Makhonge (2009) determined that most firms and organisations hardly mention H&S issues in their strategic plans. Hence planning for the prevention of accidents, diseases and ill health in workplaces is hardly adequate.

The following sections discuss the factors / conditions contributing the global H&S problem, and the impacts of inadequate H&S practices to workers and their families, project parameters and society.

3.3 CONSTRUCTION H&S HAZARDS

According to Mustapha *et al.* (2015), the construction industry is regarded as a hazardous work sector due to the high prevalence of workplace hazards causing fatal and non-fatal injuries. The existence of hazards at the workplace expose construction workers and non-construction workers to the risk of fatal and non-fatal injuries. Several studies indicate that occupational accidents are never intentional. According to Campbell (2008), accidents occur as a result of inadequate risk identification, incorrect analysis of the risks or ineffective response strategy.

3.3.1 Types of construction hazards

The workers in the construction industry are exposed to a wide variety of H&S hazards (Weeks, 2011; Labour Department, 2004). A hazard is a source, situation or act with potential for harm in terms of human injury or ill health, or a combination of these (Kadiri and Niesing, 2015; Griffith and Howard, 2014; OHSAS, 2007; BSI, 2007). There are several classifications of construction hazards in literature. Dias (2009) grouped the H&S hazards on projects into two categories: hazards that cause fatal or non-fatal accidents immediately or soon after they occur, and hazards that may cause fatal or non-fatal illnesses in the medium or long term. The most widely used classification categorises hazards into physical, chemical, biological, and social hazards (Labour Department, 2004; Holt, 2001). The physical hazards are viewed as the most obvious, while chemical, biological, and ergonomic hazards are often subtler in their effects.

The typical physical hazards associated with construction work include work at heights, use of ladders and scaffolds, noise, heat and cold, radiation, vibration, barometric pressure, lifting and other manual handling, electric shock and ergonomic hazards.

According to Reese (2008), a biological hazard is presented by the exposure to infectious micro-organism, to toxic substances of biological origin or animal attacks. These include vermin, insects, moulds, fungi, virus and bacterial contaminants. Chemical hazards arise from excessive airborne concentrations of mists, vapours, gases, or solids in the form of dusts or fumes. Typical chemical hazards include exposure to harmful substances (Griffith and Howard, 2014). These are transmitted through inhalation or absorption through skin contact. The social hazards arise from the social organisation of the industry (Reese, 2003). The examples of social hazards include workplace violence and stress arising from working alone or in isolated workplaces (Kadiri and Niesing, 2015).

The exposure to hazards increases workers' likelihood of getting injured or contracting diseases. It is the thesis of accident causation theory that an accident does not just happen but is caused by exposure to hazards. The impact of hazards on H&S vary depending on the intensity of exposure, the type of hazard, and the risk response strategy. Several studies in the construction industry determined that falls are the leading cause of death on construction projects (OSHA, 2012; Haslam *et al.*, 2005). According to OSHA (2012), 48% of all fatal falls in private industry involved construction workers. In the UK, a study by Haslam *et al.* (2005) determined that falls from height contributed 46% of construction fatalities.

3.3.2 Hazard management process

The exposure to hazards is probably the greatest cause of workplace accidents, injuries, diseases and fatalities. Therefore, the management of workplace hazards is a key function with regards to H&S management. The management of workplace hazards involves a series of processes / activities, namely, the identification of the hazards, assessment of the impact of the hazards, and responding to the hazards. In some construction regulations such as CDM Regulations and South African Construction Regulations, hazard identification and risk assessment (HIRA) is a requirement for all duty holders.

The following sections will briefly describe the process involved in managing hazards at construction projects.

3.3.3 Hazard identification

Hazard identification is the process of recognizing that a hazard exists and defining its characteristics (Campbell, 2008; OHSAS, 2007). It involves a systematic recognition of any aspects of a project, which have a potential to be a danger to those persons working on or being around a project (Griffith and Howard, 2014). Formal hazard identification in the workplace is the fundamental basis on which successful H&S management is founded (BSI, 2007; Carter and Smith, 2006; Trethewy *et al.*, 2003).

In addition to being part of 'better practice', HIRA is also a requirement in some construction regulations. The CDM Regulations and South African Construction Regulations place the responsibility for hazard identification and control on clients, designers and contractors. In South Africa, designers are required to inform the client of any known or anticipated hazards relating to construction work; clients are also required to prepare a baseline risk assessment (BRA); and contractors are required to identify, analyse and evaluate hazards and risks using a documented method, and produce a plan and applicable safe work procedures (Smallwood, 2015). The CDM Regulation 13 require designers to, *inter alia*, identify hazards and risks arising from these hazards and to eliminate, reduce, or control the risks (Clarke, 1999). To be effective, HIRAs must be a responsibility of multi-stakeholders who have a bearing on H&S management. Nevertheless, Behm (2006) established that contractors bear the greatest responsibility for HIRAs. The consequence of the delegation of HIRAs to contractors is that some of the hazards will remain unidentified thereby exposing workers to the risk of injuries, diseases and fatalities.

There are several hazard identification methods in literature. A study conducted by Gould *et al.* (2000) identified a total of 40 hazard identification techniques in use across production sectors. However, with the notable exception of hazard and operability study (HAZOP), there are few formal guidance documents on the application of such techniques (Gould *et al.*, 2000). According to Dunjóa *et al.* (2010), a HAZOP is a highly disciplined procedure meant to identify how a process may deviate from its design intent. It involves application of formal and systematic examination of the process and engineering intentions of new / existing facilities to assess the potential for malfunctioning of individual items of equipment, and the consequential effects of the

facility as a whole (Dunjóa *et al.*, 2010). A HAZOP is best carried out by a multi-disciplinary team with sufficient relevant knowledge and experience.

However, most formalised hazard recognition methods are generally unsuitable for construction because of the lack of standardization of tasks and the inherent dynamic nature of construction projects (Albert *et al.,* 2014b). Therefore, the common methods of identifying hazards in the construction industry involve imaginative anticipation of hazards, operation problems based on individual knowledge of operations, experience with similar works, and group discussion and / brainstorming-type activities (Albert *et al.*, 2014a; Kumasaki and Shoji, 2013; Campbell, 2008). Workplace hazards can be identified through workplace inspection, consulting workers and review of available information (SWA, 2011); scenario-based approach (Kumasaki and Shoji, 2013); job hazard analysis (JHA) (Rosenfeld *et al.*, 2009) and use of hazardous element and component checklists; tool box talks (Trethewy *et al.*, 2003); and use of method statements (Carter and Smith, 2006). According to Albert *et al.* (2014b), most construction H&S management processes rely on the hazard recognition capability of workers. While this approach is important, it is insufficient because most workers are not sufficiently trained for that purpose. In that regard, training of workers to be able to identify and communicate hazards is fundamental.

The available evidence suggests that hazard recognition methods used in the industry are insufficient to ensure worker H&S. This is explained by the following factors:

- lack of information sharing across projects (Carter and Smith, 2006),
- the subjective nature of hazard identification and risk assessment (Mustapha *et al.*, 2015);
- the nature of construction sites which make the identification, evaluation and control of health hazards a difficult task (Baxley, 2000);
- the lack of industry standard method of hazard recognition (Carter and Smith, 2006), and
- the lack of the resources, knowledge or willingness among most stakeholders to identify hazards in a formal way (Trethewy *et al.*, 2003).

The aforementioned factors suggest that some hazards remain unidentified. The unidentified hazards are difficult to manage and would continue to put workers at the risk of injuries, diseases and fatalities.

3.3.4 Risk assessment

The BSI (2007) define risk assessment as a process of evaluating risks arising from a hazard, taking into account the adequacy of any existing controls, deciding whether or not the risks are acceptable. A risk is a combination of the likelihood of an occurrence of a hazardous event or exposure(s) and the severity of injury or ill health that can be caused by the event or exposure(s) (OHSAS, 2007). Risk assessment is concerned with both the scale and the expected frequency or probability of hazards. Accordingly, a suitable and sufficient risk assessment process should be able to consider hazards in terms of their probability of occurrence and severity of consequences. The process includes: estimating the probability of the hazard's occurrence, that is, its frequency and probably severity if it does occur; evaluating the risk associated with the hazard based upon the frequency and severity estimates; and responding to the hazard by implementing suitable control measures (Carter and Smith, 2006; Clarke, 1999). Therefore, risk estimation and risk evaluation are conducted for each hazard identified at the beginning of a risk assessment process. Pinto *et al.* (2013) postulate that the main aim of H&S risk assessment is to improve the H&S level of a site by either preventing accidents and injuries or minimizing their consequences. Therefore, knowledge of risk assessment is beneficial to contractors with regards to the identification of high-risk construction activities and efficient allocation of H&S precautions. According to the HSE (2015), H&S management is about putting in place a system to manage the risk of ill health caused by work activities.

The quality of risk assessment will largely depend on the quality of hazard identification (Kumasaki and Shoji, 2013; Mitropoulos and Namboodri, 2011). Hazard identification represents the first step toward risk assessment. However, a major challenge within the construction industry is the consistent failure to identify and control hazards prior to construction thereby exposing workers and the public to dangerous risk of injury (Albert *et al.*, 2014b; Kumasaki and Shoji, 2013; Carter and Smith, 2006). Several factors explain why risk assessment is often poorly conducted in the construction industry. The factors include: the separation of design and construction (Clarke, 1999),

and the dynamic nature of construction work (Holt, 2001) and the operational pressures and lack of construction experience (Goh and Chua, 2010). The unidentified hazards during the design process pose challenges to H&S during the construction and maintenance phases of the project.

3.3.5 Risk prevention and control

The results of hazard identification and risk assessments influences the risk response strategy to be adopted. There are two main approaches to risk control, namely preventative and precautionary controls. Figure 3.1 provides a graphical representation of how the strategies may be implemented in accident prevention.

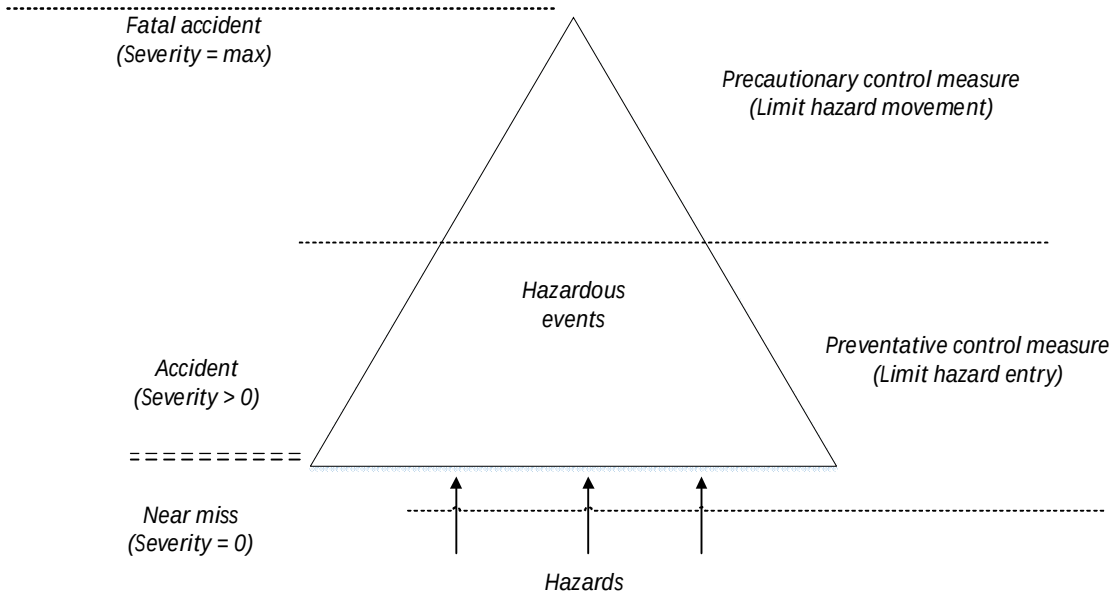

Figure 3.1 Modified triangle of accident causation

(Source: Carter and Smith, 2006)

According to Carter and Smith (2006), uncontrolled hazards result in the occurrence of accidents on projects. Therefore, hazards will be managed through preventative measures designed to limit the entry of a hazard into the project by reducing its probability of occurrence. The precautionary control measure, which is designed to limit the movement of the hazardous event within the project to reduce the severity of the hazard if it occurs (Carter and Smith, 2006). These observations are consistent with the “hierarchy of controls” presented in Figure 3.2, wherein the most effective method to manage hazards is through elimination.

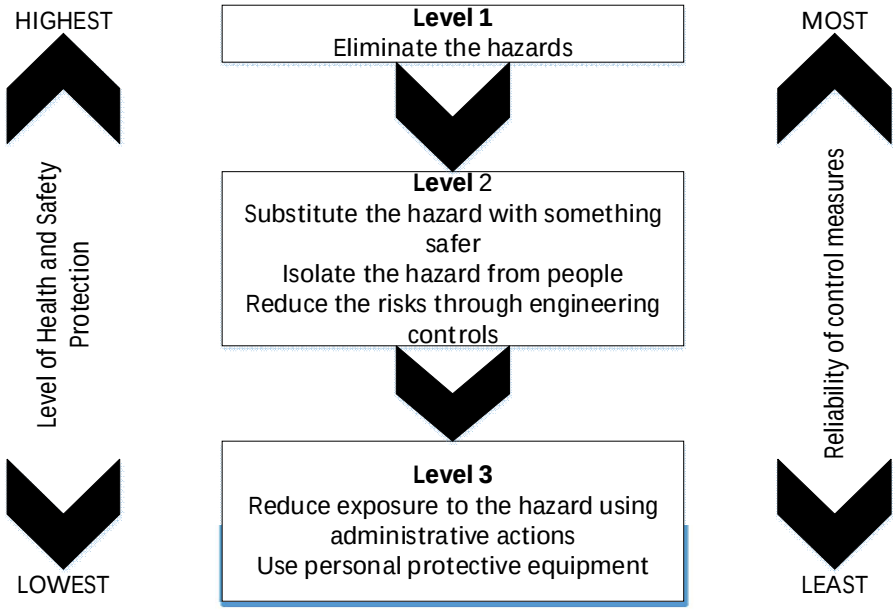

Figure 3.2 Hierarchy of hazard control

(Source: Safe Work Australia, 2011)

The hierarchy of hazard control presents three levels of response that can be adopted on a project. Level 1 represents the most effective way to control a hazard through the elimination of the hazard and associated risk (Safe Work Australia, 2011; OSHAS 18001, 2007; Lingard and Rowlinson, 2005). At level 2, project stakeholders can substitute something safer or where it cannot be substituted engineering control can be used to manage the hazard. These interventions are more effective than the interventions in level 3. At level 3, project stakeholders resort to administrative measures or the use of PPE (a last line of defence) to manage risks. According to the Safe Work Australia (2011), administrative controls should be used when there are no other practical control measures, as an interim measure until a more effective way of controlling the risk can be used, and to supplement higher level control measures. Despite being the least effective, administrative controls and the use of PPE are the most commonly implemented risk control strategies. However, relying on low order as the main response strategy such as the use of administrative controls and PPE is not sustainable.

A growing body of research perceive that integrating H&S into design can positively contribute to risk prevention on construction projects. The concept of prevention through design (PtD) is briefly explored in Section 3.3.4

3.3.6 Prevention through design (PtD)

It is now widely accepted that design for safety (DfS) / prevention through design (PtD) offers a great opportunity for prevention of the occurrence of injuries, diseases and fatalities. According to Schulte *et al.* (2008), PtD refers to the practice of anticipating and designing out potential H&S hazards and risks associated with new processes, structures, equipment, or tools, and organising work, such that it takes into consideration the construction, maintenance, decommissioning, and disposal / recycling of waste material, and recognising the business and social benefits of doing so. Thus, PtD goes beyond the designing of the structure to include designing of the work processes and equipment design. During another study, Griffith and Howard (2014) determined that the design stage is the most effective time to consider project H&S and eliminate potential hazards as the opportunity to design out hazards diminishes as a construction project progress.

According to Trethewy *et al.* (2003), it is impossible to ignore proper design when dealing with the elimination of hazards in the workplace. Architects and design engineers can positively affect construction worker H&S through the choices they make in the design process (Dharmapalan *et al.*, 2014). The need for PtD is reinforced in several studies. Trethewy *et al.* (2003) report on the results of a major research project by the European Union in 1988 involving 750 000 accidents and 1 413 fatalities. This study determined that 35% of injuries were attributed to a failure to properly identify hazards and control risks during the design process. During a study involving 100 construction accidents, Haslma *et al.* (2005) determined that up to half of these accidents could have been mitigated through a design change. In the USA, a study conducted by Behm (2006), which involved an analysis of 450 reports of construction workers' deaths and disabling injuries determined that in about one-third of the cases, the hazard that contributed to the incident could have been eliminated or reduced if PtD measures had been implemented.

The PtD concept is consistent with the traditional 'hierarchy of controls' approach used by H&S professionals. This hierarchy emphasise the importance of eliminating hazard before relying on administrative measures or PPE to protect workers. Therefore, elimination or reduction of risks through design or alternative methods is highly desirable (Haslma *et al.,* 2005). This aforesaid is corroborated in later studies (Behm, 2006; Smallwood, 2015) wherein implementing the PtD concept alongside other intervention strategies is identified as a viable option to prevent injuries and death among construction workers.

Notwithstanding the importance of PtD to H&S, the concept has not been widely embraced by designers. The study conducted by Haslam *et al.* (2005) determined that some designers are reluctant to adopt the PtD concept as part of their standard practice. The design professionals lack motivating forces – legal, contractual, or regulatory – to adopt PtD methods. A study conducted by Trethewy *et al.* (2003), determined that Architects perceive that if H&S and environmental hazards had been considered in the design of the major landmark structures, such structures may not have been erected. Despite this, designers often consider post construction H&S issues into their designs.

The adoption of PtD initiatives and their effectiveness depends on the extent to which construction hazards have emerged and are recognisable during the design phase, and the capability of designers to identify and mitigate hazards encountered by construction workers (Hallowell and Hansen, 2016; Hansen, 2015), and the background training pf the design professional (cidb, 2009). The PtD initiative can be extended to other project stakeholders. For instance, during purchase of materials / services, clients can insist on specifications that prevent and minimise H&S risks (Schulte *et al.*, 2008).

3.3.7 The impact of inadequate hazard management on H&S

The management of hazards is fundamental to the prevention of fatalities, injuries, and disease,. The HSE (2006) argue that inadequate hazard identification is one of the most significant threats to healthy and safe construction. Nevertheless, a large proportion of hazards remain unidentified, uncontrolled, and unmanaged thereby exposing workers and members of the public to the risk of injury. Approximately 38% (Albert *et al.*, 2013) and 66.5% - 89.9% (Carter and Smith, 2006) of the hazards are identified. These studies show that approximately 11.1% to 33.5% of the hazards are unidentified. The unidentified hazards present the most unavoidable risk thereby compromising H&S (Kadiri and Niesing, 2015; Mustapha *et al.*, 2015; Carter and Smith, 2006). This low level of hazard identification results in the implementation of H&S programmes that are inadequate to manage H&S risks. A study conducted by McKay *et al.* (2005) determined that 84% of accidents result from inadequacies in risk management. However, the effects of inadequate HIRAs relative to H&S vary depending on the degree of exposure and the type of hazard. A health hazard may produce serious immediate and long-term (chronic) problems (Skan and Logan, 2010; Dias, 2009; Labour Department, 2004; Holt, 2001) to workers and members of the public. In addition to exposure to primary hazards, Weeks (2011) observe that workers are also exposed to bystander hazards produced by those who work nearby or upwind.

3.4 THE IMPACT OF ACCIDENTS ON PROJECT PARAMETERS

3.4.1 Introduction

There is a growing body of evidence suggesting that H&S compliments the successful completion of projects within budget, quality, duration and environment. These parameters also define project performance. A study conducted by Smallwood (2002) determined that inadequate or lack of H&S increases project risk and negatively affects cost, productivity, quality, schedule, the environment and client satisfaction. These findings from Smallwood's study are corroborated by results of later studies which suggest that construction accidents delay project progress, increase project cost, damage the reputation of contractors (Wang *et al.,* 2006) and cause dissatisfaction among project stakeholders (Asanka and Ranasinghe, 2015). This analysis demonstrates that the effects of inadequate H&S practices are not limited to workers

and their families but to project delivery. Nevertheless, limited researches have explored the relationship between H&S and project parameters (Love *et al*., 2015; Han *et al.,* 2013; Wanberg *et al.,* 2013). The following section will discuss the impact of inadequate H&S on selected project parameters.

3.4.2 The impact of H&S practices on project duration

Studies that have investigated the relationship between schedule performance and H&S have shown that inadequate H&S results in schedule delays and that schedule pressure negatively affects H&S performance. A study conducted by Wang *et al.* (2006) determined that accidents cause construction delays. During another study investigating causes of delay on construction projects in Ghana, Frank *et al.* (2010) determined that the occurrence of accidents was an important factor contributing to construction delays. Nevertheless, studies conducted by Assaf and Al-Hejji (2005) suggest the impact of construction accidents with regards to construction delays is generally low to moderate. The aforesaid is confirmed in a study in Zambia where Aigbavboa *et al.* (2014) determined that the occurrence of accidents had less effect with regards to project duration.

However, inadequate H&S in the form of schedule acceleration result in the occurrence of construction accidents (Irumba *et al.,* 2010). According to Dembe *et al.* (2005), long working hours adversely affect the health and wellbeing of workers. Using Shuster and Rhodes' model, Dembe *et al.* (2005) determined that overtime and long hours of work are presumed to increase the risk of workplace accidents by precipitating various intermediary conditions in affected workers such as fatigue, stress and drowsiness. Dembe *et al.* (2005) presented this relationship in a conceptual model in Figure 3.3.

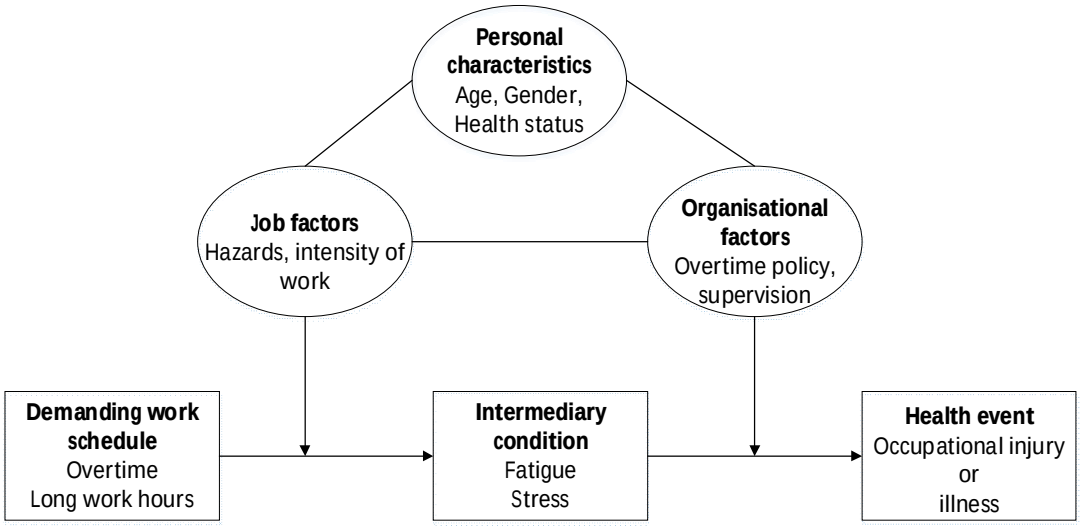

Figure 3.3 Relationship between work schedule and injuries

(Source: Dembe *et al.*, 2005).

According to Dembe *et al.* (2005), the pathway linking a demanding work schedule to the intermediary condition and ultimately to a workplace accident can be mediated by a variety of individual and environmental factors, including personal characteristics, job factors and organisational factors. The lack of coordination between functional departments within an organisation affects the integration of H&S in other activity functions such as scheduling (Dembe *et al.*, 2005). This is particularly so when a team member in charge of scheduling commonly pays little attention to the impact of the schedule on H&S performances.

According to Hinze (1997), schedule status of projects is correlated with the frequency of injuries. The study determined that subcontractors who were ahead of schedule had less injuries than subcontractors who were behind schedule on their projects. This implies that managerial actions for the recovery of schedule delays adversely influence workers' H&S through pressure to increase their production rates. According to Smallwood (1999), a shortened project duration invariably increases intensity of resources (including workers, plant and equipment, subcontractors etc.) and activities on site, which increases the possibility accidents. The results of Smallwood's study are further corroborated by Han *et al.* (2013), wherein their study determined that schedule delays often result in production pressure which negatively affects H&S performance. This study determined that schedule pressure and rework were important factors with regards to accident occurrence for the monitored project. According to

Love and Edwards (2013), unrealistic schedules to complete task adversely affect an individual's cognitive functions and increase their propensity to commit errors / omit tasks to meet organisational and project demands. A shortened contract period may result in a production duration that is incompatible with the nature and scope of works to be executed (Liu, 2014). In these circumstances, workers may take shortcuts with associated risk of injury.

The above discussion confirms the existence of a reciprocated relationship between H&S and project duration. Omissions in one area will lead to negative effects on the other. Yet construction schedules are mostly prepared in complete disregard for H&S.

3.4.3 The impact of H&S practices on project quality

Several studies demonstrate that H&S and quality management systems share similar characteristics and therefore proposals have been made for a possible integration of the two systems (Love *et al.*, 2015; Husin and Adnan, 2008; Loushine *et al.*, 2006). The performance standards for the two management concepts, that is, 'zero injuries' for H&S and 'zero defect' for quality, are very much about achieving the same result. According to Love *et al.* (2015), H&S and quality performance are mutually beneficial, though sometimes there are some overlaps. Loushine *et al.* (2006) argue that combining the principles and methods from the two management systems should capitalise on the similarities that exist between them and hence create a single synergistic management system for improving both H&S and quality.

Some studies argue that quality management is either a means to address H&S or as an outcome of H&S (Loushine *et al.*, 2006). Quality is defined as conformance to the customer requirements documented through plans, specifications, contracts and applicable codes and standards (Wanberg *et al.*, 2013). Rework, defects, and non-conformance are the common indicators of quality failures. In a similar vein, occupational fatalities, injuries, and disease constitute defects as they are not project requirements (Smallwood, 1999).

Contextualising H&S from the perspective of defects makes it just another dimension of quality since the elimination of defects would ordinarily involve removal of unsafe work. Irumba *et al.* (2010) equates the occurrence of an accident as a measure of

quality of practice on construction projects wherein this may be attributed to defective designs or lapse in supervision. According to Loushine *et al.* (2006), the focus of quality improvement methods is to minimise the variability inherent in product qualities, while that for H&S management is to minimise the chance of occurrence, and the severity of those non-planned events or incidents that can cause harm to workers. According to Husin and Adnan (2008), a healthy and safe work environment, which allows a worker to concentrate on the job increases the probability that the job will be done correctly. The quality of workforce also influences the quality of the of the product. An injury to a worker comprises the quality of construction output where the injured worker is replaced by a worker of a lower level workmanship. Therefore, the objective of any quality programme should extend to protecting the same workforce from defects like accidents. This is very critical in the construction industry where shortage of skilled tradesmen is huge setback.

The H&S and quality management are indispensable in a successful management (Farooqui and Umer, 2013). Love *et al.* (2015) state that if contractors are to meet the requirements to provide a quality product or service, they must also fulfil the H&S requirements for a given project. Thus, zero defects programme should help with the zero accidents programme (Husin and Adnan, 2008). According to Farooqui and Umer (2013), the link between H&S and quality is based on employee motivation wherein perception of a H&S climate at work will influence quality performance in the construction industry.

The quality omissions / deviations resulting in reworks often result in production pressure with its concomitant effects on H&S. According to Love and Edwards (2004), rework represents the unnecessary effort of redoing a process or activity that is incorrectly implemented the first time. It is a typical indicator of quality failure. In a study involving 161 construction projects in Australia, Love and Edwards (2004) determined that rework negatively influence H&S. Their results were corroborated by Wanberg *et al.* (2013) and Love *et al.* (2015) wherein the results of their researches suggest that a significant correlation exists between recordable injury rate and rework. Based on a case study of 32 construction projects and opinion-based surveys, Wanberg *et al.* (2013) concluded that OSHA recordable injury rate is directly correlated to rework. This suggests that a project with poor quality performance has a higher chance of injuries.

During another study, Farooqui and Umer (2013) established that a significant majority (83%) of the surveyed companies perceived that that quality, safety and productivity are correlated in the construction industry. The results of a case study conducted by Love *et al.* (2015) comparing the frequency of incident before and after introduction of a rework prevention programme suggests that the number incidences significantly dropped after introduction of a rework prevention programme. These findings are consistent with earlier observations by Loushine *et al.* (2004) who determined that improving H&S through quality management techniques such as total quality management (TQM) significantly reduce injuries. Consistent with the foregoing, Das *et al.* (2008) used the theory of motivation to explain the relationship between H&S, and quality management. In their presentation, Das *et al.* (2008) assert that H&S is a basic need. This analogy suggests that an organisation's failure to meet the employee's basic needs may demotivate the employee with regards to pursuing organisational goals such as quality improvement. Workers will not be motivated to meet quality standards where their H&S and wellbeing are put at risk by the organisation.

The discussions above indicate that there is a reciprocated relationship between H&S practice and quality performance. According to Love *et al.* (2015), when workers feel unsafe, they are unlikely to give attention to quality outcomes. Research conducted by Das *et al.* (2008) also determined that when there is increasing discontent with H&S, its climate deteriorates, which invariably results in further accidents and rework. Given the notable association between incidents rates and rework, the two should not be considered in isolation (Love *et al.*, 2015). According to Pheng and Shiua (2000), immense benefits and synergy can be reaped by integrating the two management systems.

3.4.4 The impact of H&S practices on project cost

The relationship between H&S and cost performance was covered in section 3.5.3

3.4.5 Summary of the impact of H&S practices on project parameters

The section above discussed the effect of inadequate H&S on project parameters. The results of literature analysis suggest that inadequate H&S affects project delivery

through influencing productivity, quality, and project cost. It is notable that an effect on one project parameter will have ripple effects to the other parameters. The failure to exploit the synergy between H&S and project parameters is one of the main reasons why projects fail.

3.5: PROCUREMENT AND FINANCIAL PROVISION FOR H&S

3.5.1 Introduction

The implementation of H&S initiatives is affected by the amount of resources available towards H&S. Nevertheless, contractors and other project stakeholders continue to make token investment in H&S. This is in contrast with empirical evidence, which demonstrates that investment in H&S makes economic sense. In Zimbabwe, the NSSA director of Occupational Safety and Health (OSH) attributed the poor H&S performance in the industry to inadequate investment in H&S (Katongomara, 2015). The disparity between the benefits and investment made towards H&S suggests that the business case of H&S investment is far from being appreciated in the industry. Gahan *et al.* (2014) argue that management commitment to investing in H&S requires a 'business case' to be made. This thesis is corroborated in other studies. Thus, despite the ethical standpoint wherein evaluating investments to determine whether they bear a positive rate of return would be regarded as redundant, the ILO (2012) determined that the economic argument provide an extra motivation to managers to invest in H&S.

The other way construction stakeholders can appreciate the importance of investing in H&S is discussing the cost of not investing in H&S. The knowledge of the economic burden imposed by inadequate H&S can motivate employers and regulators to provide a healthy and safe workplace (Smallwood and Emuze, 2013; Sun *et al.*, 2010). According to the cidb (2009), the cost of accidents is a financial measure readily related to by many stakeholders. The aforementioned is consistent with Doorman's (2000) findings that workplace injuries and illness are also a matter of economics, since they stem from work, and work is an economic activity.

To analyse this, the costs incurred by contractors with regards to H&S are divided into two categories: 'cost of accident prevention' and 'costs of accidents' (Fellows *et al.*, 2002)

3.5.2 The cost of accident prevention

In this section, 'cost of accident prevention', 'H&S investment' and 'financial provision for H&S' will be used interchangeably to refer to the financial resources provided by contractors to cover the costs associated with preventing the occurrence of

construction injuries, disease and fatalities (López-Alonso, 2013; Ikpe *et al.,* 2011; Zou *et al*., 2010; Lancaster *et al.,* 2004). The amount of financial provision for H&S is a very important factor affecting H&S practices on projects. Several studies reveal that the amount of H&S investment is inversely proportional to the occurrence of incidents (Tang, 2004; Son *et al.*, 2000). Based on a study spanning eleven years from 1985 to 1995, Son *et al.* (2000) determined that the accident rate decreased proportionally with an increase in H&S investment as shown in Figure 3.4.

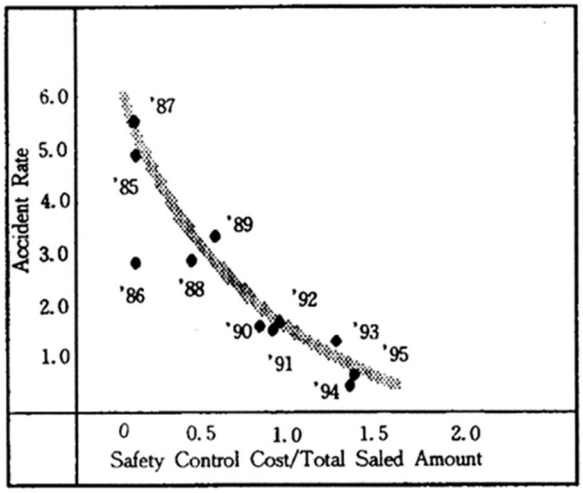

Figure 3.4 Interrelation curve

(Source: Son, 2000)

The findings from Son's study are corroborated by Tang (2004). According to Tang (2004), the H&S performance of a site varies with the amount of H&S investment. Inadequate resource provision inhibits effective implementation of H&S initiatives designed to prevent occurrence of accidents, injuries and fatalities. Financial provision, among other factors, has considerable impact on the success of an organisations' H&S initiatives. According to the ILO (2014), inadequate appropriation of financial and human resources creates a vicious and self-reinforcing circle in H&S management. In previous studies, inadequate financial and technical resources were identified as barriers to achieving sustainable H&S practices (ILO, 2014; Kheni *et al*., 2006). According to Linhard (2005), inadequate resources will contribute to contractors delaying H&S improvements beyond that which is necessary to satisfy compliance with legal requirements.

The financial provision for H&S should cover costs related to: salaries for H&S and certain administrative personnel; H&S meetings; H&S training; inspection of tools and plant and equipment; site inspections; provision of PPE; H&S programme, and miscellaneous supplies and equipment (Ikpe *et al.*, 2011; Fellows *et al.*, 2002). Zou *et al.* (2010) schematically summarised the components of financial provisions for H&S in Figure 3.5.

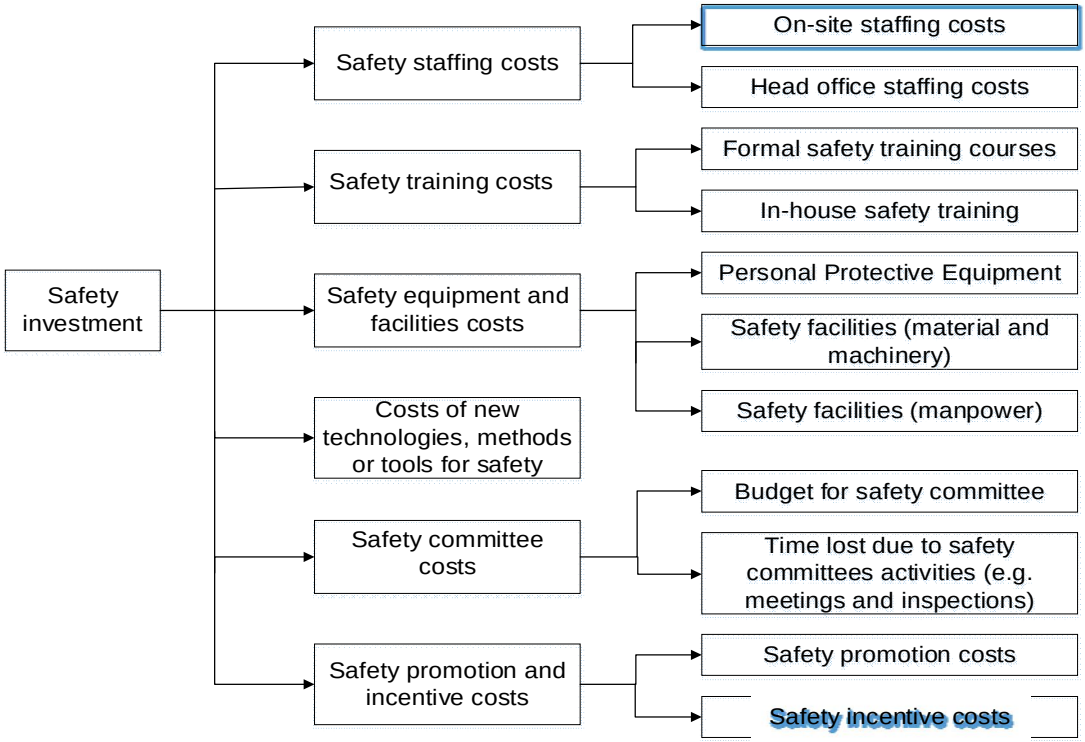

Figure 3.5 Components of H&S investment

(Source: Zou *et al.,* 2010)

Kamar and Ahmad (2016) distinguished financial provision to cover the cost of accident prevention, and the cost of evaluation and monitoring. Although their assessment with regards to the components of accident prevention are consistent with other studies, Kamar and Ahmad (2016) indicate that the financial provision for evaluation and monitoring cover the costs of actions taken by the firm for appropriate testing and maintenance of H&S measures adopted to reduce or minimise the risk of accident or occupational disease.

3.5.3 Optimum financial provision for H&S

According to Fellows *et al.* (2002), the optimum cost of prevention is reached when the value of the costs of prevention per worker are compared against the costs of accidents

per worker, and preventative costs of accidents equal the costs of accidents. An optimum investment should also consider that the provision of resources for H&S is not only financially / economically justified, but also environmentally responsible and socially relevant. According to the ILO (2012), investment in H&S should be justified from both an economic and social standpoint. However, very few studies have been conducted to investigate the optimal H&S investment strategies (Hallowell and Hinze, 2011). Despite that, available studies provide valuable guidance with regards to how much contractors allocate for H&S. The financial provision for H&S is usually expressed as percentage of the contract sum / projects cost, and known as the H&S investment ratio (HSIR).

According to Son *et al.* (2000), approximately 1.2 to 1.3% of project cost represents the optimal financial provision for H&S. During another study, Sun *et al.* (2010) determined that the industry average for H&S investment is approximately 2% of project cost. In a study seeking to quantify the investments made by top construction organisations in H&S, Hallowell and Hinze (2011) determined that on average, firms invest approximately 2.5% of the total bid price on H&S programme elements.

In South Africa, financial provision for H&S is approximately 0.5 to 3% of project cost (cidb, 2009). In Hong Kong, Tang (2004) determined that most contractors' financial provision for H&S is less than 0.5% and sometimes less than 0.25% of the contract sum. However, the results of a study involving 576 accidents related to 18 building projects, concluded that the optimal H&S investment on building projects should be 0.8% of the contract sum (Tang, 2004). In Singapore, Feng (2011) conducted a survey involving 47 building projects and concluded that H&S investment accounts for 1.62% to 3% of contract sum with a mean of 2.05%. The varying statistics relative to the size of investment towards H&S suggest that several factors influence the amount of financial provisions. The factors are discussed in Section 3.5.5.

3.5.4 The cost of workplace accidents

These are costs incurred due to occurrence accidents, injuries, diseases and fatalities. Generally, the costs are indisputably enormous. The ILO (2009) estimates that 4% of the annual global Gross Domestic Product, or US$1.25 trillion is siphoned off by direct and indirect costs of occupational accidents and diseases. In Singapore, the

Workplace Safety and Health (WSH) Institute estimates that the cost of workplace injuries and ill health in 2011 was 3.2% of GDP (WSH, 2013). In the USA, the ILO (2003) established that the business community spent US$170.9 billion a year on costs associated with occupational injuries and illnesses. During another study, Leigh (2011) determined that medical and indirect costs of occupational injuries and illnesses are sizeable, at least as large as the cost of cancer, translating to about 1.8% of US GDP in 2007; 5.9% of GDP in Australia (ASCC, 2012); 2.6% to 3.8% of the European Union's gross national product (Rikhardsson and Impgaard, 2004); £14.3 billion in the UK (HSE, 2015); 3.5% of GDP in South Africa (Republic of South Africa in Musonda *et al*., 2013) and 3% of GDP in Zimbabwe (Loewenson, 1998).

To put these costs into context relative to construction, several studies express the cost of accidents as a percentage of the contract value or value of construction. Previous studies determined that the cost of accidents constitutes 11% of the total costs of construction in Australia (ASCC, 2010), 1.6% of the total added-value in construction sector in Turkey (Yilmaz, 2014), and 5% of project value in South Africa (cidb, 2009; Smallwood, 2004). Considering the problems encountered in computing the costs, namely underreporting of H&S incidents, uncompensated injuries and illnesses, and other hidden costs, the cost of accidents are likely to be higher than what is presented above (Gahan *et al.*, 2014).

The costs of workplace accidents are distributed among workers, employers and society in varying proportions. Several studies suggest that workers bear the greatest burden of the accidents. Specifically, the distribution of the burden is as follows: workers (50.5%), community (27.4%) and employers (22.1%) of the total cost (WSH Institute, 2013); workers (74%), community (21%), and employers (5%) of total costs (ASCC, 2012); in the UK, individuals (57%), employer (19%) and government (24%) (HSE, 2015). Takala (2014) summarised the distribution of costs of injuries and ill health among the various agents on Figure 3.6.

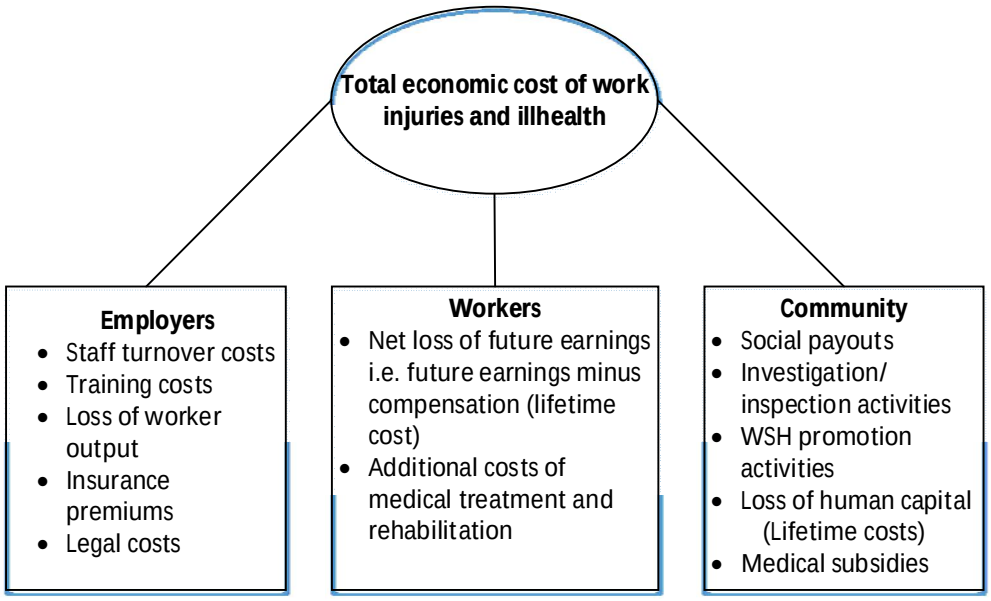

Figure 3.6 Cost of accidents

(Source: Takala, 2014)

The cost of accidents are broadly divided into direct and indirect costs, and quality of life costs. Direct costs are those costs of occupational incidents within the industry which are directly measurable in financial terms, while indirect costs are those measured first in labour time and subsequently translated into financial equivalents (Zou *et al.*, 2010). Indirect costs refer to all costs resulting from injury that are not covered through insurance coverage (Ahmed *et al.*, 2006). Despite the clear distinction between direct and indirect cost, practitioners lack consensus with regards to what should be included under each group (ILO, 2012).

In terms of the distribution, indirect costs are generally more than the direct costs. In Australia, only 25% of the total cost of work–related injury and disease was due to the direct costs of work-related incidents (ASCC, 2012). According to Sun and Zou (2010), the distribution of the burden of costs is achieved by defining the major aspects of total costs and assigning the proportion of these cost groups to each of the economic agents (workers, employers and the community) and these are discussed below.

3.5.5 The cost of accidents to employers

According to the ILO (2012), the employer's share of cost of accidents has been subject to intense scrutiny, since there is a vibrant demand from the business community for this type of work. The direct costs include: payments made by firms to workers who

have suffered an injury or disease or to medical providers to defray treatment costs (ILO, 2012), insurance costs, staff turnover costs, threshold medical expenses, and legal fines and penalties (Sun and Zou, 2010). On the other hand, indirect costs include lost, delayed or degraded production disrupted schedules, administrative time for investigations and reports, clean up and repair, third-party liability claims against the owner, equipment damage, loss of productivity, downtime, cost of overtime and over employment, employer excess payments, recruitment training and staff turnover costs; investigation costs, legal fines and penalties (HSE, 2015; ILO, 2012; Sun *et al.*, 2010; ASCC, 2009; Ahmed *et al.*, 2006). The production process may be halted due to an accident, absence of the insured or sick worker, negative effects on co-workers, reduced productivity when workers' health is impaired, costs of administrative response, additional recruitment costs (ILO, 2012).

3.5.6 The costs of accidents to society

According to the ILO (2012), the costs of accidents to society manifest through programmes that indemnify workers and employers or directly finance health care providers when the funding is not tied to the health events themselves. Direct costs include social welfare payments for lost income earning capacity, rehabilitation, health and medical costs, inspection and investigation, travel concessions for permanently incapacitated workers (Sun *et al.*, 2010). The indirect costs include medical and rehabilitation costs, social welfare payments, rehabilitation, loss of government revenue (ASCC, 2009), compensation payments, loss of government revenue (Sun *et al.*, 2010), social payouts, investigation / inspection activities, loss of human capital, medical subsidies (Takala, 2014), monetary value of the impact on quality and loss of life of affected workers (HSE, 2015). In Zimbabwe, the government, through the NSSA meets the costs related to compensation and rehabilitation of injured workers.

3.5.7 The costs of accidents to workers

The cost of accidents to workers is discussed in Section 3.6.2 to 3.6.4

3.5.8 The economic case for H&S investment

From an economic standpoint, the costs of H&S investment are less than the costs of accidents, therefore H&S investment is good business. Economically, the decision to spend more on costs of accident prevention or not is about making profit (Ikpe, 2009). In Sections 3.5.2 and 3.5.3, it was demonstrated that the cost of accident prevention is

lower than the costs of accidents. During a study conducted in the UK, Ikpe *et al.* (2011) determined that the total benefits of accident prevention outweigh the cost of accidents by a ratio of approximately 3:1. During another study, Huang *et al.* (2011) determined that the average perceived return on H&S investment was about $4.41 for every $1. These results corroborate the results from the study conducted by Fellows *et al.* (2002), which determined that costs expended on accident prevention result in a reduction in risk and consequently a reduction in accidents.

The ability of the cost engineer to adequately estimate the cost of accident prevention and commitment from both the contractor, and client commitment to finance H&S are important factors with regards to sustaining the H&S of construction workers. According to the ILO (2001), the employer should have overall responsibility for the protection of workers' H&S and provide leadership for H&S activities within the organisation. Clients can contribute to investment in construction H&S through a range of actions: committing to contractor H&S; committing financial resources; including H&S as a criterion for pre-qualification; scheduling H&S requirements prior to the bidding process; structuring documentation to ensure equitable provision for H&S by contractors; conducting H&S audits during construction, adopting a partnering approach (cidb, 2009; Smallwood, 1999). An analysis of the above factors reinforces the importance of procurement strategy relative to financial provision for H&S. In Zimbabwe, financial provision for H&S is inhibited by the lack of regulations, which compels clients to make such provision (Chigara and Moyo, 2014).

The H&S regulations also influence contractors' decision with regards to allocating financial resources for H&S. According to Joyce (2003), the CDM Regulations require contractors to allocate enough resources to ensure compliance with the regulations. Although the regulations do not make express requirements for clients to provide resources for H&S, they put a duty on clients to ensure that the appointed contractor has allocated resources to matters covered in the H&S plan (Joyce, 2003). The aforesaid is important because any improvement in H&S practices is supported by the provision of adequate financial resources. To achieve this, quantity surveyors should promote bills of quantities (BOQs) that provide adequate allowance for H&S (cidb, 2009) and facilitate equitable basis for tendering or bidding on projects by contractors (Smallwood and Emuze, 2013).

In addition to procurement related factors, the amount of financial provision for H&S is also influenced by the level of risk associated with the project (Loosemore *et al.*, 2003), the type of work being performed (Son *et al.*, 2000) and the size and complexity of the project (Hallowell and Hinze, 2011; Joyce, 2003). The riskier the situation, the more the investment. However, the level of risk depends upon the type of work being undertaken and effectiveness of H&S system (Loosemore *et al.*, 2003).

The costs expended on accident prevention also lead to some non-monetary benefits such as greater peace of mind of workers, better reputation of company, and greater job satisfaction (Tang, 2004) and a reduction in risk, and consequently a reduction in accidents (Fellows *et al.*, 2002). According to Hallowell and Hinze (2011), investment in H&S enhances organisational performance. In a high-risk industry, such as the construction industry, an organisation with successful H&S programme can promote H&S performance as a sustainable competitive advantage (Rechenthin, 2004).

Contrary to the above, Fellows *et al.* (2002) argue that benchmarking of investments in H&S using financial metrics such as return on investment (ROI) is inconsistent with the contractor's moral and legal obligation to ensure that construction sites are healthy and safe. According to Fellows *et al.* (2002), the cost considerations and calculations of cost optimisation only act as a guide to determining priorities and improving H&S in construction. In addition, a study conducted by López-Alonso *et al.* (2013) determined that there is no significant relationship between a higher investment in H&S and any decrease in the number of accidents or their cost.

