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Refinement of the culture transformation framework (CTF) for the South African mining industry (SAMI)

Fleckson Magweregwede

A dissertation submitted to the Faculty of Engineering and the Built Environment, University of the Witwatersrand, Johannesburg, in fulfilment of the requirements for the degree of Master of Science in Engineering

Johannesburg, 2021

DECLARATION

I declare that this research report is my own, unaided work. It is being submitted to the Degree of Master of Science to the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination to any other University.



_____

This 15th day of September 2021

ABSTRACT

Background

The mining industry remains one of the pillars of the South African economy and effective management of occupational health and safety (OHS) is critical for the continued sustainability of the sector. Although the South African mining industry (SAMI) has made significant strides in improving OHS conditions over the past two decades, the performance improvements appear to have plateaued at unacceptably high levels.

Aim of the study

The purpose of the study was to assess whether the culture transformation framework (CTF) provides sufficient guidance for cultivation of positive OHS culture in the SAMI. The emphasis on OHS culture is important when OHS performance improvements plateaued, following efforts to improve OHS through technical interventions and occupational health and safety management systems (OHSMS), incorporating considerations about human factors and risk management.

Methods

A literature review was conducted on relevant local and international literature relating to the concept of OHS culture and best practices in OHS culture management. Occupational health culture was not specifically covered in the literature but relates to concerns about the work environment and the well-being of the workforce. The term "safety" is often used in practice to refer to 'health and safety' and workplace health risks have generally been receiving less attention as compared to safety. In line with best practices of integrated OHS management, the term OHS culture was adopted for the purpose of the study. The CTF was examined against best practices in OHS culture management that were revealed by the literature survey.

A total of 36 in-depth interviews (IDIs) were conducted to understand key informants' experiences of the management of OHS culture in the SAMI and their insights into the concept of OHS culture. Two questionnaires were utilised, customised to accommodate mining industry stakeholders who were not employed by mining companies, and participants who were employed by mining companies.

A deductive thematic analysis method was applied to analyse the data and some level of saturation was observed during the analysis of data. The findings from the qualitative study were reviewed for convergence of perspectives among the stakeholders and compared against the CTF and findings from the review of the literature. Moreover, the insights that were obtained from the qualitative and literature studies were consolidated to draw up some conclusions and recommendations to strengthen the CTF.

Findings

Similarities were observed between gaps identified by analysing the CTF against findings of the qualitative and literature studies. Common gaps were identified on aspects such as narrow definition of OHS culture, inadequate coverage of key OHS culture elements, and non-existence of definition and responsibilities of OHS leadership and meaning and rationality of zero harm. Additional common gaps include lack of emphasis on importance of collaborative culture, good OHS behaviour, OHSMS, systematic OHS management approach, technological innovation and holistic consideration of potential threats to establishment of positive OHS culture. Lack of guidance on approaches for determining prevailing OHS culture, managing OHS culture change, managing OHS risks, cultivating good OHS behaviour and nurturing collaborative, just, reporting and learning cultures were also identified as similar gaps. The similarities in the identified gaps could be as a result of the implementation of global best practices in OHSMS and OHS culture management by some mines in the SAMI.

Findings that were revealed by the literature study but not addressed by the qualitative study and CTF include the importance of establishing a flexible culture and potential cost savings and improved OHS resulting from the use of cleaner and efficient energy sources. Moreover, the qualitative study revealed additional findings that were not covered by the literature that was reviewed or CTF. The findings include the requirement to empower OHS representatives to stop unsafe work and introduce mandatory OHS behaviour screening and minimum educational requirements for employment in the sector. Appendix 6 provides a summary of the combined gaps between the CTF and findings from the qualitative study and an analysis of CTF against the literature available on OHS culture.

Recommendations

The following recommendations are proposed based on the outcomes of the literature and qualitative studies:

Practice

The Mine Health and Safety Council (MHSC) and other SAMI stakeholders implementing the CTF should note the gaps identified and summarised in Appendix 6, with a view to supplementing the content of the CTF. Moreover, the MHSC is advised to develop and implement programmes to nurture positive health and safety culture at societal levels.