3.5.9 Factors influencing financial provision for construction H&S

Despite the benefits that arise form adequate financial resources provision for H&S, contractors make minimal investments with respect to construction H&S. Several studies note that adequate resourcing for H&S is obstructed by, *inter alia*, competitive tendering without reference to H&S (Smallwood and Emuze, 2014; Sumner and Farrell, 2003); inadequate provision of H&S in contract documents (Smallwood and Emuze, 2014; Smallwood and Haupt, 2005); procurement systems that do not prioritise H&S (Smallwood and Emuze, 2014). In Zimbabwe, the limited amount of construction tenders available increases the level of competition, which can marginalise H&S as

contractors try to out-bid each other to win the tender. This observation is corroborated by Chari and Chiriseri (2014) who determined that competitive bidding, which prioritises tender value ahead of the other project parameters such as the H&S and the environment inhibits the integration of H&S and the environment in sustainable procurement in Zimbabwe.

The other barrier to financial provision for H&S is the stakeholders' perception that H&S is an additional economic burden (Muiruri and Mulinge, 2014; Agumba and Haupt, 2009; Linhard, 2005; Sumner and Farrell, 2003; WHO, 2002). These cost pressures may prevent management from providing the required H&S measures or appropriate tools and equipment (Mitropoulos *et al.*, 2005). According to López-Alonso *et al.* (2013), employers do not consider investing in H&S as financially profitable.

Lack of adequate H&S information on which contractors can price for H&S (DETR, 1998) is another barrier to adequate investment in H&S. Lack of clarity within most conditions of contract with regards to H&S investment 'removes' the parity in pricing for H&S thereby leaving contractors to use their own discretion with regards to the amount they allocate for H&S. These problems are further amplified by the lack of express requirements with H&S regulations for clients to allocate sufficient resources to H&S (Joyce, 2003). In Zimbabwe, the problem of inadequate allocation of financial provisions for H&S is amplified by the fragmentation of H&S regulations

3.5.10 Overview of financial provision for H&S

The section presented an economic justification for investment in H&S. The literature review determined that the total costs of accidents far exceed the cost of H&S (Ikpe *et al.*, 2011; cidb, 2009; Smallwood, 2004; Fellows *et al.*, 2002) thereby showing that investment in H&S makes economic sense. Despite that, financial provisions for H&S are marginal. With regards to the factors, which determine the quantum of financial provision for H&S, literature analysis categorise them into client-related and contractor-related factors. This classification reinforces the important role of both clients and contractors relative to improving H&S practices for construction projects.

3.6 THE IMPACT OF INJURIES AND DISEASES ON WORKERS

3.6.1 Introduction

According to Wells and Hawkins (2009), securing a job in construction offers a potential route out of poverty for many of the world's poorest. However, subsequent inability to work due to injury or ill-health can drive workers and their families back into destitution. Workplace injuries and illnesses adversely affect the quality of life of construction workers. Even though economics will inevitably drive many contractors' H&S programmes (since making money is the bottom line), efforts to improve construction H&S should also consider human values (Schneider, 2012). Muiruri and Mulinge (2014) state that H&S is an economic as well as humanitarian concern that requires proper management control. The former UN Secretary General, Kofi Annan described H&S at work as not only a sound economic policy - but as a basic human right (Amponsah-Tawiah and Dartey-Baah, 2011). Human life stands at the centre of all productive activities and must not be compromised at any cost (Amponsah-Tawiah and Dartey-Baah, 2011). According to the WHO (1994), workers have a right to safe work and to a work environment that enables them to live a socially and economically productive life. In Zimbabwe, occupational injuries are among the top ten health priorities (Chimamise *et al.*, 2013).

According to Iunes (2002), workers spend more than one-third of each day at work and for this reason working conditions can have a major and direct impact on the health and wellbeing of the workers and their families. Workplace accidents exert an enormous economic, social and personal toll for workers and their families. Previous studies (HSE, 2015; WSH, 2013; ASCC, 2012) suggest that workers bear the greatest proportion of the burden of workplace injuries. Sadly, reliable information with regards to the impact of occupational injuries on families and children is limited (Matthews *et al.*, 2015; Harrington, 2007). According to Dembe (2001), most outcome studies of occupational injuries and illnesses rarely focus on the broader social consequences of work-related disorders or their impacts on injured workers' families, co-workers and the community.

To understand the effects of injuries, illnesses or fatalities on workers and their families, the family is viewed as an interconnected system, in which events that occur in the

individual family member cause changes in the behaviour of family members as individuals or as a group (Dembe, 2005). The available information relies on inferring potential consequences to family (Harrington, 2007) suggesting that occupational injuries, disease and fatalities, have notable repercussions for the worker's family and children. Families of workers who die at work may experience serious and enduring health and financial ramifications (OSHA, 2015) and that these effects can extend beyond families to friends (Matthews *et al.*, 2015).

Sections 3.6.2 to 3.6.4 discuss the socio-economic ramifications of work-related injuries, illnesses and fatalities to workers and their families.

3.6.2 The economic burden of workplace injuries

In addition to dealing with emotional impact of grief and loss, workers and their family also bear the considerable financial hardship as a result of the death (Matthews *et al.*, 2015). According to Doorman (2000), the two main economic costs that result from disability and premature death at work are the worker's lost wages and cost of treatment.

According to Dembe (2001), workers injured on the job are likely to face significant disruption in their working lives and subsequent labour experiences. After an occupational injury, workers are likely to change or lose their jobs (OSHA, 2015; Hrymak and Pérezgonzález, 2007; Burton *et al*., 2002; Keogh *et al*., 2000; Pransky *et al*., 2000). According to Hrymak and Pérezgonzález (2007), a significant proportion of employees also incur ongoing financial losses due to a change in employment status as a result of the accident. The workers may have to shift to other jobs, retrain to change careers, and being completely unable to continue what they had been doing, and actually doing nothing (Burton *et al*., 2002). A study conducted by Keogh (2000) involving 537 workers' compensation claimants showed that 38% of the respondents had suffered job losses. According to the (OSHA, 2015), approximately half of recorded injuries require at least a day away from work, a job transfer or a work restriction for recovery. Pransky *et al.* (2000) state that the social effects were much more widespread among workers with injuries that caused at least one week of missed work.

According to the OSHA (2015), after a worker injury, family caregivers must reduce their own hours of work and wages to care for the disabled family member. Workplace injuries, disease and fatalities place a considerable strain on worker's real incomes as a result of lost wages during the period of absence from work and possible reduced wages after return to work (OSHA, 2015; Hrymak and Pérezgonzález, 2007; Camm and Girard-Dwyer, 2005; Burton *et al.,* 2000). The effects are aggravated where a workplace injury affects the sole wage earner in a single-parent household (Boden, 2005). The results of a study done by Hrymak and Pérezgonzález (2007) suggest that the amount of money lost by employees varied greatly with approximately 85% due to lost salary and overtime payments. During another study, the Centre for Organisation and Work (COW) (2009) determined that post injury wages reduced significantly. The findings of the COW corroborate earlier findings by Burton *et al.* (2000) who determined that a significant number of injured employees, even those on compensation schemes, experience a drop in their incomes.

According to OSHA (2015), the costs of injuries not compensated through workers' compensation or through the social safety net increase financial burden on injured low-wage earners and their families. A study conducted by Matthews *et al.* (2015) comparing household finances before and after an injury concluded that household financial savings dropped by around 30%. In another study, Camm and Girard-Dwyer (2005) determined that workplace injuries contribute to reduced income, depletion of savings and loss of assets. These results are consistent with Pransky *et al.* (2000) whose study reveal that 44% of the study's respondents suffered significant injury-related financial problems and 33.7% dipped into savings; 33.4% had problems paying bills; 28.4% borrowed money, and 14.8% sold personal belongings.

The other major economic element is the cost of medical treatment, care during the period of disability, and rehabilitation (Doorman, 2000). Medical treatment brings about a financial burden (European Commisssion, 2011). The effects of workplace injuries are aggravated by an 'ineffective' compensation system. Burton *et al.* (2002) established that weekly compensation pays 80% of the employee's pre-accident earnings. In New York, OSHA (2015) determined that workers lose approximately 15% of their earnings in workers' compensation benefits for wage losses caused by workplace injuries. Reduced income results in workers and their families experiencing

serious financial strain. However, the economic burden of workplace injuries, disease, and fatalities is more severe for lower-wage earners.

3.6.3 Social burden of workplace injuries

According to the NCOSH (2014), no dollar figure can measure the immense cost in human suffering to injured workers and their families. Even when social security benefits are granted, they cannot fully cover the economic costs and non-monetary costs incurred (Iunes, 2002). The problem is compounded for the workers in the informal sector. These workers are largely outside the ambit of national social security system and so the burden of workplace injury is borne by the worker and their families.

The studies, which investigated the effects of workplace accidents determined that injuries or illnesses diminish self-esteem and self-confidence, increase stress between spouses, children and other family members, strain relations with friends, colleagues and supervisors; and change an individual's role in the family and community (OSHA, 2015; Eurpoean Commission, 2011; Camm and Girard-Dwyer, 2005). According to Dembe (2001), social costs of work-related injuries and ill-health can be classified under: emotional and affective states (depression, alienation, anger, resentment, stress, violence, sleep problems, impatience, irritability); impaired relationships (separation, divorce, poor communication, conflict, withdrawal, less intimacy, less family time); and functional changes and domestic roles (family care giving, child care duties, household chores, work less /or more, transportation needs, educational change, less social activities, home helpers).

During another study, Kendrick *et al.* (2011) determined that employees also suffer from psychological consequences emanating from injuries sustained. The results of a study conducted by Hrymak and Pérezgonzález (2007) indicate that over half the employees reported suffering anxiety, a quarter reported suffering depression while over half reported that their close family and friends were affected. Furthermore, Camm and Girard-Dwyer (2005) determined that professional counselling, caregiver services in the home, home modifications and equipment related to disability, and deferred or loss of educational opportunities are additional potential costs to workers and their families. A more recent study suggests that injuries and illnesses contribute to the pressing issue of income inequality (OSHA, 2015) and early retirement. Families may

have to change their domestic and family responsibilities to care for the injured or ill individual (Burton *et al.*, 2002).

3.6.4 Worker disablements

According to MacKenzie *et al.* (1998), injury is well recognized as a leading contributor to work disability. An injury can 'disable' an employee shifting such employee from active labour market into the disabled / long-term absence category. The WHO (1983) define disability as any restriction or lack (resulting from impairment) of ability to perform an activity in a manner or within the range considered normal for human beings. A disabling injury exert costs on the injured worker, the employer and society (Tüchsen *et al.*, 2010; Smith, 2008). The lack of an appropriate framework for return to work may result in some injured workers taking a long time to get back to work, or make repeated unsuccessful attempts, or find themselves trapped and unhappy in low-end jobs (Eakin *et al.*, 2002).

According to Smith (2008), there are devastating psychological, medical, social and economic effects of unnecessarily prolonged work disability and loss of employability. Smith's thesis is based on the fact that employees are the organisation's most valuable asset, and any injury or illness that interrupts work activities hurts both the employee and the employer. According to Tüchsen *et al.* (2010), disability retirement is a burden and a loss of opportunities for individuals, their family, employers and society at large. Although disability retirement rates differ between industries, an estimated 38-40% can be attributed to non-optimum work environment (Tüchsen *et al.*, 2010).

According to Conroy (2006), absence from the workplace as a result of work injury generally leave individuals dependent on the social welfare disability payments system. The dependency on social welfare disability benefits coupled with exclusion from a work environment decrease workers' ability to participate in all aspects of life. This will place a financial cost on society and a taxation burden on business. According to Smith (2008), the prolonged absence from work is detrimental to the worker's physical, mental and social well-being.

3.6.5 Return to work (RTW) programmes

The results of several studies relative to return to work for injured workers (Smith, 2008; Conroy, 2006; Walker, 2006) suggest that there are benefits to employers and employees and society to be realised from return to work programmes. According to Smith (2008), return to work programmes reduce the frequency and duration of lost time, workers' compensation costs, medical and indemnity costs, litigation, wage replacement costs, utilization of short-term and long-term disability benefits, worker replacement costs, and productivity losses. The rehabilitation programmes improve prospects of retention, reduced costs from absence and medical retirement, good practice on H&S and promoting a H&S 'culture' at work (Conroy, 2006). The return to work programme is a cost-effective way to control the effects of disability and absenteeism in the workplace (Smith, 2008; Walker, 2006). The development and implementation of return to work procedures that support optimal health and function for injured workers encourages continued contribution of injured workers to society, help control disability programme costs and protect the competitive vitality of the state's economy (Smith, 2008). Consistent with the foregoing, Conroy (2006) suggest that there is strong evidence that a greater emphasis on rehabilitation would improve workers' H&S. Thus, an effective return to work process can dramatically reduce workers' compensation costs.

Gonzales (2013) determined that organisations can spend as much as 14 to 21 % of total payroll on both direct and indirect disability costs as a result of employees being off work. Yet such amounts could be saved through return to work programmes. Walker (2006) also determined that employers could save as much as $35 for every $1 spent on rehabilitation services to get the injured worker back to work. In New Zealand, the rehabilitation services contributed to 68 % of claimants returning to work within three months of their injury, 85 % returning within six months, and 93 % within twelve months (Conroy, 2006). According to Eakin *et al.* (2002), resumption of employment after injury on the job is a very significant issue for injured workers and their families. In Zimbabwe, the National Social Security Authority is responsible for the rehabilitation procedures of injured workers and preparing the workers for return to work. Apart from medical rehabilitation, the injured workers are trained in vocational trades to enhance their future economic prospects.

Contrary to the assertion that injured workers may fail to return to work, Eakin *et al.* (2002) and MacEachen *et al.* (2010) argue that workers who are injured on the job usually return to work following a straightforward path.

3.6.6 Challenges in RTW programmes

Although RTW is beneficial to both employers and workers (Smith, 2008), several barriers / factors inhibit the process. According to Foreman *et al.* (2006), the criterion of return-to-work is not straightforward. A few employers realize that workplace disability is so expensive and as such few approach disability management proactively. Conroy (2006) argue that many employers only think about how to manage the return to work of an employee when the accident happens. Against that background, employers lack resources and experience and they are ill-equipped to deal with the situation effectively.

The return to work for injured workers is affected by the lack of coordinated and supportive processes, procedures and practices (Smith, 2008) and lack of awareness in the workplace of the supports and resources available to assist both employer and the injured worker (Conroy, 2006). According to Jakobsen and Lillefjell (2014), knowledge of the factors, which facilitate RTW process is limited among employers and employees. The COW (2009) state that some injuries are so debilitating that they do not permit a worker to return to work. The problem is exacerbated by the lack of capacity to offer alternative duties or working arrangements to accommodate a worker's return to work.

3.6.7 Factors influencing return to work for injured workers

The return to work for injured workers is influenced by several factors. The identified factors include, *inter alia*; personal characteristics of the injured person and his or her family; the injured person's social and economic environment and job characteristics; and the extent to which disability compensation is received; severity and nature of injury, employer's commitment to returning the worker to the workplace; collaboration and trust between employers, injured workers, health practitioners and insurers (COW, 2009; Foreman *et al.,* 2006; MacKenzie *et al.,* 1998).

An analysis of these factors suggests that return to work for injured workers depends on worker characteristics, employer characteristics, and policy and regulatory framework. This observation reinforces the need for cooperation between the employers, workers and policy makers with regards to H&S management. The interaction of the worker with the compensation system also has a bearing for a worker to be reintegrated. Workers may also use the accident as an excuse to withdraw from the jobs they consider to be unsatisfying.

According to Belton (2011), return to work is a multifaceted and interactive process encompassing both employer-specific factors, employee-specific factors and workers' compensation system design. Belton's conclusion is consistent with Foreman *et al.* (2006) who determined that work disability and return-to-work are multi-determined outcomes that cannot be accurately predicted just from knowledge of the medical or physical dimensions of the injury or condition.

There are several factors which influence return to work for injured workers. Some of the factors, include: the degree of disability, age of the worker and salary / wage the worker earns. The workers who are seriously injured, ageing and have limited transferable skills have a greater risk of not being re-employed. According to Conroy (2006), the number of people claiming long-term disability payments is rising, exceeding 10% of the labour force in some member states of the European Union.

According to Smith (2008), the construction industry recorded the lowest RTW in New York. Smith's findings are corroborated by Welch (2010) who suggest that 10% of construction workers do not return to work after an injury. The return to work for construction workers is also affected by the physical nature of construction which requires workers to be physically strong. However, failure to return to work coupled with poor compensation may push disabled workers into a poverty trap. According to Camm and Girard-Dwyer (2005), workplace injuries diminish the quality of life of the injured workers and their families. The problem is exacerbated in small firms where injured workers tend to have lower rates of reemployment, longer periods of compensation and less access to assistance (Eakin *et al.*, 2002).

3.7 SUMMARY OF THE CONSTRUCTION INDUSTRY H&S PROBLEM

The preceding discussion highlighted several issues with regards to construction H&S practices. The results of the literature survey suggest that:

- the construction sector has a poor H&S record. The occurrence of fatalities, injuries, and disease on projects demonstrates that the H&S performance is poor. Sadly, poor H&S performance has social, economic and environmental ramifications to workers, enterprises and society. From a social perspective, injured workers and their families suffer pain, loss of jobs, diminishing quality of life and society has to incur huge expenditure with regards to healthcare and rehabilitation of the injured workers. Although the burden of poor H&S performance is shared between workers, employers and society, it is generally agreed among researchers that workers bear the greatest burden of injuries sustained at work;
- inadequate H&S practices affect project delivery through influencing project cost, quality, duration, and the environment. Failure to leverage the synergy between H&S and project parameters in the construction industry is contributing to projects being completed late, costs exceeding value, occurrence of reworks and environmental pollution and damage;
- inadequate management of hazards is a major problem affecting construction H&S practice. Despite a growing appreciation of the impact of hazards on workers' H&S, construction workers remain exposed to hazards contributing to the occurrence of injuries, diseases and fatalities. The lack of appropriate frameworks for hazard identification, inadequate response to hazards, lack of training relative to hazard identification, among other factors, contribute to workers' exposure to hazards. The problem is exacerbated by the lack of a strong and effective risk prevention strategy. For instance, failure to incorporate PtD techniques in projects result in project missing an opportunity to eliminate the hazard at source. Against this background, the construction industry continues to be regarded as the most hazardous work sector because of the extent to which workers are exposed to various forms of hazards on projects;
- statistics with regards to workplace fatalities, injuries, and disease demonstrate that despite several interventions, the construction industry continue to maim its workers far more than other sectors. The review of literature determined that the construction sector records the highest incidence of workplace injuries, diseases

and fatalities than the other economic sectors. The occurrence of fatalities is attributed to the unsustainable H&S practices implemented in the sector, and

- contractors and other project stakeholders make token investments towards H&S. The lack of sufficient financial provisions affects the implementation of H&S initiatives on construction projects.

Sections 3.1 to 3.6 demonstrates that construction H&S practices are unsustainable. Unsustainable H&S practices are characterised by workers' exposure to conditions which systematically diminish their capacity to meet their current and future needs because of fatalities, injuries, or disease, incurred during their employment. Chapter indicates that workers are systematically exposed to hazards which contribute to fatal, or non-fatal injuries, or illnesses. The economic and social burden arising from workplace fatalities, injuries, or disease, is enormous and detrimental to the realisation of sustainable development objectives. From the workers' perspective, exposure to hazards and the risk of injury diminish the worker's quality of life and their ability to meet current and future needs. Despite the adoption of sustainability as a development strategy by most organisations, H&S remains outside the ambit of sustainability and continues to be treated as an ordinary social issue, rather than a sustainability concern. Nevertheless, the failure to optimise this relationship results in missed opportunities for solutions that do not cause new sometimes worse problems (Brown and Robert, 2015). The failure to observe that the H&S problems are, in fact, symptoms and indicators of an inherently unsustainable social, economic and environmental system, means that the challenge is underestimated and possibilities for 'root solutions' are missed.

Although preventive actions to mitigate risks have yielded some positive results, Boileau (2016) argue that isolated actions that are taken in reaction to a hazardous situation may not always be the most efficient to prevent its recurrence. The strategies to prevent workplace injuries, disease and fatalities should rely on much broader perspectives to ensure that their impact relative to creating a health and safe environment is long-term and susceptible to being permanent (Boileau, 2016). Considering that, several studies (OSHA, 2016; Boileau, 2016) acknowledge that today's business has widely integrated sustainability into their economic development strategies. The OSHA (2016) determined that the environmental movement registered improved environmental outcomes through leveraging the sustainability movement.

Consistent with that, Chapter 4.0 discusses the approaches to integrate sustainability principles into H&S practices to improve H&S outcomes.

4.0: SUSTAINABILITY FOR HEALTH AND SAFETY

4.1 INTRODUCTION

This chapter examines sustainability principles in relation to sustainable construction H&S. A brief background is provided with regards to sustainable development and sustainable construction.

4.2 SUSTAINABLE DEVELOPMENT

The theoretical framework for sustainable development evolved around 1972 through the United Nations Conference on the Environment in Stockholm in 1972 (Drexhage and Murphy, 2010; Harding, 2005) and further evolved through a series of international conferences and initiatives. According to Munasinghe (2009), the Stockholm Conference was a watershed gathering that brought the international community together to focus on development and environmental issues at the global scale. The recommendations from Stockholm were further elaborated in the 1980 World Conservation Strategy - a collaboration between the International Union for the Conservation of Nature, the World Wildlife Fund (WWF) and UNEP, which aimed to advance sustainable development by identifying priority conservation issues and key policy options (Drexhage and Murphy, 2010). According to Dresner (2002), the term 'sustainable development' emerged in the World Conservation Strategy of 1980 wherein it was defined as the integration of conservation and development to ensure that modifications to the planet do indeed secure the survival and wellbeing of people.

In 1983, the UN General Assembly established the World Commission on Environment and Development (WCED), chaired by Gro Harlem Brundtland, to address growing concern over the accelerating deterioration of the human environment and natural resources and the consequences of that deterioration for economic and social development (Drexhage and Murphy, 2010). The outcome of their efforts was a landmark report, *Our Common Future* also known as the Brundtland Report, published in 1987 (Dresner, 2002). The WCED defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own." (WCED, 1987) The WCED definition of sustainable development is the most widely used and cited definition of sustainable development.

The Brundtland Report provided the impetus that popularised the concept of sustainability. It brought the concept of sustainable development into the mainstream of the political arena of international development thinking (Elliot, 2013; Hill and Seabrook, 2013; Munasinghe, 2009). According to Elliot (2013), for the first time the commission shifted from considering environmental concerns arising from development from a unidimensional perspective based on science to a more holistic approach that included the economic, social and political perspective. The Report advocated a form of economic development that was mindful of the long-term health of humans and the planet (Shrivastava and Berger, 2010).

The WCED was followed by several UN Conferences on sustainable development. The United Nations Conference on Environment and Development in Rio de Janeiro in 1992 (also known as the Earth Summit) and the World Summit on Sustainable Development in Johannesburg in 2002 set the tone and defined key milestones for the operationalisation of sustainable development. Global commitment to sustainable development is demonstrated through the ratification of the Rio Declaration on Environment and Development by 180 countries. The Rio Declaration on Environment and Development set out 27 principles for sustainable development (Perdan, 2005). Another key outcome of the Earth Summit was the global plan of action, also known as Agenda 21, to deliver a more sustainable pattern of development. Agenda 21 provided an operational framework for sustainability implementation. At the national level, nations were required to produce national sustainable development strategies (Harding, 2005; Perdan, 2005) to operationalise sustainable development within the national context. The UN Commission on Sustainable Development (CSD) was also established to monitor progress with regards to Agenda 21 (Munasinghe, 2009).

The Johannesburg Summit focussed on, *inter alia,* the shortcomings of the post-Rio development process, reinvigorating sustainability agenda further, and consolidating and broadening the understanding of sustainable development (Perdan, 2005). Leaders and representatives of 183 countries reaffirmed sustainable development as a central element of the international agenda (Perdan, 2005). It yielded the goal oriented and comprehensive Johannesburg Plan of Implementation, including targets relating to poverty, water, energy, health, agriculture and biodiversity (WEHAB) (Munasinghe,

2009). In 2005, the UN Millennium Development Project was endorsed to press forward with the Millennium Development Goals (MDGs).

Global commitment to sustainable development was further reaffirmed in September 2015 at the United Nations Sustainable Development Summit in New York. This Summit adopted a new global development framework: "*Transforming our World: the 2030 Agenda for Sustainable Development*" (UN, 2015). The Summit endorsed 17 sustainable development goals (SDGs) also known as Global Goals. Table 4.1 presents the SDGs.

Table 4.1 Sustainable development goals

SDG	Sustainable Development Goal
1	End poverty in all its forms everywhere
2	End hunger, achieve food security and improved nutrition and promote sustainable agriculture
3	Ensure health lives and promote well-being for all at all ages
4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
5	Achieve gender equality and empower all women and girls
6	Ensure availability and sustainable management of water and sanitation for all
7	Ensure access to affordable, reliable, sustainable and modern energy for all
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
9	Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation
10	Reduce inequality within and among countries
11	Make cities and human settlements inclusive, safe, resilient and sustainable
12	Ensure sustainable consumption and production patterns
13	Take urgent action to combat climate change and its impacts
14	Conserve and sustainability use the oceans, seas and marine resources for sustainable development
15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
17	Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development

(Source: UN, 2015)

The 17 SDGs seek to build on the achievements of the MDGs and complete the outstanding work from the MDGs (UN, 2015). The SDGs are integrated, indivisible, and built around the three dimensions of sustainable development namely, economy, social equity and environmental integrity (UN, 2015). Among other objectives, the world leaders committed to creating conditions for sustainable, inclusive and sustained economic growth, shared prosperity and decent work for all (UN, 2015). With regards to H&S, it is notable that SDGs, Number 1, 3 and 8 relating to poverty, health, and decent work respectively have direct and indirect ramifications for H&S.

The Government of Zimbabwe, as a signatory to the SDGS prioritised 10 SDGs, which relate to economic growth: energy; agriculture, food security and nutrition; infrastructure; water and sanitation; global partnership and financing; health; combating climate change, and gender and women empowerment (Mpofu, 2017). The importance of sustainable development in Zimbabwe is demonstrated through the alignment of the economic blueprint, the Zimbabwe Agenda for Sustainable Socio-Economic Transformation (ZIMASSET) to the SDGs. This was preceded by the consolidation of environmental legislation and the institutionalization of environmental management through the creation Environmental Management Agency (EMA), Gender Commission and the Poverty Reduction Strategy Paper. Despite these positive steps to entrench sustainable development into development initiatives, no framework of sustainable development principles has been developed to guide implementation of an integrated approach to sustainable development.

4.3 PRINCIPLES OF SUSTAINABLE DEVELOPMENT

Sustainable development is guided by commonly accepted principles (Drexhage and Murphy, 2010; du Plessis, 1999). Glavic and Lukman (2007) define principles as fundamental concepts that serve as a basis for actions and an essential framework for the establishment of a more complex system. According to Shrivastava and Berger (2010), sustainability principles deal with moving organisations towards sustainability by changing their vision / mission, their use of natural and human resources, their production and energy practices and their products and waste management. Sustainability principles have regard for both local and global consequences, and as well as for short- and long-term impacts (Shrivastava and Berger, 2010). The sustainability principles can be classified into the general (broad assessments of

progress toward sustainable development) or industry specific principles (frameworks for making smarter decisions about growth management and responsibilities within specific industry sectors) (Shrivastava and Berger, 2010).

The Rio Declaration on Environment and Development endorsed 27 general principles to guide sustainable development at national and local levels. The Rio Principles of Sustainable Development provided the 'benchmark' for nations to design development principles and frameworks to guide development within their countries. The aftermath of the Earth Summit saw several countries and organisations domesticating these principles to match with local standards. McKeown *et al.* (2006) summarised the Rio Principles from 27 principles to 18. The UK Government published 'A better quality of life - A strategy for sustainable development for the United Kingdom' in May 1999 (DETR, 2000) with 10 principles of sustainable development. This guiding document was replaced by the 2005 strategy entitled 'Securing the Future' which has 5 sustainable development principles.

However, lack of a common reference set with regards to sustainable development principles has contributed to the various versions / variants of sustainable developemt principles being formulated by nations and organisations. Despite this, the generally agreed position among organisations that operationalised sustainability principles is that the principles are interdepent and revolve around the tripple bottom line: economic prosperity, social equity and environmental protection. The three dimensions of sustainable development are interrelated; each dimension needs to function properly to ensure the maintenance of the larger system (Almahmoud and Doloi, 2013; SDC, 2011; Munasinghe, 2009). The SDC (2011) argue that a systems approach does not mean tackling every aspect of a complex problem at the same time. Instead this can be achieved by looking at the big picture to identify specific steps to initiate an improvement throughout the entire system (SDC, 2011).

According to the WHO (1997), sustainable development is anchored on principles that imply a concern for the long term healthy and integrity of the environment, embraces concern for the quality of life (not just income growth), for equity between people in the present (including prevention of poverty), for intergenerational equity and for social and ethical dimensions of human welfare. According to Drexhage and Murphy (2010), a

commitment to equity and fairness; long-term view that emphasises the precautionary principle; and integration, understanding and acting on the complex interconnections that exist between the environment, economy and society are key defining principles for sustainable development.

The principles of sustainable development can be adopted to inform the process of development at all levels and within all disciplines (SDC, 2011; du Plessis, 1999). In the construction industry, the US Green Building Council principles for the Leadership in Energy and Environmental Design (LEED), Sanborn principles for Building Design and Construction, and the Hannover Principles, attempt to integrate technological, financial, environmental and community elements in the context of industry realities (Shrivastava and Berger, 2010). In a nutshell, the set of principles should be aligned to match the type of assessment to be made.

Table 4.2 presents a set of principles for sustainable development.

Table 4.2 Sustainable development principles

S/N	**RIO Principles of Sustainable Development** (McKeown *et al*., 2006)	**The South African Sustainable Development Principles** (DET, 2008)	**UK Government Sustainable Development Principles (**SDC, 2011)
1	People are entitled to a healthy and productive life in harmony with nature.	Human dignity and social equity	Ensuring a strong, healthy and just society
2	Development today must not undermine the development and environment needs of present and future generations.	Justice and fairness	Living within environmental limits
3	Nations have the sovereign right to exploit their own resources, but without causing environmental damage beyond their borders.	Democratic governance	Achieving a sustainable economy
4	Nations shall develop international laws to provide compensation for damage that activities under their control cause to areas beyond their borders.	Efficient and sustainable use of natural resources	Using sound science responsibly
5	Nations shall use the precautionary approach to protect the environment.	Socio-economic systems embedded within, and depended upon ecosystems	Promoting good governance
6	In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.	Basic human needs must be met to ensure resources necessary for long term survival are	

		not destroyed for short term gain	
7	Eradicating poverty and reducing disparities in living standards in different parts of the world are essential to achieve sustainable development and meet the needs of the majority of people.	Integration and innovation	
8	Nations shall cooperate to conserve, protect and restore the health and integrity of the Earth's ecosystem.	Consultation and participation	
9	Nations should reduce and eliminate unsustainable patterns of production and consumption and promote appropriate demographic policies.	Implementation in phased manner	
10	Environmental issues are best handled with the participation of all concerned citizens.		
11	Nations shall enact effective environmental laws and develop national law regarding liability for the victims of pollution and other environmental damage.		
12	Nations should cooperate to promote an open international economic system that will lead to economic growth and sustainable development in all countries.		
13	The polluter should, in principle, bear the cost of pollution.		
14	Nations shall warn one another of natural disasters or activities that may have harmful trans-boundary impacts.		
15	Sustainable development requires better scientific understanding of the problems. Nations should share knowledge and innovative technologies to achieve the goal of sustainability.		
16	The full participation of women is essential to achieve sustainable development.		
17	Warfare is inherently destructive of sustainable development and nations shall respect international laws protecting the environment in times of armed conflict and shall cooperate in their further establishment.		
18	Peace, development and environmental protection are interdependent and indivisible.		

(Source: McKeown *et al.*, 2006; DET, 2008; SDC, 2011)

There are several conceptual presentations of the interconnectedness of sustainable development principles. Munasinghe (2009) used a balanced triangle (Figure 4.1) to depict the interface between the three dimensions of sustainability. According to Munasinghe (2009), each viewpoint corresponds to a domain (and system) with its own distinct driving forces and objectives.

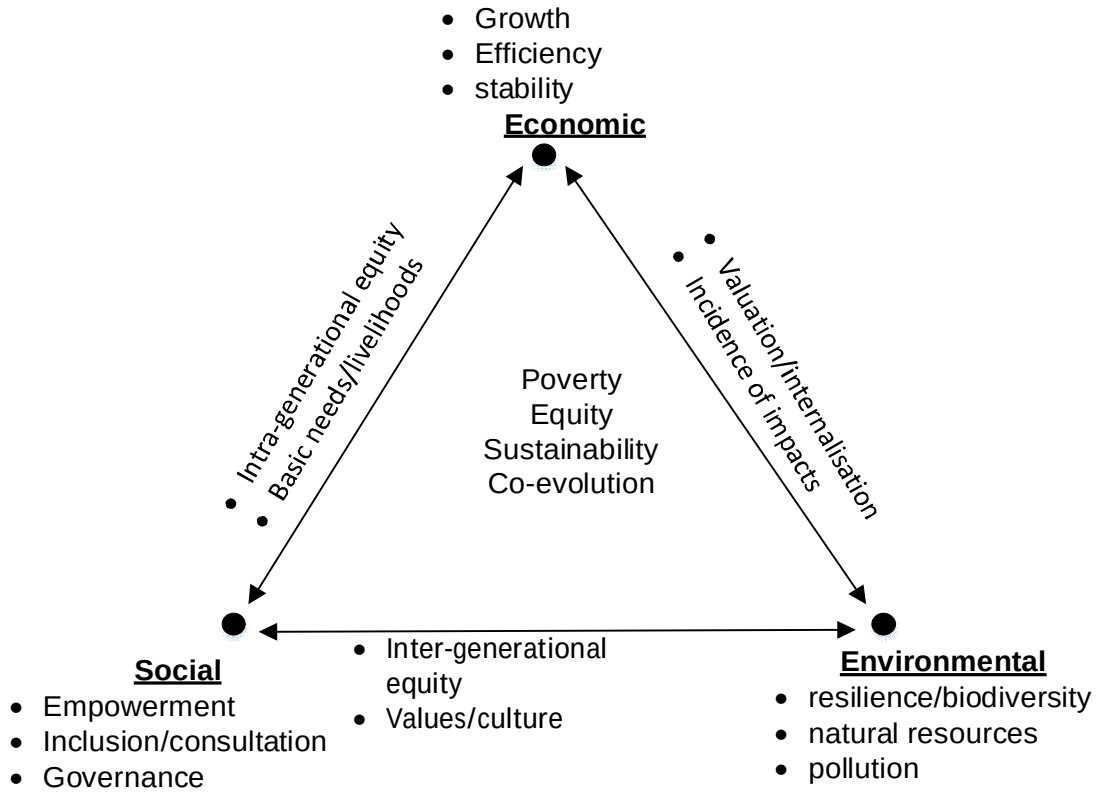

Figure 4.1 Sustainable development triangle

(Source: Munasinghe, 2009).

The economy is geared mainly towards improving human welfare. This can be achieved through creating prosperity for all, not just profits for a few (du Plessis, 2001). However, sustainable economic growth should be achieved within the bounds of ecologically possible limits and without infringing on basic human rights. Munasinghe (2009) argue that the economic system should facilitate equitable access to resources and opportunities and the fair sharing of finite ecological productive space. This is corroborated by Robertson (2014) who argue that economic growth that uses, pollutes the soil, air and water and depletes the ecosystem is counterproductive as it eventually leads to a decline in quality of life.

The environmental domain focuses on protection of the integrity and resilience of ecological systems to resist shock and adapt to change (Munasinghe, 2009). It requires a balance between protecting the physical environment and its resources and using these resources in a way that will allow the earth to continue supporting an acceptable quality of life for humans (du Plessis, 2001). The social domain emphasises the

enrichment of human relationships and the achievement of individual and group aspirations (Munasinghe, 2009). The commitment to sustainable development or sustainability should equally address the three pillars of sustainable development.

According to Munasinghe (2009), to ensure sustainability, issues placed at the centre / interior of the triangle are analysed within three dimensions of sustainable development. However, most development projects fall short in achieving optimisation of all three respects (Edmun-Fotwe and Price, 2009; Harris, 2000). Available evidence indicate that development initiatives continue to be driven by economic or environmental objectives or both representing first and second order levels of sustainability. In Zimbabwe, the environmental objectives are given more focus because of stringent environmental laws and policies. A study conducted by Edmun-Fotwe and Price (2009) determined that achieving the third order level of sustainability (where the three dimensions meet) is a formidable task.

Despite having been embraced as a development paradigm by nations as well as the business community, the concept of sustainable development is not without some problems. Some scholars argue that the concept of sustainability is vague and problematic relative to what exactly should be sustained. According to Faucheux (2009), environmentalists want environmental systems sustained, consumers want consumption sustained and workers want jobs sustained.

Nevertheless, most forward-looking companies and business enterprises are integrating sustainability into corporate strategies and practice (Perdan, 2005). The UN Global Compact (2010) developed 10 principles for sustainable development benchmarked on four areas: human rights, labour, environment and anti-corruption. The principles can be applied by construction organisations within their programmes or practices. Section 4.4 discusses the interface between sustainable development and the construction industry.

4.4 SUSTAINABLE DEVELOPMENT IN THE CONSTRUCTION INDUSTRY

The construction industry is a strategic industry, which employs a significant number of skilled and non-skilled workers and provides infrastructure for socio-economic activities to take place. Nevertheless, the industry generates substantial amount of

waste, greenhouse gases, and consumes a considerable amount of energy. According to Ofori (2012), construction activities involve excessive resource consumption, land degradation, loss of habitats, air and water pollution. The waste that result from the construction process often pollute air, water and pose serious H&S problems. Against that background, sustainable construction was introduced to combat environmentally destructive construction practices and ensure efficiency in energy consumption. According to Gunnell (2009), the green building concept is a response to the substantial environmental impacts of buildings which are designed to be energy efficient, use non-hazardous materials and provide healthy productive environments.

4.4.1 Sustainable construction

According to Kibert (2013), sustainable construction is a subset of sustainable development, which addresses the role of the built environment in contributing to the overarching vision of sustainability. The concept has its background in multinational engineering, construction and architectural firms in Europe and the USA. It seeks to restore and maintain harmony between the natural and built environments and create settlements that affirm human dignity and encourage economic equity (du Plessis, 2002b).

Although the terms 'high performance buildings', 'green construction' and 'sustainable construction' are often used interchangeably, Kibert (2008) indicate that the concepts are not synonymous. The green building concept focuses on addressing environmental sustainability of a building. However, sustainable construction goes beyond addressing environmental sustainability to embrace economic and social sustainability of a building. du Plessis (2007) identified three key aspects of sustainable construction, namely:

- requires a broad interpretation of construction as a cradle to grave process;
- emphasises both environmental protection and value addition to the quality of life of individuals and communities, and
- embraces not just technological responses, but also the non-technical aspects related to social and economic sustainability.

In recognition of the major role of construction in sustainable development of human settlements, the International Council of Research and Innovation in Building and Construction (CIB) commissioned Agenda 21 for Sustainable Construction in 1999. The Agenda 21 document provided a detailed overview of the concepts, issues and challenges of sustainable development and sustainable construction, and posed certain challenges to the construction industry (du Plessis, 2001). However, to facilitate the development of a strategy for introducing sustainable construction in developing countries a special framework, that is, Agenda 21 on Sustainable Construction in Developing Countries was also commissioned by the CIB in partnership with the United Nations Environment Programme (du Plessis, 2007). According to Hodgson (2002), Agenda 21 for Sustainable Construction in Developing Countries represents both a sector response and a developing country response to the challenge of sustainable development.

Sustainable construction is informed by seven principles with regards to decision making during each phase of the design and construction processes, continuing through the building's entire lifecycle. The principles include:

- reduce resource consumption;
- reuse resources;
- use recyclable resources;
- protect nature;
- eliminate toxics;
- apply life cycle costing, and
- focus on quality (Kibert, 2013; Baloi, 2003)

Despite the intention to focus on the triple bottom line, sustainable construction principles focus primarily on ensuring environmental and to some extent economic sustainability. Social sustainability issues such as workplace H&S are marginally implied through the principle dealing with elimination of toxics.

4.4.2 Green building and H&S

The introduction of green buildings and their widespread acceptance, especially in most high-income countries, offers several opportunities to promote worker H&S as a

fundamental dimension of true sustainability (NIOSH, 2011). However, most green building agendas are too narrowly focused on environmental issues and ignore social sustainability issues such as workplace H&S (Behm *et al.*, 2011; Gambatese *et al.*, 2007). Consistent with the above agenda, most green building prominent rating programmes do not address workers H&S aspects during construction of green buildings (Hinze *et al., 2*013; NIOSH, 2011; Behm *et al.,* 2011; Gambatese *et al*., 2007). According to Gambatese *et al.* (2007), only one component (indoor air quality) of the LEED rating system has some focus on the H&S of building occupiers. Nevertheless, green building design focuses its attention to a large extent on the sustainability of end users and the end use, while the process by which the building is constructed is somewhat ignored (Hinze *et al.*, 2013; Behm *et al.*, 2011; Gambatese *et al.*, 2007).

According to Schulte *et al.* (2013), the opportunity to fully incorporate H&S into the green chemistry has not yet been realised. The green buildings focus on the H&S of occupants of completed buildings. Nevertheless, a growing body of research (Hinze *et al*., 2013; Behm *et al.,* 2011; NIOSH, 2011; Gambatese *et al*., 2007; Rajendran, 2006), is exploring the opportunities of integrating worker H&S into green construction to make green construction safe. The general conclusion is that green buildings increase the exposure of construction workers to hazards, some of which are relatively unexplored, hence the recommendations for the integration of H&S in green construction as an effort to make green jobs safe.

Nevertheless, research seeking to integrate H&S in green building is mainly domiciled in the developing countries where the concept of green building is ‘widely’ taken on board by both private and public sector developers.

4.5 THE NEXUS BETWEEN H&S AND SUSTAINABLE DEVELOPMENT

A fundamental aspect that connects H&S and sustainable development is the concern for human wellbeing. The sustainable development agenda centralises improvement in human wellbeing in its initiatives. The primary objective of H&S is to improve the quality of life of workers through prevention of workplace accidents, injuries, illnesses or fatalities. Taubitz (2010) explain the relationship between H&S and sustainable development as centred on the concern for resource conservations, in which case sustainability is concerned with conserving natural resources and H&S is concerned

with conserving human resources. Section 4.5.1 to 4.5.3 explores the relationship between the two concepts.

4.5.1 Environmental sustainability

In a study exploring the interface between H&S, the environment and sustainable development, Molamohamadi and Ismail (2014) concluded that the three concepts are extremely interrelated and adopting one of these policies requires the other to be implemented properly. The conclusions made by Molamohamadi and Ismail reinforces the findings of the WHO (1994), which determined that environmental hazards that endanger the populace's health were initially observed in the work environment / among the working population. In a more recent and related study in the health-care sector, Kaplan and Forst (2017) concluded that environmental sustainability improves worker H&S. The protection of workers' H&S and the environment are mutually reinforcing objectives (Hinze *et al.*, 2013; Schulte *et al.*, 2013; ILO, 2012a). Nevertheless, the connection between the two concepts has not been fully appreciated by decision makers in the health-care organisations or oversight organisations (Kaplan and Forst, 2017). The failure to promote the convergence between workplace H&S and the larger environment expose workers to the risk of contracting diseases. According to Amponsah-Tawiah (2013), promoting workers' H&S while polluting the environment within which they reside with their families is retrogressive. On the other hand, unhealthy / unsafe practices, such as concrete run-off / spillage, fires, oil spillage, waste and uncontrolled sanitation adversely affect the environment (Enshassi, 2003). The many toxic substances in products such as paints, solvents, wood preservatives, pesticides, adhesives and sealants found at construction sites have H&S ramifications for the workers. According to Emuze and Smallwood (2013), the generation of dust, hazardous materials and the release of bio-degradable material into the environment have H&S implications for construction workers and the general public. The air currents, which easily carry dust and vapours from construction sites into occupied areas exacerbates the problem.

From the preceding discussion, environmental sustainability principles, which can enhance attaining H&S sustainability are environmental protection (WHO, 2017; Kaplan and Forst, 2017; Amponsah-Tawiah, 2013), the precautionary principle (Boileau, 2016; Schulte *et al.*, 2013) and the polluter pays principle. According to the

Interdepartmental Liaison Group on Risk Assessment ILGRA (2002), the application of the precautionary principle applies beyond its initial focus on environmental damage as enunciated by the 1992 Rio Declaration on Environment and Development. The Rio Declaration on Environment and Development, states that where there are threats of serious or irreversible environmental damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental damage. The precautionary principle has been extended to apply where there is threat to human health, as well as situations where there is threat to environmental damage. In construction H&S, the precautionary principle is applied through design for safety (DfS) and procurement systems to prevent workers' exposure to hazards. This is consistent with the primary goal of a H&S programme, that is, to eliminate or reduce H&S risk before work begins. According to the ILGRA (2002), the purpose of the precautionary principle is to create an impetus to take a decision notwithstanding scientific uncertainty about the nature and extent of the risk; that is, to avoid 'paralysis by analysis' by removing excuses for inaction on the grounds of scientific uncertainty.

With regards to the polluter pays principle, the Rio Declaration on Environment states that the polluter should, in principle bear the cost of pollution (McKeown *et al.,* 2006). This principle has an application beyond environmental considerations. With regards to H&S, the person / organisation / institution, which causes injuries, disease and fatalities to workers should pay. Therefore, enforcement of H&S regulations and penalties is essential to attain sustainability ibn H&S practices.

Nevertheless, H&S and environmental initiatives remain separated. In Zimbabwe, H&S and environmental management have separate procedures and regulating institutions. In addition, the leading rating frameworks, namely LEED and BREAM, negligibly consider construction worker H&S amongst its certification criteria (Hinze *et al.*, 2013; Rajendran and Gambatese, 2009). However, the lack of coordination between environmental and H&S operations may expose workers to the problem of risk shifting.

4.5.2 Social sustainability

According to du Plessis (2007), sustainable development focuses on sustaining homo sapiens. This is consistent with the Rio Declaration on Environment and Development which, succinctly states that 'human beings are at the centre of sustainable

development'. The concern for human well-being is at the centre of both sustainable development and H&S (Molamohamadi and Ismail, 2014; Rajendran and Gambatese, 2009; du Plessis, 2002; WHO, 1994). According to the WHO (1994), occupational health is a basic element and constitutes a social and health dimension of the principle of sustainable development. The ILO (2009) state that protection of workers against sickness, disease and injury arising out of employment is a fundamental element of social justice (ILO, 2009). Human suffering as a result of workplace injuries, disease and fatalities is unacceptable from a social justice perspective. Therefore, the basic framework for achieving social equity is the need to embrace workers' rights, that is, right to freedom, right to wellbeing and the right to equality.

According to Lingard (2012), workers have a moral right to be treated fairly and to be provided with healthy and safe work environment. The importance of respect for human dignity is central to achieving the SDGs (UN, 2015). According to Valdes-Vasquez (2013), a truly sustainable project needs to include not only the social considerations of the final users but also considerations such as the project's impact on the surrounding community and the H&S and training of the workforce. Social sustainability elements include community involvement, corporate social responsibility, and social design. These components address the H&S aspects of construction workers throughout the project life cycle and integrating them in H&S will improve both long-term project performance and the quality of life for those affected by the project. This is important because workers and their families bear the greatest burden of workplace accidents (Gahan *et al.*, 2014). Regrettably, social sustainability remains neglected by the majority of organisations (John and Narayanamurthy, 2015).

4.5.3 Economic sustainability

According to Chen (2004), economic effectiveness and H&S are interrelated and inseparable. It is through the engagement of workers in the productive processes that the triple bottom line for sustainable development may be achieved. According to the WHO (1994), H&S facilitate undisturbed production which increases the quality of products, productivity and process management. The observations of the WHO are corroborated by Burton (2010) who determined that H&S and wellbeing of workers are important determinants of productivity, competitiveness, and sustainability of

organisations. According to Doorman (2000), H&S issues are matters of economics since they stem from work, and work is an economic activity. A sustainable approach to H&S enhances economic sustainability through lowering H&S compliance costs, reducing sicknesses and absenteeism on the job, reducing costs associated with workplace accidents and fatalities, and increased productivity as a result of improved morale (Gahan *et al.*, 2014). Several studies, which investigated the cost aspects of H&S determined that the total costs of accidents exceed the cost of accident prevention (Ikpe *et al.*, 2011; cidb, 2009; Smallwood, 2004; Fellows *et al.*, 2002) thereby making H&S good business. This shows that investing in better H&S represent strategic value to business, rather than simply an avenue for immediate economic value (Gahan *et al.*, 2014). The foregoing is also corroborated by Tang (2004) and Katongomara (2015) who state that investment in H&S is the most crucial factor in determining H&S performance. From the foregoing discussion, to realise economic sustainability for H&S, economic efficiency, a long-term approach and responsible production should be integrated into H&S decision making. According to Weiss (2013), leveraging H&S initiatives with sustainability help organisation to improve profitability and enhances team member attachment to the organisation. Boileau (2016) indicate that sustainability in H&S will be attained through incorporation of H&S concerns in the organisation's business or management plan. Nevertheless, contractors continue to make marginal investments towards H&S with concomitant knock-on effects on implementation of H&S.

Section 4.5.1 to 4.5.3 explored the relationship between H&S and sustainable development. It is expected that exploiting the synergy between H&S and sustainable development can raise the profile of H&S.

4.6 APPLYING SUSTAINABILITY PRINCIPLES TO CONSTRUCTION H&S

Sustainable H&S represents a new response by the construction sector to address the H&S problem in the sector. While the traditional approaches to addressing the H&S problem have yielded some results as demonstrated by the gradual reduction in accidents in construction, however, the focus on tactical issues such as recordkeeping, incident reporting, PPE and other elements while necessary, do not resonate as part of long-term strategic initiatives (Taubitz, 2010). The focus on single order regulated

aspects of sustainability is important, but not adequate. A long-term, holistic and strategic approach to H&S embracing the three dimensions of sustainable development is needed.

Rajendran (2006) is probably the first scholar to focus a research on sustainable construction H&S. According to Rajendran (2006), sustainable construction health and safety (SCHS) seeks to sustain a worker's H&S for the duration of the current and future projects a worker is involved in, and during the worker's remaining lifetime after retirement, without any injuries. During another study, Rajendran and Gambatese (2009) proposed a set of elements which should be implemented to achieve sustainable H&S practice. The framework of elements for sustainable construction H&S presented by Rajendran and Gambatese (2009) provided the foundation for understanding sustainable construction H&S in the construction industry. Nevertheless, the elements are more inclined to addressing the social sustainability issues relative to sustainable buildings. During another study seeking to apply sustainability to construction H&S, Reyes *et al.* (2013) applied the Integrated Value Model to assess the sustainability of construction projects based on their contribution to H&S. The model uses a H&S index developed from a set of indicators, which seek to evaluate a building's sustainability based on its compliance with accident rate reduction procedures.

The transition towards sustainable H&S involve aligning current H&S practices with the principles that frame sustainable development. To be succinct, sustainable construction H&S refers to the application of sustainability principles to construction H&S decision making. According to Boileau (2016), the principles which frame sustaiable development are capable of being applied to H&S practices to improve outcomes. This reinforces earlier findings from a study conducted by Flouris and Yilmaz (2011), which determined that firms can only express sustainable development when sustainability principles are incorporated in its policies, products, and practices. The studies by Boileau (2016), Flouris and Yilmaz (2011), Rajendran (2006), and Rajendran and Gambatese (2009), among other studies, demonstrate that aligning H&S practices with sustainability principles is feasible and necessary to improve H&S outcomes. Nevertheless, there is dearth of frameworks to facilitate the integration of sustainability into construction H&S.

Section 4.6.1 discusses the principles of sustainable development which can be applied to construction H&S.

4.6.1 Interpreting sustainability principles for H&S

The sustainability principles agreed to at the Rio Conference on Environment and Development have been widely applied by most nations and organisations to operationalise sustainable development in their programmes, policies or practices. Given that, the Rio principles of sustainable development provides the foundation upon which sustainability principles for construction H&S are formulated. To align H&S practice with sustainability principles, the macro-level principles are disaggregated to micro-level principles before operationalization. According to Ugwu *et al.* (2006) and Akadiri and Olomolaiye (2012), sustainability objectives should be translated into concrete practical actions at the micro / project-level to be implementable.

The sustainability principles to frame sustainable H&S were compiled from the review of sustainable H&S literature (Boileau, 2016; OSHA, 2016; CSHS, 2013; Hinze *et al.*, 2013; Reyes *et al.*, 2013; Schulte *et al.*, 2012; Rajendran and Gambatese, 2009; Rajendran, 2006) and national sustainability frameworks (Table 4.2). However, due to the dearth of literature relative to sustainable H&S, related literature seeking to integrate sustainability into value management (Abidin and Pasquire, 2005), project management (Siew, 2016) and sustainability frameworks, namely the LEED, Global Reporting Initiative (GRI), Dow Jones Sustainability Index, CSHS and WHO framework on healthy workplaces were also reviewed.

Since the principles were generated from several sources, it is important to provide an interpretation of the principles in the context of H&S. The interpretation of sustainability principles relies on the vision of sustainable construction H&S presented in the preceding Sections of this Chapter and the the researcher's understanding of the concept of sustainable development. In addition, the interpretation was also informed by the European Commission (2005) and the UN Global Compact (2010) sustainable development principles. Table 4.3 presents an interpretation of sustainability principles for H&S.

Table 4.3 Interpretation of sustainability principles in construction H&S

	Principle	Interpretation of sustainability principles for H&S
SOCIAL	Human dignity and social equity	Address the needs of workers at the current and future projects where the workers are involved without exposing them to the risk of injuries, diseases or fatalities
	Consultation and participation	Enhance the participation of workers and other project stakeholders in H&S decision making.
	Justice and fairness	Place workers at the centre of organisational and project policies by promoting fundamental workers' rights and combating all forms of unfair labour practices and discrimination.
ECONOMIC	A long-term perspective	Taking a long-term (life-cycle) approach relative to costs and benefits of investments in H&S
	Responsible production	Promote healthy and safe production methods / process that minimise waste, and optimise the use of resources.
	Economic efficiency	Ensure cost effectiveness relative to investments in H&S. Apply life cycle costing.
ENVIRONMENTAL	Environmental protection	Ensure the work environment is protected from degradation, pollution and unsustainable waste disposal
	Precautionary approach	Take precautionary and preventive approach where there is objective scientific uncertainty in order to avoid potential damage to workers' H&S
	The polluter pays principle	Ensure those primarily responsible for injuries to workers and damage to the environment to pay for the damage.

In previous studies, it was determined that to implement sustainability principles, the broad / macro-level principles should be disaggregated to micro-level / project-level principles. In light of that, Table 4.4 presents the macro-level and micro-level sustainability principles / factors / concepts for H&S.

Table 4.4 The sustainability principles in construction health and safety

Sustainability dimension	Sustainability principle	Sustainability issues / factors for H&S
Social	Human dignity & social equity Justice and fairness Consultation & participation	• Respect of the right to healthy and safe work • Planning for H&S • Reporting and investigations • Policies, standards and systems • Participation in decision making • Leadership / governance • Provision of effective training and access to information
Environmental	Environmental protection Precautionary principle Polluter pays	• Pollution preventing • Waste minimisation and management • Site hygiene / welfare provisions • Selection / procurement of low- risk materials • Prevention through design (PtD) • Occupational and environmental exposure limits • Hazard identification and risk assessments (HIRAs)

		• Compliance with environmental, H&S laws, regulations, and standards
Economic	Responsible production	• Productivity management • Integration of H&S into a firm's business plan / vision • Provision of appropriate aids and PPE
	Economic efficiency	• Optimum resource provision for H&S • Contractual provisions for H&S • Responsible project procurement functions
	Long term perspective	• Compensation, rehabilitation, and reintegration • Life cycle cost analysis relative to H&S investments • Incorporation of economic considerations in H&S policy

(Source: Jilcha and Kitaw, 2017; Boileau, 2016; Mosly, 2016; OSHA, 2016; Emas, 2015; Knott *et al.*, 2014; Reyes *et al.*, 2013; Schulte *et al.*, 2013; Amponsah-Tawiah, 2013; Duncan and Henderek, 2013; Hinze *et al.*, 2013; GoZ, 2013; Berry and McCarthy, 2011; ILO, 2011; SDC, 2011; Shen *et al.*, 2010; Azapagic and Perdan, 2005; Drexhage and Murphy, 2010; Gibson, 2006; McKeown *et al.*, 2006; du Plessis, 2001; WHO, 1997; Factories and Works Act 14:08; Labiour Act 28:01; Constitution of Zimbabwe No. 20 of 2013)

It is notable that some of the principles, especially the social sustainability principles are already existing within H&S practice. This confirms that integrating sustainability is not an addition of a foreign value to H&S, but an enhancement to improve performance outcome relative to H&S practice. The social sustainability principles emphasise the need to put workers' wellbeing at the centre of all project decision making. This will be achieved through informed participation of workers and other project stakeholders in matters concerning H&S, education and empowerment of workers and other project stakeholders relative to sustainable development and H&S.

From an environmental perspective, the key principles that can be integrated into H&S decision making and practices are: environmental protection, the precautionary approach, and the polluter pays principle. This entails the minimisation of waste, pollution and consequently minimising the H&S risks from the environment. In addition, the precautionary approach entails that project stakeholders take the necessary precautionary action to avoid any real / perceived harm to workers and the public. The concepts that may be integrated include the PtD, HIRAs and designing production processes anchored on hazard prevention and control. The use of PtD to enhance H&S sustainability is well documented (Boileau, 2016; Toole and Carpenter, 2012; Rajendran and Gambatese, 2009). Valdes-Vasquez (2013) indicate that integrating

H&S in design will improve both long term project performance and the quality of life for those affected by the project. Another important environmental principle to be integrated into H&S is the polluter pays principle. Compliance with regulatory frameworks relative to H&S and the environment should be enforced. Adequate penalties for causing injuries / polluting the environment will have an impact on the behaviour of project stakeholders relative to H&S and protection of the environment.

The economic sustainability integrates the principles of responsible production, cost efficiency and a long-term approach in H&S decision making along the project life cycle. This entails a paradigm shift in approach to H&S from a short-term approach to a long-term approach wherein project stakeholders appreciate the benefits of H&S investment from a long-term basis. Integration of economic principles may also be realised through the procurement process wherein the procurement of construction stakeholders (contractors, consultants, suppliers) and materials to consider H&S requirements.

Although the principles which frame sustainable H&S are distinctly classified under social, environmental and economic dimensions of sustainability, in practice the classification is affected by the substantial overlaps that exist between the principles. Nevertheless, using these principles to inform H&S decision making across the project life cycle has great potential to improve the outcomes.

Figure 4.2 shows a conceptual framework for integrating sustainability principles in construction health and safety.

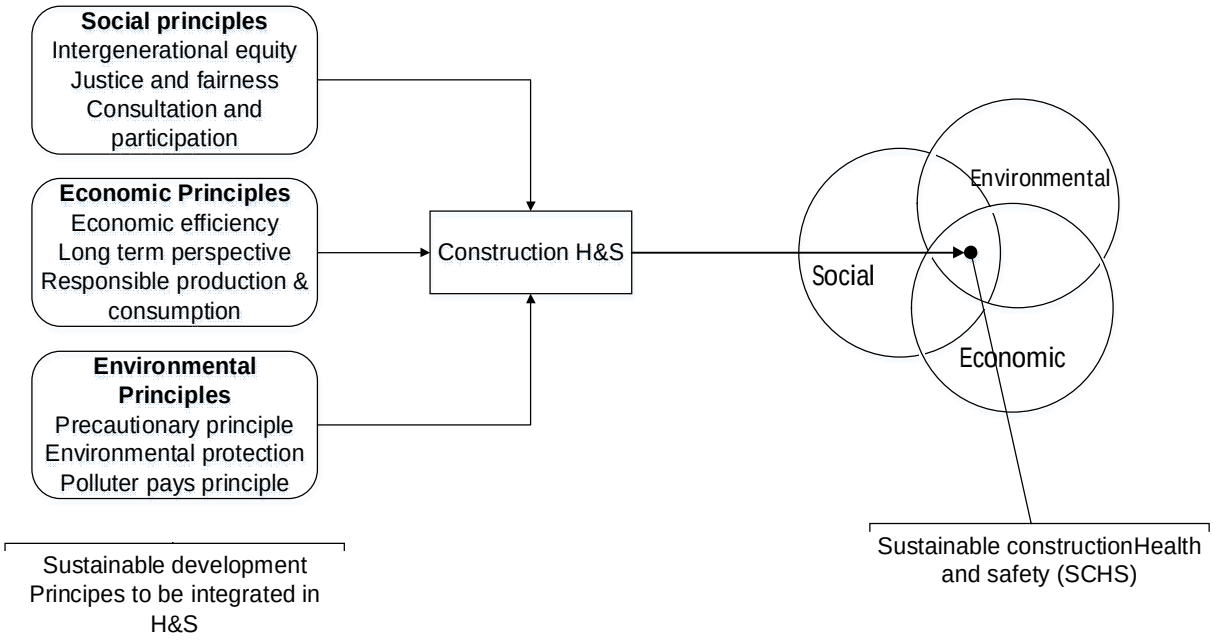

Figure 4.2 Conceptual framework for integrating sustainability into H&S

(Source: developed by the author based on literature review)

The conceptual framework demonstrates that sustainable construction H&S is realised through integrating sustainability principles in H&S practices, programmes, objectives and policies. The integration process involves trade-offs among the three domains of sustainable development. Conceptually, SCHS will be achieved at the point of convergence of three domains. Each of the principles represents a necessary, but not sufficient condition (Flouris and Yilmaz, 2011) for achieving sustainable construction H&S. To ensure continuous improvement of the system, a feedback loop is provided from SCHS to the sustainable development principles.

4.7 THE BENEFITS OF INTEGRATING SUSTAINABILITY IN H&S

As discussed in Section 4.4, the benefits of integrating sustainability principles in H&S arises from enhancing the synergistic value that exists between the two concepts. The integration of sustainability in H&S is becoming increasingly important for the following reasons:

- enhance a holistic approach to H&S practice through putting sustainability thinking at the forefront H&S decision making (OSHA, 2016);
- improve H&S outcomes (OSHA, 2016);

- enhancing value on construction because accidents will be minimised (Smallwood and Emuze, 2014);
- environmental sustainability reduces environmental risks to workplace H&S (WHO, 2017); and
- enhancing contractor selection by better practice clients because improved H&S performance.

Despite this, sustainability integration in H&S remains marginal. Section 4.8 discusses the barriers to integration.

4.8 BARRIERS TO INTEGRATION

According to Chan *et al.* (2014), adoption of sustainable H&S practices in the construction industry has generally been slow. The slow shift is explained by the existence of some barriers in the integrative process. However, due to the dearth of studies investigating barriers to integrating sustainability into H&S, related studies relative to barriers to integrating sustainability in construction practices, project management, value management and procurement were reviewed to determine some potential / possible barriers that can that inhibit integration of sustainability into H&S practices.

According to Roelofs (2007), technical and financial barriers are the main factors inhibiting implementation of sustainable practices relative to construction H&S. Abidin (2009) established that implementing sustainable practices need a significant amount of time and is a costly investment. This problem is compounded by the perceived cost implications of sustainable practices (Abidin, 2009) and H&S (ILO, 2014), which may culminate in low resource provisions for sustainable H&S initiatives.

The other barrier to integration is the lack of knowledge relative to sustainability initiatives (Knott *et al*., 2014; Chan *et al*., 2014; OSHA, 2014). This is due to inadequate awareness of sustainability and its interface with H&S, and inadequate incorporation of sustainability in built environment programmes. A study conducted by Hecker and Gambatese (2004) established that design professionals limit their focus to the H&S of the facility's end-users such as building occupants while overlooking the H&S of construction workers. In another study investigating the incorporation of sustainability

issues in civil engineering education, Valdes-Vasquez and Klotz (2011) conclude that social sustainability is often overlooked in preference to environmental and economic considerations. Lack of knowledge affects construction practitioners' commitment (Karunasena *et al.*, 2016) and decision-making relative to sustainability and H&S issues. According to Abidin and Pasquire (2005), clients need to show commitment by avoiding pressure on the team with respect to cost and time, which would affect overall performance.

Inadequate legal requirements to apply sustainability principles in H&S also affect the integrative process. A study conducted by Toole and Carpenter (2012) determined that construction lacks comprehensive framework to define social sustainability aspects with regards to its projects. The results of a study conducted by Roelofs (2007) suggest that weak standards and weak enforcements affects integration of environmental and worker protection worlds. According to Mosly (2016), in most countries, construction H&S regulations and green building rating systems are not integrated. In Zimbabwe, H&S and environmental management have separate procedures and regulating institutions.

According to Edmun-Fotwe and Price (2009), focus on single order sustainability is an obstacle to integrating H&S and sustainable construction. Green building rating frameworks such at the Leadership in Energy and Environmental Design (LEED) are biased towards achieving environmental sustainability (Karakhan, 2016; OSHA, 2016; Hinze *et al.*, 2013) while marginalising key social issues such as workers' H&S.

4.9 SUMMARY

The results of literature analysis indicate that sustainability and H&S are mutually reinforcing concepts. Therefore, integrating sustainability in H&S practices has great potential to enhance value on construction projects when accidents are reduced. The section also identified principles of sustainable development which can frame sustainable H&S practice. The developed framework of principles of sustainable H&S, provides a working framework to initiate the integration and assessment of sustainability principles into construction H&S practices.

5.0: RESEARCH METHOD

5.1 INTRODUCTION

This Chapter presents the research approach, design and methods employed to collect data for the study. Section 5.2 examines the research paradigm informing this study, Section 5.3 and 5.4 articulates the research design and methods adopted for this research.

5.2 THE DATA

The type of data, research design and methods adopted for data collection are influenced by the philosophical assumptions underpinning what constitutes acceptable knowledge in a field. Mertens (2010) states that a researcher's philosophical stance has implications for every decision made in the research process, including choice of methods. According to Guba and Lincoln (1994), questions of method are secondary to questions of paradigm. This is corroborated by Holden and Lynch (2004) who suggest that research should not be methodically led, rather methodological choice should be consequential to the researcher's philosophical stance and the phenomenon to be investigated. According to Blumberg *et al.* (2005), knowledge of philosophical assumptions helps to clarify the research design and facilitates the choice of an appropriate one. The following sections will discuss the research philosophy subscribed, followed by research strategy and finally the research methods or techniques within which diverse instruments are utilised.

5.2.1 Research philosophy

A philosophy is a belief about the way in which data about a phenomenon should be collected, analysed, and interpreted (Alolo, 2007). The philosophical assumptions have been variously described as paradigms (Mertens, 2010), worldviews (Creswell, 2014), ontological and epistemological perspectives. The research methodology develops, either implicitly or explicitly, within a paradigm and will embody the philosophical assumptions and principles of the paradigm (Dainty, 2008; Mingers and Brooklesby, 1997). Consequently, research methods cannot be viewed in isolation from the ontological and epistemological position adopted by the researcher. Epistemology concerns what constitute acceptable knowledge in the field of study (Saunders *et al.*, 2016). Ontology concerns with the assumptions in conceptual reality and the question

of existence apart from specific objects and events (Fellows and Liu, 2008). The ontological and epistemological assumptions will, in turn, influence the actual research methods that are used to investigate a problem and to collect, analyse, and interpret data (Zou *et al.*, 2014; Dainty, 2008).

Although several research paradigms are discussed in literature, positivism and interpretivism are identified as the two main research paradigms (Collins and Hussey, 2014; Alolo, 2007). Positivism is based on the rationalistic and empiricist philosophy (Mertens, 2010) underpinned by the belief that reality is independent of the researcher and the goal is the discovery of theories, based on empirical research (Collins and Hussey, 2014). According to Blumberg *et al.* (2005), three principles underpin positivism: (1) the social world exists externally and is viewed objectively, (2) research is value-free and (3) the researcher is independent, taking the role of objectivist analyst. In this research philosophy, theories provide the basis for explanation of causal relationships between variables (Collis and Hussey, 2014; Scotland, 2012; Creswell, 2009). Theory development starts with hypothesizing fundamental laws and deducing what kind of observations support or reject the theoretical predictions of the hypotheses (Blumberg *et al.*, 2005). The hypothesis developed, leads to the gathering of facts that provide the basis for subsequent testing of the hypothesis (Saunders *et al.*, 2016). Positivism has been closely linked to quantitative methodology in social sciences (Babbie and Mouton, 2015; Collins and Hussey, 2014).

On the other hand, interpretivism is an epistemology that advocates the need for researchers to understand differences between humans in their role as social actors (Saunders *et al.*, 2016). It developed because of the perceived inadequacy of positivism to meet the needs of social scientists. The argument of interpretivism is that social reality is highly subjective since it is shaped by the subject's interactions and perceptions of the world (Collins and Hussey, 2014; Gray, 2009). Interpretivists argue that an objective observation of the social world is impossible, as the social world has a meaning for human beings and is constructed by intentional behaviour and actions (Blumberg *et al.*, 2005). Interpretivism is the epistemology that qualitative researchers tend to invoke (Gray, 2009; Crotty, 1998), which reject the notion of objectivity, value-free research and causality. According to Blumberg *et al.* (2005), gathering and

measuring facts will not disclose the essence of social phenomenon; rather, researchers need to explore why people have different experiences.

Figure 5.1 demonstrates the relationship between philosophical worldviews, research design and research methods.

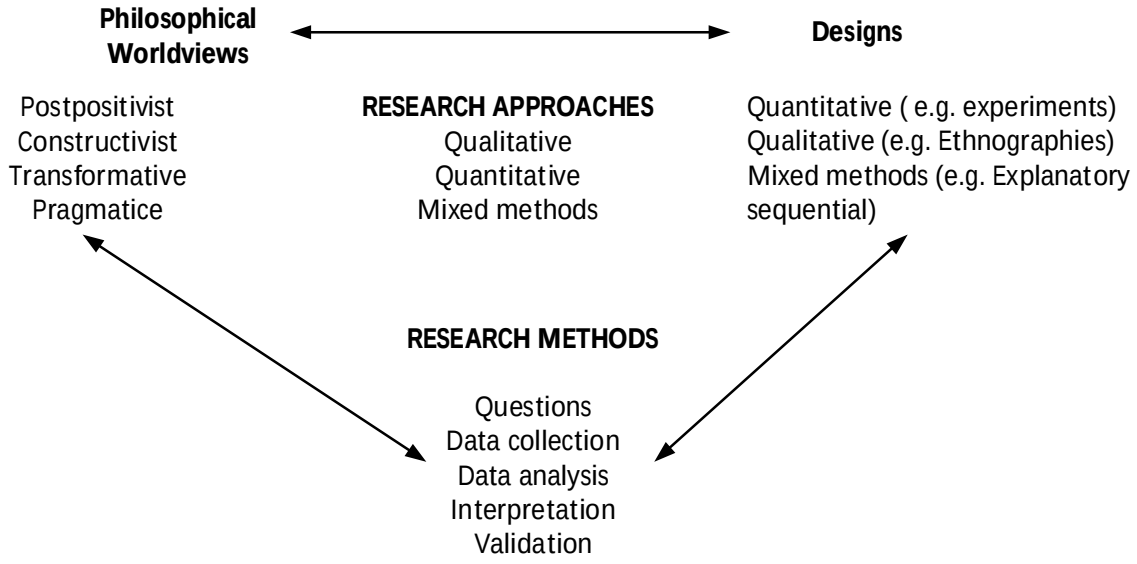

Figure 5.1 A framework for research

(Source: Creswell, 2014)

5.2.2 Philosophical paradigm underpinning the research

This research is influenced by a pragmatic philosophical paradigm, which attempts to counterbalance positivism and interpretivism. This philosophy emphasises the research problem ahead of the methods and it allows the researcher to use all approaches available to understand the problem (Creswell, 2014). This is consistent with the complexity and multidimensional nature of the construction H&S problem. The problem can be better addressed through a combination of qualitative and quantitative data. According to Blumberg *et al.* (2005), research practice shows that researchers rarely subscribe consistently to one philosophy, and in the management of research, a more pragmatic view prevails. The proponents of pragmatism argue that it allows the researcher to focus on the 'what' and 'how' of the research problem (Creswell, 2014; Johnson and Onwuegbuzie, 2004). According to Denscombe (2010), pragmatism is generally regarded as the philosophical partner of the mixed methods research approach.

5.3 RESEARCH DESIGN

A research design involves deciding what data is required, how the data will be compiled and what types of analyses will be performed on the data (Remenyi and Money, 2012). According to Creswell (2014), research design is a type of inquiry within qualitative, quantitative, and mixed methods approaches that provide specific direction for procedures in a research.

Guided by the pragmatic research philosophy described above, and the multidimensionality and complexity of the H&S problem, this research adopts a mixed methods research design. The mixed methods research design integrates qualitative and quantitative methods in a single study. This is consistent with the phenomena under investigation. According to Mingers and Brooklesby (1997), the multi-dimensionality of H&S within the construction industry requires a method of investigation that is comprehensive and capable of integrating thematic and statistical data. These observations are corroborated by Dainty (2008), who argues that the problem-focused orientation of construction management research makes the theoretical benefits of multi-methodology obvious.

A sequential mixed method research (SMMR) was adopted. The SMMR starts with an exploratory qualitative study to explore a phenomenon and then builds to the second, quantitative phase (Creswell and Plano Clark, 2011; Maruyama *et al.,* 2014). This approach provided a rich lens to understand the H&S problem in the construction industry in Zimbabwe. Since the H&S problem is both a social and technical issue, an objectivist and phenological perspectives is necessary to fully appreciate the problem (Dainty, 2008; Zou *et al.,* 2011; Gilbert *et al*., 2011). Although construction management research has traditionally been predominantly quantitative, Zou *et al.* (2011) notes that researchers in construction management are progressively embracing the mixed methods approach to address the shortcomings of a quantitative approach and view of H&S. This development is consistent with other researchers (Dainty, 2008; Alolo, 2007; Creswell, 2014) who determined that no single research methodology is intrinsically better than any other methodology. Accordingly, several studies recommend the adoption of a combination of research methods to improve the quality of research (Venkatesh *et al.*, 2012; Jogulu and Pansiri, 2011; Teddlie and

Tashakkori, 2009; Creswell, 2014) and increase the validity and generalisability of results (Creswell, 2014; Easterby-Smith *et al.*, 2012; Jogulu and Pansiri, 2011). The results of the exploratory interviews provided base-line information which, together with data from literature, informed the development of the survey questionnaire to collect quantitative data. According to Denscombe (2010), the use of use of exploratory interviews to inform questionnaire development improves validity of a subsequent survey questionnaire.

Nonetheless, Easterby-Smith *et al.* (2012) argue that the incompatibility thesis and practical limitations imposed by competencies of the researcher affect the use of mixed method.

5.4 RESEARCH METHODS

Primary data was collected from Harare and Bulawayo. Harare is the capital city of Zimbabwe and Bulawayo is the second largest city. Due to the dominance of these two centres over other towns and cities, administrative offices for government agencies, contractors and consultants are located in these two cities. The two cities generally have more construction activities compared to other towns and cities in Zimbabwe (Saungweme, 2011), and collectively account for 80% of registered contractors and consultants (Chigara *et al.*, 2013). The data was collected in two separate but complimentary phases involving interviews and questionnaire surveys.

5.4.1 Phase 1: Interviews and observations

Interviews were used to collect qualitative data from selected construction practitioners from government, the regulatory authority, contractors, consultants and clients. The interviews with construction practitioners gathered information relating to the general state of H&S practices in Zimbabwe and the factors contributing such a state. This information was important to inform questionnaire design and for triangulation of the results of the study. According to Babbie and Mouton (2015), the basic individual interview is one of the most frequently used methods of data gathering within the qualitative approach. The interviewees were purposively selected based on their experience and knowledge of construction H&S and role of their organisation relative to construction H&S management. Where permission was granted, interviews were

audio recorded and in other instances a note book was used for making notes from the interviews. The demographic profile of the interviewees is presented in Table 6.6. To facilitate the interview, permission was sought, and appointments were set at agreed dates and times.

Except for telephone interviews, face-to-face interviews were conducted at the office of the interviewee. A semi-structured interview protocol was adopted. The semi-structured interview protocol promotes flexibility in terms of the order in which questions were asked (Denscombe, 2010) and allowed the researcher to probe the interviewee for clarification or more detail on an item discussed. A copy of the interview protocol is attached in Appendix 6. However, Farrell *et al.* (2017) indicate that the use of interviews to collect data is limited because interviewees may tell the interviewer what they think the interviewer wants to know.

During the administration of workers' questionnaires at selected sites, the researcher managed to make some observations relative to site H&S practices. According to Kumar (2012), observation is a purposeful, systematic and selective way of watching and listening to an interaction or phenomenon as it takes place. The primary focus of the observation was to observe site H&S practices and workers' responses / behaviour on sites. During the cumulative two weeks period where the researcher interview / research administered questionnaires to workers at the selected projects, observations were made relative to site H&S practices, workers' behaviours and workers' exposure to various types of hazards. According to Rowley (2002), case studies are widely used because they may offer insights that might not be achieved with other approaches. This use of case studies allows a phenomenon to be understood in great depth in a real-life context (Leedy and Ormrod, 2013; Remenyi and Money, 2012; Yin, 2009).

5.4.2 Phase 2: Surveys

The primary data were mostly collected through semi-structured questionnaire survey from contractors, consultants, government, clients and construction workers. A survey design provides a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population (Creswell, 2014) through the collection of significant amounts of data (Gray, 2009). According to Alolo (2007), surveys provide requisite data to draw thorough and logical conclusions on the causes

and effects of the variables under study. The data collected through questionnaire surveys included: factors / variables leading to workers' exposure to hazards and the occurrence of fatalities, injuries or disease; factors leading to contractors lacking resources for H&S; the impact of inadequate H&S on project parameters; post injury quality of life for workers and their families; and sustainability principles that underpin H&S. The majority of the questions were structured with responses on a five-point Likert scale. Table 6.8 presents an interpretation of the Likert scales used in the survey questionnaire.

The five-point Likert scale format was adopted because it keeps the response categories straight and maintains the number of response categories meaningful to respondents (Losby and Wetmore, 2012), reduce frustration level of respondents, and would increase the response rate and quality of responses (Babakus and Mangold, 1992).

The questionnaire items / statements / questions were developed from the review of literature, the findings of the exploratory qualitative data and reference to the data required to test the hypotheses of the study. The interview findings informed the question items in Section A and D of the contractors, consultants and government questionnaires and Question 3 for clients' questionnaire. The questionnaires were semi-structured comprising both closed-ended and open-ended questions. The structured questions are fairly easy to complete for respondents, while the information gathered by the way of the responses to open-ended questions reflected the full richness and complexity of the views held by the respondent (Denscombe, 2010). However, open ended questions demand more effort on the part of the respondent to analyse the data (Denscombe, 2010).

According to Mouton (2013), surveys have advantages with regards to potential to generalize to large population, high measurement reliability, and high construct validity. Questionnaires have been widely used in previous doctoral studies conducted in construction management. The quantitative data collected through closed-ended questions is used to establish the cause-effect relationship between several variables and H&S as defined in the hypotheses. This is consistent with previous studies which suggest that quantitative research is dominant in management studies (Zou *et al.*,

2014; Jogulu and Pansiri, 2011; Dainty, 2008). Nevertheless, questionnaires are criticised for the lack of depth and insider perspective which may lead to surface level analyses (Mouton, 2013).

5.4.3 Questionnaire design and administration

A pilot survey of 10 questionnaires was conducted with selected construction practitioners from contractors, consultants and academia in Bulawayo. The pilot survey sought to determine the clarity of questions and comprehensiveness of the questionnaire relative to the issues under investigation. The respondents for the pilot study were purposefully selected based on their knowledge of H&S, experience in the construction industry and / or previous construction management research experience. The respondents were asked to complete the questionnaire and make comments relative to ambiguities, which were likely to affect the admissibility of the questionnaire.

According to Babbie and Mouton (2015), pre-testing of questionnaires helps to avoid ambiguous questioning. The comments received from the pilot survey provided useful insights, which informed the final design of the questionnaires. For example, the pilot survey noted that some questions, relating to 'factors determining financial provisions for H&S', 'the extent to which H&S is a condition for the appointment of contractors and designers' and 'the extent to which designers considered H&S issues during the design phase' were not universally applicable to the selected respondents. In light of the comments of respondents to the pilot survey, separate questionnaires were developed for the respondents as follows:

- Questionnaire 1: Contractors, government, consulting quantity surveyors / project managers;
- Questionnaire 2: Designers (engineers / architects), and
- Questionnaire 3: Private sector clients.

Despite the different questionnaires, approximately 80% of the questions included in questionnaires 1 and 2 addressed similar issues in line with the sub-problems and hypotheses. However, questionnaire 3 focussed mainly on procurement and sustainability principles for construction H&S. The sample questionnaires are provided in Appendices 10.1 to 10.4.

The questionnaires for contractors, consultants, clients and government were self-administered through personal delivery or via email. Personal delivery of questionnaires provided the researcher with an opportunity to explain the purpose of the survey and to get assurance with regards to respondents' willingness to complete the questionnaire (Babbie and Mouton, 2015). Although personal delivery of questionnaires was a tedious process especially in Harare due to the wide geographical distribution of the respondents' offices, it enhanced the overall response rate for this survey. The completed questionnaires were collected from the respondents' offices or were scanned and returned to the researcher via email.

The fourth questionnaire was research / interview administered to construction workers. To reach out to workers, two large commercial development sites were selected from the two cities under study. The sites were selected based on size. It was anticipated that a large sized project had a greater chance of having workers from diverse trades. Secondly, it was also anticipated that by virtue of the size of the projects and the large sample of workers, the probability of interacting with workers who experienced workplace injuries in the last two years was high.

The research administered questionnaires allowed the researcher to explain issues in the questionnaire to construction workers and to probe the workers with regards to the issues raised during data collection. This was particularly important especially with regards to the need to dissect the challenges and experiences of workers who had previously been involved in work-related accidents. According to Fellows and Lieu (2008), investigation of a phenomena (for example, a specific type of construction accident), which does not occur frequently enough for the researcher to obtain many participants displaying the phenomena for study, is best addressed through an interview or research administered questionnaire. The use of open-ended questions allowed construction workers to articulate the nature, cause and effects of construction injuries to workers and their families. To ensure that data collected from workers was reliable, the purpose of the research was explained to workers during the tool box meeting and workers were further assured, during the data gathering process, that their responses will remain anonymous and confidential, and will not be disclosed to their supervisors. However, the pace of administering questionnaires had to be

organised so as not to interfere with production activities on site. Accordingly, the questionnaire was mostly administered to workers during the lunch break.

5.4.4 Sampling

Sampling is the statistical process of selecting a subset (a sample) of a population of interest for the purpose of making observations and making statistical inferences about that population (Battacherjee, 2012; Kumar, 2012). A population is a precisely defined body of people or objects under consideration for statistical purposes (Collins and Hussey, 2014). According to Lynn (1996), the sampling method and sample size can only be determined when the population of interest has been precisely defined.

The survey population for the study comprised of:

- General contractors: Registered with CIFOZ / ZBCA / Ministry of Local Government, Public Works and Urban Development;
- Government / Local Authority infrastructure development departments;
- Consultants:
  - Architects: Architects Institute of Zimbabwe (AIZ);
  - Quantity Surveyors: Zimbabwe Institute of Quantity Surveyors (ZIQS); and
  - Engineers: Zimbabwe Association of Consulting Engineers (ZACE);
- Construction workers: based on selected case study projects; and
- Clients: Based on selected projects and other active clients in construction / property development

According to Israel (1992), to determine the sample size the following equations are used.

$$n_o = \frac{Z^2 pq}{e^2} \quad \text{(Equation 1)}$$

Where: n_o is the sample size, Z^2 is the confidence level (1.96), p is base indicator (0.5); q is 1 – p, e is the absolute error (0.05).

Israel (1992) indicates that where the population is small, the sample size can be adjusted by using the equation below.

$$n = \frac{n_o}{1+\frac{(n_o-1)}{N}}$$ (Equation 2)

Israel (1992)

Where n is the sample size and N is the population size.

Table 5.1 shows the target population and the proposed sample size.

Table 5:1 Population and sample size for defined population

Category	**Population**	**Sample**
Building Contractors (Categories A - C)	67	58
Architects	49	44
Quantity Surveyors	21	20
Engineers	42	38
Workers	-	100
Clients (private sector)	-	15
Public sector	-	20
TOTAL	**-**	**295**

According to Kumar (2012), the size of the sample is important for testing hypothesis or establishing an association. According to Naoum (2013), drawing a representative sample is usually done either randomly or non-randomly.

Purposive sampling approach was adopted to select workers, clients and interview respondents. Purposive sampling is a non-probability sampling technique where the researcher makes a deliberate choice of an informant due to qualities the informant possesses (Tongco, 2007). According to Leedy and Ormrod (2013), those individuals or objects that will yield the most information about the topic under investigation will be selected. Purposive sampling is considered as the most preferred method for sampling respondents in a sequential exploratory design (Guest *et al.,* 2006).

5.5 VALIDITY OF THE RESEARCH

To ensure validity of the research findings, the data from questionnaires was triangulated with data from collected through interviews. In previous studies, the use of data from multiple sources was found to enhance validity of findings. According to Ihantola and Kihn (2011) cited by du Toit (2012), the mixed methods approach can be used to improve the validity of the theoretical perspectives, and to obtain a less biased picture of the phenomenon. Validity can be categorised as internal or external validity. Internal validity is the degree to which the researcher draws accurate conclusions with

respect to the effects of an independent variable (Fellows and Liu, 2008). External validity is the degree to which the results obtained in one study can be replicated or generalised to other samples, research settings and other procedures (Fellows and Liu, 2008). Test of internal reliability and consistency of the Likert scale used to generate responses were carried using the Cronbach's Alpha statistic and the results presented in Table 6.9 shows that the Cronbach's Alpha co-efficient are generally greater than the lower limit of 0.70 (Hair *et al*., 2010).

To ensure content validity, 10 questionnaires were piloted on construction practitioners and academics to assess admissibility, clarity of wording, and comprehensiveness of the questionnaire.

5.6 THE TREATMENT OF THE DATA

5.6.1 Qualitative data analysis

According to Babbie and Mouton (2015), qualitative data analysis refers to all forms of analysis of data that was gathered using qualitative techniques, regardless of the paradigm used to govern the research. Content analysis was used to analyse qualitative data generated from interviews and from open ended questions in the questionnaire. Hsieh and Shannon (2005) defines qualitative content analysis as a research method for subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns. The use of conventional content analysis is consistent with Hsieh and Shannon (2005) who state that this type of design is appropriate when existing literature on a phenomenon is limited and where researcher wants to gain direct information from study participants without imposing preconceived categories / patterns / themes or theoretical perspectives.

The analysis of qualitative data involved a step-by-step process which started with breakdown or build up transcripts into manageable data comprising a few short sentences or words. This process involved reading the transcripts in an iterative manner to determine the overall sense of the interviews. This was followed by coding and marking the underlying ideas in the data or attaching meaning to segment of text. According to Farrell *et al.* (2017), coding is the labelling of the data to illustrate the key

themes and ideas that can be identified within it. The coding of the data was informed by an analysis of the study participants' data, experience of the researcher and review of literature. After the data coding process, similar kinds of information were grouped into categories / thematic groups (O'Connor and Gibson, 2003) and where necessary, frequency counts were performed to determine the most frequent factors / sub-themes as highlighted by the interview respondents. The final phase of analysis of interview data involved the narration and discussion of the themes derived from the analysis.

5.6.2 Quantitative data analysis

The data from closed-ended questionnaires constituted quantitative data for this research. The data were analysed with the assistance of a Statistical Package for Social Scientists (SPSS) software generating descriptive and inferential statistics. Initially, the data set was explored across demographic characteristics which were presented by means of frequency tables and descriptive charts. Quantitative data analysis involved measurement of central tendency (averages) and dispersion (standard deviations). The use of inferential statistics involved testing for significant effect of several independent factors / variables on the dependent variable. The computations involved statistics such as a factor analysis and one-sample Wilcoxon-test.

The responses from open-ended questions from the questionnaires were analysed through a process of coding the data and grouping the data into a relatively small number of categories / themes. To determine the most important issue / aspect, frequency counts were performed / computed from the coded data. The use of quantitative techniques to analyse qualitative data is supported by Maruyama *et al.* (2014), who determined that the open-ended responses can be analysed quantitatively as well as qualitatively.

5.7 SECONDARY DATA

Secondary data are research data collected from an existing source, such as publications, databases or internal records and may be available in hard form or on the internet (Collins and Hussey, 2014). Review of published data from textbooks, peer reviewed journal publications, conference proceedings, government publications, among other sources provided secondary data for this research. Online secondary

was accessed through using Internet search engines such as Google Scholar, EBSCO, Hinari, e-resources library database at NMMU.

5.8 ETHICAL CONSIDERATIONS

Research ethics refers to the moral principles that guide activity from inception to completion (including the publication of results) (Smith, 2010). It is the appropriateness of the researcher's behaviour in relation to the rights of those who become the subject of the research project, or who are affected by it (Saunders and Lewis, 2012). This research adheres to the Code of Conduct for Researchers at the Nelson Mandela University (NMU).

Participation in this research was voluntary. The researcher sought consent of the participants first before soliciting data. Consent was sought through 'request for permission to undertake research' letters, direct contact, telephone and emails. Research participants were informed of the objectives of the research and their freedom to participate or not participate in the research. According to Smith (2010), informed consent entails that the research is conducted openly, honestly and participants should be aware of what taking part in the research entails and that participation must be voluntary and participants must give consent to being involved in a project. The participants' right to privacy was observed through protecting their identity in the research report and publications emanating from this research. Permission was also sought and granted from key institutions such as the National Social Security Authority and the Ministry of Public Works and Urban Development. The copies of permission to carry research are attached in Appendix 10.6.

5.9 LIMITATIONS

The challenge encountered during data collection is that the data base for contractors and consultations had not been updated to capture some of the companies which had shut down due to the depressed macro-economic environment. This made the use of simple random sampling to select contractors and consultants difficult.

With regards to secondary data, the main challenge experienced related to the dearth of literature on sustainable construction H&S. The researcher supplemented the

available literature with related literature from construction management research to develop the theoretical framework for sustainable construction H&S management.

6.0: RESEARCH FINDINGS

6.0 INTRODUCTION

This chapter presents an analysis of the results from the primary data collection. The chapter is organised as follows: Section 6.1 presents the profile of respondents; Section 6.2 to 6.8 presents an analysis of the results and Section 6.9 presents the testing of the hypotheses.

6.1 SAMPLE STRATUM AND RESPONSE RATE

Table 6.1 shows the sample stratum and response rate for questionnaires administered to contractors, construction consultants (civil engineers, quantity surveyors and architects), construction professionals in government / local authorities, private clients and construction workers.

Table 6.1 Response rate

Stakeholder	**Sample**	**Response**	
	Frequency	**Frequency**	**%**
Contractors	58	44	67.2
Quantity surveyors / project managers	20	15	75.0
Architects	44	9	20.5
Engineers	38	8	21.1
Total	**160**	**76**	**47.5**
Government / LA	20	15	75.0
Private sector clients	15	10	66.7
Workers	100	63	63.0
Total	**135**	**88**	**65.2**
Overall Response Rate	**295**	**164**	**55.6**

The sample stratum consisted of 299 construction stakeholders distributed as shown in Table 6.1. A total of one hundred and sixty-four questionnaires were successfully completed, received, and included in the analysis of the data. This equates to an overall response rate of 55.6%.

In terms of the distribution of responses from contractors, Table 6.2 indicates that 79.1% of the responses were received from Category A, 11.6% from Category B and 9.3% from Category C contractors.

Table 6.2 Distribution of responses from contractors

Contractor Category	A	B	C	Total
Responses (No.)	35	5	4	44
Response rate (%)	79.5	11.6	9.3	100.0

6.1.1 The profile of survey respondents: construction practitioners

Table 6.3 shows that the survey respondents' designation ranges from technicians to directors. The analysis shows that responses were received from a wider spectrum of personnel with influence relative to construction H&S practices. The designation and experience of respondents shows that the study benefited from the experience and knowledge of personnel involved in H&S decision making and implementation. The aforementioned validates and authenticates the findings of the research. It is notable that senior personnel such as directors / chief executive officers / partners constitute the predominating category of respondents (28.7%).

Table 6.3 Designation of survey respondents

Designation	Response	
	Frequency	%
Chief executive / director / partner	29	28.7
Quantity surveyor	17	16.8
Site agent / contracts manager	11	10.9
Construction / project manager	11	10.9
Architect / chief architect	9	8.9
H&s officer / manager	7	6.9
Civil / principal engineer	7	6.9
Technician	6	5.9
Development manager	3	3.0
Deputy director	2	2.0
TOTAL	**101**	**100**

6.1.2 Educational background of survey respondents

The respondents' educational qualifications range from National Certificate to Masters' degree. The leading qualification for the respondents was a Bachelors' Degree (50.5%), followed by a Masters' Degree (25.5%), National Diploma (19.8%), and National Certificate (2.0%)

Table 6.4 Level of education of survey respondents

Highest Qualification attained	Response	
	Frequency	%
Masters' degree	26	25.7
Honours degree	51	50.5
Higher national diploma	1	1.0
National diploma	20	19.8
National certificate	2	2.0
Not stated	1	1.0
TOTAL	**101**	**100**

6.1.3 Work experience of survey respondents

The respondents' work experience in the construction industry ranges from 2 years to 40 years with a mean of 12.0 years, and standard deviation of 8.66. Figure 6.1 shows that the respondents who had 5 to 10 years work experience in the construction industry constituted 36.6%. It is important to note that 15.8 % of the respondents had more than 20 years' work experience in the construction industry. Despite the skills flight affecting the construction industry in Zimbabwe, the analysis shows that the research data was collected from experienced construction stakeholders.

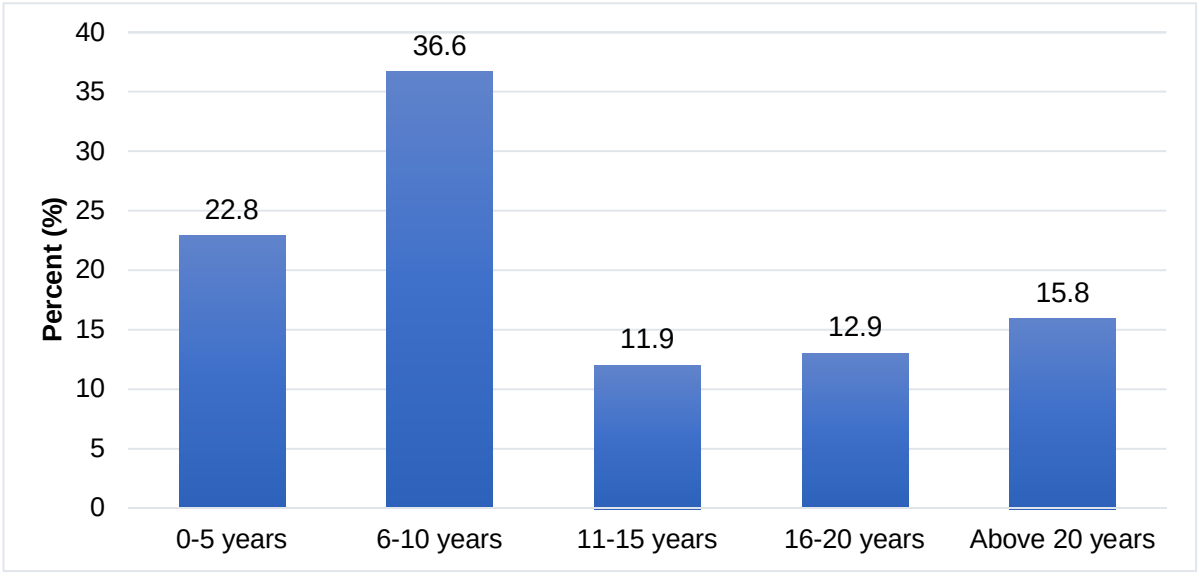

Figure 6.1 Respondents' work experience in the construction industry

6.1.4 Profile of respondents: construction workers

The profile of respondents presented in Table 6.5 confirm the dominance of male workers in the construction industry.

Table 6.5 Profile of construction workers

Characteristics	**Response**	
	No.	**%**
Gender		
Male	56	88.9
Female	7	11.1
Total	**63**	**100.0**
Educational level (last stage completed)		
Tertiary certificate	9	14.3
Advanced level	7	11.1
Ordinary level	37	58.7
Zimbabwe junior certificate	2	3.2
Primary level	2	3.2
Not stated	6	9.5
Total	**63**	**100.0**
Type of Work		
General workers	12	19.0
Bricklaying	9	14.3
Scaffolding	6	9.5
Electrical work	5	7.9
Carpentry	5	7.9
Trainee workers	4	6.3
General foreman / chargehand	4	6.3
Assistant bricklayer / plasterer etc.	3	4.8
Tiller	3	4.8
Steel fixing	2	3.2
Clerical	2	3.2
Machine operators (concrete, excavator)	2	3.2
First aider	2	3.2
Plasterer	2	3.2
Roofer sheeting	1	1.6
Welding	1	1.6
Total	**63**	**100.0**

Male workers constituted 88.9 % of the respondents and females were 11.1%. The aforesaid may be explained by the physical and hazardous nature of construction work.

With regards to educational background, Table 6.5 shows that most workers were literate as demonstrated by the fact that 58.7 % had attained ordinary level, 11.1% advanced level, and 14.3% had tertiary education. This level of literacy was important for the study since the respondents could comprehend the H&S issues being investigated.

The respondents were selected from a wide cross section of workers at the two selected construction sites, which included general workers (19.0%), bricklayers (14.3%), scaffolders (9.5%), electrical workers (7.9%), carpenters (7.9%), and trainee / apprenticeship workers (6.3%).

The respondents' work experience in the construction industry ranges from less than 1 year to 48 years, a mean of 9.4 years, and a standard deviation of 9.67. The respondents' work experience in their current position range from less than 1 year to 43 years, a mean of 5.4 years, and standard deviation of 7.42. Figure 6.2 shows a breakdown of work experience for construction workers who participated in the survey.

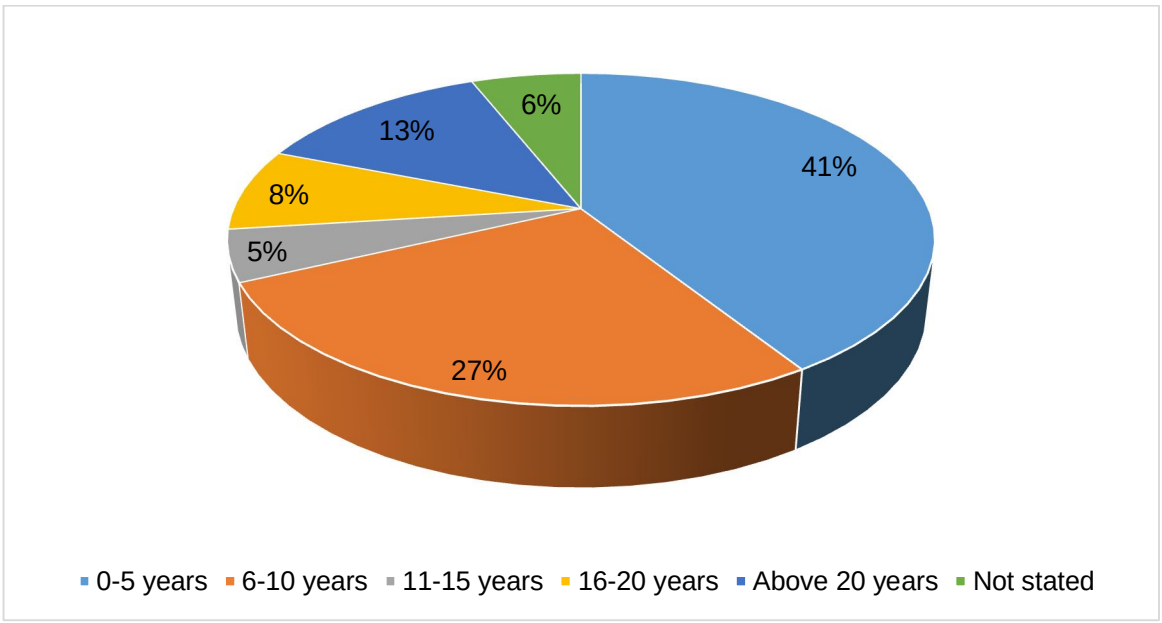

Figure 6.2 Workers' work experience in the construction industry

6.1.5 Profile of interview respondents: construction practitioners

Table 6.6 shows the demographic information of the selected interview respondents. The profile of respondents shows that they are people who have direct or indirect influence relative to construction H&S practices.

Table 6.6 Profile of interview respondents

No.	Designation	Organisation	Highest Qual. attained	Experience (Years)
1	Chief Inspector	Regulatory Agency	Not stated	Not stated
2	Project Manager	Client / Property Developer	MSc	10
3	Project Manager	Consultant Project Managers	MSc	25
4	Site Agent / Engineer	Consulting Engineers	BSc	6
5	Site Manager	Contractor	Diploma	17
6	Director	Government	BArch	16
7	SHE Officer	Contractor	Diploma	10
8	SHE Officer	Contractor	Diploma	7
9	General Foreman	Contractor	Artisan	45
10	Executive Director	Sub-Contractor	Artisan	31
11	Architect	Consulting Architects	BArch	12
12	Architect	Consulting Architects	BArch	17
13	Quantity Surveyor	Consulting Quantity Surveyors	BSc	6
14	Partner / QS	Consulting Quantity Surveyors	BSc	20
15	Construction Manager	Contractor	MSc	11
16	Compensation & Benefits Manager	Regulatory Agency	BSc	Not stated

6.1.6 An overview of the respondents

Sections 6.1.1 to 6.1.5 show that the data was collected from a cross section of research participants selected from the construction industry in Zimbabwe. It is important to note that the research participants who took part in this survey are experienced persons in the industry, and their level of education suggests that the they could comprehend the issues under investigation. The distribution of research participants also suggests that the research benefited from a wide spectrum of stakeholders with relevant experience and influence with regards to H&S. It can therefore be inferred that the data collected is reliable since it was collected from respondents with requisite experience and knowledge of the issues being investigated.

6.2 PRESENTATION AND ANALYSIS OF FINDINGS FROM INTERVIEWS

6.2.1 Introduction

This section presents and discusses the research findings from the interviews. The interviews investigated the perceptions of the construction and related / allied practitioners from government, contractors, consultants, clients, and the regulatory agency with regards to the state of H&S practice in Zimbabwe and the factors contributing to this situation.

6.2.2 An overview of the state of construction H&S practices in Zimbabwe

The interviewees from government, contractors, consultants, clients, and the regulatory agency generally concur that H&S practices construction industry in Zimbabwe are poor and ineffective. The interviewee from the regulatory authority highlighted that compliance with H&S provisions in the construction industry is approximately 23%. This observation is consistent with the assessment made by the site agent from a contractor who asserted that H&S is not a priority in most companies. This assessment reflects the level of prioritisation afforded to H&S by contractors and clients. The assessment confirms the findings of Mutetwa (2010) and NSSA (2012) wherein the studies determined that the construction industry in Zimbabwe has the highest non-compliance with H&S provisions. During another study, Puplampu and Quartey (2012) determined that most African countries have poor occupational H&S practices.

Nevertheless, the interviewees acknowledge the efforts of some 'better practice' clients from the mining sector and multi-national corporations (MNCs) with regards to improving H&S practices in Zimbabwe. The interviewees perceive that these clients are advocating and enforcing better practice with regards to H&S on their projects. This transition has been achieved through integrating upstream aspects of H&S into procurement systems. This development reinforces the results from studies conducted by Smallwood and Venter (2012) and the AIHA (2006), which determined that inclusion of H&S in procurement systems compels contractors and other stakeholders to demonstrate the ability to meet these requirements. Accordingly, some contractors are responding to this drive as a strategy to secure tenders. Nevertheless, except for the few international and mining companies, the interviewees concur that a significant

proportion of construction clients and contractors in Zimbabwe are still lagging behind in terms of their H&S practice.

6.2.3 Factors contributing to inadequate H&S practices

The data collected from the interviews was condensed according to common themes following a process of coding the data from the interview transcripts. From the analysis, 6 themes emerged: management related factors; financial provision related factors; compliance related factors; procurement related factors; information / knowledge related, and design related factors.

Table 6.7 presents the factors and themes, which emerged from an analysis of interview transcripts. The research findings suggest that several factors are deemed to contribute to poor construction H&S practices in Zimbabwe.

Table 6.7 Factors contributing to inadequate H&S practices

Factors	Theme
• Perceived cost implications of H&S / focus on profit • Inadequate H&S planning • Inadequate integration of H&S into procurement • Inadequate commitment to finance H&S	Management related factors
• Insufficient H&S budgets • Diversion of H&S resources • Lack of understanding of H&S resource requirements by offsite management • Lack of capacity by sub-contractors to adequately price for H&S	Financial provision related factors
• Inadequate manpower and vehicles at the NSSA • Inadequate inspections and enforcements • Collusion	Compliance related factors
• Inadequate consideration / weighting of H&S during tender • Vague reference to H&S in contract documents • Siloed procurement • Inadequate consultants' role in facilitating integration of H&S in procurement	Procurement related factors
• Lack of H&S knowledge among the Built environment (BE) stakeholders • Inadequate training / awareness programmes, • Lack of construction background for some contractor executives	Information / Knowledge related
• Hazardous material substances • Inadequate design hazards identification • Orientation of buildings	Design related factors

The following sections will discuss the factors, which affect H&S practices in Zimbabwe according to the emergent themes.

Management related factors

The research participants concur that H&S practices in Zimbabwe are affected by management related issues. The main factors / items identified by the interviewees under this cluster are 'perceived cost implications of H&S', inadequate H&S planning', 'inadequate integration of H&S into procurement', and 'inadequate commitment to finance H&S'. The factors identified under this cluster suggest that H&S practices are affected by a lack of contractor and client management commitment to H&S.

The research participants observe that contractors' management lack commitment to H&S. This observation was shared among interviewees from contractors, quantity surveyors, project managers, architects and government. The following excerpt from a site manager working for a contractor suggests that contractors are profit centred and perceive H&S as an extra cost.

> *"…contractors do not want to lose a single cent even if it means protecting the workers who help them make more money*."

The above is also buttressed by one of the architects, who asserted that key stakeholders such as clients, contractors and architects ignore fundamental H&S issues. Nevertheless, the trickle-down effects of inadequate commitment affect the other faculties of H&S management such as financial provision to implement H&S, and integration of H&S in the scheduling of construction work. The H&S Officers assert that production pressure exerted on workers to meet targets is compromising workers' H&S on projects. On the other hand, the resident engineer, and one of the architects concur that the local client is not prepared to pay for H&S – they respond only when the site is closed as a result of a H&S incident.

Inadequate commitment to H&S is amplified by the perceived cost implications of H&S, lack of knowledge, inadequate integration of H&S in procurement and the economic recession. With regards to the economic recession, previous studies by the ILO (2012) determined that H&S budgets are most likely to be revised downwards during periods of economic recession. In Zimbabwe, the economic recession characterised by liquidity crisis and high interest rates, increases the level of competition for the few available

projects. As a result of the need to out-compete each other to win the tenders, contractors may be 'forced' to focus on survival strategies thereby neglecting H&S.

Notwithstanding the above, the interviewees concurred that H&S practices on construction projects sponsored by the mining sector, international clients, and bank is above average. As noted by a consultant quantity surveyor, H&S practices are better in the mining sector where a contractor may lose a contract as a result of inadequate H&S practices. The commitment to H&S is driven by, among other factors, certification to international standards such as ISO and OSHAS. In these circumstances, the resident engineer highlighted that contractors and clients are compelled to implement H&S provisions on projects since an accident would affect the certification. This observation is shared by one of the SHE officers, who indicated that top-notch contractors embraced H&S as a merit to protect their image and also to secure contracts from better practice clients.

Financial provision related factors

The interviewees perceive that inadequate financial provision for H&S affects construction H&S practices. The key factors identified under this cluster are 'insufficient budgets for H&S', 'diversion of H&S resources', 'lack of understanding of H&S requirements by management' and 'lack of capacity by sub-contractors to price H&S'. The interviewees from the contractor and consultants generally concur that financial provisions for H&S are inadequate to cover H&S requirements on projects and hence adversely affect H&S practice. As observed by a consultant project manager, 'contractors provide the bare minimum for H&S - just enough to win tender'.

The interviewees identified several factors as influencing financial provision for H&S, namely, inadequate management commitment, the client's H&S specifications, perceived effect of the budget on the contractors' profit margin / tender competition, contractual clauses relative to H&S, and inadequate knowledge relative to pricing for H&S by the principal contractors and sub-contractors and inadequate consultation between the pricing and H&S departments. As noted by a construction manager for a contractor, the inadequacy of financial provision for H&S is amplified by the diversion of H&S funds to other project functions or simply diverting the resources for personal use by the contractor.

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Consistent with the above presentation, the interviewees from contractors, consultants, clients and government concur that financial provision for H&S is influenced by the client position relative to H&S. The interviewees acknowledge that while most clients are generally not committed to finance H&S, clients are the mining sector, international clients and banks are an exception, as H&S comes first before costs to these clients.

As noted by a quantity surveyor, the problem of inadequate financial provision for H&S is amplified by the increasing use of management contracting, where subcontractors are 'forced' to under-price to win the tender. In addition, research participants perceive that subcontractors lack the capacity to adequately price H&S.

The research findings suggest that inadequate financial provision is amplified by the diversion of the budgeted amount for H&S to other project activities. On one of the projects selected to administer workers' questionnaires, workers were not adequately provided with PPE, despite the fact that it was adequately priced from in the contract.

Compliance related factors

The interviewees from contractors, project managers, and the regulatory agency agree that inadequate H&S practices by site management and inadequate enforcement by the regulatory authority adversely affect H&S outcomes. The main factors in this cluster are 'inadequate resources (manpower and vehicles)', 'inadequate inspections and enforcements', and 'collusion'.

The research participants from the regulatory agency attribute the lack of enforcement of H&S provisions to a lack of adequate resources (manpower and vehicles), lack of local standards on occupational health, and inadequate reporting of occupational incidents. Although occupational health (OH) surveillance is conducted on construction projects, it is limited to once a year and mainly focuses on regulated medical conditions such as pneumoconiosis.

Another interviewee from the regulatory agency highlighted that the capacity of the regulatory agency to enforce H&S on construction sites is limited because of inadequate human and capital resources. For example, at the time of the study, only

13 inspectors were available to enforce H&S in Harare Metropolitan Province, part of Mashonaland West Province, part of Mashonaland East Province, and surrounding areas. The limited human resources to enforce H&S also limits the visibility of the NSSA at construction sites. The interviewee rated the level of compliance with H&S in the construction industry to approximately 23%. This assessment is consistent with the findings of NSSA (2012), which determined that the construction industry has the highest H&S non-compliance, estimated at approximately 80%.

The interviewees from contractors, client, consultants and government agree that the NSSA's reactionary approach to H&S contributes to poor H&S practices in the construction industry in Zimbabwe. As noted by the site manager, the NSSA reacts when an accident occurs on site. This observation is consistent with the regulatory authority wherein the research participants indicated that scheduled site inspections, and OH surveillance are limited to twice and once per year respectively.

The situation is compounded by the lack of enforcement of H&S by site management, and client representatives. As observed by the consultant project manager, clients depend on the appointed consultants or internal project managers to implement H&S on construction sites. Yet the responsibilities of the appointed internal project manager may be conflicting. In the following excerpt an internal project manager highlights how such conflicting responsibilities may compromise H&S practices.

> "… enforcement of H&S provisions is compromised by the need to balance the Project Manager's key result areas such as managing project time, cost and quality, and managing H&S."

At project level, the interviewees concurred that enforcement of H&S is affected by resistance to change by the workers. For example, the construction manager highlighted some workers complain of discomfort when using PPE, and that they also perceive that their output will be compromised because of the use of the PPE. This view, is however, not corroborated by the SHE Officer who indicated that workers cooperate with H&S education and regular awareness programmes.

It is notable that the interviewees from contractors and consultants generally concur that H&S practices are affected by collusion between the regulatory agency inspectors, and site management. A previous study conducted by Chigara and Moyo (2014) determined that collusion was a major factor contributing to poor H&S practices on construction projects in Zimbabwe.

Procurement related factors

The interviewees perceive that inadequate integration of H&S in procurement contribute to inadequate consideration of H&S during tendering. The main factors identified by respondents under this cluster are 'inadequate weighting of H&S during tender evaluation', 'vague reference to H&S in contract documents', 'siloed procurement', and 'inadequate consultants' role in facilitating integration of H&S in procurement'.

Although procurement offers an opportunity to deal with H&S issues during the upstream stage of the construction supply chain, the research participants highlighted that most clients in the public and private sector do not consider H&S issues during the procurement of project stakeholders such as contractors and consultants. This situation is exacerbated by the lack of sufficient regulations to enforce clients to make H&S a requirement during procurement. A project manager for the client indicated that the siloing of procurement away from project management functions contributes to inadequate consideration of H&S during procurement. An interviewee from government highlighted that H&S is not given priority when procuring construction works. The main requirement relative to H&S for the contractor to be considered to tender for public sector projects is the proof of current registration with the NSSA (statutory requirement).

The interviewees also identified the factors contributing to inadequate procurement relative to H&S. As observed by the executive director of a subcontractor firm, some clients do not have a full appreciation of H&S, wherein H&S practices are equated to the provision of PPE. The situation is amplified by the lack of a H&S department in most client organisations and inadequate role of construction consultants to inform the client relative to H&S.

Information / knowledge related factors

The interviewees from contractors, consultants, contractors and regulatory agency concur that inadequate information / lack of knowledge relative to H&S among construction stakeholders contributes to inadequate H&S practices in the construction industry. The factors perceived to contribute to inadequate H&S practices under this cluster are 'lack of H&S knowledge among BE stakeholders', 'inadequate training / awareness programmes' and 'lack of construction background among some contractor executives.'

The interviewees perceive that lack of knowledge relative to H&S is attributed to lack of construction background among contractor executives, lack of training, inadequate awareness, and inadequate inclusion of H&S in built environment programmes. However, lack of knowledge / information relative to H&S practices has far reaching implications for H&S management. It affects the commitment to H&S, hazard identification and risk management, and resource provision for H&S on construction sites. As noted by the SHE Officer, lack of basic knowledge among contractor's management, especially off-site management, contributes to the conflict between production targets and the need to ensure health and safe work practices.

Design related factors

The architects concur that inadequate design for H&S affects construction H&S practices in Zimbabwe. The factors identified by the interviewees under this cluster are 'hazardous material substances', 'inadequate design hazard identification', and 'orientation of buildings'. One of the architects observed that although the design for H&S is considered important, the principles that inform it are hardly considered in the construction industry in Zimbabwe. The architects concur that design can affect H&S through the selection of low risk materials and the orientation of the buildings.

6.3 PRESENTATION AND ANALYSIS OF FINDINGS FROM SURVEY DATA

6.3.1 Introduction

This section presents and discusses the research findings from the questionnaire surveys. The questionnaire consisted mainly of close ended Likert Scale type questions. Table 6.8 shows the interpretations of Likert Scales used in the survey.

Table 6.8 Interpretation of Likert scales

Scale	Meaning
1	Not at all, Strongly Disagree, Not Important, Never,
2	Minor, Disagree, Less than important, Rarely
3	Moderate, Neutral, Important, Sometimes
4	Near major, Agree, More than important, Often,
5	Major, Strongly Agree, Very important, Always

The mean scores will be interpreted according to the following ranges / scales:

- MS > 4.20 ≤ 5.00: between a near major to a major / major extent; agree to strongly agree / strongly agree; between more than important to very important / very important, and between often to always / always;
- MS > 3.40 ≤ 4.20: between a moderate to a near major / near major extent; agree to strongly agree / strongly agree; between important to more than important / more than important, and between moderate to often / often;
- MS > 2.60 ≤ 3.40: between a minor to moderate / moderate extent; agree to strongly agree / strongly agree; between less than important to important / important, and between rarely to moderate / moderate, and
- MS > 1.80 ≤ 2.60: between not at all to a minor / minor extent; agree to strongly agree / strongly agree; between not important to less than important; between strongly disagree to disagree, and between never to rarely / rarely (Smallwood, 2016).

6.3.2 Test of reliability

According to Hair *et al.* (2010), reliability is the extent to which a variable or a set of variables is consistent in what it is expected to measure. To determine internal reliability of the information collected Cronbach's alpha was calculated for the determinants of workers' exposure to hazards, occurrence of accidents, financial

provisions, return to work, and the impact of inadequate H&S on project parameters, impact of procurement on H&S and the importance of sustainability for H&S. The results are presented in Table 6.9.

Table 6.9 Test of reliability

Perception	Cronbach α values	No. of items
Determinants of workers' exposure to hazards	0.871	9
Determinants of the occurrence of fatalities, injuries or disease	0.859	12
Determinants of financial provisions for H&S	0.730	6
Determinants of return to work	0.750	9
Determinants of financial difficulties	0.755	6
Effect of inadequate H&S o project parameters	0.783	5
Impact of procurement on H&S	0.970	9
Importance of sustainability principles for H&S	0.950	29

The results presented in Table 6.9 shows that the Cronbach's α are greater than the generally agreed upon lower limit for Cronbach's α is 0.70 (Hair *et al.,* 2010). The results suggest that the individual items or indicators of the scale are measuring the same construct and highly intercorrelated. Windapo (2013) states that a high Cronbach's α indicate that the research tool is reliable because it shows that the difference in opinion among respondents does not arise from the questionnaire being confusing or having multiple interpretations. According to Tavakol and Dennick (2011), internal consistency describes the extent to which all the items in a test measure the same construct and hence it's connected to the interrelatedness of items within the test.

6.4 EXPOSURE TO HAZARDS, FATALITIES, INJURIES, AND DISEASE

To understand the factors contributing to workers' exposure to hazards and the occurrence of workplace fatalities, injuries, and disease on construction sites, the study sought the perceptions of construction industry practitioners and workers. The results are presented and analysed in Section 6.4.1 and 6.4.2.

6.4.1 Determinants of workers' exposure to hazards

Table 6.10 indicates the extent to which factors / conditions result in workers being exposed to workplace hazards in terms of percentage responses to a scale 1 (not at all) to 5 (major extent), and a MS between 1.00 and 5.00, the midpoint being 3.00. It is notable that all the factors / conditions have MSs greater that the midpoint score of

3.00 suggesting that the effect of these factors relative to workers' exposure to hazards is deemed to be major as opposed to a minor extent.

Table 6.10 Determinants of workers' exposure to workplace hazards

Factor	Response (%)						MS	Rank
	Un-sure	Not at all……Major						
		1	2	3	4	5		
Lack of contractor H&S planning	0.0	1.1	8.8	16.5	35.2	38.5	4.01	1
Inadequate HIRAs	0.0	4.4	7.7	20.9	27.5	39.6	3.90	2
Inadequately managed hazards	0.0	1.1	10.1	24.7	38.2	25.8	3.78	3
Inadequate OH surveillance	0.0	1.4	8.1	31.1	32.4	27.0	3.76	4
Appointment of stakeholders who do not systematically manage H&S	1.1	2.2	12.2	16.7	41.1	26.7	3.74	5
Inadequate design HIRAs	2.3	4.5	12.5	20.5	27.3	33.0	3.65	6
Lack of integration of H&S and environmental systems	1.1	3.4	14.6	33.7	25.8	21.3	3.44	7
Inadequate design for H&S	1.1	6.6	14.3	29.7	26.4	22.0	3.40	8
Inadequate project management	0.0	6.7	25.6	33.3	15.6	18.9	3.14	9

Lack of contractor H&S planning (MS = 4.01) is perceived to be the main factor with regards to the extent to which factors / conditions result in workers' exposure to occupational hazards. From the MS range, given that 'lack of contractor H&S planning' has a MS > 3.40 ≤ 4.20, the extent to which this factor results in workers' exposure to occupational hazards is deemed to be between a moderate to a near major / near major extent. Lack of proper planning for H&S results in contractors lacking strategy and resources for H&S management, which can increase the risk of exposure to hazards. Although the contractor has the primary responsibility for H&S planning, lack of client and designers' involvement in H&S planning exacerbates the situation. The results are consistent with previous studies (Griffith and Howard, 2014), which determined that systematic planning for H&S is an important factor in achieving a healthy and safe environment.

The MSs for the factors ranked 1st to 7th are > 3.40 ≤ 4.20, suggests that these factors / conditions result in workers' exposure to occupational hazards between a moderate to a near major / near major extent. The factors ranked 8th and 9th have MSs > 2.60 ≤ 3.40, which indicates that respondents deem the effect of 'inadequate project

management' and 'inadequate design for H&S relative to workers' exposure to occupational hazards to be between a minor to a moderate / moderate extent. Some of the factors are discussed in the following paragraphs.

The results presented in Table 6.10 indicate that several factors contribute to workers' exposure to workplace hazards. The results also reinforce the importance of the role of multi stakeholders in H&S management. From a procurement perspective, the results reveal that appointment of contractors / designers who do not systematically manage H&S increase the risk of workers' exposure to hazards. This reinforces the importance of integrating H&S decision making within the upstream stages of the construction supply chain. The findings of this study are consistent with previous studies. A study conducted by Rwelamila and Smallwood (1999) determined that incorrect choice and use of procurement systems contribute to neglect of H&S by project stakeholders. Through inclusion of H&S in procurement systems, the H&S responsibility is shared by more stakeholders thereby reducing the passing of that responsibility solely unto contractors. Despite this, anecdotal evidence coupled with literature survey show that clients inadequately consider H&S as a precondition for the appointment of construction stakeholders.

The study results also indicate that workers' exposure to hazards is a consequence of inadequate HIRAs (MS = 3.90) and inadequate design HIRAs (MS = 3.65). The findings suggest that inadequate precautionary practices result in workers being exposed to hazards between a near major to a major extent. HIRA is paramount to sustainable prevention of workers exposure to hazards. The unidentified hazards expose workers to the risk of injury or death. Although contractors have a primary responsibility with regards to HIRAs, the results reinforce the notion that other stakeholders should also be involved. Designers have the responsibility to identify and communicate hazards associated with their designs to contractors and other project stakeholders. However, interviews with construction practitioners suggest that design HIRA information is hardly communicated to the project team. This problem is amplified by lack of explicit provisions within the H&S regulations regarding the role of designers in construction H&S. Nonetheless, the results corroborate findings from previous research which determined that inadequate hazard identification is one of the most significant threats to safe construction (HSE, 2006).

The other factor deemed to contribute to workers' exposure to hazards is inadequate occupational health surveillance (MS = 3.76). Occupational health (OH) surveillance is an important tool to ensure that controls of health hazards are working. It assists in early detection of changes in workers' health status as a result of work. Although OH surveillance is regulated in Zimbabwe for workers who are exposed to hazards such as noise, asbestos, silica, fumes, or dust; interviews with construction practitioners and personnel from the regulatory authority suggests OH surveillance is 'non-existent' on most construction sites. However, exceptions are noted at construction projects sponsored by clients from the mining sector. The findings confirm the results of a study in Zimbabwe (Moyo *et al.,* 2015) and South Africa (Deacon, 2003), which determined that that little exists in terms health surveillance in the construction industry. Nonetheless, lack of OH surveillance increase the risk of workers' exposure to work conditions that are detrimental to health.

The study findings indicate that workers' exposure to hazards is amplified by inadequate management of the identified hazards (MS = 3.78). The failure to manage identified hazards aggravates the risk of injury since workers will remain exposed to the hazard. This observation is corroborated by the results of the workers' survey. A previous study conducted by Carter and Smith (2006) determined that inadequately managed hazards increase the possibility and severity of accident occurrence. This reinforces the need to implement effective mechanisms for hazard management throughout the construction supply chain. However, failure to identify the hazards prior to construction and the subsequent overreliance on lower order control systems such as PPE, amplifies the problem.

The lack of integration of H&S and environmental management systems (MS = 3.44) is another factor / condition contributing to workers' exposure to workplace hazards. This may be explained through the synergy between H&S and the environment. Inadequate integration result in workers being exposed to agents of environmental hazards at construction sites. The results are consistent with the separation of environmental and H&S regulations, policies and procedures in Zimbabwe. However, failure to exploit the synergy that exist between the two frameworks may increase the risk of workers' exposure to environmental hazards.

The other factor perceived to lead to workers' exposure to hazards is inadequate designing for H&S (MS = 3.40). The concept of design for H&S is a preventative and precautionary strategy that facilitates elimination of potential hazards to workers' H&S through design. This principle is consistent with the traditional "hierarchy of controls" and is vital for sustainable construction H&S. However, designers' reluctance to adopt design for H&S as part of their standard practice (Gambatese, 2005) exposes workers to construction hazards and risk of accidents. Inadequate consideration of H&S throughout the design process exposes construction workers to hazards arising from the choice of materials and construction methods employed. The results confirm earlier findings of a study conducted by Griffith and Howard (2014), in which the design stage was identified as the most effective time to consider project H&S and eliminate potential hazards.

Table 6.11 presents an assessment of the factors contributing to workers' exposure to hazards by respondent groups.

Table 6.11 Determinants of workers' exposure to hazards by respondent group

Factor / Variable	Contractor		Consultants		Government		Overall	
	MS	Rank	MS	Rank	MS	Rank	MS	Rank
Lack of contractor H&S planning	3.98	1	4.06	1	4.00	3	4.01	1
Inadequate HIRAs	3.87	2	3.81	2	4.20	1	3.90	2
Inadequately managed hazards	3.84	3	3.73	3	3.67	7	3.78	3
Inadequate OH surveillance	3.80	4	3.56	5	4.08	2	3.76	4
Appointment of stakeholders who do not systematically manage H&S	3.72	5	3.70	4	3.87	5	3.74	5
Inadequate design HIRAs	3.72	5	3.36	6	4.00	3	3.65	6
Lack of integration of H&S and environmental systems	3.33	7	3.47	7	3.71	6	3.44	7
Inadequate design for H&S	3.31	8	3.38	8	3.67	7	3.40	8
Inadequate project management	3.31	9	2.80	9	3.33	9	3.14	9

The results presented in Table 6.11 show that there are no major variations in the perception of construction practitioners from contractors, consultants, and government relative to the factors contributing to workers' exposure to hazards. It is notable contractors and consultants perceive that lack of contractor H&S planning is the main factor leading to workers' exposure to hazards. However, this factor is rated 3rd by the

government. Nonetheless, the results suggest that respondents concur that 'inadequate contractor H&S planning', inadequate HIRAs', inadequate OH surveillance' and 'appointment of stakeholders who do not systematically manage H&S' are the top 4 key factors contributing to workers' exposure to hazards. It is notable that these factors have MSs > 3.40 ≤ 4.20, suggesting that these factors / conditions result in workers' exposure to occupational hazards between a moderate to a near major / near major extent. The results imply that improving contractor H&S planning, HIRAs, OH surveillance and integrating H&S in procurement will potentially improve H&S outcomes. On the other hand, inadequate project management is perceived to the least factor contributing to workplace by all the three respondent groups. The general agreement among the construction stakeholders relative to factors contributing to accidents is important relative to designing intervention strategies to improve the situation.

6.4.2 Determinants of workplace injuries, disease and fatalities

Table 6.12 indicates the extent to which contractors, government and consultants collectively perceive the selected factors / conditions to result in workers' exposure to risk of accidents and the resulting fatalities, injuries, or disease in terms of percentage responses to a scale 1 (not at all) to 5 (major), and MS between 1.00 and 5.00, the midpoint being 3.00.

Table 6.12 Factors contributing to workplace fatalities, injuries and disease

Factor / Condition	Response (%)						MS	Rank
	Unsure	Not at all……Major						
		1	2	3	4	5		
Unsafe work practices	0.0	1.1	6.6	9.9	29.7	52.7	4.26	1
Inadequate H&S inspections and enforcements	0.0	2.2	6.7	15.6	37.8	37.8	4.02	2
Inadequately managed hazards	0.0	1.1	8.9	18.9	37.8	33.3	3.93	3
Inadequate H&S planning	1.1	1.1	7.8	20.0	43.3	26.7	3.83	4
Inadequate training	1.1	0.0	6.7	28.9	33.3	30.0	3.83	4
Inadequate design HIRAs	1.1	2.2	11.0	28.6	27.5	29.7	3.68	6
Inadequate management commitment to H&S	1.1	2.2	11.0	23.1	38.5	24.2	3.68	6
Shortcomings with equipment & PPE	0.0	4.4	11.1	21.1	45.6	17.8	3.61	8
Poor site layout	0.0	3.3	11.0	29.7	34.1	22.0	3.60	9
Inadequate OH surveillance	1.1	1.1	13.3	26.7	38.9	18.9	3.58	10
Appointment of stakeholders who do not systematically manage H&S	0.0	5.5	6.6	34.1	33.0	20.9	3.57	11
Inadequate project management	0.0	4.4	14.3	39.6	26.4	15.4	3.34	12

It is notable that all the factors / conditions have MSs > 3.00, which indicates that the respondents perceive the factors to contribute to the occurrence of injuries, diseases or fatalities to a major extent as opposed to a minor extent. From the MS range, given that 'unsafe work practice' has a MS > 4.20 ≤ 5.00, it suggests that respondents deem the extent to which this factor results in the occurrence of fatalities, injuries, or disease to be between a near major to a major / major extent. The results suggest that construction practitioners from contractors, consultants, and government perceive that 'unsafe work practice' is the leading contributor to the occurrence of injuries, diseases or fatalities at construction sites. This result substantiates the findings from previous studies which determined that most accidents and resulting injuries are attributed to unsafe acts (Choudhry *et al*., 2008). The research findings imply that investing in H&S practices that seek to address workers' behaviour is necessary to realise improved H&S outcomes. The results are generally consistent with the workers' survey which determined that unsafe work practice is a leading factor relative to the occurrence of injuries, disease and fatalities.

It is notable that the factors ranked from the 2nd to 11th have MSs > 3.40 ≤ 4.20, which indicates that the respondents deem the extent to which these factors / conditions result in the occurrence of injuries, diseases, or fatalities to be between a moderate to a near major / near major extent. The results presented in Table 6.11 show that the factors, which fall under this band are 'inadequate H&S inspections and enforcements', 'inadequately managed hazards', 'inadequate H&S planning', 'inadequate training', 'inadequate design HIRAs', 'inadequate management commitment to H&S'. shortcomings with equipment and PPE', 'poor site layout' and 'inadequate OH surveillance'. The results suggest that workplace injuries, disease and fatalities are caused by factors along the construction supply chain arising from the shortcomings of several stakeholders.

From a compliance management perspective, the construction practitioners perceive that 'inadequate H&S inspections and enforcements' and 'inadequate occupational health (OH) surveillance' result in workers being exposed to risk of injuries, disease and fatalities at construction sites. In an industry characterised by inadequate commitment to H&S, the need for enforcement of regulatory provisions cannot be overstated. However, due to a cocktail of factors discussed in Section 6.2.2, the

regulatory authority is not implementing these provisions in a comprehensive manner. The situation is compounded by the lack of corresponding efforts from contractors and clients to enforce the H&S provisions at construction sites. The problem of inadequate enforcement of regulations is also highlighted previous studies in South Africa (Deacon, 2003) and Zimbabwe (Chigara and Moyo, 2014).

The results suggest that workers are exposed to fatalities, injuries, or disease because of some site management inadequacies. This observation is confirmed by the influence of factors such as 'inadequately management hazards', 'inadequate planning', 'inadequate training', 'shortcomings with equipment / PPE', and 'poor site layout'. This finding reinforces the important role of contractors in ensuring a healthy and safe work environment. The contractors have a responsibility to provide a healthy and safe work environment for their workers and to ensure that production takes place in a safe manner. However, the results presented in Table 6.10 and Table 6.12 collectively suggest that contractors H&S practices may increase workers' exposure to risk of injuries, diseases or fatalities. The results generally confirm the findings of previous studies (Edmund, 2015; Chigara and Moyo, 2014; Musonda and Smallwood, 2005).

The respondents from contractors, government and consultants also perceive that workers' exposure to risk of fatalities, injuries, or disease is attributable to 'inadequate design hazard identification and risk assessment (HIRAs)'. While prevention through design (PtD) is regulated in some countries, in Zimbabwe, the construction H&S regulations are not explicit with regards to the role of designers relative to H&S. Against that background, designers may lack legal, contractual, or regulatory motivation to provide information with regards to the H&S risks associated with their designs. The nature of training for designers (cidb, 2009) also influence their approaches to design for H&S. However, failure to conduct design HIRAs may increase the risk of workers' exposure to hazards and the associated incidences of injuries, diseases or fatalities. The results are, however, partially at variance with the designers' assessment of the extent to which they incorporate H&S issues within the design process. The designers deem the extent to which they consider H&S issues in design (MS = 3.22) to be between a minor to a moderate / moderate extent.

The results presented in Tables 6.10 and 6.12 further indicate that workers' exposure to the risk of fatalities, injuries, or disease is attributed to the appointment of construction stakeholders (contractors and / designers) who do not systematically include H&S in their operations. This is perceived to increase the risk of fatalities, injuries, or disease through the actions of the appointed stakeholders. While the client may not be directly involved with the daily management of the project, they have an influence relative to the occurrence of accidents through their actions in the appointment of project stakeholders. The results are consistent with Rwelamila and Smallwood (1999), who determined that incorrect choice and use of procurement systems contribute to neglect of H&S by project stakeholders. This further reinforces the important role of clients with regards to sustainable H&S practices.

It is notable that the factors contributing to workplace injuries, disease or fatalities corroborate with interview findings. The results further reinforce the important role of multi stakeholders relative to prevention of the occurrence of fatalities, injuries, or disease at construction sites. The results further confirm earlier findings by Schulte *et al.* (2012) who determined that most workplace diseases, injuries and other health conditions are multi-factorial.

Table 6.13 presents the results of an analysis of the factors contributing to the occurrence of injuries, disease or fatalities against the respondent's organisation. It is notable that the ratings of contractors, consultants and government relative are not significantly different. For example, the three respondent groups perceive that the top four factors contributing to injuries, disease or fatalities are 'unsafe work practices', 'inadequate H&S inspections', 'inadequately managed hazards' and 'inadequate H&S planning'. There is consensus among the respondent group that workplace injuries, disease or fatalities are caused by unsafe work practices. This implies that addressing workers behaviour and related factors is important in trying to reduce the occurrence of workplace injuries, disease or fatalities.

Table 6.13 Factors contributing to fatalities or injuries by respondent groups

Factor / Variable	Contractors		Consultants		Government		Mean	
	MS	Rank	MS	Rank	MS	Rank	MS	Rank
Unsafe work practices	4.22	1	4.26	1	4.40	1	4.26	1
Inadequate H&S inspections and enforcements	3.93	2	4.07	2	4.20	3	4.02	2
Inadequately managed hazards / Inadequate HIRAs	3.93	2	3.87	3	4.07	4	3.93	3
Inadequate H&S planning	3.80	5	3.68	5	4.29	2	3.83	4
Inadequate training	3.86	4	3.74	4	3.93	8	3.83	4
Inadequate design HIRAs	3.76	6	3.38	11	4.07	4	3.68	6
Inadequate management commitment to H&S	3.75	7	3.61	6	3.60	12	3.68	6
Shortcomings with equipment & PPE	3.51	12	3.60	7	3.93	8	3.61	8
Poor site layout	3.58	8	3.48	8	3.93	8	3.60	9
Inadequate OH surveillance	3.54	10	3.42	9	4.00	6	3.58	10
Appointment of stakeholders who do not systematically manage H&S	3.53	11	3.42	9	4.00	6	3.57	11
Inadequate project management	3.57	9	3.03	12	3.27	11	3.34	12

6.4.3 Factors contributing to incidents: workers' perspectives

The workers were asked to list the factors / conditions, which may contribute to the occurrence of workplace injuries, diseases or fatalities on construction projects. The inclusion of workers' perceptions regarding the factors leading to fatalities, injuries, or disease is important because workers often identify specific problems (Khosravi *et al.*, 2014). In addition, workers are the downstream recipients of the industry directly affected by decisions made upstream (Deacon and Smallwood, 2016)

The content analysis of the workers' responses to the open-ended question relative to the occurrence of fatalities, injuries, or disease on construction projects revealed that several factors are perceived to contribute to the occurrence of injuries, diseases or fatalities. The responses to open-ended question relative to the factors contributing to the occurrence of fatalities, injuries, or disease was analysed qualitatively and the results from the analyses were transformed into quantitative data and presented as frequencies. The factors were selected through a process involving coding the responses and then condensing them into seven common categories / themes (Khosravi *et al.*, 2014) namely, 'management factors', 'workplace practice', 'hazard identification and risk assessment', 'information / knowledge', 'PPE', 'plant and equipment', and 'anxiety'. The themes were named in accordance with literature.

Broadly, the factors identified by workers can be classified under 'unsafe conditions' and unsafe acts' analogue. These results reinforce Henrich and the ARCTM accident causation model (Abdelhamid and Everett, 2000).

The results presented in Table 6.14 indicate that the occurrence of accidents, fatalities, injuries, or disease at a construction site is a function of several factors. The factors are discussed below under their main thematic headings.

Table 6.14 Factors contributing to workplace incidents

Factor		**Frequency**	**%**
Management	Poor communication	13	39.4
	Pressure to meet targets	10	30.3
	Site conditions / layout	6	18.2
	Management style	4	12.1
	Total	**33**	**100.0**
Workplace practice	Negligence	17	53.1
	Drug abuse	7	21.9
	Shortcuts	4	12.5
	Failure to adhere to regulations	4	12.5
	Total	**32**	**100**
Hazard identification and risk assessment (HIRA)	Inadequate risk assessment & response	6	28.6
	Exposure to falling objects	5	23.8
	Work at heights	5	23.8
	Total	**21**	**100**
Information / Knowledge	Inadequate training	10	55.6
	Lack of knowledge	8	44.4
	Total	**18**	**100**
Personal protective equipment (PPE)	Inadequate provision of PPE	9	64.3
	Inappropriate PPE / Use of PPE	5	35.7
	Total	**14**	**100**
Plant and equipment	Overloading the scaffold	5	38.5
	Failure / Collapse of equipment	3	23.1
	Moving equipment	3	23.1
	The use of power tools	2	15.4
	Total	**13**	**100**
Anxiety	Stress, fear	7	58.3
	Late payment of salaries	5	41.7
	Total	**12**	**100**

Management related factors

The workers perceive that inadequate construction management is the predominant factor with regards to the occurrence of accidents, injuries, diseases and fatalities at construction sites.

In accordance with their frequencies, the workers perceive that the factors contributing to the occurrence of fatalities, injuries, or disease under this cluster are 'poor communication', 'pressure to meet targets', 'site conditions', and 'management style'. The construction workers highlighted that poor communication exists between management and workers. The results of workers' assessment of factors leading to the occurrence fatalities, injuries, or disease corroborates interview findings relative to the effect of 'pressure to meet production targets'. The results imply that securing top management support relative to H&S is important to enhance better H&S practices.

Workplace practices

The workers perceive that the factors, which contribute to workplace injuries, diseases and fatalities under this cluster include 'negligence', 'drug abuse', 'shortcuts' and 'failure to adhere to regulations'. It is notable that workers identified their own actions as contributing to workplace accidents. This suggests that workers should be integrated to improve H&S practices. The workers perceive that 'negligence' is the main factor contributing to workplace incidents followed by drug abuse. The key items listed under negligence include lack of concentration, horse play, use of cell phones, and carelessness. The findings reinforce the importance of behaviour-based change among construction workers as a strategy to improve H&S practice.

Hazard identification and risk assessment (HIRAs)

As depicted in Table 6.14, the workers perceive that factors which fall under this cluster include 'inadequate risk assessments and response', 'work at heights' and 'exposure to falling objects'. The workers perceive that inadequate pre-job HIRAs are a main cause of the occurrence of fatalities, injuries, or disease under this category. In addition, workers highlighted exposure to hazards, such as work at heights and falling objects as contributing factors to the occurrence of fatalities, injuries, or disease on construction projects. This demonstrates that site management has a significant bearing on the H&S of construction workers. The situation is compounded by the lack of H&S knowledge among workers and inadequate management of identified hazards.

Information / knowledge related factors

This cluster comprises two factors, namely, 'inadequate training' and 'lack of knowledge'. The workers perceive that they are exposed to a risk of fatalities, injuries, or disease because of lack of knowledge and inadequate training. A combination of inadequate training and a lack of knowledge with regards to H&S work tasks compounds the problem. Although workers are trained with regards to H&S, the depth of training is shallow and mostly limited to tool box talks. The results suggest that contractors do not just have a responsibility for providing H&S education, but to also increase the effectiveness training through integrating it with behaviour-based interventions.

In addition to the above clusters, the workers also perceive that workers are exposed to risk of injuries, disease and fatalities because of the lack of PPE, plant / equipment and anxiety related factors.

The results from the workers' survey are generally consistent with the findings from previous studies. In a recent study, Cubies and Felipe (2017) determined that lack of PPE, fear of retaliation when demanding safe sites, employers' unsafe demands of productivity over safety, and inadequate / no training as the most common factors leading to occupational injuries and illnesses. In another study, Sherratt *et al.* (2015) determined that unsafe acts contributed approximately 80-90% of accidents.

6.4.5 Types of accidents

The construction practitioners from the government, contractors and consultants were asked to highlight the types / nature of accidents occurring on a construction project based on the experience from one project they participated within the last five years. The results are presented in Figure 6.3.

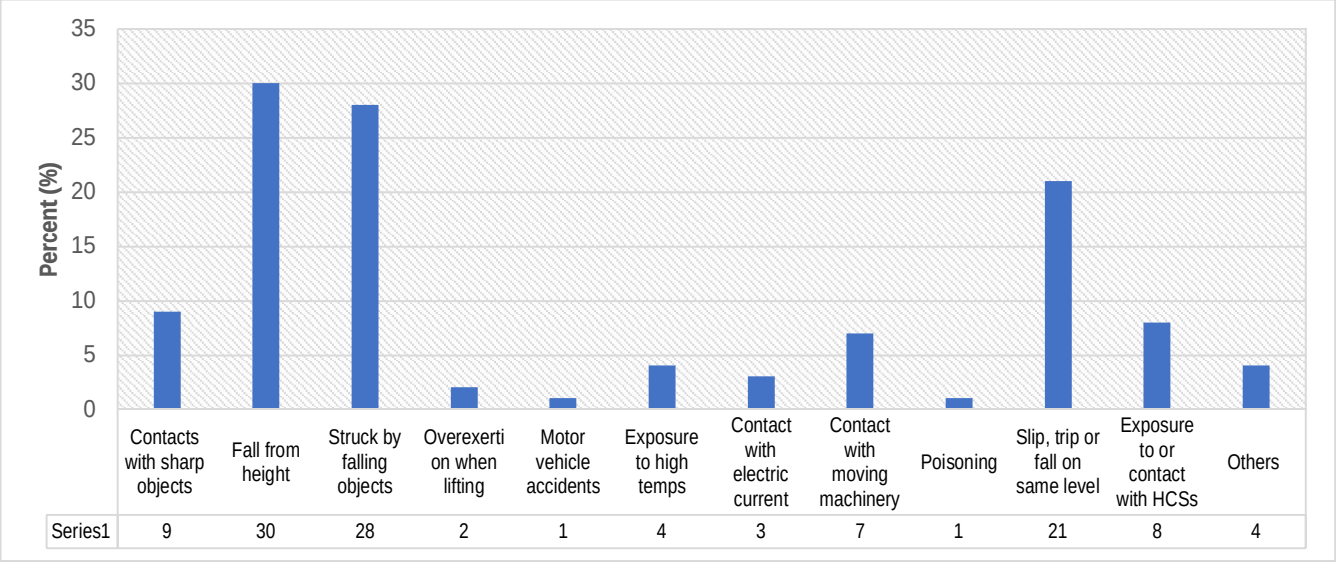

Figure 6.3 Types of accidents on construction projects

The results in Figure 6.3 indicate that the most common type of accidents on construction projects in Zimbabwe are falls of persons from height, struck by falling objects, slips / trips, contacts with sharp objects, exposure to electric current and contact with moving machinery. The respondents highlighted that workers fall from improperly secured scaffolding and ladders. In addition, workers are hit by falling materials and hand tools. The results of this study are consistent with the NSSA statistics with regards to the types of construction accidents.

These results reinforce the results from Table 6.10 and 6.12, which indicates that workers are exposed to hazards because of improper management of the hazards, inadequate HIRAs and inadequate enforcements of H&S provisions including the provision of PPE and training. The results reinforce the need for a holistic approach anchored on preventative strategies to H&S management. The results of this study also confirm the results of a study conducted by Enshassi *et al.* (2014), which determined that falls from height, electric shock, and slips / trips were they main types of construction accidents in the Gaza strip. The results reinforce the importance of hazard prevention and control / management on construction projects.

6.4.6 Overview of the factors contributing to workplace injuries

In conclusion, it is notable that the findings from interviews, and questionnaires with contractors, consultants and government imply that H&S practices are inadequate.

This is demonstrated by the congruence of the results from the interviews, and questionnaire survey of contractors, consultants, government, and workers. The results indicate that several factors affect H&S practices in Zimbabwe.

The factors contributing to inadequate H&S practices from the interview findings were grouped into six clusters, namely management related factors, financial provision related factors, compliance related factors, procurement related factors, information / knowledge related factors and design related factors. The factors developed from the workers' questionnaire were clustered into six thematic areas, namely management factors, workplace factors, HIRAs, PPE, plant and equipment, and anxiety.

The survey results for contractors, consultants and government suggest that the top five factors contributing to exposure to hazards are inadequate H&S planning, inadequate HIRAs, inadequately managed hazards, inadequate OH surveillance and appointment of stakeholders who do not systematically manage H&S. In addition, the results also show that the top five contributors to the occurrence of injuries, disease or fatalities are: unsafe work practices, inadequate enforcements, inadequately managed hazards, inadequate H&S planning, and inadequate training.

It is notable that the results of the questionnaire survey for both workers and construction practitioners, and interviews, are consistent and confirm that H&S management is influenced by the activities of several stakeholders upstream and downstream of the construction supply chain. Regrettably, fragmentation of the regulatory framework for H&S makes the enforcement of H&S responsibilities to duty holders difficult. Nevertheless, the accord among construction stakeholders relative to factors contributing to poor H&S performance / inadequate H&S practices is important for developing sustainable solutions. However, the multifarious nature of the sources of the H&S problem suggest that the intervention strategy should seek to integrate the activities of the construction stakeholders with a bearing on H&S practices.

Although general agreement is observed among construction practitioners and workers relative to factors contribution to inadequate H&S practice, some divergent assessment was noted relative to the impact of site management and construction supply chain related factors. The results presented in Table 6.12 suggest that workers perceive that

factors which result in accidents in construction are workplace based, and revolve around the role of the contractor and workers. However, the results presented in Table 6.11 reveal that workplace accidents arise from the activities / omissions along the construction supply chain.

6.5 PROCUREMENT AND FINANCIAL PROVISION FOR H&S

6.5.1 Introduction

Financial provision for H&S is important for the effective implementation of sustainable prevention initiatives. This section discusses the impact of inadequate facilitation of financial provision on construction H&S practices, and the factors that determine the quantum of financial provision made for H&S.

6.5.2 Financial provision for construction H&S

The survey sought to determine the perceptions of construction practitioners in government, contractors, and consultants relative to the extent to which contractors facilitate the provision of adequate budget for H&S. The results of this assessment are presented in Table 6.15.

Table 6.15 Facilitation of financial provisions for H&S

Statement	Response (%)						MS	Rank
	Unsure	Not at all…….. Major						
		1	2	3	4	5		
Provision of financial resources towards construction H&S	3.1	10.3	40.2	28.9	9.3	8.2	2.56	1

Given that the MS for ‘provision of financial resources towards construction H&S’ is below the midpoint of 3.00, the results indicate that respondents deem the extent to which contractors make financial provision for H&S to a minor as opposed to a major extent. The results are consistent with the interview results, which determined that contractors insufficiently provide financial resources for H&S.

The construction practitioners from contractors, consultant quantity surveyors, and government were asked to assess the extent to which inadequate facilitation of financial provision affects H&S practices in terms of percentage responses to a scale of 1 (not at all) to 5 (major), and MS range from 1.00 to 5.00, the midpoint being 3.00. The results are presented in Table 6.16.

Table 6.16 Extent to which non-facilitation of financial resources affect H&S

Statement	Response (%)						MS	Rank
	Unsure	Not at all…….. Major						
		1	2	3	4	5		

Effect of non-facilitation of financial provision on H&S	5.9	3.5	4.7	16.5	28.2	41.2	3.81	1

Given that 'inadequate facilitation of financial resources for H&S' has a MS > 3.40 ≤ 4.20, it suggests that respondents deem the effect of this factor relative to H&S to be between a near major to a major / major extent. Financial provision enables H&S activities and the implementation of programmes. Inadequate financial provision for H&S affects preventive initiatives relative to H&S. The results are consistent with the findings from interviews with construction industry practitioners and previous studies (Hon *et al.*, 2012), which determined that inadequate provision of resources for H&S is an obstacle to implementation of H&S initiatives.

6.5.3 Factors influencing financial provision for H&S

Table 6.17 indicates the respondents' perceptions with regards to the extent to which selected factors influence contractors' financial provision for construction H&S in terms of percentage responses to a scale of 1 (not at all) to 5 (major), and a MS range from 1.00 to 5.00, the midpoint being 3.00. It is notable that all the factors / conditions have MSs above the midpoint score of 3.00, which indicates that the respondents deem the effect of these factors is deemed to be major as opposed to minor.

Table 6.17 Determinants of financial provisions for H&S

Factor / Variable	**Response (%)**						**MS**	**Rank**
	Unsure	**Not at all…….. Major**						
		1	**2**	**3**	**4**	**5**		
Inadequate client commitment	2.9	4.4	7.4	20.6	25.0	38.2	4.37	1
Inadequate weighting of H&S during tender evaluation	3.0	3.0	3.0	17.9	25.4	47.8	4.03	2
Tender competition	0.0	7.4	13.2	11.8	30.9	36.8	3.76	3
Non-specific contract clauses relative to H&S	0.0	5.9	14.7	16.2	27.9	35.3	3.72	4
Lack of standard framework for H&S pricing	1.5	7.4	8.8	20.6	26.5	35.3	3.69	5
Inadequacies in H&S regulations	1.5	10.3	16.2	27.9	14.7	29.4	3.32	6

To demonstrate the degree of agreement among the various respondents to the issues under investigation, a composite analysis is presented in Table 6.17.

The results suggest that 'inadequate client commitment' to finance H&S is the overall leading factor affecting contractors' financial provisions for construction H&S. The MS

for this factor lies in the range MSs > 4.20 ≤ 5.00 suggesting that the respondents deem the extent to which this factor affects financial provision for H&S to be between a near major to a major / major extent. In addition to reinforcing the important role of clients relative to H&S, this result is consistent with the results of the interviews, wherein respondents perceive that contractors' H&S budget is influenced by a client's H&S specifications. As financiers of projects, clients can directly and indirectly influence the amount of financial provision for H&S. The results concur with previous studies, wherein client's ignorance of H&S was perceived to contribute to contractors cutting their inputs into H&S management (Zou *et al.*, 2010) as they try to manage the risk of losing the tender to some contractors who inadequately price for H&S (Enshassi, 2000).

It is notable that 66.7% of the factors have MSs > 3.40 ≤ 4.20, which indicate that the effect of these factors is deemed to be between a moderate to a near major / near major extent. Inadequate weighting of H&S during tender evaluation (MS = 4.03) is more likely to lead to contractors undercutting their H&S budgets and consequently lacking resources for effective implementation of the H&S plan. In addition, clients who are less committed to H&S are more likely to inadequately include H&S as a key criterion for the appointment of contractors.

The respondents also perceive that the level of tender competition (MS = 3.76) contributes to contractors providing inadequate resources for H&S. The aforementioned is exacerbated by the preference for the traditional method of procurement (which favours competitive bidding), economic recession and shortage of projects. For instance, in the case of 77.6 % of projects in which respondents participated in the last five years, the traditional procurement approach was adopted. The results are, however, generally consistent with previous studies (Enshassi, 2000; Smallwood and Emuze, 2014), who determined that competitive bidding marginalises H&S through inadequate provision of financial resources.

The results in Table 6.17 also indicate that non-specific contract clauses relative to H&S (MS = 3.72) result in contractors lacking resources for H&S. The standard forms of contracts make implied reference to H&S. With respect to the foregoing, respondents were asked to indicate the type of contract document used on a previous

project they participated in the last five years. The results suggest that 36.8% used standard forms of contract, and 23.5% the NJPC. These contract documents make implicit provision with regards to H&S, thereby making H&S a non-contractual issue, which makes it difficult to administer alongside other contractual obligations. Such omissions promote minimal H&S provision by contractors, enough to satisfy regulatory and tender requirements. This finding confirms previous research findings (Kartam *et al.*, 2000), which determined that most contractors do not consider H&S costs in their tenders unless it is recognised in contract documents. Another study conducted by Smallwood and Emuze (2014) determined that contract documentation inadequately addresses H&S issues.

The results also show that lack of standard framework for H&S pricing (MS = 3.69) result in contractors lacking resources for H&S. This may be explained by the lack of a structured Bill of Quantities (BOQs) for H&S pricing. The aforesaid result in lack of parity with regards to H&S pricing. The available structure for H&S pricing relies on the provision of a lump sum in the Preliminaries and Generals (P&Gs) section of the BOQ. However, this provision does not give the assessor a yardstick to check the adequacy of the budget, thereby making it difficult for the client to assess validity of tenders on a 'like for like' basis (Sumner and Farrell, 2003).

To conclude this section, it is important to highlight that the analysis presented in Table 6.17 substantiates the important role of procurement relative to improving construction H&S practices. Nevertheless, inadequate integration of H&S in procurement of key project stakeholders and other suppliers exacerbates the problem. The following section will assess the extent to which H&S is integrated in procurement.

6.5.4 The H&S considerations in the procurement of stakeholders

The integration of H&S in procurement facilitates the consideration of H&S during the upstream phases of the project development. This gives the client a great opportunity to screen those stakeholders who do not systematically consider H&S in their practice. Table 6.18 indicates the respondents' perceived assessment of the extent to which H&S is integrated in the procurement of contractors and designers in terms percentage response on a scale of 1 (not at all) and 5 (major), and a MS range between 1.00 and 5.00, the midpoint being 3.00.

Table 6.18 H&S consideration upon appointment of project stakeholders

Stakeholder	Response (%)						MS	Rank
	Unsure	Not at all…….. Major						
		1	2	3	4	5		
Contractors	2.6	10.5	22.4	30.3	158	18.4	3.01	1
Designers	0.0	23.8	28.6	23.8	14.3	9.5	2.57	2

Given that the MS is > 2.60 ≤ 3.40 with regards to contractor appointment, it suggests that respondents perceive the extent to which H&S is incorporated into procurement of contractors to be between a minor to a moderate / moderate extent. This reinforces the interview results, which revealed that some 'better practice' clients include H&S issues (such as demonstrated commitment to H&S, past performance, and H&S budgets) into procurement protocols for contractors. Regrettably, the better practice clients are an exception as the majority of clients have not integrated H&S in their procurement practices. According to Smallwood (2005), clients' consideration of H&S during procurement is based on lower order H&S requirements.

With regards to the procurement of designers, the MS is > 1.80 ≤ 2.60, which indicates that respondents perceive the extent to which H&S is integrated into the procurement of designers to be between not at all (never) to a minor / minor extent. The lack of H&S specifications relative to the appointment of designers implies that the consideration of H&S issues during design is to the discretion of the designer. Regrettably, previous studies suggest that designers sub-optimally integrate H&S in design (Gambatese *et al.*, 2017). However, the results of this study indicate that designers deem the extent to which they consider H&S during the design process (MS = 3.22) to be between a minor extent to a moderate / moderate extent. The lack of explicit provision within the H&S regulations relative to design for H&S exacerbates the problem.

6.5.5 The effects of procurement on H&S

The respondents were asked to rate the extent to which selected procurement factors / conditions affect H&S in terms of percentage responses to a scale of 1 (not at all) to 5 (major), and MS between 1.00 and 5.00, the midpoint being 3.00. Table 6.19 shows the extent to which selected procurement variables / factors affects H&S practice. It is notable that all the factors have MS greater than the midpoint score of 3.00, which suggest that the effect of these factors is deemed to be a major as opposed to a minor effect. The results presented in Table 6.19 indicate that the factors ranked 1st to 6th

have MSs > 3.40 ≤ 4.20, which indicates that respondents deem the extent to which these factors affect H&S to be between a moderate to a near major / near major extent.

The results suggest that inadequate inclusion of H&S in the contract documents (MS = 4.04) is perceived to be the factor with the greatest effect on H&S. The results confirm the findings of a study conducted approximately two decades ago (Smallwood, 1998), which determined that contract documentation makes general reference to H&S. Inadequate inclusion of H&S in contract documents affects resource provisions for H&S and enforcement of H&S issues as contractual obligations.

Table 6.19 The effect of procurement on H&S

Procurement factor / Condition	Response (%)						MS	Rank
	Unsure	Not at all…….. Major						
		1	2	3	4	5		
Inadequate inclusion of H&S in contract documents	1.1	3.3	5.6	12.2	35.6	42.2	4.04	1
Appointment of contractors who have not fully considered H&S aspects of a project	1.1	4.4	3.3	21.1	34.4	35.6	3.90	2
Inadequate contractor financial resources provision	1.1	5.6	5.6	16.7	33.3	37.8	3.89	3
Pushing H&S issues to project implementation stage	3.3	2.2	7.8	13.3	36.7	36.7	3.88	4
Inadequate client commitment to finance H&S	2.2	6.7	6.7	13.3	28.9	42.2	3.87	5
Appointment of designers who do not systematically consider H&S aspects in design	4.4	3.3	5.6	16.7	34.4	35.6	3.80	6
Client procurement strategy	7.8	3.3	10.0	27.8	33.3	17.8	3.29	7
Late appointment of contractors and other project stakeholders	6.7	20.0	20.0	24.4	23.3	5.6	2.54	8

The research results show that H&S is marginalised by appointment of stakeholders such as contractors (MS = 3.90) and designers (MS = 3.80) who do not systematically consider H&S aspects of the project. This is consistent with the inadequate integration of H&S in the appointment of contractors and designers. The lack of a proper system to remove stakeholders who do not show demonstrated commitment to H&S increase the risk of accidents. The aforementioned reinforces the need to revise procurement protocols to ensure that appointed stakeholders are committed to H&S of workers and the public. Previous studies have demonstrated that if clients integrate H&S into all stages of the procurement process, contractors and suppliers will need to demonstrate their ability to meet these requirements (ASCC, 2006; AIHA, 2005).

The respondents perceive that H&S practice is affected by the amount of resources contractors allocate towards H&S (MS = 3.89). Resources are necessary for effective implementation of H&S initiatives. However, available evidence from interviews and past studies demonstrate that contractors' H&S budgets are insufficient to cover the H&S aspects.

The results indicate that respondents perceive that postponing the consideration of H&S issues until project implementation (MS = 3.88) adversely affect H&S. This challenge with this arrangement is that the H&S responsibility is exported to contractors. Although this result confirms the long-held understanding that contractors bear the greatest responsibility for H&S (Lingard *et al.,* 2008), it is inconsistent with the growing body of evidence in which H&S is considered as a multi-stakeholder responsibility.

The other factor perceived to adversely affect H&S performance is inadequate client commitment (MS = 3.87). The client can directly / indirectly influence H&S through inclusion of H&S as a criterion for procurement of suppliers, contractors and designers, and adopting conditions of contract that incorporate H&S. However, lack of commitment towards H&S affects the preparedness of the client to finance H&S, and hence to integrate H&S in procurement systems.

Two factors, namely, 'choice of procurement strategy' and 'late appointment of contractors' have MSs > 2.60 ≤ 3.40, suggesting that the effect of these factors relative to H&S performance is deemed to be between a minor to a moderate / moderate extent. The procurement strategy determines the stage at which H&S is addressed within the construction supply chain. However, the perception by respondents relative to the effect of late appointment of contractors on H&S is inconsistent with the growing body of knowledge suggesting that early involvement of contractors in the project development stages has a positive bearing on H&S.

6.6 THE EFFECTS OF FATALITIES, INJURIES, AND DISEASE

6.6.1 Introduction

The study gathered data from contractors, consultants, and government, and construction workers with regards to the effects of workplace fatalities, injuries, and disease to workers and their families. The results are discussed in accordance with the respondent groups, and a composite discussion is provided at the end of this section.

6.6.2 Construction practitioners' perspectives of the effects of workplace injuries

The effects of workplace injuries are discussed under two thematic areas, namely, return to work and financial effects.

6.6.3 The effect of injuries on return to work

The respondents were asked to indicate the frequency with which workers who experience (disabling) injuries at work are reintegrated into employment with the same employer or another employer. Table 6.20 indicates respondents' perception regarding the effects of workplaces injuries relative to prospects of re-employability for the injured workers based on percentage responses on a scale of 1 (never) and 5 (always), and a MS range between 1.00 and 5.00, the midpoint being 3.00.

It is notable that both MSs are less than the midpoint of 3.00, which indicate that respondents deem the extent to which injured workers return to work at the previous employer or a new employer to be rare as opposed to always.

Table 6.20 Extent to which injured workers return to work

Employer	Response (%)						MS	Rank
	Unsure	Not at all……Always						
		1	2	3	4	5		
Return to a different employer	13.2	7.7	23.1	26.4	26.4	3.3	2.55	1
Return to previous employer	9.9	15.4	22.0	35.2	13.2	4.4	2.42	2

Given that both MSs > 1.80 ≤ 2.60, the extent to which injured workers return to work at the same employer or at a different employer is deemed to be between rarely to sometimes / sometimes. The results suggest that workplace injuries have a great effect on the prospects of a worker to secure future economic prospects. There injured worker may also endure several downstream effects from the loss of employment. The

loss of employment and the concomitant effects can potentially drive the workers and their families into poverty.

Section 6.5.3 examines the downstream effects of workplace injuries from a workers' perspective.

The respondents were also asked to indicate the extent to which selected factors influenced the reintegration of injured workers at work in terms of percentage responses on a scale of 1 (not at all) and 5 (major), and MSs between 1.00 and 5.00. The results are presented in Table 6.21. It is notable that 7 of the 8 factors have MSs greater than the midpoint score of 3.00, which indicates that the extent to which the factors / conditions influence the prospects of an injured worker to be re-employed are deemed to be a major as opposed to a minor.

Table 6,21 Factors affecting prospects of return to work

Factor / Condition	**Response (%)**						**MS**	**Rank**
	Unsure	**Not at all…….. Major**						
		1	**2**	**3**	**4**	**5**		
Severity / nature of injury	5.5	2.2	3.3	12.1	19.8	57.1	4.10	1
Physical nature of construction work	2.2	3.3	3.3	11.0	39.6	40.7	4.04	2
Expected standard of output	5.6	1.1	10.1	20.2	40.4	22.5	3.56	3
Lack of contractor capacity to offer alternative employment	4.4	7.7	11.0	13.2	37.4	26.4	3.51	4
Shortcomings in rehabilitation programmes	7.7	8.8	8.8	16.5	27.5	30.8	3.40	5
Inadequate employer commitment to CSR	6.6	2.2	17.6	22.0	36.3	15.4	3.25	6
Inadequate organisational RTW policy	13.2	2.2	11.0	26.4	24.2	23.1	3.15	7
Inadequate national RTW policy	20.9	7.7	9.9	25.3	14.3	22.0	2.70	8

The results suggest that a return to work outcome for injured workers is affected by several factors. The factors ranked 1 to 5 have MSs > 3.40 ≤ 4.20, which indicate that their effect with regards to workers' prospects to RTW after a workplace injury is deemed to be between a moderate to a near major / near major extent. The severity / nature of the injury (MS = 4.10) is deemed to be the main factor with regards to determining the prospects of injured workers to return to work at the current or alternative employer. This suggests that workers with minor injuries are most likely to return to work compared to those with major / severe injuries. In addition, respondents

perceive that the physical nature of construction work (MS = 4.03) influence the prospect of RTW for injured workers. This is consistent with the fact that most aspects of construction involve heavy tasks, which require the services of healthier and strong workforce.

The results indicate that the respondents perceive that a RTW outcome is marginalised by the expected level of output for workers (MS = 3.57). The results are consistent with an output-based system of remuneration for workers in the construction industry. The expected daily production output is generally high, which makes it difficult for someone with a disabling injury to meet. The workers' prospects to be re-employed after experiencing an injury at work is also affected by lack of capacity within a construction firm to offer alternative employment (MS = 3.48). Depending on the severity of the injury / illness, some injured workers may require alternative duties upon returning to work. However, lack of employer capacity to offer suitable tasks to the injured workers reduce the prospects of injured workers to return to work. The study results also confirm the results of a previous study conducted by Comcare (2015).

It is also notable that 50 % of the factors which influence return to work outcomes for injured workers have MSs > 2.60 ≤ 3.40, which indicate that respondents deem the effect of these factors to be between a minor to a moderate / moderate extent. The factors in this category are 'inadequate national policy on return to work' (MS = 2.70), 'inadequate organisational policy with regards to return to work' (MS = 3.15), 'inadequate corporate social responsibility' (MS = 3.25), and 'shortcomings with rehabilitation programmes' (MS = 3.40).

The results further indicate that a RTW outcome is affected by both workplace and national factors. From a workplace perspective, injured workers are more likely to fail to be reintegrated into organisations where the employer has no operational return to work policy and lack commitment to corporate social responsibility. The problem is amplified by the inadequate rehabilitation programmes. In a previous study, Chikova *et al.* (2016) determined that injured construction workers stayed longer at the rehabilitation centre compared to workers from other industries.

Given that the MS for 'inadequate national RTW policy' is below the midpoint score of 3.00, it suggests that respondents deem the effect of this factor relative to a RTW for injured workers to be minor as opposed to major. This is consistent with the fact that the country's Constitution and the Labour Act prohibits discrimination, or victimisation of workers as a result of a disability arising from work related activities.

These findings are generally supportive of previous studies. In a study conducted by Comcare (2015), it was established that the severity of injury influences the return to work outcomes. In addition, studies conducted by Welch (2010) and the Texan Department of Insurance (2014) highlight that workers were more likely to fail to return to work if they worked in a physically strenuous job.

6.6.4 The financial ramifications of workplace injuries on workers

The research findings indicate that contractors, consultants, and government deem the extent to which injured workers and their families suffer financial difficulties (MS = 3.71) to be between a moderate to a near major / near major extent. The results reinforce the interview findings, which determined that injuries sustained at work impose financial ramifications on the injured workers and their families. Nevertheless, the long-term effects of workplace injuries or diseases to workers and their families can be severe and may result in workers being driven into poverty traps, which perpetuate intergenerational inequality.

The study results also suggest that several factors lead to the families of injured workers experiencing financial difficulties after a worker is injured at work. The respondents were asked to assess the extent to which selected factors may contribute to injured workers and their families experiencing financial difficulties in terms of a percentage response on a scale of 1 (not at all) and 5 (major), and a MS range between 1.00 and 5.00. The results presented in Table 6.22 indicate that factors ranked 1st and 2nd have MSs > 4.20 ≤ 5.00, indicating that these factors result in the families of injured workers experiencing financial difficulties between a near major to a major / major extent. The results further indicate that respondents deem that loss of employment as a result of work-related injury / illness to be the principal factor contributing to injured workers and their families to experience financial difficulties. This is consistent with the

assessment in Table 6.20 wherein industry practitioners perceive that injured workers are more likely to fail to return to work.

Table 6.22 Determinants of financial difficulties for injured workers and families

Factor	Response (%)						MS	Rank
	Unsure	Not at all…….. Major						
		1	2	3	4	5		
Loss of employment for the injured worker	2.3	1.1	4.5	6.8	13.6	71.6	4.43	1
Poor compensation	1.1	3.4	3.4	9.1	27.3	55.7	4.25	2
Death of worker	4.6	3.4	6.9	9.2	17.2	58.6	4.07	3
Loss of earning during period of sick leave	1.1	5.7	10.2	18.2	25.0	39.8	3.80	4
Increase cost of home-based care	2.3	3.4	6.8	19.3	27.3	40.9	3.38	5
Reduced earnings for reintegrated workers	13.9	11.4	10.2	19.3	22.7	22.7	2.94	6

The respondents also perceive that inadequate compensation for the injured worker may lead to the families of injured workers experiencing financial difficulties. This finding corroborates the interview results, which revealed that compensation for injured workers is generally not enough to fully sustain the injured workers and their families' needs. The level of compensation depends on the degree of disability and earnings of the injured workers at the time of injury. However, interviews with the WCIF suggest that the maximum level of compensation due to injured workers is approximately 70% of the worker's last monthly earnings at the time of accident / injury. However, given the low wages earned by construction workers, it can be concluded that the compensation received for workplace injuries is inadequate. Some of the workers do not receive any compensation because of the numerous barriers within the state-run WCIF. These results support findings of from previous studies (Michaels, 2016; Spieler *et al.,* 2012 and Boden, 2012), which determined that only a fraction of injured workers receive workers' compensation benefits.

It is notable that respondents perceive that factors ranked 3 to 5 have MSs > 3.40 ≤ 4.22, suggesting that the factors are deemed to result in families of injured workers experiencing financial difficulties at between a moderate to near major / near major extent. The factors identified in this range are 'increased cost of home-based care', 'loss of earnings during sick leave' and 'death of worker as a result of work-related injuries'. Families of the injured worker are more likely to spend part of their savings to

cater for the medical and related needs of the injured worker, and this may strain the family's finances. In a previous study, Fox (2016) noted that costly medical bills and treatment for chronic conditions can destroy savings and affect the family's livelihood. The problem is exacerbated where the injured worker is the sole breadwinner for the family.

With regards to the impact of reduced salaries for workers who are reintegrated', respondents deem the impact to minor as opposed to major. This result suggest that the reintegrated workers were unlikely to get their salaries reduced. The results are generally consistent with results from workers who were reintegrated after an injury, which determined that the majority of them did not experience a reduction of salary thereafter.

6.6.5 The workers' perspectives of the effects of workplace injuries

The workers were asked to identify the effects of workplace injuries on workers and their families. The responses to the open-ended questions were coded and condensed into common themes. The data was transformed to quantitative data and presented as frequencies. The results of a content analysis of the workers' responses presented in Table 6.23 indicate that workers perceive that workplace injuries / diseases have financial and social effects on workers and their families.

Table 6.23 Workers' perspectives of the effects of workplace injuries

Theme	**Factors**	**Frequency**	**%**
Financial	Financial difficulties / constraints	26	52
	Loss of employment	9	18
	Inadequate / lack of compensation	8	16
	Medical expenses	5	10
	Reduced salary	2	4
	Total	**50**	**100**
Social	Family problems	16	39.0
	Anxiety	10	24.4
	Loss of breadwinner	8	19.5
	Pain and disability	5	12.2
	Burden to family / friends	2	4.9
	Total	**41**	**100**

The effects are collated according to common themes and grouped into two broad categories, namely financial and social effects. It is clear from Table 6.23 that the

burden of workplace injuries has ramifications on the quality of life for the affected workers and their families as discussed in the following sections.

6.6.6 Financial implications of workplace injuries

The factors which were highlighted and included in this category are ‘financial difficulties’, ‘loss of employment’, ‘reduced salaries’, ‘inadequate compensation’ and ‘medical expenses’, and ‘reduced salary’. Financial challenges are perceived to be the main economic problem affecting the injured workers and their families. This problem is aggravated by loss of employment, poor compensation and medical expenses. Although the NSSA meets the medical and rehabilitation costs for workers who are injured at worker, however, inadequate reporting of accidents coupled with inadequate compensation suggests that a section of the injured workers is not covered by the WCIF. Against that background, workers and their families use personal savings to cover the costs of medical treatment for the injured worker. In previous studies, the cost of medical treatment (EC, 2011; Doorman, 2000), inadequate compensation (OSHA, 2015) and change in employment status as a result of an accident (Pérezgonzález, 2007) were identified as factors which increases the financial burden on low wage earners and their families. The impact on the family is aggravated where the injured worker is the sole primary wage earner.

The results suggest that improving workplace H&S practices is beneficial to workers, employers and society. To the workers, reduced occurrence of injuries, disease and fatalities is a cost saving as they cut on the expenses they could incur for medical and related bills. To the government, a reduction of workplace injuries improves revenue flow as workers continue in employment and pay tax. On the other hand, it reduces the social services bill related to the provision of rehabilitation and medical services, and compensating injured workers. A healthy workforce is a productive workforce.

6.6.7 Social implications of workplace injuries

The factors identified and included within this category are ‘family problems (divorce / strained marriages’, ‘anxiety’, ’loss of breadwinner’, ‘pain and disability’, and ‘burden to family and friends. The results reveal that the most pressing effect of workplace accidents is that they result in family problems. The workers perceive that workplace injuries can contribute to strained family relationships, divorce and failure to provide

basic requirements for the family such as paying school fees and providing enough food for the family. The respondents perceive that these problems may increase the poverty status of the workers, who may subsequently depend on government assistance for their daily requirements. Alternatively, the family may resort to selling household assets to make ends meet.

The workers also highlighted that injured workers and their families suffer from anxiety related problems. This may be aggravated by the fear of job loss, victimisation and potential loss of income. In addition to the pain suffered, workers also perceive that injuries may result in a disability taking them away from the active labour market. The results are consistent with earlier studies, which determined that workplace injuries may result in impaired relationship and stress (Dembe, 2001) and can contribute to worker disability (MacKenzie *et al.,* 1998).

6.7 THE IMPACT OF WORKPLACE INJURIES ON PROJECT PARAMETERS

6.7.1 Introduction

While H&S has been treated as a social issue, there is a growing body of evidence linking project performance with improvements in H&S or vice versa. This section will present and analyse results of questionnaire survey with regards to the effects of H&S practice on selected project parameters.

6.7.2 The extent to which inadequate H&S affects project parameters

The respondents were asked to assess the extent to which workplace injuries, diseases and fatalities affects project cost, duration, productivity, quality and the environment in terms of percentage responses to a scale of 1 (not at all) to 5 (major), and MS between 1.00 and 5.00, the midpoint being 3.00. The results are presented in Table 6.24.

Table 6.24 Extent to which inadequate H&S adversely affect project parameters

Project parameter	Response (%)						MS	Rank
	Unsure	Not at all…….. Major						
		1	2	3	4	5		
Projects experiencing delays	0.0	3.3	13.3	24.4	31.1	27.8	3.67	1
Reduced productivity	0.0	3.3	17.6	25.3	39.6	14.3	3.44	2
Increase project cost	2.2	9.9	18.7	16.5	25.3	27.5	3.35	3
Environment emissions	3.3	3.3	20.9	25.3	33.0	14.3	3.24	4
Non-conforming work and the occurrence of rework	3.3	10.0	24.4	26.7	23.3	12.2	2.93	5

It is notable that 4 of the 5 (80%) MSs are above the midpoint score of 3.00, which indicates that respondents deem the effect of inadequate H&S on the selected project parameters to be major as opposed to minor. These results reinforce the synergy between H&S and the traditional project parameters and highlights the need to integrate H&S as a key project parameter in decision making. The results are consistent with Smallwood (1998) who determined that inadequate H&S adversely affects project cost, productivity, quality, schedule, and the environment. The results suggest that inadequate H&S practices have a greater effect with regards to project duration where it contributes to project delays.

The MSs ranked 1st and 2nd are > 3.40 ≤ 4.20, which indicates that respondents deem the extent to which inadequate H&S affect these project duration and productivity to be between a moderate to a near major / near major extent.

6.7.3 The extent to which inadequate H&S affects duration

The results demonstrate that inadequate H&S is perceived to lead to schedule delays. The occurrence of site accidents often interrupts site operations due to work stoppages and project suspensions. The aforementioned was confirmed at one of the selected sites where the project was suspended for two days to pave way for investigation following an accident which seriously injured two workers. The situation is amplified by inadequate integration of H&S in project activities such as scheduling. Nevertheless, the results are generally consistent with the findings from previous studies conducted by Frank *et al.* (2010), Alinaitwe *et al.* (2013) and Aigbavboa *et al.* (2014).

6.7.4 The extent to which inadequate H&S affects productivity

The results suggest that inadequate H&S is perceived to result in reduced productivity. Given that the MS for this parameter is > 3.40 ≤ 4.20, the extent to which inadequate H&S affects productivity is deemed to be between a near major to a major / major extent. Unsatisfactory work conditions increase the risk of accidents, which adversely affect productivity and cause project delays. Workplace accidents may result in work stoppages, hospitalisation of the injured workers and absence of affected workers which collectively result in reduced productivity. In addition, the workers may be less productive because of discussions with fellow workers concerning the accident (Enshassi, 2000). The results also confirm the findings of a previous study conducted in Zimbabwe wherein Chigara and Moyo (2014) determined that inadequate H&S affected productivity at construction sites. Furthermore, the results reinforce the importance of H&S in ensuring productivity since diminished productivity may result in projects experiencing delays which may then increase pressure on workers thus exposing them to further risk of injury.

6.7.5 The extent to which inadequate H&S affects project cost

The results of the study suggest that inadequate H&S is deemed to result in increased project cost (MS = 3.35). The occurrence of injuries, diseases and fatalities, result in work stoppages, lost productivity, damage to property and equipment and medical expenses for the injured workers. The expenditure with regards to the above will

directly or indirectly influence the overall project cost. An increase in the cost of accidents is more likely to result in the overall project cost exceeding the budget and consequently diminishing the contractor's profit margins. However, given that the contractor's motive is to make profit, the costs of accidents can be a substantial burden to contractors who may not realise value. A previous study conducted by Enshassi (2000) determined that an increase in the cost of accidents increases project cost, and consequently reduce profits radically.

6.7.6 The extent to which inadequate H&S affects environment

The results also suggest that inadequate H&S affects the environment (MS = 3.24). This confirms the synergistic relationship that exists between H&S and the environment. Unsafe work practices resulting in construction accidents may release pollutants, which are detrimental to the environment and may have concomitant effects to the H&S of the workers and the public. The results further confirm earlier studies (Enshassi, 2000; Doorman, 2000; Smallwood, 1998), which determined that accidents may result in environmental contamination with concomitant effects to the H&S of workers and the community.

6.7.7 The extent to which inadequate H&S affects project quality

Given that the MS for the occurrence of non-conforming work and rework is > 2.60 ≤ 3.40, it suggests that respondents deem the effect of inadequate H&S on project quality to be between a minor to a moderate / moderate extent. Taking rework as an indicator of failure to conform to quality specifications, the results then imply that inadequate H&S is perceived to have a minor effect on the project quality. The results are inconsistent with results from previous studies (Enshassi, 2000; Doorman, 2000), which determined that the occurrence of accidents marginalises, *inter alia*, project quality.

6.8 SUMMARY OF THE RESULTS

The study entailed the survey of contractors, consultants, and government, and workers to establish the state of construction H&S practices in Zimbabwe. It is notable that the results from the various respondent groups confirm that construction H&S practices are sub-optimal. This assessment is supported by the results of questionnaire surveys for the contractors, consultants, government, and construction workers, which

demonstrated that workers are exposed to hazards and the occurrence of workplace fatalities, injuries, and disease. There are several factors contributing to workers' exposure to hazards and the occurrence of injuries, diseases and fatalities at construction projects in Zimbabwe.

The study results suggest that inadequately managed hazards, inadequate OH surveillance, appointment of stakeholders who do not systematically manage H&S, inadequate design HIRAs, inadequate planning for H&S, and lack of integration of H&S and environmental procedures are the factors contributing to workers' exposure to hazards and the occurrence of injuries, diseases and fatalities. The problem is compounded by unsafe work practices, inadequate inspections and enforcements and inadequate training.

Furthermore, the study determined that inadequate H&S practices arise from the failure to integrate H&S throughout the construction supply chain. The study determined that H&S issues are inadequately considered during the appointment of project stakeholders such as contractors and designers. In addition, the procurement framework does not sufficiently facilitate financial and other resource provisions for H&S. The study determined that the amount of financial provisions for H&S is affected by inadequate client commitment to finance H&S, non-specific contract clauses relative to H&S, tender competition, lack of standard framework for pricing H&S and inadequate regulations.

The consequences of inadequate H&S extend beyond fatalities, injuries, and disease. The study determined that inadequate H&S has several economic and social ramifications for workers, society, and the economy. Inadequate H&S can potentially drag workers and their families into a poverty trap because of constrained opportunities for the injured worker to secure future economic engagements, increased cost of home-based care, poor compensation, and medical expenses. In addition to the effects on workers, inadequate H&S practices affect project delivery through increasing project cost, delaying project completion, and reducing labour productivity.

The results suggest that interventions to improve H&S practices should address issues relating to, *inter alia*, hazard prevention and control, procurement systems, planning,

integration of H&S and environmental systems, and a behaviour-based approach. However, dependency on a piecemeal and disjointed approach to H&S is not enough to address the H&S problem. Thus, construction workers remain subjected to conditions, which systematically diminish their capacity to meet current and future needs. Exposure to hazards, fatalities, injuries and diseases affects the quality of life of workers and their ability to contribute meaningfully to the development of the nation and their families. Against that background, alternative approaches to ensuring protection of workers from conditions that reduce their ability to meet current and future needs is needed. The following section will discuss the option of aligning H&S practices, policies and programmes with sustainable development principles / concepts.

6.9 THE INTERFACE BETWEEN SUSTAINABILITY AND CONSTRUCTION H&S

6.9.1 Introduction

The results presented in the Section 6.2 to 6.86 suggest that construction workers are subjected to work conditions, which systematically diminish their capacity to meet their current and future needs. The poor H&S performance in the construction industry demonstrated by the occurrence of fatalities, injuries, and disease(Smallwood and Haupt, 2005) suggests that the current practices are not sustainable in the long-term. This section examines sustainability principles / factors for H&S practices.

6.9.2 Importance of sustainability principles in construction H&S

To make the integration of sustainability into H&S practices possible, it is important to determine the importance of the sustainability factors for H&S practice. Therefore, this section discusses the extent to which selected sustainability principles / factors are important for H&S practice in Zimbabwe. The respondents were asked to rate the importance of integrating selected sustainability principles / factors to construction H&S practice in terms of percentage responses to a scale 1 (not important) to 5 (very important), and MS between 1.00 and 5.00, the midpoint being 3.00. The results are presented in Tables 6.25 to 6.27.

6.9.3 Social sustainability

Table 6.25 indicates the respondents' perceived assessment of the importance of social sustainability factors in H&S practice.

Table 6.25 Degree of importance of social sustainability principles

Social sustainability principle / factor	Response (%)						MS	Rank
	Unsure	Not ……..…….Very						
		1	2	3	4	5		
Workers' rights to safe work	0.0	0.0	1.0	10.1	19.2	69.7	4.58	1
Access to information	0.0	0.0	0.0	6.1	30.3	63.6	4.58	1
Training	0.0	1.0	3.0	7.1	19.2	69.7	4.54	3
Accident investigation & reporting	0.0	0.0	1.0	10.1	24.2	64.6	4.53	4
H&S policies	0.0	1.0	0.0	13.3	21.4	64.3	4.48	5
Supervision and monitoring	0.0	0.0	2.0	8.1	32.3	57.6	4.45	6
Corporate social responsibility	0.0	0.0	2.1	16.7	18.8	62.5	4.42	7
H&S planning	0.0	0.0	4.0	11.1	26.3	58.6	4.39	8
Prevention through design	0.0	1.0	5.1	18.4	24.5	51.0	4.19	9
Inclusive participation	0.0	2.0	2.0	19.2	33.3	43.4	4.14	10
Return to work	2.0	3.0	6.1	13.1	29.3	46.5	4.04	11

It is notable that the MSs for all the factors are greater than the midpoint score of 3.00, which indicates that the respondents deem the principles / factors to be very important as opposed to not important. Given that 8 of the 11 factors (72.7%) have MSs > 4.20 ≤ 5.00, the results indicate that respondents deem the importance of the factors relative to H&S practice to be between more than important to very important / very important. Two factors, namely inclusive participation and return to work have MSs > 3.40 ≤ 4.20, which indicates that respondents deem the extent to which the factors are deemed important for H&S to be between a moderate to a more than important / more than important. It is notable that most of the social sustainability factors replicate the principles of H&S.

The results suggest that achieving social sustainability relative to H&S is important to enhance H&S outcomes. This will be realised through increasing stakeholder involvement in H&S, respect of workers' rights to healthy and safe work, training and access to information. Consistent with the Constitution of Zimbabwe, respondents perceive that access to information and respect for workers' rights to healthy and safe work are the most important social sustainability factors for H&S practice. The right to healthy and safe work is recognised as a fundamental human right in several government documents, namely the Constitution of Zimbabwe, the Zimbabwe National OSH Policy and associated H&S regulations. It is also through training and provision of information that stakeholders, including decision makers are reminded of their responsibilities relative to H&S and the necessary preventive measures to be instituted. According to Zou *et al.* (2012), social sustainability is achieved on construction projects through engagement of stakeholders in decision making.

The results suggest that integration of social sustainability principles is important for construction H&S practices in order to sustain the quality of life of a worker at the current work, for future work assignments, and during post work lifetime. The occurrence of workplace injuries may perpetuate intergenerational cycles of poverty and inequality in society.

6.9.4 Environmental sustainability

Table 6.26 presents the results of an assessment of the importance of environmental sustainability principles / factors in construction H&S practice. Given that all the MSs

are greater than the midpoint score of 3.00, it is deemed that the principles / factors are deemed to be very important as opposed to not important.

Table 6.26 Degree of importance of environmental sustainability principles

Environmental sustainability principle / factor	Response (%)						MS	Rank
	Unsure	Not ……..…… Very						
		1	2	3	4	5		
HIRAs	1.0	1.0	2.0	6.1	21.4	68.4	4.51	1
Environmental waste management	0.0	0.0	3.0	11.1	24.2	61.6	4.44	2
Environmental preservation	0.0	0.0	5.1	14.1	28.3	52.5	4.28	3
Site welfare provisions	1.0	0.0	3.1	18.4	33.7	43.9	4.15	4
Enforcement of environmental policies / regulations	1.0	0.0	8.2	13.3	32.7	44.9	4.11	5
Site organisation / layout	2.0	1.0	4.0	15.2	35.4	42.4	4.08	6
Selection of low risk material	1.0	4.1	6.2	17.5	32.0	39.2	3.93	7
Environmental information	2.1	2.1	4.3	24.5	34.0	35.1	3.85	8
The polluter pays for damage to H&S and the environment	6.2	3.1	9.3	25.8	20.6	35.1	3.56	9
Environmental thermal changes	7.1	6.1	10.1	28.3	27.3	21.2	3.26	10

The results presented in Table 6.26 indicate that HIRAs, environmental waste management, and environmental protection have MSs > 4.20 ≤ 5.00, which indicates that respondents deem the importance of these factors to construction H&S to be between more than important to very important / very important. The factors ranked 4 to 11 have MSs > 3.40 ≤ 4.20, which indicate that respondents deem their level of importance for construction H&S to be between moderate to more than important / more than important.

The incorporation of environmental sustainability into construction H&S addresses the environmental aspects that bear on construction H&S and the environment. The H&S of workers can be adversely affected by agents of environmental pollution such as improper waste management, oil spills, and hazardous chemical substances (HCSs). Therefore, protecting the environment will protect workers against environmental health hazards. According to Agenda 21, incorporating environmental protection into social development foster greater human wellbeing (Dernbach, 2003). In addition to environmental protection environmental sustainability is also anchored on the precautionary principle. The precautionary principle will be realised through heightened HIRAs and selection of low risk materials. The results support the contentions of NIOSH (2011) and Boileau (2016), who determined that H&S practices can be improved through integrating H&S in design. Another environmental sustainability

principle which is perceived important for H&S is the polluter-pays. The principle encourages responsible production and adoption of H&S practices that do not contribute to the occurrence of workplace injuries, diseases or fatalities through compelling those who cause damage to environment / H&S to pay for the damage.

6.9.5 Economic sustainability

Table 6.27 presents the extent to which integrating economic sustainability principles is important for H&S practices. Given that all the MSs are greater than the midpoint score of 3.00, the results suggest that integration of economic sustainability principles in construction H&S is perceived to be very important as opposed to not important.

Table 6.27 Degree of importance of economic sustainability principles

Economic sustainability principle / factor	**Response (%)**						**MS**	**Rank**
	Unsure	**Not ……..…….. Very**						
		1	**2**	**3**	**4**	**5**		
Financial and other resource provisions for H&S	2.1	0.0	6.4	12.8	27.7	51.1	4.17	1
Incorporating H&S in scheduling construction works	1.0	1.0	7.2	12.4	29.9	48.5	4.14	2
Integration of H&S in business plans of an organisation	1.0	1.0	7.2	12.4	39.2	39.2	4.05	3
Integrating economic considerations in H&S policies	1.0	1.0	7.2	12.4	39.2	39.2	4.05	3
Responsible production / employment	4.1	2.1	5.2	15.5	34.0	39.2	3.91	5
Economic analysis of H&S investment	3.1	1.0	7.2	21.6	26.8	40.2	3.89	6
Long term investment in H&S	2.1	0.0	10.3	18.6	33.0	36.1	3.89	6
Responsible procurement	2.1	1.0	9.3	20.6	30.9	36.1	3.86	8

It is notable that all the MSs > 3.40 ≤ 4.20, which indicate that respondents deem the extent to which these factors are important for H&S sustainability to be between important to more than important / more than important. The economic sustainability factors address three principles of sustainable development, namely, responsible production, long-term perspective and economic efficiency / effectiveness. The respondents perceive that H&S can be sustained when sufficient financial provision and other resource provision are made for H&S, economic considerations are integrated in the business plan and in H&S policy, and when production processes are not only motivated by profitability, but by the concern for human wellbeing. Economic sustainability ensures that stakeholders consider the costs and benefits of H&S from a long-term rather than a short-term perspective. This will be accomplished through a

cost analysis of H&S investment and accidents / incidents. Therefore, applying the principles which frame economic sustainability into H&S, provides an economic motivation for construction stakeholders to consider H&S beyond the short-term interests / benefits. The results are consistent with previous studies, which determined that transition to sustainable practice is enhanced through integrating H&S into business plans (Boileau, 2016), and sustainable criteria into procurement policies and procedures (du Plessis, 2002).

To determine the extent to which respondent organisations perceive sustainability to be important in enhancing construction H&S practices, Table 6.28 presents a disaggregated analysis by respondent group.

Table 6.28 Degree of importance of sustainability by respondent' organisation

Sustainability principle	Contractors		Consultants		Government		Clients		Overall	
	MS	Rank	MS	Rank	MS	Rank	MS	Rank	MS	Rank
Social										
Workers' rights to healthy and safe work	4.52	1	4.77	1	4.23	10	4.70	1	4.58	1
Information of H&S hazards / risks	4.47	3	4.70	2	4.53	7	4.70	1	4.58	1
Training of workers / supervisors	4.48	2	4.67	4	4.73	2	4.10	8	4.54	3
Reporting & investigating incidents	4.43	4	4.60	6	4.60	5	4.60	3	4.53	4
H&S policies, regulation & enforcement	4.23	7	4.70	2	4.60	5	4.50	4	4.48	5
Supervision, monitoring & evaluation	4.34	6	4.47	8	4.73	2	4.50	4	4.45	6
Corporate social responsibility	4.20	8	4.62	4	5.00	1	4.40	6	4.42	7
H&S planning	4.36	5	4.37	9	4.73	2	4.10	8	4.39	8
Prevention through design	4.07	9	4.17	11	4.47	8	4.40	7	4.19	9
Site welfare provisions	4.00	4	4.10	5	4.21	8	4.37	3	4.15	4
Transparency & informed participation	4.00	10	4.53	7	4.20	11	4.10	10	4.14	10
Post injury reintegration & disability management	3.73	11	4.33	10	4.40	9	4.00	11	4.04	11
Environmental										
HIRAs	4.23	1	4.70	1	4.73	1	4.80	1	4.51	1
Environmental pollution / waste management	4.22	2	4.50	2	4.67	3	4.63	2	4.44	2
Preserving and protecting the Environment	4.11	3	4.50	2	4.73	1	4.23	5	4.28	3
Environmental policies, regulations	3.95	5	3.90	6	4.40	5	4.27	4	4.11	5
Site organisation / layout	3.75	7	4.40	4	4.67	3	4.17	6	4.08	6
Selection of material with low H&S risk	3.90	6	3.80	7	4.07	9	3.93	8	3.93	7
Environmental information dissemination	3.63	8	3.70	8	4.36	6	3.96	7	3.85	8
The polluter pays	3.29	9	3.70	8	4.26	7	3.57	9	3.56	9
Environmental thermal changes	7.1	6.1	10.1						3.26	
Economic										

Financial and other resource provisions for H&S	4.07	1	4.05	4	4.66	1	4.22	3	4.17	1
Incorporating H&S in scheduling construction works	409	2	4.17	2	4.07	3	4.40	1	4.14	2
Integration of H&S in business plans of an organisation	3.77	8	4.21	1	4.66	1	3.90	6	4.05	3
Integrating economic considerations in H&S policies	3.95	3	4.17	2	4.07	3	4.10	4	4.05	3
Responsible production / employment	3.84	4	3.93	5	3.73	8	4.40	1	3.91	5
Economic analysis of H&S investment	3.84	4	3.93	5	3.87	7	4.00	5	3.89	6
Long term investment in H&S	3.81	6	3.90	7	4.07	3	3.90	6	3.89	6
Responsible procurement	3.81	6	3.90	7	4.07	3	3.60	8	3.86	8

The results of the analysis presented in Table 6.28 indicate that contractors, consultants, government and clients perceive that sustainability principles / factors are important to improve construction H&S practice in Zimbabwe. It is notable that sustainability factors ranked 1st to 6th, have MSs > 4.20 ≤ 5.00, which indicates that respondents deem the importance of the factors to construction H&S to be between more than important to very important / very important. With regards to environmental factors, hazard identification and risk assessment is perceived as the lead factor by all the respondents. It is notable that from an economic perspective, respondents perceive that financial provisions, responsible production and integration of H&S in scheduling are the top three factors, responsible procurement is considered the least important factor. There are several implications, with regards to the effect of procurement on H&S as reflected in some previous studies

6.9.6 The extent to which sustainability is integrated into H&S practices

The study sought to determine the extent to which the sustainability factors are incorporated in H&S practices. The results presented in Table 6.29.

Table 6.29 Extent to which sustainability is integrated into H&S practices

Sustainability principle / factor	**Response (%)**						**MS**	**Rank**
	Unsure	**Not at all…..……Major**						
		1	**2**	**3**	**4**	**5**		
Social sustainability								
Information of H&S hazards / risks	2.0	2.0	20.2	44.4	20.2	11.1	3.12	1
Supervision, monitoring & evaluation	1.0	4.1	28.9	34.0	17.5	14.4	3.06	3
Workers' rights to healthy and safe work	3.0	5.1	23.2	40.4	18.2	10.1	2.96	4
H&S policies, regulation & enforcement	1.0	4.0	25.3	44.4	18.2	7.1	2.96	4
H&S planning	1.0	4.2	31.3	35.4	19.8	8.3	2.94	5
Reporting & investigating incidents	2.1	5.2	27.8	35.1	21.6	8.2	2.94	5
Site welfare provisions	2.0	6.1	21.4	42.9	21.4	6.1	2.94	5
Training of workers / supervisors	1.0	7.1	28.6	39.8	14.3	9.2	2.87	8

Prevention through design	2.0	14.1	30.3	29.3	16.2	8.1	2.68	9
Transparency & informed participation	3.1	6.1	41.8	31.6	12.2	5.1	2.59	10
Corporate social responsibility	7.4	9.3	33.3	29.6	13.0	7.4	2.54	11
Post injury reintegration & disability management	6.1	9.2	37.8	28.6	11.2	7.1	2.51	12
Environmental sustainability								
HIRAs	1.0	4.0	21.2	43.4	20.2	10.1	3.08	1
Environmental policies, regulations	3.1	7.1	21.4	38.8	20.4	9.2	2.94	2
Site welfare provisions	2.0	6.1	21.4	42.9	21.4	6.1	2.94	2
Site organisation / layout	2.0	5.1	25.5	49.0	11.2	7.1	2.84	4
Preserving and protecting the Environment	3.1	11.2	29.6	29.6	19.4	7.1	2.72	5
Environmental pollution / waste management	4.0	9.1	28.3	36.4	15.2	7.1	2.71	6
Environmental information dissemination	4.1	10.2	30.6	32.7	17.3	5.1	2.64	7
Selection of material with low H&S risk	5.1	17.3	32.7	28.6	12.2	4.1	2.38	8
The polluter pays	8.2	21.4	28.6	25.5	11.2	5.1	2.26	9
Environmental thermal changes	8.1	17.2	35.4	31.3	6.1	2.0	2.16	10
Economic sustainability								
Responsible production targets & timelines	4.1	3.1	28.6	34.7	20.4	9.2	2.92	1
Responsible production & employment	2.0	5.1	23.5	48.0	13.3	8.2	2.90	2
Integrating economic considerations in H&S policies	3.0	6.1	29.3	46.5	9.1	6.1	2.71	3
Integration of H&S in business plans of an organisation	4.0	9.1	34.3	34.3	13.1	5.1	2.59	4
Financial provisions for H&S	3.1	10.3	40.2	28.9	9.3	8.2	2.56	5
Economic analysis of H&S investment	6.1	12.1	34.3	27.3	14.1	6.1	2.50	6
Life cycle assessment of investment in H&S	4.0	9.1	43.4	27.3	14.1	2.0	2.44	7
Responsible procurement	6.1	9.2	41.8	30.6	7.1	5.1	2.39	8

Given that 26 of the 29 (89.7%) factors have MSs below the midpoint score of 3.00, it indicates that respondents deem the extent to which sustainability factors are integrated into H&S practices to be minor as opposed to major. The results indicate that only three factors, namely access to information, HIRAs and supervision are currently integrated in construction H&S practices.

However, given that nineteen of the principles / factors have MSs > 2.60 ≤ 3.40, it indicates that the respondents deem the extent to which these factors are incorporated into H&S practices to be between a minor to a moderate / moderate extent. These results further support the findings presented in Sections 6.2 to 6.6.

6.9.7 The extent to which social sustainability is integrated in H&S

Given that the factors ranked 1st to 8th have MSs > 2.60 ≤ 3.40, it suggests that the respondents deem the extent to which these factors are integrated in H&S to be

between a minor to a moderate / moderate extent. The results suggest that despite being regulated, social sustainability factors are inadequately integrated in H&S practices. The results also reinforce the observations by the NSSA (2012) that H&S noncompliance in the construction industry is approximately 80%. The factors ranked 9th to 11th have MSs > 1.80 ≤ 2.60, which indicates that respondents deem the extent to which informed participation, CSR and return to work are integrated in H&S practices to be between not at all integrated to a minor / minor extent. Although the results confirm interviews with construction stakeholders, they are inconsistent with the requirements to promote stakeholder participation in H&S matters as enshrined in the H&S regulations. The results suggest that while having H&S regulations is important, it is not enough to sustain H&S practices on projects as some of the regulated expects are also inadequately implemented on projects.

6.9.8 The extent to which environmental sustainability is integrated in H&S

The results indicate that sustainability factors ranked 1st to 7th have MSs > 2.60 ≤ 3.40, which indicate that respondents deem the extent to which environmental sustainability factors are integrated in H&S to between a minor to a moderate / moderate extent. It is also notable that the remaining three factors have MSs > 1.80 ≤ 2.60, which indicates that respondents deem the extent to which environmental sustainability factors are integrated into H&S practices to between not at all to a minor / minor extent. The sustainability factors in this category are: 'selection of low risk materials', 'the polluter pays', and 'environmental thermal thresholds. These results confirm the separation of environmental and H&S practices. However, lack of coordination between environmental and H&S operations exposes workers to the problem of risk shifting.

6.9.9 The extent to which economic sustainability is integrated in H&S

The results indicate that 3 of the 8 (37.5%) economic sustainability factors have MSs > 2.60 ≤ 3.40, which indicates that respondents deem the extent to which economic sustainability factors are integrated in H&S to between a minor to a moderate / moderate extent. The MSs for the other economic sustainability factors are > 1.80 ≤ 2.60, which indicates that respondents deem the extent to which environmental sustainability factors are integrated in H&S to between not at all to a minor / minor extent. The results suggest that H&S practices are marginally aligned with economic

sustainability principles. The results also confirm the findings from the interviews with the construction industry practitioners which determined that H&S is marginalised by, *inter alia*, inadequate funding. However, lack of integration of economic principles into H&S amplifies the problem by promoting minimal compliance relative to regulatory requirements. The failure to integrate economic sustainability may result in insufficient budgets being allocated to H&S, inadequate screening of contractors and other project stakeholders who do not systematically manage H&S, and inadequate alignment of production with H&S provisions.

To determine the perceptions of respondents by their various groups, a disaggregated analysis of the extent of the extent to which sustainability is integrated in H&S practices in presented in Table 6.30. It is notable that respondents from consultants perceive that all the sustainability principles / factors (social, environmental and economic) are inadequately integrated in H&S practices. Nevertheless, contractors, government and clients perceive that some regulated social sustainability principles / factors have MSs greater than the midpoint score of 3.00 suggesting that respondents perceive these principles to be partially integrated into H&S practices. Nevertheless, all the MSs for economic sustainability principles are less than the midpoint score pf 3.00 suggesting that the principles are inadequately integrated into H&S practices. Inadequate consideration of economic principles has implications on the implementation of H&S practices. For instance, it will be difficult to implement H&S provisions without any resources.

Table 6.30 Extent of integration of sustainability by respondent's organisation

Sustainability principle	**Contractors**		**Consultants**		**Government**		**Clients**		**Overall**	
	MS	**Rank**	**MS**	**Rank**	**MS**	**Rank**	**MS**	**Rank**	**MS**	**Rank**
Social										
Information of H&S hazards / risks	3.23	1	2.97	1	3.00	6	3.30	3	3.12	1
Supervision, monitoring & evaluation	3.17	3	2.77	4	3.13	3	3.40	1	3.06	3
Workers' rights to healthy and safe work	3.20	2	2.60	8	3.00	6	2.90	7	2.96	4
H&S policies, regulation & enforcement	3.02	5	2.87	3	2.93	10	3.00	5	2.96	4
H&S planning	3.04	4	2.73	5	3.07	5	2.90	7	2.94	5
Reporting & investigating incidents	2.81	8	2.93	2	3.14	2	3.20	4	2.94	5
Site welfare provisions	2.93	7	2.70	7	3.13	3	3.40	1	2.94	5
Training of workers / supervisors	2.95	6	2.73	5	3.00	6	2.70	11	2.87	8
Prevention through design	2.80	9	2.17	11	3.27	1	2.80	9	2.68	9

Transparency & informed participation	2.74	10	2.23	10	2.73	11	2.80	9	2.59	10
Corporate social responsibility	2.50	12	2.36	9	2.17	12	3.00	5	2.54	11
Post injury reintegration & disability management	2.63	11	2.03	12	3.00	6	2.70	11	2.51	12
Environmental										
HIRAs	3.28	1	2.67	2	3.20	2	3.30	1	3.08	1
Environmental policies, regulations	2.91	2	2.80	1	3.27	1	3.00	4	2.94	2
Site organisation / layout	2.77	3	2.67	2	3.07	4	3.30	1	2.84	3
Preserving and protecting the Environment	2.67	5	2.50	4	3.00	5	3.20	3	2.72	4
Environmental pollution / waste management	2.68	4	2.43	6	3.13	3	3.00	4	2.71	5
Environmental information dissemination	2.59	6	2.45	5	2.93	6	3.00	4	2.64	6
Selection of material with low H&S risk	2.40	7	2.20	7	2.60	7	2.50	8	2.38	7
The polluter pays	2.27	9	2.00	8	2.36	8	2.80	7	2.26	8
Environmental thermal changes	2.36	8	1.73	9	2.27	9	2.40	9	2.16	9
Economic										
Responsible production targets & timelines	2.84	2	2.78	1	2.87	4	3.80	1	2.92	1
Responsible production & employment	2.98	1	2.53	3	3.00	2	3.50	2	2.90	2
Integrating economic considerations in H&S policies	2.68	3	2.57	2	2.93	3	2.90	3	2.71	3
Integration of H&S in business plans of an organisation	2.66	4	2.37	4	2.87	4	2.50	7	2.59	4
Financial provisions for H&S	2.60	6	2.13	7	3.20	1	2.66	4	2.56	5
Economic analysis of H&S investment	2.61	5	2.30	5	2.53	8	2.50	7	2.50	6
Life cycle assessment of investment in H&S	2.52	7	2.17	6	2.67	7	2.60	5	2.44	7
Responsible procurement	2.49	8	2.00	8	2.73	6	2.60	5	2.39	8

6.9.10 Barriers to integrating sustainability principles into construction H&S

The results presented in Section 6.9.2 to 6.9.9 suggests that despite being important, sustainability factors are marginally integrated in H&S practices. Based on these results and the results discussed in Section 6.2 to 6.8, it can be concluded that the current H&S practices are not sustainable in the long-term. The gap exhibited between the importance of sustainability factors and the extent to which the factors are integrated in H&S demonstrates that some barriers are inhibiting the integration. This section discusses the barriers to integration of sustainability factors into H&S practices.

Table 6.31 presents the respondents' assessment of the extent to which selected factors / barriers inhibit the integration of sustainability principles / factors into H&S in terms of percentage responses to a scale 1 (not at all) to 5 (major), and MS between 1.00 and 5.00, the midpoint being 3.00.

Table 6.31 Barriers to integrating sustainability in construction H&S practices

Sustainability principle / issue	Response (%)						MS	Rank
	Unsure	Not at all…..……Major						
		1	2	3	4	5		
Inadequate financial and other resource provision for sustainable H&S	0.0	0.0	4.2	20.8	29.2	45.8	4.09	1
Inadequate client commitment to promote sustainable H&S	0.0	0.0	12.0	24.0	28.0	36.0	3.91	2
Inadequate knowledge of sustainability among team members	0.0	4.0	0.0	28.0	44.0	24.0	3.88	3
Inadequate contractor management commitment to sustainability	0.0	0.0	8.0	28.0	48.0	16.0	3.85	4
Perceived cost implications of sustainability	4.0	0.0	4.0	32.8	28.0	32.0	3.82	5
Lack of comprehensive frameworks for integrating sustainability aspects for H&S	0.0	0.0	8.0	28.0	48.0	16.0	3.71	6
Inadequate understanding of the synergy between H&S and sustainability	4.0	4.0	12.0	16.0	44.0	20.0	3.57	7
Separation of design and construction	0.0	8.0	24.0	28.0	24.0	16.0	3.26	8
Passive and negative perception about integration	12.0	0.0	12.0	16.0	48.0	12.0	3.15	9
Lack of collective view around the concept of sustainability	12.0	0.0	12.0	36.0	28.0	12.0	3.14	10
Fragmentation / lack of relevant H&S laws and regulations	12.5	4.2	8.3	29.2	29.2	16.7	3.09	11
Inadequate integration of H&S in business and environmental operations	12.5	12.5	0.0	50.0	0.0	25.0	3.06	12
Separation of H&S and environmental laws and policies	4.3	4.3	17.4	34.8	21.7	17.4	3.06	13
Skepticism around the business value of sustainability	8.3	0.0	20.8	25.0	25.0	20.8	2.97	14

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The results indicate that all the factors have MSs above the midpoint 3.00, which indicates that respondents deem the extent to which the factors constrain the integration of sustainability factors into H&S practices to be major as opposed to minor. Based on the review of sustainability and H&S literature, the barriers to integrating sustainability into H&S practices can be categorised into three major thematic areas, namely economic, social, and institutional. The barriers to sustainability integration are discussed below under three thematic clusters.

Economic barriers

The factors which constitute economic barriers are ‘inadequate financial and other resource provision for sustainable H&S’, ‘perceived cost implications of sustainability’, ‘inadequate integration of H&S in business and environmental operations’ and ‘skepticism about the business value of sustainability’. It is notable that 75% of the barriers / factors have MSs greater than the midpoint 3.00, which indicates that respondents deem the barriers to have a major as opposed to minor impact relative to integration of sustainability principles into H&S practices. The MSs for ‘inadequate financial and other resource provision for sustainable H&S’ and ‘perceived cost implications of sustainability’ are > 3.40 ≤ 4.20, which indicates that the respondents deem the extent to which these factors inhibit integration to be between a moderate to a near major / near major extent. The results are consistent with the fact that the implementation of H&S programmes requires sufficient budgetary provision. The problem is, however, amplified by the preconceived view that H&S is an extra cost, and the integration of sustainability factors will further escalate the cost of its provision. In previous studies, the effect of inadequate resources was also identified as a barrier to the implementation of sustainable work practices (Sourani and Sohail, 2011; Roelofs, 2007; Eijkemans *et al*., 2004). The integration of sustainability in H&S means expanding the H&S campus beyond the traditional areas and this requires resources.

The results show that the MSs for ‘inadequate integration of H&S in business and environmental operations’ and ‘skepticism about the business value of sustainability’ are > 2.60 ≤ 3.40, which indicates that respondents deem the extent to which factors inhibit integration to be between a moderate to a near major / near major extent.

Social barriers

The factors in the social barriers cluster are ‘inadequate client commitment to promote sustainable H&S’, inadequate knowledge of sustainability among team members’, ‘inadequate contractor commitment to sustainability’, ‘inadequate understanding of the synergy between H&S and sustainability’, and ‘lack of collective view of the concept of sustainability’. It is notable that the MSs of 5 of the 6 (83.3%) barriers under the social cluster are greater than the midpoint of 3.00, which indicates that respondents deem their effect relative to integration of sustainability into H&S practices to be major as opposed to minor. The results suggest that the principal social barrier to integration is inadequate client commitment (MS = 3.91), followed by inadequate knowledge of

sustainability (MS = 3.88) and inadequate contractor commitment to sustainable H&S practices (MS = 3.85). The results suggest that the transition to sustainable H&S requires a change of mindset among project stakeholders. In this regard, training and awareness of the benefits of sustaining H&S is an important prerequisite of the transition. The results generally mirror the problems affecting implementation of sustainability in the country. For instance, lack of knowledge was identified as one of the key factors, which constrained implementation of the Millennium Development Goals (MDGs) in Zimbabwe (Mpofu, 2017). With regards to client commitment to H&S, Chari and Chiriseri (2014) determined that H&S is not among the key considerations of sustainable procurement in Zimbabwe.

Institutional barriers

The factors in the institutional barriers cluster are 'lack of a comprehensive framework for integrating sustainability into H&S practices', 'separation of design and construction' and 'fragmentation / lack of relevant regulations'. The respondents perceive that the main institutional barrier for integrating sustainability principles into H&S practices is the lack of a comprehensive framework to facilitate the integration (MS = 3.71). The respondents deem the effect of this factor to be between a moderate to a near major / near major extent. The results suggest the availability of an integration framework is necessary to ensure the transition to sustainable H&S practices.

The MSs for 'separation of design and construction' and 'fragmentation / lack of relevant regulations > 2.60 ≤ 3.40, which indicates that the respondents deem the effect of the two factors relative to inhibiting integration of sustainability into construction H&S practices to be between a minor to a moderate / moderate extent. The results are consistent with the current practices where the H&S regulations are fragmented and the preference for traditional procurement, which promotes the separation of design from construction. Nevertheless, the separation of design and construction means that opportunities to eliminate hazards during design may be missed.

7.0 : TESTING OF THE HYPOTHESES

7.1 INTRODUCTION

This section presents the testing of the hypotheses. The presentation will follow the presentation of sub-problems in Chapter 1. The method used in the analysis of the data follows that used in the Likert type data analysis. The data collected was classified into five different classes coded on a scale from 1 to 5 as defined in Table 6.8. Likert type data are an ordinal measurement scale. Descriptive statistics recommended for the ordinal measurement scale items include a mode or median for central tendency, and frequencies for variability (Boone & Boone, 2012). Since the Likert type data is ordinal in nature, a non-parametric approach is recommended for the data analysis. Nanna and Sawilowsky compared the power of the independent samples t-test to that of the Wilcoxon rank-sum procedure with actual data sets measured on an ordinal scale based on the Functional Independence Measure (FIM) scores in medical rehabilitation. The authors established that the Wilcoxon rank-sum procedure had a higher power than the t-test for almost all combinations of sample size and alpha level examined (Nanna & Sawilowsky, 1998). The researcher used the Wilcoxon test, where under the null hypothesis the median of the data is equal to 3 (H_0 = 3.00), whilst under the alternative hypothesis the median is not equal to 3 ($H_0 \neq 3.00$). If the null hypothesis is rejected ($p < 0.05$), the conclusion is that the factor under consideration is statistically significant.

7.2 Hypotheses for sub-problem 1

Hypothesis 1.1: Inadequately managed hazards and poor occupational health (OH) surveillance result in workers being exposed to occupational hazards, and the occurrence of fatalities, injuries, and disease on projects

Hypothesis 1.2: Inadequate design hazard identification and risk assessments (HIRAs) result in workers being exposed to hazards on projects and the occurrence of fatalities, injuries, and disease

Hypothesis 1.3: Appointment of stakeholders that are not committed to construction H&S contributes to the occurrence of fatalities, injuries, and disease.

A one sample Wilcoxon-test for the medians of the variables against the median neutral point of 3.00 was performed and the results are presented in Table 7.1. It should be

noted that Hypothesis 1.1 has two independent variables, namely iinadequately managed hazards and poor occupational health (OH) surveillance.

Table 7.1 One-sample Wilcoxon-tests for hypothesis 1

Hypotheses test summary

	Null Hypothesis	Test	Sig.	Decision
1	The median of Appointment of stakeholders who do not systematically manage H&S equals 3.00.	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis
2	The median of Inadequately managed hazards equals 3.00.	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis
3	The median of Inadequate occupational health (OH) surveillance equals 3.00.	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis
4	The median of Inadequate design hazard identification and risk assessment equals 3.00.	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis

Asymptotic significances are displayed. The significance level is .05.

Table 7.1 confirms the results in 6.5.1 that the factors generally account for fatalities, injuries, and disease on projects. Testing the reliability of these findings at the 95% confidence interval, the fourth column has statistically significant p-values implying that similar findings are expected to be yielded in at least 95 runs of every 100 trials of the same survey. Based on the results in the Table 7.1, it can be assumed that for the above hypothesis the median is significantly greater than the reference constant, hence H_0 can be deemed rejected and there is insufficient evidence to reject the alternative hypothesis. Hence, it can be concluded that generally inadequately managed hazards, poor OH surveillance, inadequate design HIRAs, and appointment of stakeholders who are not committed to construction H&S results in workers being exposed to occupational hazards, and the occurrence of fatalities, injuries, and disease on projects.

7.3 Hypotheses for sub-problem 2

Hypothesis 2.1: Injuries sustained at work prevent workers from securing subsequent employment

Hypothesis 2.2: Labour productivity expectations set for workers by contractors reduces re-employability chances for injured and disabled workers

Hypothesis 2.3: Inadequate policy and regulations on post injury return to work (RTW) result in injured workers failing to be reemployed

Table 7.2 presents the one-sample Wilcoxon-tests against median neutral point of 3.00 of the scale to establish significant factors for hypothesis 2.

Table 7.2 One-sample Wilcoxon-tests for hypothesis 2

Hypotheses test summary

	Null Hypothesis	Test	Sig.	Decision
1	The median of Injuries sustained at work equals 3.00	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis
2	The median of Labour productivity expectations set for workers by contractors equals 3.00	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis
3	The median of Inadequate policy and regulations on post injury return to work (RTW) equals 3.00	One-Sample Wilcoxon Signed Rank Test	.346	Retain the null hypothesis

Asymptotic significances are displayed. The significance level is .05.

Table 7.2 has p-values greater than 0.05 for inadequate policy and regulations on return to work. This implies that this factor is insignificant at the 95% confidence level, and therefore do not result in injured workers failing to be reemployed. Based on the results in Table 7.2, it can be assumed that for hypothesis 1.1 and 1.2 the median is significantly greater than the reference constant, hence H_0 can be deemed rejected, while H_1 can be deemed accepted. Hence, it can be concluded that generally injuries sustained at work and labour productivity expectations set for workers by contractors reduce / prevent workers from securing subsequent employment. The hypotheses are also supported by the results in Table 6.20, which indicate that construction practitioners perceive that injured workers have limited chances to be reemployed by their previous employers or new employers.

7.4 Hypotheses for sub-problem 3

Hypothesis 3.1: Workers who are permanently absent from work due to death or injury results in their families experiencing financial difficulties

Hypothesis 3.2: Poor compensation for injured or deceased workers result in their families experiencing financial difficulties

*Hypothesis 3.2***:** Increased cost of home care for injured workers result in their families experiencing financial difficulties

Table 7.3 presents the one-sample Wilcoxon-tests against the median neutral point of 3.00 to establish significant factors for hypothesis 3.

Table 7.3 One-sample Wilcoxon-tests for hypothesis 3

Hypotheses test summary

	Null Hypothesis	Test	Sig.	Decision
1	The median of Workers who are permanently absent from work due to death or injury equals 3.00	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.
2	The median of Poor compensation for injured or deceased workers equals 3.00	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.
3	The median of Increased cost of home-based care for injured workers equals 3.00	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Table 7.3 above shows that all the p-values are statistically significant at the 5% level of significance. This implies that workers who are permanently absent from work due to death or injury, poor compensation for injured or deceased workers, increased cost of home-based care result in families of the injured workers experiencing financial difficulties. Based on the results in the Table 7.3, it can be assumed that the hypothesis median is significantly greater than the reference constant, hence H_0 can be deemed rejected, while H_1 can be deemed accepted. Hence, it can be concluded that generally death of a worker, poor compensation for injured or deceased workers, and increased cost of home care for injured workers result in their families experiencing financial difficulties. The hypotheses are supported by the results from workers' survey, which determined that workers and their families experiences financial and other problems as a result of workplace injuries.

7.5 Hypotheses for sub-problem 4

Hypothesis 4.1: Lack of contractor H&S planning exposes workers to numerous hazards on projects

Hypothesis 4.2: Inadequate designing for construction H&S results in workers being exposed to numerous hazards on projects

Hypothesis 4.3: Inadequate project management results in workers being exposed to numerous hazards on projects

Hypothesis 4.4: Lack of integration of H&S and environmental management systems expose workers and the general public to work-generated environmental hazards

Table 7.4 presents the one-sample Wilcoxon-tests against the median neutral point of 3.00 to establish significant factors for hypothesis 4.

Table 7.4One-sample Wilcoxon-tests for hypothesis 4

Hypotheses test summary

	Null Hypothesis	Test	Sig.	Decision
1	The median of Lack of contractor H&S planning equals 3.00	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.
2	The median of Inadequate designing for construction H&S equals 3.00	One-Sample Wilcoxon Signed Rank Test	.003	Reject the null hypothesis.
3	The median of Inadequate project management equals 3.00	One-Sample Wilcoxon Signed Rank Test	.003	Reject the null hypothesis.
4	The median of Lack of integration of H&S and environmental management systems equals 3.00	One-Sample Wilcoxon Signed Rank Test	.001	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Table 7.4 shows that all the outlined factors in sub-problem 4 are statistically significant at the 95% confidence level. Based on these results, it can be concluded that the lack of contractor H&S planning, inadequate designing for construction H&S, inadequate project management, lack of integration of H&S and environmental management systems results in workers being exposed to numerous hazards on projects. Hence H_0 can be deemed rejected, while H_1 can be deemed accepted. The hypotheses are also supported by the interview results from construction practitioners, which indicate that workers are exposed to inadequate H&S conditions because of inadequacies in HIRAs, poor planning, and inadequate incorporation of H&S in design decisions.

7.6 Hypotheses for sub-problem 5

*Hypothesis 5.1***:** Inadequate H&S is linked to occurrence of rework on construction projects

Hypothesis 5.2: Accidents result in project costs exceeding value

Hypothesis 5.3: Loss of output due to workers being absent, injured, or sick results in projects experiencing delays and or being completed late

Table 7.5 presents the one-sample Wilcoxon-tests against the median neutral point of 3.00 for hypothesis 5.

Table 7.5One-sample Wilcoxon-tests for hypothesis 5

Hypothesis test summary

	Null Hypothesis	Test	Sig.	Decision
1	The median of Inadequate H&S is linked to occurrence of reworks on construction projects equal 3.00	One-Sample Wilcoxon Signed Rank Test	.715	Retain the null hypothesis.

2	The median of Accidents results in project costs exceeding value equals 3.00	One-Sample Wilcoxon Signed Rank Test	.017	Reject the null hypothesis.
3	The median of Loss of output due to workers being absent, injured, or sick equals 3.00	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Table 7.5 shows that responses relative to hypothesis 5.2 and 5.3, are significantly higher than the median of the scale. Based on these results, it can be concluded that aaccidents result in project costs exceeding value, and loss of output due to workers being absent, injured, or sick results in projects experiencing delays / being completed late. Hence H_0 can be deemed rejected, while H_1 can be deemed accepted. However, the p-value relative to hypothesis 5.1 is greater than 0.05, implying that inadequate H&S is not significantly linked to occurrence of rework on construction projects. Hence H_0 can be deemed accepted, while H_1 can be deemed not accepted.

7.7 Hypotheses for sub-problem 6

Hypothesis 6.1: Non-facilitation of financial and other provision for H&S results in contractors lacking resources for construction H&S

Table 7.6 presents the one-sample Wilcoxon-tests against the median neutral point of 3.00 for hypothesis 6.

Table 7.6 One-Sample Wilcoxon-tests for hypothesis 6

Hypothesis test summary

	Null Hypothesis	**Test**	**Sig.**	**Decision**
1	The median of Non-facilitation of financial and other provision for H&S equals 3.00	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Table 7.6 shows that the outlined factor in sub-problem 6 is statistically significant at the 95% confidence level. Based on these results, it can be concluded that non-facilitation of financial and other provision for H&S results in contractors lacking resources for construction H&S.

7.8 Summary

The test of the hypotheses suggest that the workers are exposed to hazards because of inadequate hazard management, inadequate OH surveillance, appointment of stakeholders who do not systematically manage H&S, inadequate design HIRAs. In

addition, the results show that workers' exposure to hazards and inadequate integration of H&S and the environment, inadequate designing for construction H&S, inadequate project management, inadequate design HIRAs and inadequate H&S planning result in the occurrence of fatalities, injuries or fatalities. The H&S problem is amplified by non-facilitation of financial provision for H&S. Nevertheless, inadequate H&S has social and economic ramifications to workers and their families and to project delivery. The tests of the hypotheses also determined that the severity of the injury and productivity expectations of employers contribute to injured workers failing to be reemployed. The problem of failing to be reemployed is amplified by the lack of alternative forms of employment at the workplace and inadequate employer's commitment to CSR. The families of injured workers experience financial difficulties because of poor compensation, death of the injured worker, cost of home-based care and loss of employment. With regards to project delivery, the hypotheses testing determined that inadequate H&S affects project cost and productivity thereby delaying project completion.

8.0: SUSTAINABILITY FRAMEWORK FOR CONSTRUCTION H&S

8.1 INTRODUCTION

According to Berardi (2012), the increasing attention to sustainability worldwide calls for sustainable practices to be introduced in every sector. The construction industry, being a leading sector in the provision of infrastructure and creation of the built environment, has a great responsibility to ensure that its various practices are sustainable. However, the poor H&S and environmental records in the construction industry suggest that the construction industry is far from being sustainable. As a result, sustainable construction emerged as a strategy for the construction industry to realise sustainability. However, the transition to sustainable construction is motivated by the business value (Ochieng *et al.*, 2014) and environmental concerns. Nevertheless, the inadequate consideration of social sustainability issues in sustainable construction highlights that the framework is not holistic. This omission is evident in leading sustainability assessment frameworks in the construction industry such as the LEED and BREAM. Against that background, several studies (OSHA, 2016; Hinze *et al.*, 2013; Schulte *et al.*, 2013; Behm *et al.*, 2011) contest the certification of buildings as sustainable where a construction worker is seriously injured or killed from a work-related accident during the construction of the building.

To address this void, a growing, but limited body of knowledge is emerging advancing the extension of sustainability practices into H&S. This transition to sustainable H&S practice arises from the realisation that current practices are not viable in the long term (Berry and McCarthy, 2011; Gibson, 2006), and hence the need for change. The importance of leveraging sustainability to improve construction H&S outcomes is acknowledged in several studies (Boileau, 2016; OSHA, 2016; Galpin *et al.*, 2015; Reyes *et al.*, 2013; Schulte *et al.*, 2013; Usrey and Falkowitz, 2013). According to the OSHA (2016), integrating sustainability principles into construction H&S ensures that sustainability thinking is put at the forefront of H&S decision making (OSHA, 2016). The transition improves H&S and project outcomes through creating healthy and safe work environments, reduced occurrence of accidents, and improved productivity. The CIB W099 theme for the 2014 Conference, *'Achieving Sustainable Construction Health and Safety',* confirms the growing importance developing among academia and industry to transform current H&S practice to sustainable practice. Sustainable practice

ensures that decision makers do not make decisions that are only economically efficient but sustainable (Paul *et al.*, 2015).

Despite these developments, the transition towards sustainable H&S practices has generally been slow. This may be attributed to the lack of a framework to align H&S practices with sustainability principles and concepts. A study conducted by Bezalel and Issa (2016) determined that only two frameworks, that is, the Sustainable Construction Safety and Health (SCSH) rating system, and the Integrated Value Model for Sustainability Assessment (IMSVA) were in existence. However, the two frameworks were developed to assess H&S sustainability of sustainable buildings in developed regions, namely the USA and Spain respectively. Despite providing guidance for developing countries to integrate H&S sustainability into construction projects, the varying conditions between developed and developing countries necessitate the need for frameworks that reflect local conditions (Ali and Nsairat, 2008). Given that, this study proposes a project-level framework for integrating sustainability into H&S practice in Zimbabwe.

8.2 FRAMEWORK DEVELOPMENT PROCESS

The framework development process involved the use of multi-methods. This includes the review of literature, questionnaire surveys, and consultations with construction industry practitioners. The processes were iterative and interactive involving drafting, redrafting, and refining the model. The model was developed through three iterative phases. Section 8.2.1 to 8.2.2 presents a description of the processes.

8.2.1 Phase 1: Review of literature

The first step involved a review of literature to determine the principles and factors that frame sustainable H&S. This included the review of sustainable H&S literature (Boileau, 2016; OSHA, 2016; Hinze *et al.*, 2013; Reyes *et al.*, 2013; Schulte *et al.*, 2013; Rajendran and Gambatese, 2009; Rajendran, 2006) and related literature seeking to integrate sustainability in various forms of construction practice (Siew, 2016; Abidin and Pasquire, 2005). In addition, the study also reviewed some global sustainability assessment instruments such as the LEED, Global Reporting Initiative (GRI), Dow Jones Sustainability Index, CSHS, and the WHO framework on healthy workplaces.

The principles that frame sustainable H&S were developed from several research projects and summarised in Tables 4.3 and 4.4. This approach is consistent with the lack of a framework for sustainable H&S in Zimbabwe. Despite ratifying several United Nations (UN) frameworks with regards to sustainable development, the Government of Zimbabwe (GoZ) did not develop a composite framework of sustainability principles to guide development within the nation. Nevertheless, the review of international literature and local H&S regulations and policies managed to capture sufficient principles and factors for H&S practices for the Zimbabwean construction industry. The principles and factors of sustainability relative to H&S presented in Tables 4.3 and 4.4 allow for an objective assessment of H&S sustainability.

However, to apply sustainability principles into H&S practices, previous studies (Akadiri and Olomolaiye, 2012; Ugwu *et al.*, 2006) recommend that broad level principles should be disaggregated into concrete practical actions at the micro-level / project-level to be implementable. According, the sustainability principles for H&S were disaggregated into factors / issues, easily understood and implementable at the project level.

8.2.2 Phase 2: Importance of sustainability for H&S

This second phase of the model development process involved assessment of the importance of the sustainability principles to the prevention of injuries, illnesses and fatalities at construction sites. This was facilitated through a questionnaire survey administered to construction industry practitioners who included construction managers, H&S managers, quantity surveyors, architects, engineers from contractors, consultants, government, and clients.

The results of the questionnaire survey presented in Tables 6.25 to 6.27 indicate that construction practitioners perceive that integration of sustainability principles into construction H&S is important. However, the respondents perceive that the current level of sustainability integration into H&S practices is sub-optimal. The detailed breakdown of these results is provided in Table 6.29. The results suggest that a gap exists between the expected practices and the actual practices. According to Abidin and Pasquire (2005), the existence of a gap between the expected and the actual

practice is an important indicator of the need to put in place strategies to improve the practice.

8.2.3 Phase 3: Sustainability Framework for Construction H&S (SFCHS)

This phase involved the development of the SFCHS presented in Figure 8.1. The development of the SFCHS was informed by a review of literature, questionnaire surveys, and consultation with construction industry practitioners. After the draft model was produced, a panel of construction practitioners reviewed it and the feedback from the review process was incorporated in the final SFCHS.

8.2.4 Application of the framework

The framework sought to assess, monitor and integrate the principles and concepts of sustainable development into construction H&S at the project level. The SFCHS adopted the six-phase project life cycle consisting of project initiation, concept and feasibility, design, procurement, construction and project closeout (Smallwood, 2017; Bennett, 2003; South African Council for the Project and Construction Management Professions, 2000). The integration of principles along the project phases centralises the key role of several H&S stakeholders along the construction supply chain. The project life cycle has been extensively used in previous studies to integrate sustainability in construction and project management (Chileshe, 2011; Shen *et al.,* 2007) and recently, to integrate procurement, design, and H&S (Deacon, 2016). According to the WHO (2014), the supply chain provides opportunities for integrating sustainable H&S practice through explicit provisions for H&S in the procurement of contractors, designers, and suppliers.

The framework is flexible and can be applied by project stakeholders (clients, contractors and consultants) to assess the extent to which their H&S practices align with principles and concepts of sustainable development. However, the client, as the project sponsor, possesses a unique advantage to initiate the integration of sustainability into construction H&S. This is consistent with the emergence of some ‘better practice’ international and mining sector clients of the construction industry in Zimbabwe. Internationally, the role of the client with regards to integration of sustainability in projects (Sunindijo and Zou, 2014; Reyes *et al.*, 2013; Berry and McCarthy, 2011; Adetunji *et al.*, 2008; Al-Yami and Price, 2006) and influencing H&S

practices (Smallwood, 2004) is acknowledged and well documented. A study conducted by Kajimo-Shakantu (2014) observed that procurement can be used to influence change in behaviour of industry participants in furtherance of intended objectives.

8.2.5 Components of the framework

The SFCHS consists of two main components:

- the integrative process, and
- assessment of sustainability integration into construction H&S practices.

The design of the SFCHS is also informed by previous frameworks seeking to integrate sustainability into construction H&S practices (Deacon, 2017; Al-Yami and Price, 2006; Karonda *et al.,* 2006; Abidin and Pasquire, 2005). The SFCHS is designed to embrace systems theory comprising inputs (sustainability principles), processes (integration and assessment), and outcomes (performance). According to Azapagic and Perdan (2005), a systems approach is needed to translate the principles of sustainable development into practice. This ensures that sustainability is not considered as a mere ‘add on’ but systematically integrated (Azapagic and Perdan, 2003) into all H&S practices and that decision making take a holistic view.

Figure 8.1 and Table 8.2 presents a general overview of the structure of the SFCHS. Sections 8.4.3.1 and 8.4.3.2 briefly outlines the components of the framework.

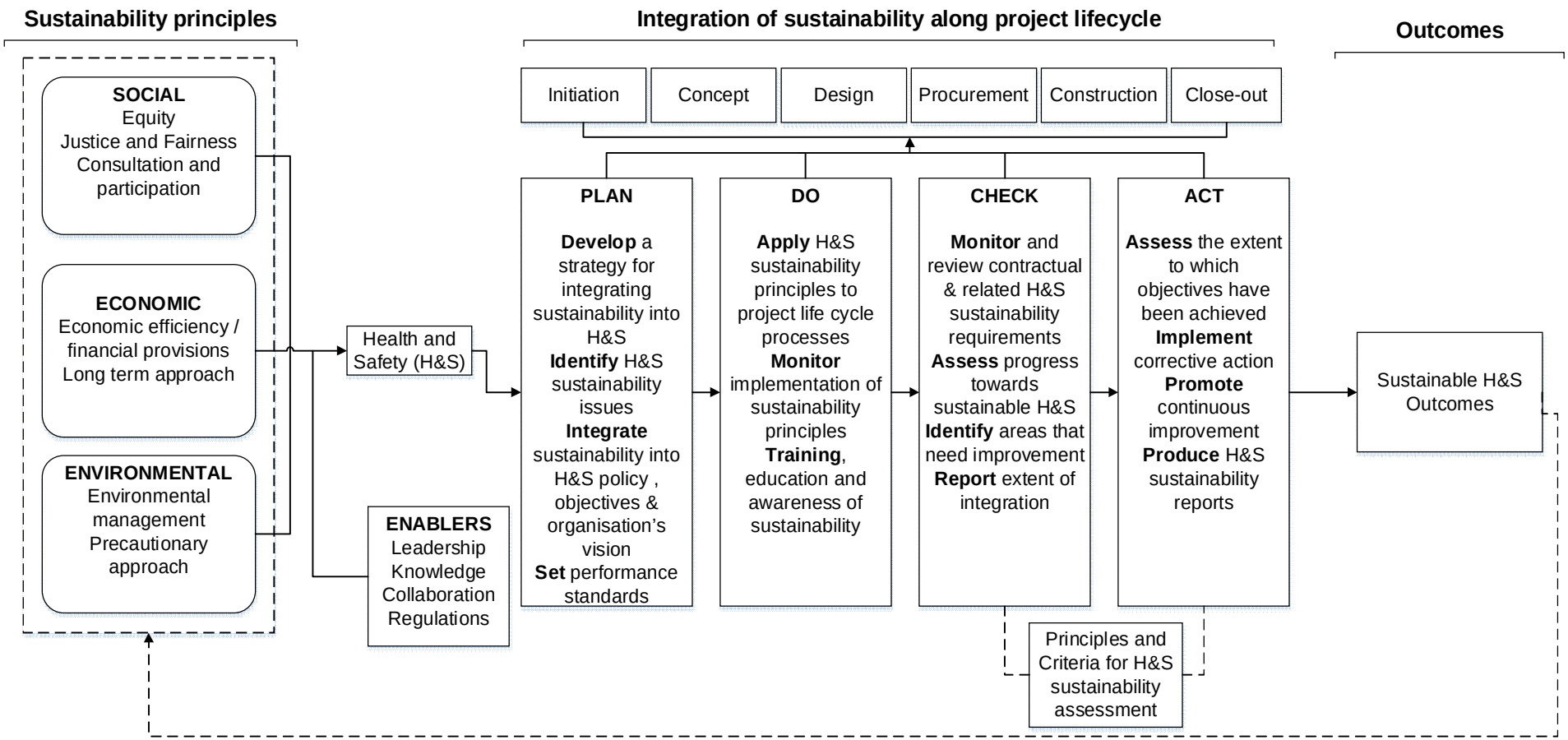

Figure 8.1 Structure of the SFCHS

8.3 THE INTEGRATION PROCESS

The is the process through which sustainability principles are incorporated into the planning and management of H&S throughout the project life cycle. Each stage of the project life cycle has a shared responsibility toward sustainable H&S. The Plan-Do-Check-Act (PDCA) methodological approach is proposed to facilitate a structured integration process of sustainability principles into H&S practices and to monitor performance on a continual basis. The PDCA is a management model developed by Deming in the 1950s to monitor business performance on a continual basis (ILO, 2011). The advantage of the PDCA for facilitating integration is its compatibility with existing H&S (such as OSHAS 1800, 2007), quality and environmental management systems. The European Commission (2014:5) summaries the four phases of the Deming cycle as follows: Plan (establish baseline for the organisation, setting objectives and measurements); Do (implement actions to achieve objectives); Check (monitor, measure and document results) and Act (improve, evaluate, apply lessons learnt, modify as necessary).

Section 8.3.1 to 8.3.4 presents a description of the main processes and activities for integration of sustainability into H&S according to the Deming cycle.

8.3.1 Step 1: Plan

This step sets out the objectives and strategy for aligning H&S with sustainability principles. A paradigm shift in thinking among stakeholders from short-term to long term, and from cost to value (Al-Yami and Price, 2006) is necessary if meaningful integration is to be achieved. This may be realised through education and awareness of sustainable H&S among project stakeholders (Knott *et al.*, 2014; Al-Yami and Price, 2006). At project inception, an all-stakeholders workshop is necessary to define the project sustainability vision with regards to H&S and how each stakeholder can contribute to the realisation of such vision. The use of innovative procurement strategies (Laryea and Watermeyer, 2014) is recommended to ensure early involvement of the contractor to be able to have a positive impact relative to H&S. In another study, Kajimo-Shakantu (2014) assert that procurement can be used as a vehicle to achieve a variety of socio-economic objectives. This platform should also set performance benchmarks and determine the sustainability principles to be applied at

each stage of the project life cycle. The client's project manager can spearhead coordination of activities. The role of the project relative to implementing sustainability initiatives is documented in previous studies (Sabini, 2016).

8.3.2 Step 2: Do

The main task of this step is to implement the vision and strategy adopted during the planning phase, and ensuring that interventions create and sustain healthy and safe workplaces, protect the environment, and enhance the firm's bottom line. To realise sustainable H&S, social, economic, and environmental sustainability principles are integrated into H&S policies, programmes, and activities across the project life cycle.

The project life cycle presents several opportunities to integrate sustainability in H&S. For instance, at design stage, H&S is integrated into design. The project stakeholders should ensure that buildings are designed to allow for health and safe construction and maintenance. The power of design to prevent H&S risks at the early stage of the project life cycle is well documented (Sunindijo and Zou, 2014; Reyes *et al.*, 2013). At the procurement stage H&S is integrated during the appointment of contractors, designers and suppliers. In addition, the stage ensures that adequate financial provisions are allocated for H&S. During project execution, social, economic and environmental considerations are incorporated in all project activities ensuring that there is adequate participation of stakeholders in H&S programmes, sufficient resources are devoted to H&S initiatives, production activities are sustainable, and the environment is healthy and safe. Some of the factors which are important at this stage include HIRAs, training, OH surveillance, supervision and compliance management. At the project close-out stage, H&S sustainability reporting will highlight the milestone achievements and areas that require further improvements. This is very important to inform future H&S practices during the operation and maintenance of the buildings / structures.

In order to establish the key sustainability principles for the sustainability framework for construction H&S (SFCHS), factor analysis was employed to regroup sustainability variables into a limited set of clusters (principles) based on shared variance. According to Hair *et al.* (2010), factor analysis is a statistical approach that can be used to analyse interrelationships among many variables and explain these variables in terms of their common underlying dimensions. Exploratory factor analysis was employed to

determine the number of factors / principles influencing sustainable H&S practices, and to place the factors into meaningful categories / clusters (Yong and Pearce, 2013). Exploratory factor analysis determines the sets of items between which there is an inter-relationship in a questionnaire. This approach was previously used by Martens and Carvalho (2016) to determine important sustainability factors in project management. The Bartlett's test of sphericity and the KMO measure of sampling adequacy (MSA) value of 0.58 was significant at the level of .05%. Hair *et al.* (2010) assert that the Bartlett's test of sphericity should be significant at 0.05, and the KMO should be greater than 0.50 to justify the application of factor analysis.

Accordingly, 7 sustainability principles / principal factors and 29 variables / factors emerged after principal component analysis was conducted on the ratings of sustainability factors for H&S. The sustainability principles and factors for H&S are presented in Table 8.1.

Table 8.1 Sustainability principles and factors / criteria

Dimension	Sustainability Principles / Principal factor	Factor / variable / criteria / item	Factor loads	% variance	communalities	MS	Std. deviation
Economic	Economic efficiency	Economic analysis of H&S relative to project and enterprise performance	0.899	45.000	0.915	3.88	1.224
		Financial resources provisions for H&S	0.857		0.892	4.12	1.104
		Responsible procurement relative to H&S	0.849		0.877	3.86	1.164
		Responsible production and employment	0.757		0.836	3.91	1.267
Environmental	Environmental protection	Environmental thermal changes	0.826	12.914	0.860	3.26	1.433
		Polluter pays	0.767		0.798	3.57	1.443
		Environmental information dissemination	0.644		0.841	3.85	1.126
		Site welfare provisions	0.635		0.755	4.15	0.945
		Environmental policies / regulations	0.545		0.810	4.11	1.034
Social	Human dignity & social equity	Pollution prevention	0.775	7.536	0.775	4.44	0.811
		Post injury management	0.71		0.800	4.04	1.203
		Workers' rights healthy and safe work	0.606		0.819	4.57	0.716
		Corporate social responsibility (CSR)	0.539		0.800	4.42	0.846
		Prevention through design	0.529		0.731	4.19	0.981
Social	Justice and fairness	Training of workers / supervisors in H&S	0.863	5.784	0.857	4.54	0.837
		Supervision, monitoring and evaluation (leadership commitment)	0.794		0.887	4.46	0.732
		H&S planning	0.666		0.859	4.39	0.843
		H&S policies, regulations and enforcements	0.550		0.806	4.48	0.802
Economic	Long-term approach	Life cycle assessment of benefits / costs of H&S	0.744	4.725	0.903	3.89	1.135
		Integrating H&S in construction planning and scheduling	0.666		0.873	4.14	1.070
		Integration of H&S in business plan of organisations	0.655		0.927	4.05	1.034
		Cost effectiveness	0.611		0.866	4.05	1.034
		Site layout / organisation of work	0.566		0.814	4.08	1.075
Environmental	Precautionary approach	Information of H&S hazards and risks	0.854	4.184	0.897	4.56	0.608
		Hazard Identification and risk assessment (HIRA)	0.722		0.910	4.51	0.911
Social	Consultation & participation	Reporting, recording and investigating incidents	0.822	3.758	0.823	4.52	0.719
		Selection of low risk materials	0.603		0.844	3.93	1.166
		Transparency, accountability, and informed participation	0.567		0.739	4.14	0.937
		Preserving the environment	0.490		0.819	4.28	0.893

The 7 extracted sustainability principles / principal factors were renamed to reflect how they represent the original variables. Based on the loaded variables, analyst judgement and review of literature related to sustainable principles for H&S (Table 4.3), the principal factors were named as ‘economic efficiency’, ‘environmental protection’, ‘human dignity and social equity’, ‘justice and fairness’, ‘long term approach’, ‘precautionary approach’, and ‘consultation and participation’.

It is notable that the extracted sustainability principles / principal factors cluster into the three sustainability dimensions as follows: social sustainability (3 principles), environmental sustainability (2 principles) and economic sustainability (2 principles). The economic sustainability principles explain the greatest variance suggesting that addressing economic fundamentals will enhance sustainable H&S practices. This analysis is, however, at variance with the extent of integration of sustainability principles in construction H&S, wherein economic principles were the least integrated in the current H&S practices. The foregoing corroborates the conclusion made from research findings from interviews and questionnaire surveys that the current H&S practices are inadequate / unsustainable.

The principles are briefly explained below:

Economic efficiency

The results in Table 8.1 show that the issues pertaining to economic efficiency explained most of the identified sustainability factors for H&S. This principal factor explains 45% of the total variance among the 29 sustainability factors. The results imply that addressing this primary factor in accordance of the factor loadings could enhance construction H&S practices in Zimbabwe. The factor loadings indicate that the sustainability factors influencing sustainable H&S practices under this cluster are ‘economic analysis of H&S relative to project and enterprise performance’, ‘financial provisions for H&S’, ‘responsible procurement’ and ‘responsible production’. The results are justified because to ensure sustainable H&S practices, there is need for adequate financial provisions (Smallwood, 2004). Previous studies have demonstrated the importance of financial provisions (Smallwood, 2004), responsible procurement

(Chari and Chiriseri, 2014) and alignment of H&S with project parameters in improving H&S outcomes.

Environmental protection

Table 8.1 show that sustainability items under the environmental protection cluster comprised 5 items of the 29 factors, and explained 12.9% of the variance. The sustainability factors in the environmental cluster, in the order of their factor loadings are 'environmental thermal changes', 'polluter pays', 'environmental information', 'site welfare provisions' and 'environmental policies / regulations'. These factors are important to ensure sustainable H&S management on construction projects. With global warming, it is becoming increasingly important for construction stakeholders to integrate climate change issues into H&S and ensure that those responsible for pollution of the environment and contributing to workplace accidents pay for the damage. Sharing environmental information is another important factor to manage environmental hazards. In addition, a health and safe work environment promotes site hygiene through enforcing environmental policies and regulations. According to Kaplan *et al.* (2017), environmental sustainability practices enhance H&S on projects.

Human dignity and social equity

The cluster contains 5 of the 29 sustainability factors, explaining approximately 7.5 % of the total variance. The items under this cluster include 'pollution prevention', 'post injury management', 'workers' rights to health and safe work', 'CSR' and prevention through design. It is notable that 'pollution prevention' was reassigned from environmental sustainability dimension to social sustainability dimension. This is consistent with the fact that workers have rights to clean and pollution free work environments. To protect human dignity, the need for post injury disability management for the injured workers is important to prevent workers and their families from driven into intergenerational cycles of poverty. Considering this, sustainable H&S practices should ensure that initiatives are in place to reintegrate, rehabilitate and compensate injured workers. The workers' rights to health and safe work as enshrined in the Constitution of Zimbabwe and other international treaties should be enforced at workplaces. To manage hazards, PtD initiatives can help to eliminate hazards at source. While the principle had been mainly focused on design of buildings and other construction structures, the elements of the PtD principle can be implemented in other

workplace activities such as procurement and the design of the work environment and work processes.

Justice and fairness

The sustainability factors under the justice and fairness cluster comprised 4 items of the 29 items, and explained approximately 5.8% of the variance. The sustainability items under this cluster are justified since sustainable H&S practices may not be realised where workers are not empowered to be able to make informed decisions. The sustainability factors under this cluster are: 'training of workers and supervisors', 'supervision and monitoring', 'H&S planning' and 'H&S policies and regulations'. To ensure fairness, H&S regulations should be fairly implemented, respecting the dignity of all workers and avoiding all forms of discrimination / harassment. It is important that supervisors increasingly monitor workers relative to H&S practices to ensure that behaviour-based issues are addressed. This development is consistent with the results of workers' survey, which indicated that workers are involved in accidents because of unsafe work practices.

Long-term approach

The sustainability factors under the long-term approach explain 4.7% of the variance. The sustainability factors include 'life cycle assessment of the benefits', 'integrating H&S in construction planning and scheduling', 'integration of H&S in business plan', 'cost effectiveness' and 'site layout'. It is notable that 'site layout' was reassigned to economic dimension from the environmental dimension. It is important to note that inadequate site layout may increase the cost of doing work, and may increase the exposure of workers to risks of accidents as they navigate the poorly organised site. The benefits of investment in H&S may not be realised within the short-term period, hence there is need for a paradigm shift with regards to the way employers and clients anticipate benefits from H&S investment. The integration of H&S in scheduling ensures that programmes is aligned to the capacity of workers to meet certain targets without compromising their H&S.

Precautionary approach

The sustainability items / factors under the precautionary approach cluster comprised 2 items of the 29 factors, and explained 4.2% of the variance. The sustainability

principles in the cluster are ‘information on H&S hazards / risks’ and ‘HIRAs’. The purpose of the precautionary approach is to create an impetus to take a decision notwithstanding scientific uncertainty about the nature and extent of the risk (ILGRA, 2002).

Consultation and participation

As depicted in Table 8.1, the sustainability factors under the consultation and participation cluster comprised 4 of the 29 sustainability factors, and explained 3.8% of the variance. The sustainability factors under this cluster are ‘reporting, recording and investigating accidents’, ‘low risk materials’, ‘transparency, accountability and informed participation’. This cluster seek to enhance sustainable health and safety through promoting participation and information dissemination. The investigation of accidents and the reporting of incidents is important to introduce measures for improvement and ensure polluters may pay for the damage caused.

The preceding presentation suggests that implementing sustainability-based practices for H&S will transform H&S practices from a conventional approach to a sustainability-based approach. In summary, Table 8.2 presents the sustainability principles for construction H&S in Zimbabwe, as extracted through factor analysis and review of the literature. These principles inform the SFCHS in Zimbabwe.

Table 8.2 Sustainability principles for construction H&S in Zimbabwe

SD	Principle	Interpretation of sustainability principles for H&S
Social	Human dignity and social equity	Address the needs of workers at the current and future projects where the workers are involved without exposing them to the risk of injuries, diseases or fatalities
	Consultation and participation	Enhance the participation of workers and other project stakeholders in H&S decision making
	Justice and fairness	Place workers at the centre of organisational and project policies by promoting fundamental workers' rights and combating all forms of unfair labour practices and discrimination
Economic	Economic efficiency	Ensure cost effectiveness relative to investments in H&S through promoting healthy and safe production methods that optimise the use of resources
	A long-term perspective / approach	Taking a long-term (life-cycle) approach relative to costs and benefits of investments in H&S
Environmental	Environmental protection	Ensure the work environment is protected from degradation, pollution and unsustainable waste disposal
	Precautionary approach	Take precautionary and preventive approach where there is objective scientific uncertainty in order to avoid potential damage to workers' H&S

8.3.3 Step 3: Check

This step provides for the monitoring of progress in terms of implementation of sustainability factors in H&S decision making and practice, and the outcomes with regards to the objectives of integration. Although this stage is more inclined to the project execution stage, the processes are ongoing to facilitate corrective action to be taken where necessary. The assessment of sustainability integration in H&S practice will be conducted at each stage of the project life cycle and the feedback from such assessment will be communicated to project stakeholders. Nevertheless, the effectiveness and value generated from this stage depends on the availability of reliable data collection system. An assessment questionnaire will be used to help the assessors to evaluate the progress made to integrate sustainability principles into construction H&S practices. A sample of the assessment questionnaire, principles and

criteria for sustainability assessment, and the procedure for assessment are provided in Appendix 10.5.

8.3.4 Step 4: Act

The stage will seek to establish whether the vision and objectives of sustainable H&S practice were achieved. This is an ex-post evaluation performed at project close-out to highlight the extent to which the project aligned its H&S activities with the principles and concepts of sustainable development. The ex-post assessment may be compared with the H&S lagging indicators such as lost time injury (LTI) incidence rate to determine the impact of integration on lagging indicators. The results of the evaluations, and lessons learnt are documented for future improvements, and are incorporated into the operation and maintenance (O&M) plan for H&S. The stage provides an opportunity to evaluate the outcomes of the integration and options for improving both the outcome and the process of integration. To be holistic, evaluation can be considered along the three dimensions of sustainability, namely social, economic and the environment.

8.6 VALIDATION OF THE FRAMEWORK

8.6.1 Introduction

This section presents the process and feedback of the validation of the draft Sustainability Framework for Construction Health and Safety (SFCHS). The validation process was conducted to determine the suitability and acceptability of the proposed framework (Cavdur, 2014; Wiegers, 2009) to the Zimbabwean construction industry. The feedback from the validation process informed improvements in the final SFCHS. Section 8.5.2 provides a brief outline of the adopted validation procedure.

8.6.2 The validation process

The Department of Defense (2009) define validation as a process of determining the degree to which a model is an accurate representation of the real world from the perspective of the intended uses of the model. The validation process gives an opportunity to stakeholders to contribute to the development of the model and to reflect on whether the model will solve the specific problem(s) in the industry. Wiegers (2009) broadly categorises the validation methods into formal and informal methods / techniques. According to Cook and Skinner (2005), formal methods rely on formal mathematical reasoning, inferences, and proofs of correctness. On the other hand, informal methods rely heavily on subject matter experts' (SMEs) expertise and evaluation (Petty, 2013). The informal methods are often used where simplicity (Cook and Skinner, 2005) and user interaction (Petty, 2013) are important. Petty (2013) highlight that informal methods often use questionnaires to elicit assessments.

8.6.3 Survey administration

The validation process used subject matter experts (SMEs), in the form of construction and allied practitioners selected from contractors, consultants, government and clients, to review and evaluate the SFCHS. The respondents were selected from organisations with a direct or indirect influence with regards to the management of H&S, namely contractors, consultants, a regulatory agency, and central government. The selection of survey respondents considered: the respondent's work experience in the construction industry; the respondent's involvement with the management of H&S on construction projects, and the respondent's knowledge of H&S and sustainability. Previous interactions with some of the practitioners during the initial phases of data

gathering helped in the identification of suitable respondents to participate in the validation process.

The respondents were presented with the draft framework together with the validation questionnaire, and the purpose of the survey. The validation questionnaire was generally structured wherein respondents were asked to rate a validation aspect on a five-point Likert Scale type questions. In addition to close-ended questions, respondents were also given an opportunity to make specific and general comments with regards to the validation aspect(s) and the Framework respectively. A sample of the validation questionnaire is provided in Appendix 10.5.

The choice of this validation method was informed by the multi-dimensional nature of the H&S problem and lessons from past studies. In a study conducted by Deacon (2016), a questionnaire survey was administered to construction practitioners for validation of the Procurement, Design and H&S model. Under another study, Abidin (2005) used a questionnaire to validate a proposed model to integrate sustainability into value management.

8.7 RESULTS OF THE VALIDATION

8.7.1 Response rate

A total of 35 construction and related practitioners were invited to participate in this survey. According to Hogg *et al*., 2015, a sample size greater than 25 or 30 is ‘sufficiently large’ for analysis. Twenty-five questionnaires were completed, received and included in the analysis. This represents an overall response rate of 71.4%. This response rate is considered reliable for validating the framework given the generally low response rates realised during construction industry surveys. The breakdown of the profile of respondents indicate that the validation process was performed by experienced and knowledgeable practitioners thereby improving the reliability of the validation feedback.

Table 8.3 presents the profile of the respondents for validating the SFCHS.

Table 8.3 Profile of validation respondents

No.	Designation of respondent	Type of organisation	Respondents' (Years) experience in construction	Qualification
1	Director	Government	16	Masters
2	Acting Deputy Director	Government	17	Masters
3	Principal Quantity Surveyor	Government	13	Honours
4	Partner	Quantity Surveying Consultancy	31	Honours
5	Partner	Quantity Surveying Consultancy	36	Honours
6	Partner	Quantity Surveying Consultancy	7	Honours
7	Senior Partner	Quantity Surveying Consultancy	42	Honours
8	Technical Director	Civil Engineering Consultancy	35	Masters
9	Managing Director	Civil Engineering Consultancy	25	Honours
10	Principal Partner	Architectural Consultancy	36	Masters
11	Principal Architect	Architectural Consultancy	16	Masters
12	Principal Architect	Architectural Consultancy	29	Masters
13	Lecturer	Academic	22	Masters
14	Director	Academic	30	Masters
15	Managing Director	Project Management Consultancy	29	Honours
16	Project Manager	Client	10	Masters
17	Heath, Safety and Environment Officer	Client	7	Honours
18	Heath, Safety and Environment Officer	Contractor	6	Post graduate diploma
19	Heath, Safety and Environment Manager	Contractor	5	Honours
20	Projects Manager	Contractor	10	Honours
21	Engineer	Contractor	10	Honours
22	Commercial Operations Manager	Contractor	18	Honours
23	Managing Director	Contractor	38	Masters
24	Regional Secretary	Contractor organisation	5	Honours
25	Principal OSH officer	Regulatory Agency	29	Masters

8.7.2 Knowledge of H&S and sustainable development

The respondents were asked to evaluate their level of knowledge with regards to H&S and sustainable development in terms of percentage responses to a scale 1 (very poor) to 5 (Excellent), and MS between 1.00 and 5.00, the midpoint being 3.00. The results are presented in Table 8.4.

Table 8.4 Knowledge of H&S and sustainable development

Knowledge area	Responses (%)						MS	Rank
	Unsure	Poor……Excellent						
		1	2	3	4	5		
H&S	0.0	0.0	0.0	15.0	35.0	50.0	4.35	1
Sustainable development	0.0	0.0	5.0	25.0	35.0	35.0	4.00	2

The results suggest that the respondents deem their knowledge of H&S (MS = 4.35) to be between good and excellent / excellent and for sustainable development (MS = 4.00) to be between moderate and good / good. It is notable that the reviewers perceive themselves as knowledgeable with respect to the two concepts under consideration.

8.7.3 SFCHS validation

The SFCHS validation process involved evaluating the framework against a set of validation criteria. Table 8.4 indicates the extent to which the SFCHS satisfies selected validation criteria in terms of percentage responses to a scale of strongly disagree (SD) to strongly agree (SA), and MS between 1.00 and 5.00, the midpoint being 3.00.

Table 8.5 Degree of concurrence with evaluation statements

Statement	Responses (%)						MS	Rank
	Unsure	SD	D	N	A	SA		
The framework addresses an important problem in the industry	0.0	0.0	0.0	0.0	24.0	76.0	4.76	1
The framework adds value to construction H&S	0.0	0.0	0.0	4.2	20.8	75.0	4.70	2
The framework integrates the roles of project stakeholders	0.0	0.0	0.0	24.0	24.0	52.0	4.28	3
The framework promotes integration & assessment of sustainability in H&S practice	0.0	0.0	0.0	4.0	24.0	72.0	4.24	4
The framework is logical	0.0	0.0	0.0	12.0	52.0	36.0	4.24	5
Implementation of a framework can reduce the occurrence of accidents on projects	0.0	0.0	0.0	20.0	36.0	44.0	4.24	6
The framework is practical	0.0	0.0	0.0	20.0	40.0	40.0	4.20	7
The framework is comprehensive	0.0	0.0	8.0	12.0	48.0	32.0	4.04	8
The framework is easy to understand	0.0	0.0	16.7	27.8	38.9	16.7	3.55	9

It is notable that all the MSs are above the midpoint score of 3.00, which indicates that there is high degree of concurrence among respondents that the SFCHS satisfies the validation criteria. The results indicate that 7 out of 9 validation criteria have MSs >

4.20 ≤ 5.00, which indicates that respondents agree to strongly agree / strongly agree that the framework addresses an important problem within the construction industry, adds value to the management of H&S, promotes integration of stakeholders roles relative to H&S, facilitates integration and assessment of sustainability in H&S practices, is logical and practical, and implementing the framework will potentially reduce the occurrence of injuries. The validation aspects / factors ranked 8th and 9th have MSs > 3.40 ≤ 4.20, which indicates the extent to which the respondents concur with the statements that 'the SFCHS is comprehensive' and 'easy to understand' to be between neutral to agree / agree.

The respondents were also asked to evaluate the extent to which the SFCHS included important sustainability issues within the social, economic and environmental dimension relative to H&S. The results presented in Table 8.6 indicate that the respondents perceive the extent to which important sustainability issues for H&S are included in the environmental dimension (MS = 4.21) to be between a near major to a major / major extent.

Table 8.6 Sustainability principles and criteria for H&S

Sustainability dimension	**Response (%)**						**MS**	**Rank**
	Unsure	**Not at all…..……Major**						
		1	**2**	**3**	**4**	**5**		
Environmental	0.0	0.0	0.0	16.7	45.8	37.5	4.21	1
Social	0.0	0.0	0.0	34.8	34.8	30.4	3.96	2
Economic	0.0	0.0	4.3	26.1	47.8	21.7	3.87	3

The results in Table 8.6 show that social and economic sustainability have MSs > 3.40 ≤ 4.20, which indicates that the respondents deem the extent to which the SFCHS includes social and economic sustainability relative to H&S is between a moderate to a near major / near major extent.

With regards to the practical application of the SFCHS within the Zimbabwean construction industry, respondents were asked to evaluate the extent to which the SFCHS can be applied by contractors and clients on projects to determine the level of integration of sustainability within H&S practices. Table 8.7 presents the results of this assessment.

Table 8.7 The use of the SFCHS by project stakeholders

Stakeholder	Response (%)						MS	Rank
		Not at all…..……..Major						
	Unsure	1	2	3	4	5		
Contractors	0.0	0.0	0.0	4.2	29.2	66.7	4.63	1
Clients	0.0	0.0	0.0	12.5	29.2	58.3	4.46	2

The MSs are > 4.20 ≤ 5.00, which indicates that the respondents deem that the SFCHS can be applied by contractors and clients on projects to determine the level of integration of sustainability within H&S practices between a near major to major extent / major extent. Although the question did not include an assessment of consultants, respondents perceive that consultants can also benefit from applying the SFCHS to assess their efforts toward contributing to realising sustainable H&S practice on projects. A comment made by one of the respondents that '…the SFCHS should involve and include designers and other consultants as well' summarises the sentiments of the respondents.

In addition to the above comments, respondents also highlighted the need for a workshop at project inception to articulate the sustainable H&S vision for the project and how each stakeholder can contribute to the realisation of that vision.

8.7.4 Implementation of the SFCHS

The SFCHS proposes to use the Plan-Do-Check-Act (PDCA) to integrate sustainability principles and concepts into H&S practices along the project life-cycle. The respondents were asked to assess their degree of concurrence with this approach in terms of percentage responses to a scale strongly disagree (SD) to strongly agree (SA) and MS between 1.00 and 5.00, the midpoint being 3.00. The results are presented in Table 8.8.

Table 8.8 Degree of concurrence with statement on the integration approaches

Approach to integration	Responses (%)						MS	Rank
		SD	D	N	A	SA		
The project-life cycle approach	0.0	0.0	0.0	0.0	44.0	56.0	4.56	1
The Plan-Do-Check-Act Model	0.0	0.0	0.0	4.0	48.0	48.0	4.44	2

The results indicate that the MSs > 4.20 ≤ 5.00, which indicates that respondents agree to strongly / strongly agree with the proposed use of the PDCA and the project life cycle for the integration of sustainability into H&S practices.

The respondents were also asked to assess the extent to which selected factors identified in the SFCHS are necessary to facilitate integration. Table 8.9 shows that all MSs > 4.20 ≤ 5.00, which indicates that respondents perceive the extent to which these factors are necessary for integration to be between a near major to a major / major extent.

Table 8.9 Enablers for integration

Factors / enablers of integration	Response (%)						MS	Rank
	Unsure	Not at all…..……Major						
		1	2	3	4	5		
Regulatory framework	0.0	0.0	0.0	8.0	8.0	84.0	4.76	1
Training / Knowledge	0.0	0.0	0.0	8.0	12.0	80.0	4.72	2
Commitment from project stakeholders	0.0	0.0	0.0	4.0	20.0	76.0	4.72	3
Collaboration of project stakeholders	0.0	0.0	0.0	8.0	12.0	80.0	4.72	4
Leadership	0.0	0.0	0.0	8.0	20.0	72.0	4.64	5

8.8 SUMMARY

The study developed a SFCHS to facilitate the alignment of H&S practices with sustainability principles along the project development phases. The SFCHS adopted the Deming cycle to facilitate operationalisation of the framework to the project life cycle. The Deming cycle is a management framework that has been widely adopted because of its ability to promote continual improvements in most H&S and related management systems. The SFCHS was developed from a combination of literature analysis, questionnaire surveys, and interviews with construction practitioners. The questionnaire survey determined that construction practitioners perceive that aligning H&S with sustainability principles is important in enhancing improved H&S outcomes. Despite the importance attributed to sustainability principles, it is incongruous that the principles are marginally integrated in construction H&S practices in Zimbabwe. Given that, the SFCHS provides an opportunity for transforming H&S practices through leveraging sustainability principles. The SFCHS was validated through structured questionnaire surveys with construction industry practitioners. The validation process confirmed the importance, suitability and relevance of the SFCHS to the construction industry in Zimbabwe. The validators also confirmed that when appropriately implemented, the SFCHS has potential to improve H&S performance and reduce the occurrence of accidents, injuries and fatalities on projects. However, to enhance the

integration of sustainability into H&S practices, a regulatory framework, training, collaboration, commitment and demonstrated leadership among project stakeholders are the important enablers. Impliedly, the validation process reinforces the need for integrated procurement systems to minimise the 'vicious blame cycle' among project stakeholders with regards to shortcomings in the implementation of sustainable H&S practices. The feedback comments from the validation process, which mainly focused on ensuring that the framework is simple, informed the refinements to the SFCHS. The SFCHS confirms the conceptual framework developed in Section 4.6.1. However, out of the 9 principles which informed the conceptual framework, 7 were retained, namely economic efficiency, environmental protection, human dignity and equity, justice and fairness, long-term approach, precautionary approach, consultation and participation. The development of a Sustainability Framework for Construction H&S as a strategy to improve H&S practices in Zimbabwe, and the validation thereof, resulted in a significant contribution to the related body of knowledge.

9.0: CONCLUSIONS AND RECOMMENDATIONS

9.1 CONCLUSIONS

The study sought to examine H&S management in the Zimbabwean construction industry and to develop a framework for integrating sustainability principles into construction H&S management practices. The general objective was informed by six objectives which sought to: investigate the factors contributing to workers' exposure to H&S hazards and the occurrence of injuries, fatalities and diseases; establish the effects of occupational injuries, disease and fatalities on workers and their families; establish the impact of inadequate H&S on project cost, duration, productivity, and quality; examine the factors that determine contractors' financial provision for H&S; assess the impact of the of procurement on H&S management on projects; establish the interface between H&S and sustainable development, and develop a framework for integrating sustainability principles into construction H&S management practices on construction projects. The requirements of these objectives were accomplished through a combination of the review of international and local literature and empirical research.

The review of literature determined that despite several interventions to address the H&S problem, the results suggest that H&S performance remains below expectations. The construction industry remains a leading sector with regards to statistics of workplace injuries, fatalities, or disease. Inadequate H&S management systematically exposes workers to conditions, which diminish their capacity to meet current and future needs. This is demonstrated where injured workers may fail to be re-employed. Regrettably, the social and economic ramifications arising from workplace injury can force the worker and his/her family into an intergenerational cycle of poverty. The review of literature also highlighted that workplace injuries affect project delivery through influencing project cost, productivity, contributing to the occurrence of rework, and delaying project completion.

Against a background where H&S problems continue to persist, more research is needed to identify alternative approaches to reducing the occurrence of accidents and improve quality of life for workers. The study adopted a mixed methods research design, which involved using interviews and questionnaire to collect data from

contractors, consultants, government, clients, and construction workers in Harare and Bulawayo to examine construction H&S management in Zimbabwe and propose a sustainability framework for H&S practices. To ensure a robust examination of the H&S problem, interviews and questionnaire were used sequentially to collect data and the data was triangulated to determine complementarity. The choice of the study area was informed by previous studies, which determined that approximately 80% of registered contractors and construction consultants are located in Harare and Bulawayo.

The research findings will be presented in summary according to the objectives of the study. Objective 1 to 4 examined H&S management in Zimbabwe, and objective 5 and 6 explored sustainability principles and development of the SFCHS. The objectives are structured in accordance with to the research sub-problems.

Objective 1: To investigate the factors contributing to workers' exposure to H&S hazards and the occurrence of injuries, fatalities and diseases. The results of the study suggest that construction workers are exposed to hazards at the workplace due to a lack of planning for H&S, inadequate HIRAS, inadequate management of hazards, inadequate OH surveillance, and appointment of stakeholders who do not systematically manage H&S, and inadequate design HIRAs. In addition to exposure to hazards, workers may succumb to the occurrence of injuries, disease or fatalities due to unsafe work practices, inadequately managed hazards, inadequate enforcements, inadequate management of hazards, and inadequate planning for H&S, lack of integration of the environment and H&S, and inadequate integration of H&S in design decisions. The contractors, consultants, government, and the workers generally concur relative to the factors contributing to construction injuries, fatalities or disease. The research findings suggest that interventions that seek to reduce workers' exposure to hazards, improvement in H&S planning, integration of H&S with the environmental systems, and integration of H&S into procurement systems will contribute to reducing the occurrence of injuries, disease and fatalities. This may be realised through enhanced participation of several stakeholders along the construction supply chain.

Objective 2: To establish the effects of occupational injuries, diseases or fatalities on workers and their families. The results suggest that workplace injuries affect worker's future economic prospects through limiting their opportunity to return to work at a new

or current employer. The return to work initiatives for the injured workers are adversely affected by the severity of injury / degree of disability, the physical nature of construction, labour productivity thresholds set by contractors, and lack of contractor capacity to create alternative forms of employment. Despite provision of rehabilitation programmes by the NSSA to improve the opportunities for injured workers to be reintegrated, inadequate reporting of accidents makes it difficult for some of the injured workers to be reintegrated. In addition to the failure to be reintegrated, research findings indicate that injured workers and their families experience social challenges such as anxiety, strained family relationships and pain, and financial difficulties. The factors perceived to lead to workers experiencing financial difficulties are loss of employment, inadequate compensation, and death of the injured workers. Although workers are entitled to compensation through the WCIF, the bottlenecks / barriers to secure compensation, inadequate reporting and poor compensation amplify the problem.

Objective 3: To establish the impact of inadequate H&S on project cost, duration, productivity, and quality. The results relative to this objective suggest that inadequate H&S affects project delivery through increasing project cost, delaying project delivery, and reduced productivity. The results reinforce previous findings (Smallwood, 2004) wherein H&S is identified as a project parameter capable of influencing other project parameters. The results suggest that improving H&S practices represents strategic value to business (Gahan *et al*., 2014) because a healthy and safe workforce can positively influence project performance. Nevertheless, the results indicate that inadequate H&S has a minor impact relative to the occurrence of reworks or non-conforming work.

Objective 4: To examine the factors that determine contractors' financial provisions for H&S. The results of both the interviews and questionnaire survey for contractors, consultants, and the government, suggest that contractors' financial provision for H&S is inadequate. The research findings indicate that respondents perceive that the quantum of financial provision for H&S is influenced by client commitment and specifications relative to H&S, inadequate prioritisation of H&S during tender, the level of tender competition, and contractual clauses for H&S. Although the results are consistent with the interview findings, they depict a situation where H&S has not been

sufficiently prioritised within conditions of contract, and during procurement. Nevertheless, the results reinforce the importance of clients in influencing H&S practices through procurement strategies adopted. The importance of clients relative to H&S practices is also confirmed through interviews with practitioners from contractors, consultants, and clients, which determined that 'better practice' clients are contributing to improving construction H&S practices through integrating H&S into procurement systems.

The foregoing discussion suggests that H&S practices are affected by several shortcomings along the construction supply chain, which subsequently contribute to workers' exposure to hazards and the occurrence of fatalities, injuries, and disease. The results generally reinforce the global position wherein the construction industry is regarded as a hazardous work sector, which contributes disproportionately to workplace injuries, fatalities or disease. Nevertheless, workers' exposure to hazardous conditions and the occurrence of injuries and disease systematically diminish the worker's quality of life and their ability to meet current and future needs. However, the effects of workplace accidents are retrogressive to the realisation of the sustainable development goals for the country. The ILO (2009) argues that from a social justice perspective, human suffering related to workplace fatalities, injuries, and disease is unacceptable. In the absence of an intervention strategy relative to H&S practices, the Government of Zimbabwe's vision to achieve an upper middle-income economy status by 2030 may not be realised, or will be realised at the expense of workers' H&S.

9.1.1 Implications of the results to construction stakeholders

The research findings have several implications for contractors, consultants, clients, government, and construction workers. At a broader level, the research findings may impact social change relative to H&S management through promoting voluntary proactiveness among contractors, consultants, clients, government, and workers relative to sustainable H&S practices on construction projects. The implications of the research findings for each stakeholder are discussed below.

The Government

Although a national OSH policy was developed and ratified in 2014, the lack of a comprehensive regulatory framework for H&S limits the implementation of H&S

provisions. The research findings suggest that a lack of harmonised H&S regulations and inadequate integration of H&S and environmental regulations adversely affect the implementation of H&S provisions on construction sites, thereby contributing to workers' exposure to hazards. In this regard, the government should demonstrate political will to harmonise construction H&S regulations, which will also pave way for the development of sector specific regulations. The government can therefore benefit from the results of this study by integrating the principles of sustainable development into the legislative provisions of the draft H&S bill.

In addition, the government, as a major procurer of construction works, can positively impact H&S by integrating H&S specifications into the procurement of contractors, consultants, and suppliers. The government, acting through the NSSA, should promote H&S through education, training, engagement of employers and workers, and enforcement of provision for H&S. The progression to sustainable H&S has great benefits for government as a reduction in the occurrence of accidents reduces the cost of social security and government expenditure.

Clients

The research findings suggest that inadequate procurement relative to H&S contributes to poor H&S performance in the construction industry. The results reinforce the important role of clients relative to H&S. The clients of the construction industry can positively impact change relative to H&S through making specific requirements for H&S at procurement and making explicit provisions relative to H&S within contract documents. To help realise improved H&S practices, the client's professional team of consultants should also include a H&S manager. During a previous study, Kajimo-Shakantu (2014) determined that procurement has been used by developed and developing countries to achieve a variety of socio-economic objectives.

Contractors

The results suggest that construction workers are exposed to hazards and the occurrence of fatalities, injuries, and disease due to inadequate contractor H&S practices, *inter alia*, inadequate HIRAs, and inadequate H&S planning. The implication of the results to contractors is that, as the implementing agents, they have a great responsibility to ensure that the work environment is always healthy and safe. This may

be realised through capacitating workers to be able to identify and prevent hazards and providing sufficient resources for H&S. The contractor may also benefit by integrating sustainability-based practices at the construction site.

Consultants

The results of the study suggest that consultants such as designers, quantity surveyors, and project managers contribute to inadequate H&S practices at construction projects. For instance, consultants occupy a strategic position to influence H&S improvements through influencing client H&S decisions. The research findings from interviews revealed that lack of client conscientisation relative to H&S affects the client's response to H&S provisions. The quantity surveyors and project managers can use their position to influence the review of the contract clauses to allow for sufficient provision for H&S within the contract documents and to provide for an equitable platform for pricing H&S. The designers should contribute to the prevention of hazards through integrating H&S issues in their designs and designing out hazards. Nevertheless, the research findings suggest that designers' consideration of PtD techniques in their designs is moderate. Yet, designing for H&S is an important and sustainable principle for the minimisation of transfer of hazards from design to the construction and maintenance phases of a building.

Workers

The results of a workers' survey determined that unsafe work practices, *inter alia*, is a major contributor to the occurrence of fatalities, injuries, and disease. This finding implies the need for a behaviour-based approach to addressing the issue of workplace fatalities, injuries, and fatalities. Simultaneously, the research results present a pathway which workers should follow to enhance sustainability of H&S practices at the workplace. Thus, workers, through their representatives, can use the results to advocate for sustainable H&S practices at the workplace. Achieving a healthy and safe workplace has long-term implications to the community. According to Hill and Seabrook (2013), workers who are accustomed to a healthy and safe work behaviour will take those habits home, and the entire community will benefit from the shared vision and knowledge of workers on H&S.

Although the interventions by individual stakeholders are important, they do not resonate as a part of a long-term strategic initiative (Taubitz, 2010) to realise sustainability in H&S practices. A holistic and long-term strategy is needed. In today's world, sustainability has been embraced by most business and public entities as a development strategy to improve business performance. Considering that, this study investigated the integration of sustainability principles into H&S practices. Although construction practitioners selected from contractors, consultants, government, and clients concur that sustainability principles are important for improving H&S practices, the principles are marginally integrated into H&S practices.

The extent to which sustainability principles are integrated into construction H&S practices is, however, incongruous with the perceived importance of these principles in addressing the H&S problem. This gap is explained by, *inter alia*, the lack of a framework to facilitate integration of sustainability into H&S practices. This research closed that gap through the development of a strategy and intervention, and a framework of improved practices in the form of a Sustainability Framework for Construction Health and Safety (SFCHS). The SFCHS offers an opportunity to the construction industry to transform its work practices to sustainable work practices. Sustainable H&S practices seek to regenerate and grow the industry's human resources instead of consuming them. The validation of the SFCHS indicated that the adoption of the recommended sustainability practices, the construction industry can recreate work environments into a sustainable work environment that is healthy and safe for the workers. The study would recommend that construction stakeholders embrace sustainability-based practices as a strategy to improve H&S practices.

9.1.2 Contribution to knowledge

The research makes an original contribution to knowledge relative to sustainable construction H&S. The research's contribution to knowledge is exhibited at two levels, namely, the theoretical framework and empirical findings.

The review of literature explored a very important, though relatively new facet to construction H&S management. The concept of sustainable construction H&S is a relatively unexplored area and hence there is dearth of literature on the subject. However, the review of literature provided new highlights relative to the potential to

improve H&S through integrating sustainable development principles into construction H&S practices. In addition to developing a comprehensive framework of sustainability principles for H&S, the theoretical framework informs debate relative to the impact of integrating sustainability into construction H&S practices.

The empirical research provided insights into the source of the construction H&S problems in Zimbabwe. This information is important for policy and other related interventions to transform H&S practices to a sustainable practice. The development of a Sustainability Framework for Construction H&S as a strategy to improve H&S practices in Zimbabwe, and the validation thereof, resulted in a significant contribution to the related body of knowledge. The validation of the framework demonstrated that implementing the SFCHS provides an opportunity for the construction industry to reduce the occurrence of workplace injuries, fatalities or disease.

Although a limited number of sustainability frameworks relative to H&S were developed in the USA (SCHS rating system) and Spain (Integrated Value Model), the two frameworks have an orientation towards assessing H&S sustainability in sustainable buildings in developed countries. However, since different conditions exist between developed and developing countries relative to sustainability requirements, a sustainability framework reflecting local conditions is required. This approach is consistent with the CIB, which had to commission a special framework, that is, Agenda 21 on Sustainable Construction in Developing Countries, as a strategy for introducing sustainable construction in developing countries. Thus, the SFCHS is a developing country response to the challenges of sustainable H&S practices. In Zimbabwe, sustainable construction is still at the infancy stage, hence the adoption of the SFCHS will help the construction sector to slowly transcend towards sustainable practices beyond the current focus on H&S.

To enhance the impact of the research on society, the research findings will be disseminated through conference presentations, seminars, lectures, and journal publications. The publications will allow researchers to have access to literature deemed by esteemed journal editors and conference reviewers to be contributing to knowledge relative to sustainable H&S. At a national level, the Safety, Health and Well-being (SHAW) conference hosted by the NSSA annually, provides a great platform to disseminate research findings to an audience that includes policy makers, construction

practitioners, academia and practitioners from the other economic sectors. The dissemination of results at such a platform can help to influence social change through influencing the adoption of sustainable H&S practices at the work place and the integration sustainability principles into the draft OSH Bill.

9.1.3 Recommendations for further research

The study examined construction H&S management in Zimbabwe and developed a SFCHS as a strategy to improve H&S practices in Zimbabwe, which was validated by 25 purposively selected construction stakeholders. Although the SFCHS provides a platform to transform H&S practices towards sustainable practice, however, effective implementation of the framework depends on the collaboration of all project stakeholders. Against that background, future research should:

- investigate alternative procurement methods to enhance integration of sustainability into construction H&S practices, or
- investigate the responsiveness of sustainability factors relative to the occurrence of injuries, disease and fatalities based on selected projects.

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10.0 APPENDICES

May 2017

Dear Sir / Madam

RE: INTEGRATING SUSTAINABILITY PRINCIPLES IN CONSTRUCTION HEALTH AND SAFETY (H&S) IN ZIMBABWE

I kindly request your participation in this survey. The survey is conducted in partial fulfillment of the requirements of a PhD (Construction Management) at Nelson Mandela Metropolitan University. The study examines H&S management in Zimbabwe and explores opportunities for integrating sustainability principles and concepts in construction H&S practices.

Your valued participation in the survey is voluntary. The information collected shall be kept in confidentiality and will be used for academic purposes only. The completed questionnaire may be returned through email to the undersigned or collected from your office.

Yours faithfully,

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10.1 APPENDIX 1: QUESTIONNAIRE 1 CONTRACTORS / QSs / GOVERNMENT

SECTION A: EXPOSURE TO CONSTRUCTION H&S HAZARDS

1. Please rate, on a scale of **1 = Not at all** to **5 = Major**, the extent to which construction workers are exposed to hazards at construction sites Zimbabwe.

	Extent of exposure to hazards	**Unsure**	**Not at all (1)……Major (5)**				
1.1	Workers' exposure to hazards	U	1	2	3	4	5

2. Please rate, on a scale of **1 = Not at all** to **5 = Major**, the extent to which the following **factors / situations** result in workers being exposed to construction hazards in Zimbabwe.

	Factor / Situations	**Unsure**	**Not at all (1)……Major (5)**				
2.1	Inadequate hazard identification and risk assessment	U	1	2	3	4	5
2.2	Lack of contractor H&S planning	U	1	2	3	4	5
2.3	Appointment of stakeholders (contractors) who do not systematically manage H&S	U	1	2	3	4	5
2.4	Inadequate designing for construction H&S	U	1	2	3	4	5
2.5	Inadequate project management	U	1	2	3	4	5
2.6	Lack of integration of H&S and environmental management systems	U	1	2	3	4	5
2.7	Inadequately managed hazards	U	1	2	3	4	5
2.8	Poor occupational health (OH) surveillance	U	1	2	3	4	5
2.9	Inadequate design hazard identification and risk assessment	U	1	2	3	4	5

3. Please rate, on a scale of **1 = Not at all** to **5 = Major**, the extent to which contractors make sufficient financial resource provisions for construction health and safety in Zimbabwe.

Not at all (1) .....Major (5)					
U	1	2	3	4	5

4. Please rate, on a scale of **1 = Not at all** to **5 = Major,** the extent to which non-facilitation of financial and other resource provisions for health and safety (H&S) result in contractors lacking resources for H&S in Zimbabwe.

Unsure	**Not at all (1)……Major (5)**				
U	1	2	3	4	5

5. Please rate, on a scale of **1 = Not at all** to **5 = Major,** the extent to which the following **factors/ parameters** affect contractors' providing financial provisions for health and safety (H&S) in Zimbabwe.

	Factor / Parameter	Unsure	**Not at all (1)……Major (5)**				
5.1	Tender competition	U	1	2	3	4	5
5.2	Non-specific contract clauses on H&S	U	1	2	3	4	5
5.3	Lack of a standard framework for H&S pricing	U	1	2	3	4	5

5.4	Inadequate information on H&S hazards / risks at tendering	U	1	2	3	4	5
5.5	Inadequacies in H&S Regulations	U	1	2	3	4	5
5.6	Inadequate client commitment and preparedness to finance H&S	U	1	2	3	4	5
5.7	Inadequate H&S weighting within client tender selection criteria	U	1	2	3	4	5

SECTION B: THE OCCURRENCE OF FATALITIES, INJURIES & DISEASES

6. Please rate, on a scale of **1= very poor to 5= Excellent**, the standard of construction health and safety practice in Zimbabwe.

Unsure	**Not at all (1)……Major (5)**				
U	1	2	3	4	5

7. Please rate, on a scale of **1 = Not at all** to **5 = Major**, the extent to which the following **situations / conditions / factors** result in occurrence of construction accidents, injuries, illnesses and fatalities in Zimbabwe.

	Situation / Condition	**Unsure**	**Not at all (1)……Major (5)**				
7.1	Inadequately managed hazards	U	1	2	3	4	5
7.2	Inadequate design hazard identification and risk assessments	U	1	2	3	4	5
7.3	Inadequate occupational health (OH) surveillance	U	1	2	3	4	5
7.4	Procurement of stakeholders (e.g. contractors) who do not systematically manage H&S	U	1	2	3	4	5
7.5	Inadequate project management and supervision	U	1	2	3	4	5
7.6	Inadequate management commitment to H&S	U	1	2	3	4	5
7.7	Unsafe work practices	U	1	2	3	4	5
7.8	Inadequate H&S planning	U	1	2	3	4	5
7.9	Inadequate H&S inspections & enforcements	U	1	2	3	4	5
7.10	Poor housekeeping, problems with site layout and space availability.	U	1	2	3	4	5
7.11	Shortcomings with equipment, including PPE.	U	1	2	3	4	5
7.12	Inadequate training	U	1	2	3	4	5

8. Making reference to one project you participated in the last 5 years, please state the type of accidents / injuries that occurred on this project (if any happened)

   _____
   _____
   _____

SECTION C: EFFECTS OF INADEQUATE H&S

9. Please rate, on a scale of **1 = Never** to **5 = Always**, the extent to which injured workers (disabling / lost time injuries) reemployed with the current or different employers in Zimbabwe.

9.1	**Employer**	Unsure	**Not at all (1)…….Major (5)**				
	Re-employed with the same employer	U	1	2	3	4	5
9.2	Re-employed with a different employer	U	1	2	3	4	5

10. Please rate, on a scale of **1 = Not at all** to **5 = Major**, the extent to which the following factors / conditions / situations affect re-employability of injured workers in Zimbabwe.

10.1	**Factor / condition**	**Unsure**	**Not at all (1)…….Major (5)**				
10.1	Severity / nature of injuries sustained	U	1	2	3	4	5
10.2	Labour productivity expectations set for workers by contractors	U	1	2	3	4	5
10.3	Inadequate organisational policy on return to work	U	1	2	3	4	5
10.4	Inadequate national policy & regulations on return to work	U	1	2	3	4	5
10.5	Inadequate contractor management commitment to Corporate Social Responsibility	U	1	2	3	4	5
10.6	Shortcomings with rehabilitation programmes	U	1	2	3	4	5
10.7	Lack of contractor capacity to offer alternative duties to the injured worker	U	1	2	3	4	5
10.8	Physical nature of construction work	U	1	2	3	4	5

11. Please rate, on a scale of **1 = Not at all** to **5 = Major**, the extent to which workers and their families suffer from financial difficulties as a result of a work-related injuries, illness or death of the worker in Zimbabwe.

Unsure	**Not at all (1)…….Major (5)**				
U	1	2	3	4	5

12. Please rate, on a scale of **1 = Not at all** to **5 = Major,** the extent to which the following factors / conditions / situations result in families of injured / deceased construction workers experiencing financial difficulties in Zimbabwe.

	Factor / Situations	Un-sure	**Not at all (1)…….Major (5)**				
12.1	Loss of employment for the injured worker(s)	U	1	2	3	4	5
12.2	Poor compensation for injured or deceased worker(s)	U	1	2	3	4	5
12.3	Increased cost of home-based care	U	1	2	3	4	5
12.4	Loss of earnings during period of sick leave	U	1	2	3	4	5
12.5	Reduced wages for workers who are reintegrated	U	1	2	3	4	5
12.6	Death of the worker as a result of injury / medical condition from work	U	1	2	3	4	5

13. Please rate on, a scale of **1 = Not at all** to **5 = Major,** the extent to which accidents, injuries and diseases contribute to the following:

	Project Parameter	Un-sure	**Not at all (1)…….Major (5)**				
13.1	Occurrence of reworks	U	1	2	3	4	5
13.2	Projects experiencing delays	U	1	2	3	4	5
13.3	Project costs exceeding value	U	1	2	3	4	5

13.4	Reduced productivity	U	1	2	3	4	5
13.5	Environmental spillovers dangerous to workers and public H&S	U	1	2	3	4	5

SECTION D: PROCUREMENT AND HEALTH AND SAFETY

14. Please rate on, a scale of **1 = Not at all** to **5 = Major,** the extent to which H&S performance is an eligibility condition for the appointment of contractors in Zimbabwe.

	Stakeholder	Unsure	**Not at all (1)…….Major (5)**				
14.1	Contractor	U	1	2	3	4	5
14.2	Designers	U	1	2	3	4	5

15. Please rate, on a scale of **1 = Not at all** to **5 = Major,** the extent to which procurement related factors / conditions / situations will affects H&S performance during project implementation.

	Procurement related factor / condition	**Un-sure**	**Not at all (1)…….Major (5)**				
15.1	Appointment of contractors that have not fully considered H&S aspects of the project.	U	1	2	3	4	5
15.2	Client procurement strategy / type	U	1	2	3	4	5
15.3	Inadequate contractor financial and other resource provisions for H&S	U	1	2	3	4	5
15.4	Inadequate client's commitment to finance H&S	U	1	2	3	4	5
15.5	Late appointment of contractors and other project stakeholders	U	1	2	3	4	5
15.6	Leaving H&S issues to project implementation phase	U	1	2	3	4	5
15.7	Inadequate inclusion of H&S in conditions of contract	U	1	2	3	4	5
15.8	Appointment of designers who do not systematically consider H&S aspects of their design	U	1	2	3	4	5

16. Making reference to the project you selected in 9 above, please state:
    a. the procurement method adopted _____
    b. type of contract document used _____

SECTION E: SUSTAINABILITY PRINCIPLES AND CONSTRUCTION H&S

17. Please rate, on a scale from **1 = Not important** to **5 = Very important,** the **importance** of the following sustainability principles / factors / concepts with regards to enhancing better practice and sustainable H&S practice (reducing injuries, diseases or fatalities) in Zimbabwe.

SUSTAINABILITY FACTORS / CONCEPTS	**Un-sure**	**Not (1)…….Very (5)**
SOCIAL		

17.1	Workers' rights to a just, equitable and safe & healthy work environment	U	1	2	3	4	5
17.2	Information on H&S hazards and risks	U	1	2	3	4	5
17.3	Prevention (of injuries / fatalities) through design	U	1	2	3	4	5
17.4	Transparency, accountability, and informed participation relative to H&S	U	1	2	3	4	5
17.5	Reporting, recording & investigating incidents, accidents or illnesses	U	1	2	3	4	5
17.6	H&S policies, regulations & enforcements	U	1	2	3	4	5
17.7	Post injury re-employment, compensation, and disability management	U	1	2	3	4	5
17.8	Health and safety (H&S) planning	U	1	2	3	4	5
17.9	Training of workers and supervisors relative to H&S	U	1	2	3	4	5
17.10	Supervision, monitoring & evaluation	U	1	2	3	4	5
17.11	Corporate Social Responsibility	U	1	2	3	4	5
	ENVIRONMENTAL						
17.12	Preserving and protecting environment	U	1	2	3	4	5
17.13	Environmental pollution / waste / toxic substances management	U	1	2	3	4	5
17.14	Site wellness / welfare provisions	U	1	2	3	4	5
17.15	Hazard Identification and Risk Assessment	U	1	2	3	4	5
17.16	Site layout & organisation of work environment	U	1	2	3	4	5
17.17	Environmental thermal changes (heat, cold, humidity) management	U	1	2	3	4	5
17.18	The Polluter Pays Principle	U	1	2	3	4	5
17.19	Environmental information dissemination	U	1	2	3	4	5
17.20	Environmental policies / regulations & enforcements	U	1	2	3	4	5
17.21	Selection of materials with low H&S risk	U	1	2	3	4	5
	ECONOMIC						
17.22	Responsible production and employment	U	1	2	3	4	5
17.23	Realistic production targets & project time	U	1	2	3	4	5
17.24	Balancing attainment of cost efficiency and maintaining good H&S	U	1	2	3	4	5
17.25	Long-term assessment of benefits / costs of H&S investment	U	1	2	3	4	5
17.26	Responsible procurement relative to H&S	U	1	2	3	4	5
17.27	Financial resource provisions for H&S	U	1	2	3	4	5
17.28	Integration of H&S within the business plan of organisations	U	1	2	3	4	5
17.29	Economic analysis of H&S relative to project / enterprise performance	U	1	2	3	4	5

18. Please rate, on a scale from **1 = Not at all to 5 = Major**, the extent to which the following sustainability principles / concepts are integrated / incorporated in construction H&S practice and / decision making in Zimbabwe.

	SUSTAINABILITY FACTORS / CONCEPTS	Un-sure	**Not at all (1)…….Major (5)**				
	SOCIAL						
18.1	Workers' rights to a just, equitable and safe & healthy work environment	U	1	2	3	4	5
18.2	Information on H&S hazards and risks	U	1	2	3	4	5
18.3	Prevention (of injuries / fatalities) through design	U	1	2	3	4	5

18.4	Transparency, accountability, and informed participation relative to H&S	U	1	2	3	4	5
18.5	Reporting, recording & investigating incidents, accidents or illnesses	U	1	2	3	4	5
18.6	H&S policies, regulations & enforcements	U	1	2	3	4	5
18.7	Post injury re-employment, compensation, and disability management	U	1	2	3	4	5
18.8	Health and safety (H&S) planning	U	1	2	3	4	5
18.9	Training of workers and supervisors relative to H&S	U	1	2	3	4	5
18.10	Supervision, monitoring & evaluation	U	1	2	3	4	5
18.11	Corporate Social Responsibility	U	1	2	3	4	5
	ENVIRONMENTAL						
17.12	Preserving and protecting environment	U	1	2	3	4	5
18.13	Environmental pollution / waste / toxic substances management	U	1	2	3	4	5
18.14	Site wellness / welfare provisions	U	1	2	3	4	5
18.15	Hazard Identification and Risk Assessment	U	1	2	3	4	5
18.16	Site layout & organisation of work environment	U	1	2	3	4	5
18.17	Environmental thermal changes (heat, cold, humidity) management	U	1	2	3	4	5
18.18	The Polluter Pays Principle	U	1	2	3	4	5
18.19	Environmental information dissemination	U	1	2	3	4	5
18.20	Environmental policies / regulations & enforcements	U	1	2	3	4	5
18.21	Selection of materials with low H&S risk	U	1	2	3	4	5
	ECONOMIC						
18.22	Responsible production and employment	U	1	2	3	4	5
18.23	Realistic production targets & project time	U	1	2	3	4	5
18.24	Balancing attainment of cost efficiency and maintaining good H&S	U	1	2	3	4	5
18.25	Long-term assessment of benefits / costs of H&S investment	U	1	2	3	4	5
18.26	Responsible procurement relative to H&S	U	1	2	3	4	5
18.27	Financial resource provisions for H&S	U	1	2	3	4	5
18.28	Integration of H&S within the business plan of organisations	U	1	2	3	4	5
18.29	Economic analysis of H&S relative to project / enterprise performance	U	1	2	3	4	5

19. Please rate, on a scale from **1 = Not at all to 5 = Major**, the extent to which the following factors / barriers constrain the incorporation of sustainability factors in H&S practices in Zimbabwe.

	Factors / barriers	Un-sure	**Not at all (1)……Major (5)**				
19.1	Inadequate financial and other resource provision for sustainable H&S	U	1	2	3	4	5
19.2	Inadequate integration of H&S in business and environmental operations	U	1	2	3	4	5
19.3	Separation of H&S and environmental laws and policies	U	1	2	3	4	5
19.4	Skepticism around the business value of sustainability	U	1	2	3	4	5

19.5	Inadequate knowledge of sustainability among team members	U	1	2	3	4	5
19.6	Inadequate client commitment to promote sustainable H&S	U	1	2	3	4	5
19.7	Inadequate contractor management commitment to sustainability	U	1	2	3	4	5
19.8	Perceived cost implications of sustainability	U	1	2	3	4	5
19.9	Lack of comprehensive frameworks for defining sustainability aspects for H&S	U	1	2	3	4	5
19.10	Inadequate understanding of the synergy between H&S and sustainability	U	1	2	3	4	5
19.11	Separation of design and construction	U	1	2	3	4	5
19.12	Passive and negative perception about integration	U	1	2	3	4	5
19.13	Lack of collective view around the concept of sustainability	U	1	2	3	4	5
19.14	Fragmentation / lack of relevant H&S laws and regulations	U	1	2	3	4	5

20. Any other comments you may wish to make, in general, relative to construction H&S management in Zimbabwe, and specifically with regards to the opportunities for integrating sustainability principles / factors / concepts.

_____
_____
_____
_____
_____

SECTION E: DEMOGRAPHIC INFORMATION

Organisation _____
If contractor, state category (e.g. A, B, C etc.) _____
Designation / Position of respondent_____
Respondent's experience (Years) in construction industry_____
Respondent's experience (Years) in current position_____
Highest educational / professional qualification attained by respondent _____

THANK YOU FOR THE VALUABLE INPUT

10.2 APPENDIX 2: QUESTIONNAIRE 2 FOR DESIGNERS

SECTION A: EXPOSURE TO CONSTRUCTION H&S HAZARDS

1. Please rate, on a scale of **1 = Not at all** to **5 = Major**, the extent to which construction workers are exposed to hazards at construction sites Zimbabwe.

	Exposure to hazards	Un-sure	**Not at all (1)……Major (5)**				
1.1	Workers' exposure to hazards	U	1	2	3	4	5

2. Please rate, on a scale of **1 = Not at all** to **5 = Major**, the extent to which the following **factors / situations** result in workers being exposed to construction hazards in Zimbabwe.

	Factors / Conditions	**Un-sure**	**Not at all (1)……Major (5)**				
2.1	Inadequate hazard identification and risk assessment	U	1	2	3	4	5
2.2	Lack of contractor H&S planning	U	1	2	3	4	5
2.3	Appointment of stakeholders (contractors) who do not systematically manage H&S	U	1	2	3	4	5
2.4	Inadequate designing for construction H&S	U	1	2	3	4	5
2.5	Inadequate project management	U	1	2	3	4	5
2.6	Lack of integration of H&S and environmental management systems	U	1	2	3	4	5
2.7	Inadequately managed hazards	U	1	2	3	4	5
2.8	Poor occupational health (OH) surveillance	U	1	2	3	4	5
2.9	Inadequate design hazard identification and risk assessment	U	1	2	3	4	5

3. Please rate, on a scale of **1 = Not at all** to **5 = Major**, the extent to which contractors make sufficient financial resource provisions for construction health and safety in Zimbabwe.

Unsure	**Not at all (1)……Major (5)**				
U	1	2	3	4	5

4. Please rate, on a scale of **1 = Not at all** to **5 = Major,** the extent to which designers consider H&S issues in designs.

Unsure	**Not at all (1)……Major (5)**				
U	1	2	3	4	5

Explain your choice in 4 above, and state the strategies, if any, that you apply to integrate H&S in your designs

_____

_____

SECTION B: THE OCCURRENCE OF FATALITIES, INJURIES & DISEASES

5. Please rate, on a scale of **1= very poor to 5= Excellent**, the standard of construction health and safety practice in Zimbabwe.

Unsure	Very poor (1)…….Excellent (5)				
U	1	2	3	4	5

6. Please rate, on a scale of **1 = Not at all** to **5 = Major**, the extent to which the following **situations / conditions / factors** result in occurrence of construction accidents, injuries, illnesses and fatalities in Zimbabwe.

	Situation / Condition	Un-sure	Not at all (1)…….Major (5)				
6.1	Inadequately managed hazards	U	1	2	3	4	5
6.2	Inadequate design hazard identification and risk assessments	U	1	2	3	4	5
6.3	Inadequate occupational health (OH) surveillance	U	1	2	3	4	5
6.4	Procurement of stakeholders (e.g. contractors) who do not systematically manage H&S	U	1	2	3	4	5
6.5	Inadequate project management and supervision	U	1	2	3	4	5
6.6	Inadequate management commitment to H&S	U	1	2	3	4	5
6.7	Unsafe work practices	U	1	2	3	4	5
6.8	Inadequate H&S planning	U	1	2	3	4	5
6.9	Inadequate H&S inspections & enforcements	U	1	2	3	4	5
6.10	Poor housekeeping, problems with site layout and space availability.	U	1	2	3	4	5
6.11	Shortcomings with equipment, including PPE.	U	1	2	3	4	5
6.12	Inadequate training	U	1	2	3	4	5

7. Making reference to one project you participated in the last 5 years, please state the type of accidents / injuries that occurred on this project (if any happened)

_____

_____

_____

SECTION C: EFFECTS OF INADEQUATE H&S

8. Please rate, on a scale of **1 = Never** to **5 = Always**, the extent to which injured workers (disabling / lost time injuries) reemployed with the current or different employers in Zimbabwe.

	Employer	Unsure	Never (1)…….Always (5)				
8.1	Re-employed with the same employer	U	1	2	3	4	5
8.2	Re-employed with a different employer	U	1	2	3	4	5

9. Please rate, on a scale of **1 = Not at all** to **5 = Major**, the extent to which the following factors / conditions / situations affect re-employability of injured workers in Zimbabwe.

	Factor / condition	Not at all (1)…….Major (5)					
9.1	Severity / nature of injuries sustained	U	1	2	3	4	5
9.2	Labour productivity expectations set for workers by contractors	U	1	2	3	4	5

9.3	Inadequate organisational policy on return to work	U	1	2	3	4	5
9.4	Inadequate national policy & regulations on return to work	U	1	2	3	4	5
9.5	Inadequate contractor management commitment to Corporate Social Responsibility	U	1	2	3	4	5
9.6	Shortcomings with rehabilitation programmes	U	1	2	3	4	5
9.7	Lack of contractor capacity to offer alternative duties to the injured worker	U	1	2	3	4	5
9.8	Physical nature of construction work	U	1	2	3	4	5

10. Please rate, on a scale of **1 = Not at all** to **5 = Major**, the extent to which workers and their families suffer from financial difficulties as a result of a work-related injuries, illness or death of the worker in Zimbabwe.

Not at all (1) .....Major (5)					
U	1	2	3	4	5

11. Please rate, on a scale of **1 = Not at all** to **5 = Major,** the extent to which the following factors / conditions / situations result in families of injured / deceased construction workers experiencing financial difficulties in Zimbabwe.

		Unsure	**Not at all (1)…….Major (5)**				
11.1	Loss of employment for the injured worker(s)	U	1	2	3	4	5
11.2	Poor compensation for injured or deceased worker(s)	U	1	2	3	4	5
11.3	Increased cost of home-based care	U	1	2	3	4	5
11.4	Loss of earnings during period of sick leave	U	1	2	3	4	5
11.5	Reduced wages for workers who are reintegrated	U	1	2	3	4	5
11.6	Death of the worker as a result of injury / medical condition from work	U	1	2	3	4	5

12. Please rate on, a scale of **1 = Not at all** to **5 = Major,** the extent to which accidents, injuries and diseases contribute to the following:

	Project Parameter	**Un-sure**	**Not at all (1)…….Major (5)**				
12.1	Occurrence of reworks	U	1	2	3	4	5
12.2	Projects experiencing delays	U	1	2	3	4	5
12.3	Project costs exceeding value	U	1	2	3	4	5
12.4	Reduced productivity	U	1	2	3	4	5
12.5	Environmental spillovers dangerous to workers and public H&S	U	1	2	3	4	5

SECTION D: PROCUREMENT AND HEALTH AND SAFETY

13. Please rate on, a scale of **1 = Not at all** to **5 = Major,** the extent to which H&S performance is an eligibility condition for the appointment of contractors in Zimbabwe.

	Stakeholder	Un-sure	Not at all (1)……Major (5)				
13.1	Contractor	U	1	2	3	4	5
13.2	Designers	U	1	2	3	4	5

14. Please rate, on a scale of **1 = Not at all** to **5 = Major,** the extent to which procurement related factors / conditions / situations will affects H&S performance during project implementation.

	Procurement related factor / condition	Un-sure	Not at all (1)……Major (5)				
14.1	Appointment of contractors that have not fully considered H&S aspects of the project.	U	1	2	3	4	5
14.2	Client procurement strategy / type	U	1	2	3	4	5
14.3	Inadequate contractor financial and other resource provisions for H&S	U	1	2	3	4	5
14.4	Inadequate client's commitment to finance H&S	U	1	2	3	4	5
14.5	Late appointment of contractors and other project stakeholders	U	1	2	3	4	5
14.6	Leaving H&S issues to project implementation phase	U	1	2	3	4	5
14.7	Inadequate inclusion of H&S in conditions of contract	U	1	2	3	4	5
14.8	Appointment of designers who do not systematically consider H&S aspects of their design	U	1	2	3	4	5

15. Making reference to the project you selected in 9 above, please state:
    c. the procurement method adopted _____
    d. type of contract document used _____

SECTION E: SUSTAINABILITY PRINCIPLES AND CONSTRUCTION H&S

16. Please rate, on a scale from **1 = Not important** to **5 = Very important,** the **importance** of the following sustainability principles / factors / concepts with regards to enhancing better practice and sustainable H&S practice (reducing injuries, diseases or fatalities) in Zimbabwe.

	SUSTAINABILITY FACTORS / CONCEPTS	Un-sure	Not (1)……Very (5)				
	SOCIAL						
16.1	Workers' rights to a just, equitable and safe & healthy work environment	U	1	2	3	4	5
16.2	Information on H&S hazards and risks	U	1	2	3	4	5
16.3	Prevention (of injuries / fatalities) through design	U	1	2	3	4	5
16.4	Transparency, accountability, and informed participation relative to H&S	U	1	2	3	4	5
16.5	Reporting, recording & investigating incidents, accidents or illnesses	U	1	2	3	4	5
16.6	H&S policies, regulations & enforcements	U	1	2	3	4	5

16.7	Post injury re-employment, compensation, and disability management	U	1	2	3	4	5
16.8	Health and safety (H&S) planning	U	1	2	3	4	5
16.9	Training of workers and supervisors relative to H&S	U	1	2	3	4	5
16.10	Supervision, monitoring & evaluation	U	1	2	3	4	5
16.11	Corporate Social Responsibility	U	1	2	3	4	5
	ENVIRONMENTAL						
16.12	Preserving and protecting environment	U	1	2	3	4	5
16.13	Environmental pollution / waste / toxic substances management	U	1	2	3	4	5
16.14	Site wellness / welfare provisions	U	1	2	3	4	5
16.15	Hazard Identification and Risk Assessment	U	1	2	3	4	5
16.16	Site layout & organisation of work environment	U	1	2	3	4	5
16.17	Environmental thermal changes (heat, cold, humidity) management	U	1	2	3	4	5
16.18	The Polluter Pays Principle	U	1	2	3	4	5
16.19	Environmental information dissemination	U	1	2	3	4	5
16.20	Environmental policies / regulations & enforcements	U	1	2	3	4	5
16.21	Selection of materials with low H&S risk	U	1	2	3	4	5
	ECONOMIC						
16.22	Responsible production and employment	U	1	2	3	4	5
16.23	Realistic production targets & project time	U	1	2	3	4	5
16.24	Balancing attainment of cost efficiency and maintaining good H&S	U	1	2	3	4	5
16.25	Long-term assessment of benefits / costs of H&S investment	U	1	2	3	4	5
16.26	Responsible procurement relative to H&S	U	1	2	3	4	5
16.27	Financial resource provisions for H&S	U	1	2	3	4	5
16.28	Integration of H&S within the business plan of organisations	U	1	2	3	4	5
16.29	Economic analysis of H&S relative to project / enterprise performance	U	1	2	3	4	5

17. Please rate, on a scale from **1 = Not at all to 5 = Major**, the extent to which the following sustainability principles / concepts are integrated / incorporated in construction H&S practice and / decision making in Zimbabwe.

	SUSTAINABILITY FACTORS / CONCEPTS	Un-sure	**Not at all (1)……Major (5)**				
	SOCIAL						
17.1	Workers' rights to a just, equitable and safe & healthy work environment	U	1	2	3	4	5
17.2	Information on H&S hazards and risks	U	1	2	3	4	5
17.3	Prevention (of injuries / fatalities) through design	U	1	2	3	4	5
17.4	Transparency, accountability, and informed participation relative to H&S	U	1	2	3	4	5
17.5	Reporting, recording & investigating incidents, accidents or illnesses	U	1	2	3	4	5
17.6	H&S policies, regulations & enforcements	U	1	2	3	4	5
17.7	Post injury re-employment, compensation, and disability management	U	1	2	3	4	5
17.8	Health and safety (H&S) planning	U	1	2	3	4	5
17.9	Training of workers and supervisors relative to H&S	U	1	2	3	4	5
17.10	Supervision, monitoring & evaluation	U	1	2	3	4	5

17.11	Corporate Social Responsibility	U	1	2	3	4	5
	ENVIRONMENTAL						
17.12	Preserving and protecting environment	U	1	2	3	4	5
17.13	Environmental pollution / waste / toxic substances management	U	1	2	3	4	5
17.14	Site wellness / welfare provisions	U	1	2	3	4	5
17.15	Hazard Identification and Risk Assessment	U	1	2	3	4	5
17.16	Site layout & organisation of work environment	U	1	2	3	4	5
17.17	Environmental thermal changes (heat, cold, humidity) management	U	1	2	3	4	5
17.18	The Polluter Pays Principle	U	1	2	3	4	5
17.19	Environmental information dissemination	U	1	2	3	4	5
17.20	Environmental policies / regulations enforcements	U	1	2	3	4	5
17.21	Selection of materials with low H&S risk	U	1	2	3	4	5
17.22	**ECONOMIC**						
	Responsible production and employment	U	1	2	3	4	5
17.23	Realistic production targets & project time	U	1	2	3	4	5
17.24	Balancing attainment of cost efficiency and maintaining good H&S	U	1	2	3	4	5
17.25	Long-term assessment of benefits / costs of H&S investment	U	1	2	3	4	5
17.26	Responsible procurement relative to H&S	U	1	2	3	4	5
17.27	Financial resource provisions for H&S	U	1	2	3	4	5
17.28	Integration of H&S within the business plan of organisations	U	1	2	3	4	5
17.29	Economic analysis of H&S relative to project / enterprise performance	U	1	2	3	4	5

18. Please rate, on a scale from **1 = Not at all to 5 = Major**, the extent to which the following factors / barriers constrain the incorporation of sustainability factors in H&S practices in Zimbabwe.

	Factors / Barriers	**Un-sure**	**Not at all (1)……Major (5)**				
18.1	Inadequate financial and other resource provision for sustainable H&S	U	1	2	3	4	5
18.2	Inadequate integration of H&S in business and environmental operations	U	1	2	3	4	5
18.3	Separation of H&S and environmental laws and policies	U	1	2	3	4	5
18.4	Skepticism around the business value of sustainability	U	1	2	3	4	5
18.5	Inadequate knowledge of sustainability among team members	U	1	2	3	4	5
18.6	Inadequate client commitment to promote sustainable H&S	U	1	2	3	4	5
18.7	Inadequate contractor management commitment to sustainability	U	1	2	3	4	5
18.8	Perceived cost implications of sustainability	U	1	2	3	4	5
18.9	Lack of comprehensive frameworks for defining sustainability aspects for H&S	U	1	2	3	4	5
18.10	Inadequate understanding of the synergy between H&S and sustainability	U	1	2	3	4	5
18.11	Separation of design and construction	U	1	2	3	4	5

18.12	Passive and negative perception about integration	U	1	2	3	4	5
18.13	Lack of collective view around the concept of sustainability	U	1	2	3	4	5
18.14	Fragmentation / lack of relevant H&S laws and regulations	U	1	2	3	4	5

19. Any other comments you may wish to make, in general, relative to construction H&S management in Zimbabwe, and specifically with regards to the opportunities for integrating sustainability principles / factors / concepts.

_____
_____
_____
_____
_____

SECTION E: DEMOGRAPHIC INFORMATION

Organisation _____
If contractor, state category (e.g. A, B, C etc.) _____
Designation / Position of respondent_____
Respondent's experience (Years) in construction industry_____
Respondent's experience (Years) in current position_____
Highest educational / professional qualification attained by respondent _____

THANK YOU FOR THE VALUABLE INPUT

10.3 APPENDIX 3: QUESTIONNAIRE 3 FOR CLIENTS

SECTION A: PROCUREMENT & H&S

1. Please rate on, a scale of **1 = Not at all** to **5 = Major,** the extent to which H&S performance is an eligibility condition for the appointment of contractors in Zimbabwe.

	Stakeholder	Un-sure	**Not at all (1)…….Major (5)**				
1.1	Contractor	U	1	2	3	4	5
1.2	Designers	U	1	2	3	4	5

2. On a scale of (**1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5= Always**), please rate the frequency with which the following **functions / activities** are part of contractors / suppliers' procurement process in your organisation.

	Variable	**Un-sure**	**Never (1)…….Always (5)**				
2.1	Adopting a procurement strategy that involve engagement of contractors during the early design stages.	U	1	2	3	4	5
2.2	Pre-qualifying potential contractors / suppliers based on their commitment to H&S improvement	U	1	2	3	4	5
2.3	Ensuring that all health and safety aspects of design and construction have been properly considered before construction work starts	U	1	2	3	4	5
2.4	Checking contractors / suppliers' compliance to stated approach to H&S during project implementation	U	1	2	3	4	5
2.5	Engaging personnel with relevant health and safety (H&S) and construction experience to review the bid H&S Plans	U	1	2	3	4	5
2.6	Providing health and safety information to contractors at tender stage	U	1	2	3	4	5

3. Please rate, on a scale of **1 = Not at all** to **5 = Major,** the extent to which procurement related factors / conditions / situations will affects H&S performance during project implementation.

	Procurement related factor / condition	**Un-sure**	**Not at all (1)…….Major (5)**				
3.1	Appointment of contractors that have not fully considered H&S aspects of the project.	U	1	2	3	4	5
3.2	Client procurement strategy / type	U	1	2	3	4	5
3.3	Inadequate contractor financial and other resource provisions for H&S	U	1	2	3	4	5
3.4	Inadequate client's commitment to finance H&S	U	1	2	3	4	5
3.5	Late appointment of contractors and other project stakeholders	U	1	2	3	4	5
3.6	Leaving H&S issues to project implementation phase	U	1	2	3	4	5

3.7	Inadequate inclusion of H&S in conditions of contract	U	1	2	3	4	5
3.8	Appointment of designers who do not systematically consider H&S aspects of their design	U	1	2	3	4	5

4. Making reference any project you procured in the last 5 years, please state:
   a. the procurement method adopted _____
   b. type of contract document used _____

SECTION B: SUSTAINABILITY PRINCIPLES / FACTORS FOR CONSTRUCTION H&S

5. Please rate, on a scale from **1 = Not important** to **5 = Very important,** the **importance** of the following sustainability principles / factors / concepts with regards to enhancing better practice and sustainable H&S practice (reducing injuries, diseases or fatalities) in Zimbabwe.

	SUSTAINABILITY FACTORS / CONCEPTS	Un-sure	**Not (1)…….Very (5)**				
	SOCIAL						
5.1	Workers' rights to a just, equitable and safe & healthy work environment	U	1	2	3	4	5
5.2	Information on H&S hazards and risks	U	1	2	3	4	5
5.3	Prevention (of injuries / fatalities) through design	U	1	2	3	4	5
5.4	Transparency, accountability, and informed participation relative to H&S	U	1	2	3	4	5
5.5	Reporting, recording & investigating incidents, accidents or illnesses	U	1	2	3	4	5
5.6	H&S policies, regulations & enforcements	U	1	2	3	4	5
5.7	Post injury re-employment, compensation, and disability management	U	1	2	3	4	5
5.8	Health and safety (H&S) planning	U	1	2	3	4	5
5.9	Training of workers and supervisors relative to H&S	U	1	2	3	4	5
5.10	Supervision, monitoring & evaluation	U	1	2	3	4	5
5.11	Corporate Social Responsibility	U	1	2	3	4	5
	ENVIRONMENTAL						
5.12	Preserving and protecting environment	U	1	2	3	4	5
5.13	Environmental pollution / waste / toxic substances management	U	1	2	3	4	5
5.14	Site wellness / welfare provisions	U	1	2	3	4	5
5.14	Hazard Identification and Risk Assessment	U	1	2	3	4	5
5.16	Site layout & organisation of work environment	U	1	2	3	4	5
5.17	Environmental thermal changes (heat, cold, humidity) management	U	1	2	3	4	5
5.18	The Polluter Pays Principle	U	1	2	3	4	5
5.19	Environmental information dissemination	U	1	2	3	4	5
5.20	Environmental policies / regulations & enforcements	U	1	2	3	4	5
5.21	Selection of materials with low H&S risk	U	1	2	3	4	5
	ECONOMIC						
5.22	Responsible production and employment	U	1	2	3	4	5
5.23	Realistic production targets & project time	U	1	2	3	4	5
5.24	Balancing attainment of cost efficiency and maintaining good H&S	U	1	2	3	4	5

5.25	Long-term assessment of benefits / costs of H&S investment	U	1	2	3	4	5
5.26	Responsible procurement relative to H&S	U	1	2	3	4	5
5.27	Financial resource provisions for H&S	U	1	2	3	4	5
5.28	Integration of H&S within the business plan of organisations	U	1	2	3	4	5
5.29	Economic analysis of H&S relative to project / enterprise performance	U	1	2	3	4	5

6. Please rate, on a scale from **1 = Not at all to 5 = Major**, the extent to which the following sustainability principles / concepts are integrated / incorporated in construction H&S practice and / decision making in Zimbabwe.

	SUSTAINABILITY FACTORS / CONCEPTS	Un-sure	**Not at all (1)…….Major (5)**				
	SOCIAL						
6.1	Workers' rights to a just, equitable and safe & healthy work environment	U	1	2	3	4	5
6.2	Information on H&S hazards and risks	U	1	2	3	4	5
6.3	Prevention (of injuries / fatalities) through design	U	1	2	3	4	5
6.4	Transparency, accountability, and informed participation relative to H&S	U	1	2	3	4	5
6.5	Reporting, recording & investigating incidents, accidents or illnesses	U	1	2	3	4	5
6.6	H&S policies, regulations & enforcements	U	1	2	3	4	5
6.7	Post injury re-employment, compensation, and disability management	U	1	2	3	4	5
6.8	Health and safety (H&S) planning	U	1	2	3	4	5
6.9	Training of workers and supervisors relative to H&S	U	1	2	3	4	5
6.10	Supervision, monitoring & evaluation	U	1	2	3	4	5
6.11	Corporate Social Responsibility	U	1	2	3	4	5
	ENVIRONMENTAL						
6.12	Preserving and protecting environment	U	1	2	3	4	5
6.13	Environmental pollution / waste / toxic substances management	U	1	2	3	4	5
6.14	Site wellness / welfare provisions	U	1	2	3	4	5
6.15	Hazard Identification and Risk Assessment	U	1	2	3	4	5
6.16	Site layout & organisation of work environment	U	1	2	3	4	5
6.17	Environmental thermal changes (heat, cold, humidity) management	U	1	2	3	4	5
6.18	The Polluter Pays Principle	U	1	2	3	4	5
6.19	Environmental information dissemination	U	1	2	3	4	5
6.20	Environmental policies / regulations enforcements	U	1	2	3	4	5
6.21	Selection of materials with low H&S risk	U	1	2	3	4	5
	ECONOMIC						
6.22	Responsible production and employment	U	1	2	3	4	5
6.23	Realistic production targets & project time	U	1	2	3	4	5
6.24	Balancing attainment of cost efficiency and maintaining good H&S	U	1	2	3	4	5
6.25	Long-term assessment of benefits / costs of H&S investment	U	1	2	3	4	5
6.26	Responsible procurement relative to H&S	U	1	2	3	4	5
6.27	Financial resource provisions for H&S	U	1	2	3	4	5

6.28	Integration of H&S within the business plan of organisations	U	1	2	3	4	5
6.29	Economic analysis of H&S relative to project / enterprise performance	U	1	2	3	4	5

7. Please rate, on a scale from **1 = Not at all to 5 = Major**, the extent to which the following factors / barriers constrain the incorporation of sustainability factors in H&S practices in Zimbabwe.

	Factors / barriers	**Un-sure**	**Not at all (1)……Major (5)**				
7.1	Inadequate financial and other resource provision for sustainable H&S	U	1	2	3	4	5
7.2	Inadequate integration of H&S in business and environmental operations	U	1	2	3	4	5
7.3	Separation of H&S and environmental laws and policies	U	1	2	3	4	5
7.4	Skepticism around the business value of sustainability	U	1	2	3	4	5
7.5	Inadequate knowledge of sustainability among team members	U	1	2	3	4	5
7.6	Inadequate client commitment to promote sustainable H&S	U	1	2	3	4	5
7.7	Inadequate contractor management commitment to sustainability	U	1	2	3	4	5
7.8	Perceived cost implications of sustainability	U	1	2	3	4	5
7.9	Lack of comprehensive frameworks for defining sustainability aspects for H&S	U	1	2	3	4	5
7.10	Inadequate understanding of the synergy between H&S and sustainability	U	1	2	3	4	5
7.11	Separation of design and construction	U	1	2	3	4	5
7.12	Passive and negative perception about integration	U	1	2	3	4	5
7.13	Lack of collective view around the concept of sustainability	U	1	2	3	4	5
7.14	Fragmentation / lack of relevant H&S laws and regulations	U	1	2	3	4	5

8. Any other comments you may wish to make, in general, relative to construction H&S management in Zimbabwe, and specifically with regards to the opportunities for integrating sustainability principles / factors / concepts.

_____
_____
_____
_____
_____

SECTION E: DEMOGRAPHIC INFORMATION

Organisation _____
If contractor, state category (e.g. A, B, C etc.) _____
Designation / Position of respondent_____
Respondent's experience (Years) in construction industry_____
Respondent's experience (Years) in current position_____

Highest educational / professional qualification attained by respondent _____

THANK YOU FOR THE VALUABLE INPUT

10.4 APPENDIX 4: QUESTIONNAIRE 4 CONSTRUCTION WORKERS

SECTION A: HEALTH AND SAFETY (H&S) INFORMATION

1. a). Did you receive any training with regards to health and safety (H&S)?

YES	NO

b). If YES, state what you were trained on & the organisation that trained you

_____

_____

2. Please rate. on a scale of 1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = always, the extent to which:

3.1	**Statement**	**Un-sure**	**Never (1)……Always (5)**				
3.1	Workers are provided with health and safety information		1	2	3	4	5
3.2	Workers are consulted with regards to Health &Safety?	U	1	2	3	4	5
3.3	You perform work in risky manner due to tight work programmes?	U	1	2	3	4	5

3. On a scale from **1 = not important, 2 = slightly important, 3 = important, 4 = more than important, and 5 = very important**, please rate the extent to which management commitment is important to health and safety.

	Statement	**Un-sure**	**Not (1)……Very (5)**				
3.1	Management commitment to health and safety	U	1	2	3	4	5

4. On a scale from 1 = poor, 2 = below average, 3 = average, 4 = very good, 5 = excellent, please rate the extent to which workers and management are committed to H&S.

	Commitment to health and safety	**Un-sure**	**Never (1)……Always (5)**				
3.1	Workers' commitment to health and safety	U	1	2	3	4	5
3.2	Management's commitment to H&S	U	1	2	3	4	5

5. On a weekly basis, do you get exposed to the following disease / injury-causing hazards at work? Tick in appropriate box.

Hazards	**Yes**	**No**	**To some extent**
Noise			
Heavy lifting, pulling, pushing etc.			
Work at height			
Repetitive motion & awkward postures			
Whole body vibration			

Sharp objects			
Moving vehicles / equipment			
Heat			
Cold			
Fires, explosions etc.			
Electric current			
Radiation			
Gases and vapours			
Fumes, dust, mist and fibres			
Bacteria and Viruses			
Poisonous animals & plants			
Animal, bird or rodent faeces, urine			
Mould (Fungi)			
Stress / isolation			
Other (specify) ……			

6. What preventive measures are taken for the hazards you are exposed to above

   _____
   _____
   _____

7. Please list the most frequent / important causes of accidents on construction projects you have been involved in Zimbabwe

   _____
   _____
   _____

8. Please list the problems that workers and their families experience when a worker gets injured from an accident at work

   _____
   _____
   _____

9. Please state any challenges / problems that workers encounter regarding their workplace health and safety (H&S).

   _____
   _____
   _____

10. a). In the last 2 years, were you ever involved in an **<u>accident, injury, or illness</u>** from work related activities

YES	NO

    b). If NO to 11 (a) above, go to 25

11. If YES to 11 (a) above,

    a) state the nature of accident / injury / illness (e.g. cuts, fracture, dislocation etc.)

    _____

    b) state severity of injury (e.g. minor, moderate, major / severe etc.)

    _____

c) state part(s) of the body affected (e.g. leg, arm etc.)

_____

d) state cause (s) of the accident (e.g. fall from height, struck by falling object)

_____

_____

e) Did you report the accident to management or Safety Officer?

YES	NO

f) Did you receive any medical treatment?

YES	NO

g) How days were you away from work as a result of that illness / injury?

_____

h) Did you remain on payroll while away from work as a result of the injury?

YES	NO

i) What happened to your earnings during period of injury?

Reduced	Did not change	Increased

j) After recovery, did you resume work with the same employer?

YES	NO

If **NO**, what were the reasons?

_____

_____

k) If YES to 16, what happened to your earnings / salary after returning to work?

Reduced	Did not change	Increased

i) Did you receive any compensation from NSSA for the injury?

YES	NO

m) Was the compensation adequate?

Very Poor	Somewhat	Moderate / Fair	Good	Excellent

12. Any other comments you may wish to make regarding H&S management in the construction industry in Zimbabwe

_____

_____

_____

SECTION B: DEMOGRAPHIC DETAILS OF THE RESPONDENT

Profile	Responses
Gender (Male / Female)	
Age (years)	
Work experience in the construction industry (years)	
Work experience with current employer (years)	
Occupation (bricklayer, carpenter, general worker)	
Highest education attained (e.g. o' level, certificate / journeyman)	

THANK YOU FOR YOUR VALUABLE CONTRIBUTION

10.5 APPENDIX 5: MODEL VALIDATION QUESTIONNAIRE

27 M 2018

Dear sir / madam,

RE: QUESTIONNAIRE FOR VALIDATING A SUSTAINABILITY FRAMEWORK FOR CONSTRUCTION HEALTH AND SAFETY PRACTICE IN ZIMBABWE

I kindly request your participation in this survey. The objective of the survey is to gather expert opinion with regards the proposed Framework for integrating and assessing sustainability of construction health and safety practices. Your evaluation is important as it will contribute to the improvement of the content and processes proposed in the Framework.

To conduct the evaluation, kindly review the attached Sustainability Framework for Construction Health and Safety (SFCHS) and then respond to questions which are provided in the attached questionnaire.

If you require any clarification, please contact me through email or telephone provided below.

Regards

Benviolent Chigara

PhD Construction Management Student

Tel: +263 772809260, +263 719809260, benviolent@gmail.com

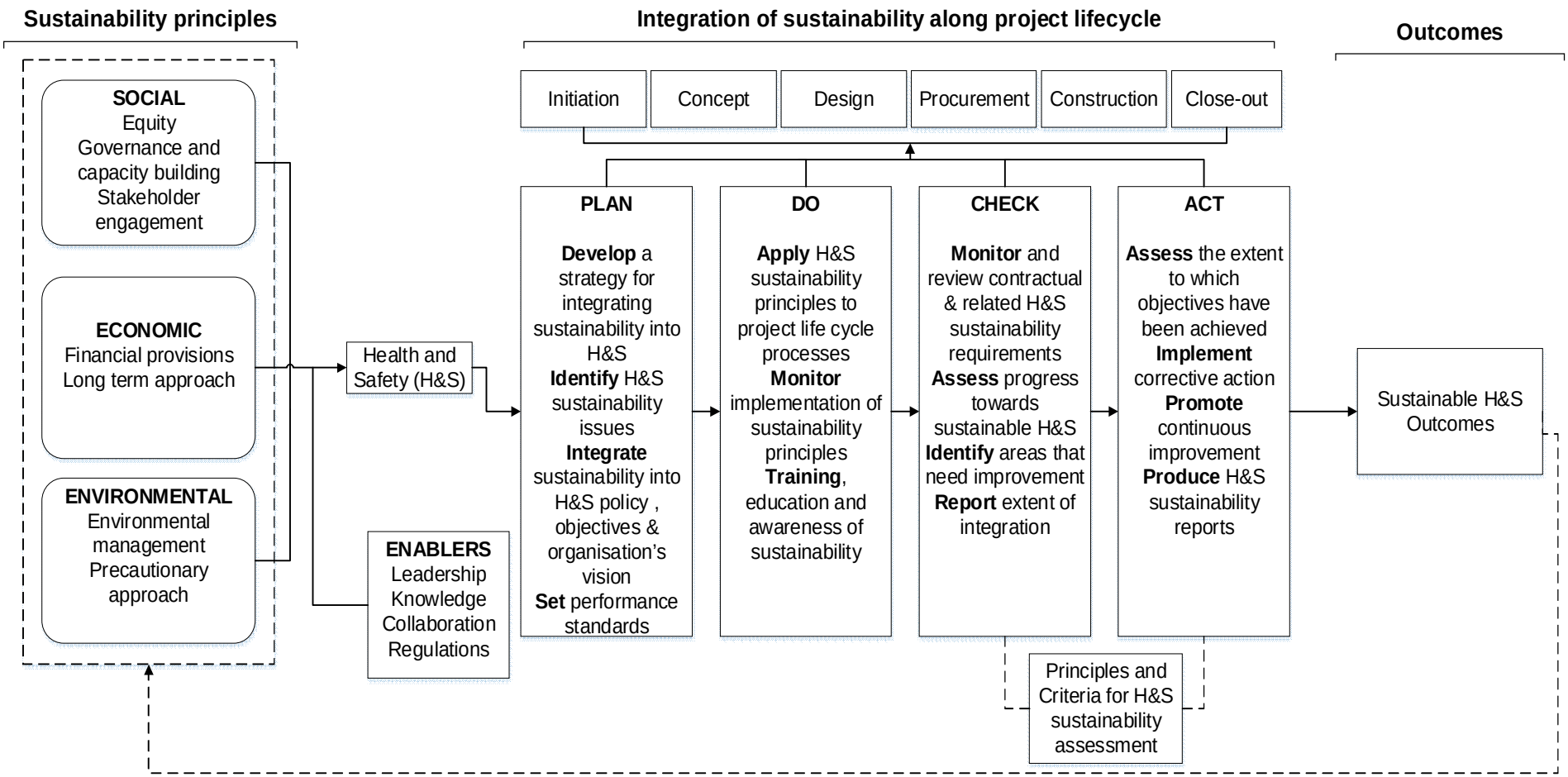
1.0 INTRODUCTION

The extent of construction health and safety problem in Zimbabwe makes achieving sustainability in construction health and safety an important objective. Sustainability rests on the principle that development must meet the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987). In this regard, stewardship of human resources through providing safe workplaces for the present and future generation of workers is of prime importance. Sustainability within health and safety seek to sustain the health and safety of a construction worker from start to finish of a given project; for each future project the worker is involved in; and during the worker's remaining lifetime after retirement, without experiencing any work-related injuries or illnesses (Rajendran and Gambatese, 2007). The transition to sustainable health and safety requires that sustainable development principles be incorporated within health and safety process, practices and decision making. Therefore, the Sustainability Framework for Construction Health and Safety (SFCHS) is proposed to facilitate the conversion of sustainability principles into practical and project-level applications. The proposed SFCHS is designed to facilitate integration of sustainability concepts within health and safety across the project life cycle. To facilitate the integration, project health and safety practice will be assessed against a a set of sustainability Principles and Criteria. The implementation of the Framework applies standards that provide the necessary foundation for achieving the sustainable health and safety objective throughout the project life cycle. Thus, the SFCHS contributes to efforts to reduce construction accidents through promoting the adoption of sustainable practice in construction health and safety.

The Framework consists of two components:

- the integrative process, and
- principles and criteria for sustainability assessment

The components of the SFCHS are briefly set out in Figure 1 and Tables 1 to 3 and briefly described in Section 2.1 and 2.2.


Sustainability principles
Integration of sustainability along project lifecycle
Outcomes
SOCIAL
Equity
Governance and capacity building
Stakeholder engagement
ECONOMIC
Financial provisions
Long term approach
ENVIRONMENTAL
Environmental management
Precautionary approach
Health and Safety (H&S)
ENABLERS
Leadership
Knowledge
Collaboration
Regulations
Initiation
Concept
Design
Procurement
Construction
Close-out
PLAN
Develop a strategy for integrating sustainability into H&S
Identify H&S sustainability issues
Integrate sustainability into H&S policy , objectives & organisation's vision
Set performance standards
DO
Apply H&S sustainability principles to project life cycle processes
Monitor implementation of sustainability principles
Training, education and awareness of sustainability
CHECK
Monitor and review contractual & related H&S sustainability requirements
Assess progress towards sustainable H&S
Identify areas that need improvement
Report extent of integration
ACT
Assess the extent to which objectives have been achieved
Implement corrective action
Promote continuous improvement
Produce H&S sustainability reports
Sustainable H&S Outcomes
Principles and Criteria for H&S sustainability assessment

2.1 THE INTEGRATION PROCESS

The integration process facilitates the incorporation of sustainable development concepts into the planning and management of health and safety throughout the project life cycle. Each stage of the project life cycle has a shared responsibility toward sustainable health and safety. The Plan-Do-Check-Act (PDCA) methodological approach is proposed to facilitate a structured integration process of sustainability principles into H&S practices and to monitor performance on a continual basis. The PDCA is compatible with existing health and safety (such as OSHAS 1800:2007), quality and environmental management systems.

The details of integration, in abridged format, are presented in Figure 1.
The integration process will be enhanced through collaboration of project stakeholders, leadership commitment, appropriate training and regulatory frameworks. To determine the extent of integration, an assessment will be conducted against a set of sustainability Principles and Criteria set out in section 2.2.

2.2 PRINCIPLES AND CRITERIA FOR SUSTAINABLE H&S

The Principles and Criteria for sustainable health and safety were developed through a process involving extensive review of literature and related frameworks, questionnaire surveys and consultations with construction practitioners in Zimbabwe. Table 1 to 3 present the description of the principles and criteria / factors of the SFCHS. The principles and criteria establish the standards to guide the H&S activities throughout the project life cycle to ensure reduction of H&S risks and impacts on workers. Although the principles are applicable to all the phases of the project life cycle, the specific application depends on the nature of construction activities and the stage of project development.

Table 1: Social sustainability principles and factors for H&S

***Social sustainability**:* The social sustainability dimension seeks to enhance workplace health and safety through promoting inclusivity, fair labour practice, respect of workers' rights, and information disclosures. These aspects will be addressed through four principles: stakeholder engagement and information disclosures, equity, capacity development, and governance.		
Principle	**Factors / criteria**	**Sub-criteria / indicators**
Human dignity and social equity	Workers' rights to healthy and safe work	The employer respects the rights of all workers to healthy and safe work
		The measures to promote fair and equitable labour practices are applied
	Post injury management	Policy to support reintegration of injured workers
		All workers are provided with adequate medical care and are covered by accident insurance
		Workers are assisted with regards to processing compensation claims
	Corporate social responsibility (CSR)	Employers provide more than the minimum legal provisions for H&S
		Provision of alternative forms of employment for injured workers
		Wellness programmes
	Prevention through design	Design to reduce health and safety risk during construction and maintenance of buildings is applied
		Constructability reviews are implemented
		Low risk materials / products are specified in design & construction
Governance and capacity development	Training	All workers are adequately trained in sustainable working practices
		Training programme cover aspects of sustainable H&S
	Supervision, monitoring and evaluation	Leadership commitment to sustainable health and safety issues
		An operational health and safety governance structure exists and is operational
		Sustainability is discussed between client and project stakeholders e.g. contractors, designers etc
	H&S planning	A site-specific H&S plan is documented, effectively communicated and implemented
		A management official responsible for ensuring sustainable work practices is nominated
	H&S policies, regulations and enforcements	Sustainable H&S policy and vision
		Sustainability is discussed between client and project stakeholders e.g. contractors, designers etc
		Compliance management
Stakeholder engagement and information disclosure	Reporting	Reports are periodically presented to management and other stakeholders on health and safety sustainability performance
	Transparency, accountability and informed participation	Disclosure of information with regards to workplace injuries, accidents and incidents
		Regular awareness of sustainable health and safety issues is maintained
		Open and transparent methods of communication are maintained
COMMENTS (*Please use this section to **edit / add** principles / criteria / sub-criteria which you consider to be important but has not been included*):		

Table 2: Economic sustainability principles and factors for H&S

Economic sustainability The economic dimension of sustainability recognises the importance of decent work creation in pursuit of poverty reduction and inclusive economic growth for the current and future generation of workers. This will be realised through addressing four principles: responsible production, cost efficiency, long-term perspective and responsible procurement		
Principle	**Factors / criteria**	**Sub-criteria / indicators**
Economic efficiency	Financial resources provisions for H&S	Financial provisions for H&S are optimal
		H&S personnel are appointed by both client and contractor
		Appropriate tools and PPE is provided to all workers
	Responsible procurement relative to H&S	Explicit H&S clauses are integrated in contract documents
		H&S is considered in the selection of contractors, sub-contractors, suppliers and materials
	Responsible production and employment	Methods of production are appropriate and do not cause harm to workers
		Ergonomic and related issues are considered in the proposed production methods
		Technology is optimised to ensure safe, efficient and effective production
	Economic analysis of H&S relative to project and enterprise performance	The costs of workplace accidents are estimated
Long-term approach	Life cycle assessment of benefits / costs of H&S	The return on investment (ROI) for investments in health and safety is estimated
	Integrating H&S in construction planning and scheduling	H&S issues are considered in the scheduling and planning of works or tasks
	Integration of H&S in business plan of organisations	H&S objectives are integrated with organisation's business strategy / vision
	Cost effectiveness	
	Site layout / organisation of work	Spatial layout of project site promotes economy and safe movement of people, vehicular traffic and equipment
COMMENTS (*Please use this section to **edit / add** principles / criteria / sub-criteria which you consider to be important but has not been included*):		

Table 3: Environmental sustainability principles and factors for H&S

Environmental sustainability The environmental dimension of sustainability helps assessors to evaluate health and safety practice through addressing environmental issues. These issues are evaluated under four aspects: pollution prevention and management, precaution, and compliance with national and international laws and requirements.		
Principle	**Factors / criteria**	**Sub-criteria / indicators**
Environmental management	Environmental thermal changes	Changes in temperatures, humidity, etc, considered in planning construction works
	Polluter pays	Penalties for causing environmental pollution
	Site welfare provisions	Portable water, ablution facilities, rest rooms, cooking and eating areas are provided in a healthy sate
	Waste management & pollution prevention	A pollution prevention and reduction plan are available, implemented and monitored
		A programme to identify and reduce significant pollutions and emissions is implemented
		Waste management and disposal plan are available, implemented and monitored

		All waste products and sources of pollution shall be identified and documented
	Environmental policies / regulations	Compliance with applicable national, local regulations, standards
		A register of relevant legal requirements is kept and updated regularly
Precautionary approach	Information of H&S hazards and risks	Disclosure of information with regards to potential health and safety risks and impacts on workers
	Hazard Identification and risk assessment	Procedures are put in place to ensure Hazard identification and risk assessment (HIRAs) is maintained or enhanced
COMMENTS (*Please use this section to **edit / add** principles / criteria / sub-criteria which you consider to be important but has not been included*):		

2.2.4 ASSESSING HEALTH AND SAFETY SUSTAINABILITY PERFORMANCE

The assessment seeks to determine the extent to which the sustainability principle / factor / criterion is implemented to ensure at various stages of the project life cycle. In order to manage the complexity of sustainability assessment, SFCHS proposes that the assessor's opinion cab be expressed as a qualitative rating on a five-point scale, set out in Table 4.

Table 4: H&S sustainability rating scale

Rating/Score	Descriptor	Measure / Sustainability consideration description
5	Very high	The level of consideration of this criterion within health and safety practice demonstrates best practice.
4	High	The principle or criterion receives high consideration within health and safety practice.
3	Moderate	The factor receives moderate consideration
2	Low	The factor is considered to a limited extent and there is potential for improvement.
1	Very Low	The issue is relevant but is hardly considered in the decision-making processes at that stage. There is a high level of non-conformity.
N/A	Not applicable	The principle / factors / criterion is not considered because it does not apply at that project stage

Although the rating is primarily qualitative, quantitative indicators may be used to inform the rating. To minimise subjectivity, the assessment should be grounded in evidence, expert judgement and benchmarked against national and international standards. In this regard, the assessor(s) should review project documents, consult project stakeholders and brainstorm the ratings with experts. Table 5 presents an example of the social sustainability assessment questionnaire.

Example: Please rate, on a scale of **1 = very low to 5 = very high**, the extent to which the sustainability factors for H&S are implemented during the project life cycle. Indicate the stage of assessment.

Table 5: Sample of an assessment questionnaire (social sustainability)

Factors / criteria	**Sub-criteria / indicators**	**N/A**	**1**	**2**	**3**	**4**	**5**	**COMMENTS**
Workers' rights to healthy and safe work	The employer respects the rights of all workers to healthy and safe work							
	The measures to promote fair and equitable labour practices are applied							
Post injury management	Policy to support reintegration of injured workers							
	All workers are provided with adequate medical care and are covered by accident insurance							
	Workers are assisted with regards to processing compensation claims							
Corporate social responsibility (CSR)	Employers provide more than the minimum legal provisions for H&S							
	Provision of alternative forms of employment for injured workers							
	Wellness programmes							
Prevention through design	Design to reduce health and safety risk during construction and maintenance of buildings is applied							
	Constructability reviews are implemented							
	Low risk materials / products are specified in design & construction							
Training	Workers are adequately trained in sustainable working practices							
	Training programme cover aspects of sustainable H&S							
Supervision, monitoring and evaluation	Leadership commitment to sustainable health and safety issues							
	H&S governance structure exists and is operational							
	H&S personnel are employed							
	Sustainability is discussed between client and project stakeholders							
H&S planning	A site-specific H&S plan is documented, effectively communicated and implemented							
	A management official responsible for ensuring sustainable work practices is nominated							
H&S policies, regulations and enforcements	Sustainable H&S policy and vision							
	Sustainability is discussed between client and project stakeholders e.g. contractors, designers etc							
	Compliance management							
Reporting	Reports are periodically presented to management and other stakeholders on health and safety sustainability performance							
Transparency, accountability and informed participation	Disclosure of information with regards to workplace fatalities, injuries or disease							
	Open and transparent methods of communication are maintained							
	Regular awareness of sustainable health and safety issues is maintained							
OVERALL RATING								

The overall rating determines the extent to which H&S practice is aligned with social sustainability principles. The performance for each stage is obtained by adding up the scores for the criterion under each principle and dividing that outcome by the total number of criteria applicable to that principle. The overall rating for each stage is a composite of social, economic and environmental sustainability assessments. A narrative description should be provided to substantiate the assessment rating. The reports of assessment can be tabled at management meetings to argue for project wide support towards sustainability.

2.3 VALIDATION QUESTIONNAIRE: SFCHS

INSTRUCTIONS

a. Based on the review of the Sustainability Framework for Construction Health and Safety, please evaluate the Framework by responding to the following questions;
b. You may enter your responses electronically / using a pen by putting an **X** in the appropriate box and send the completed questionnaire to benvirolent@gmail.com; and
c. Please note the Unsure option on each question.

SECTION A: THE SUSTAINABILITY FRAMEWORK

1.0 Please rate, on a scale of **1 = strongly disagree** to **5 = strongly agree**, the extent to which you concur with the following statements with regards to the Sustainability Framework for Construction Health and Safety (SFCHS).

	Statement	Un-sure	SD (1)……SA (5)				
1.1	The framework addresses an important problem with regards to promoting sustainable health and safety practice	U	1	2	3	4	5
1.2	The framework can assist construction practitioners to integrate sustainability aspects within health and safety practice	U	1	2	3	4	5
1.3	Implementation of this framework has potential to reduce injuries, illnesses, and accidents	U	1	2	3	4	5
1.4	Collaboration among clients, contractors, designers is necessary to realise sustainable health and safety practice	U	1	2	3	4	5
1.5	The Framework integrates the responsibilities of clients, contractors and designers with regards to health and safety	U	1	2	3	4	5

2.0 Please rate, on a scale of **1 = strongly disagree** to **5 = strongly agree**, the extent to which you concur with the following statements with regards to the integration process of sustainability principles / factors in construction H&S.

Approach	**Un-sure**	**SD (1)……SA (5)**

2.1	The Plan-Do-Check-Act approach can facilitate integration of sustainability principles within health and safety practice.	U	1	2	3	4	5
2.2	To realise sustainability within health and safety practice, the principles / concepts should be integrated from project inception through to project closeout.	U	1	2	3	4	5

3.0 Making reference to Tables 10.1 to 10.3, please rate, on a scale of **1 = Not at all to 5 = Major,** the extent to which important sustainability issues which should be addressed in health and safety have been incorporated under the following dimensions of sustainability?

	Sustainability Dimension	Un-sure	**Not at all (1)……Major (5)**				
3.1	Environmental sustainability	U	1	2	3	4	5
3.2	Economic sustainability	U	1	2	3	4	5
3.3	Social sustainability	U	1	2	3	4	5

4.0 Please rate, on a scale of **1 = Not at all to 5 = Major**, the extent to which the Framework meets the following criteria:

	Criteria	Un-sure	**Not at all (1)……Major (5)**				
4.1	Add value to construction health and safety practice	U	1	2	3	4	5
4.2	Practical	U	1	2	3	4	5
4.3	Logical	U	1	2	3	4	5
4.4	Comprehensive	U	1	2	3	4	5
4.5	*Straightforward / easy to understand*	U	1	2	3	4	5

5.0 Please rate, on a scale of **1 = Not at all** to **5 = Major,** the extent to which the following factors are necessary to facilitate better integration of sustainability within health and safety practice.

	Factors / Enablers	Un-sure	**Not at all (1)……Major (5)**				
5.1	Training	U	1	2	3	4	5
5.2	Leadership	U	1	2	3	4	5
5.3	Commitment from project stakeholders (client, contractor, consultants)	U	1	2	3	4	5
5.4	Regulatory framework	U	1	2	3	4	5

6.0 Please rate, on a scale of **1 = Not at all** to **5 = Major,** the extent to which the Framework can be used by clients / contractors to integrate and evaluate health and safety practice on projects.

	Criteria	Un-sure	**Not at all (1)……Major (5)**				
6.1	Clients	U	1	2	3	4	5
6.2	Contractors	U	1	2	3	4	5

7.0 Please rate, on a scale of **1 = Poor** to **5 = Excellent,** your knowledge with regards to the following aspects:

	Aspect	Un-sure	Poor (1)……Excellent (5)				
7.1	Construction health and safety	U	1	2	3	4	5
7.2	Sustainability / sustainable development	U	1	2	3	4	5

8.0 Please provide any other general information that you may want to make regarding the framework / suggests for improvement of the model

_____

_____

_____

SECTION B: DEMOGRAPHIC DETAILS OF THE RESPONDENT

Organisation _____

Position / Designation within the organisation _____

Work experience in current position / designation (Years) _____

Work experience in the construction industry (Years) _____

Highest attained academic qualification _____

THANK YOU FOR YOUR VALUED CONTRIBUTION

10.6 APPENDIX 6: INTERVIEW GUIDE

1. Please explain your role relative to construction H&S management in your organisation.
2. Given your experience related to construction works, how would you the current state of construction H&S practices in the Zimbabwean construction industry.
3. Please explain the factors which contribute to the assessment you made in question 2 above.
4. Are there any other comments / points / issues you may wish to share regarding construction H&S practices in Zimbabwe with a focus to ensuring sustainable management of H&S.
5. As we conclude our discussion, may you please share with me some demographic details about yourself, which may be important for the interpretation of the results e.g. experience in the industry, qualifications, etc.

I appreciate your time and the invaluable information you have provided relative to my study.

Thank you.

10.7 Appendix 7: Permission to conduct research letters

F

MINISTRY OF LOCAL GOVERNMENT, PUBLIC WORKS AND NATIONAL HOUSING

Telephone 263 4 793700,
791470,794166,791865
Fax 263 4 700859

ZIMBABWE

The Office of the Secretary
Private Bag 7706
Causeway,
Harare

MIN. OF LOCAL GOVT PUBLIC WORKS AND NATIONAL HOUSING
HUMAN RESOURCES 3
30 NOV 2015
P BAG 7706, CAUSEWAY
ZIMBABWE TEL: 04-793700

Ref: ADM/23/8.

30 November 2015

Mr. Chigara B.
PO BOX AC 939
Ascot
Bulawayo

MR CHIGARA BENVIOLENT: NELSON MANDELA METROPLITAN UNIERSITY STUDENT: REQUEST FOR AUTHORITY TO UNDERTAKE AN ACADEMIC RESEARCH

The above subject matter refers.

It is my pleasure to advise you that, the Head of the Ministry has approved your application to undertake a field research within the Ministry.

Please be advised that the research findings should not be subjected to external consumption and must be solely used for academic purposes only. You are mandated to complete the Official Secret Act before commencement of the research project. Moreover, the final copy of the research should be submitted to the office of the secretary upon completion.

It is our hope that the research findings will help the Ministry in coming up with relevant strategies and actions in the study area undertaken.

M. Matenga
FOR: SECRETARY FOR LOCAL GOVERNMENT, PUBLIC WORKS AND NATIONAL HOUSING
cc: The Director Construction and Maintenance
The Provincial Public Works Director- Bulawayo

NATIONAL SOCIAL SECURITY AUTHORITY

Head Office
NSSA House
Selous Avenue / Sam Nujoma St
Box CY 1387, Causeway, Harare

Tel: (04) 706523-5, 706545-8
Fax: (04) 796320, 799042

14 September 2016

The Head of Department
Construction Management
Nelson Mandela Metropolitan University
Port Elizabeth 6031
South Africa

Dear Sir

Subject: Authorisation to carry out a study at the National Social Security Authority (NSSA)

This is to certify that Mr. Benviolent Chigara has been granted permission to carry out research at NSSA. The Authority will endeavour to assist him in every way possible for him to successfully complete his research.

Yours Faithfully

Henry Chikova (PhD)
Chief Social Security Officer