Potential for further research

There is no inherent generalisability of the study findings as the research methodology was restricted to a limited qualitative study. Insights were obtained from a sample of key informants representative of stakeholders in the SAMI but not from members of the workforce. The results of this limited study however suggest that further research is warranted. While the analysis of the CTF against the findings of research into OHS culture and the tools in service, is comprehensive, the small size and narrow composition of the sample of key informants is a

significant limitation. Generalisation of the study findings could be advanced by use of mixed research methods (qualitative and quantitative approaches), with a larger and representative study population, which includes solicitation of the views of the workforce and verification of the strategies and practices adopted by individual mining companies. Further studies could thus build on the findings of the current study and provide further recommendations on improving the CTF.

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LIST OF ACRONYMS

ACSNI	Advisory Committee for Safety in Nuclear Installations
AIDS	Acquired Immunodeficiency Syndrome
ART	Antiretroviral Therapy
BBS	Behaviour Based Safety
CEO	Chief Executive Officer
CTAC	Culture Transformation Advisory Committee
CTF	Culture Transformation Framework
dB(A)	A-weighted decibels
DIFR	Disabling Injury Frequency Rate
DMR	Department of Mineral Resources
DPM	Diesel Particulate Matter
FGD	Focus Group Discussion
GDP	Gross Domestic Product
HCT	HIV Counseling and Testing
HEMP	Hazards and Effects Management Process
HIV	Human Immunodeficiency Virus
HSC	Health and Safety Commission
ICS	International Chamber of Shipping
IDI	In-Depth Interview
ILO	International Labour Organisation
IOSH	Institution of Occupational Safety and Health
IQV	Index of Qualitative Variation

IRR	Institute of Race Relations
ISSA	International Social Security Association
KRA	Key Result Area
KRA	Key Result Area
LTI	Lost Time Injury
MCSA	Minerals Council South Africa
MHSA	Mine Health and Safety Act
MHSC	Mine Health and Safety Council
MHSI	Mine Health and Safety Inspectorate
MMP	Mandela Mining Precinct
MOSH	Mining Industry Occupational Safety and Health
MPRDA	Minerals and Petroleum Resources Development Act
MQA	Mining Qualifications Authority
NIHL	Noise Induced Hearing Loss
OHS	Occupational Health and Safety
OHSA	Occupational Health and Safety Act
OHSMS	Occupational Health and Safety Management System
PDCA	Plan-Do-Check-Act
PGM	Platinum Group Metals
PPE	Personal Protective Equipment
SAMI	South African Mining Industry
SCMM	Safety Culture Maturity Model

SMART	Specific, measurable, attainable, realistic and time bound
TARP	Triggered Action Response Plan
TB	Tuberculosis
TRIFR	Total Recordable Injury Frequency Rate
UN	United Nations
USA	United States of America
VFL	Visible Felt Leadership

CHAPTER 1 : INTRODUCTION TO THE STUDY

1.1 Introduction

This chapter provides a high-level overview of the South African Mining Industry (SAMI). The significance of the SAMI, occupational health and safety (OHS) legislative framework, OHS performance, culture transformation framework (CTF) and OHS summit milestones are discussed. The purpose of the chapter is to support the rationality of the current study by providing a comprehensive and authentic basis for assessing the adequacy of the CTF as a tool for the improvement of OHS culture in the SAMI.

1.2 The South African mining industry

South Africa is proudly a mineral resource-rich country that is endowed with a number of valuable and sought-after mineral commodities (Figure 1.1). Some of the notable highlights of South Africa's mineral resource endowment include the following (Rossouw and Baxter, 2011):

- The country hosts the world's largest non-energy mineral resources.
- South Africa possesses about 87%, 80%, 70% and 40% of the planet's platinum group metals (PGM), manganese, chromium and vermiculite resources respectively.
- Globally, South Africa is ranked number one in terms of PGM, manganese, chromium, gold and alumina-silicates deposits. It is also noteworthy that the gold deposits in South Africa constitutes about 15% of the world's known gold reserves.
- The country is ranked second for hosting the world's known vermiculite, vanadium, zirconium, titanium and fluorspar resources.

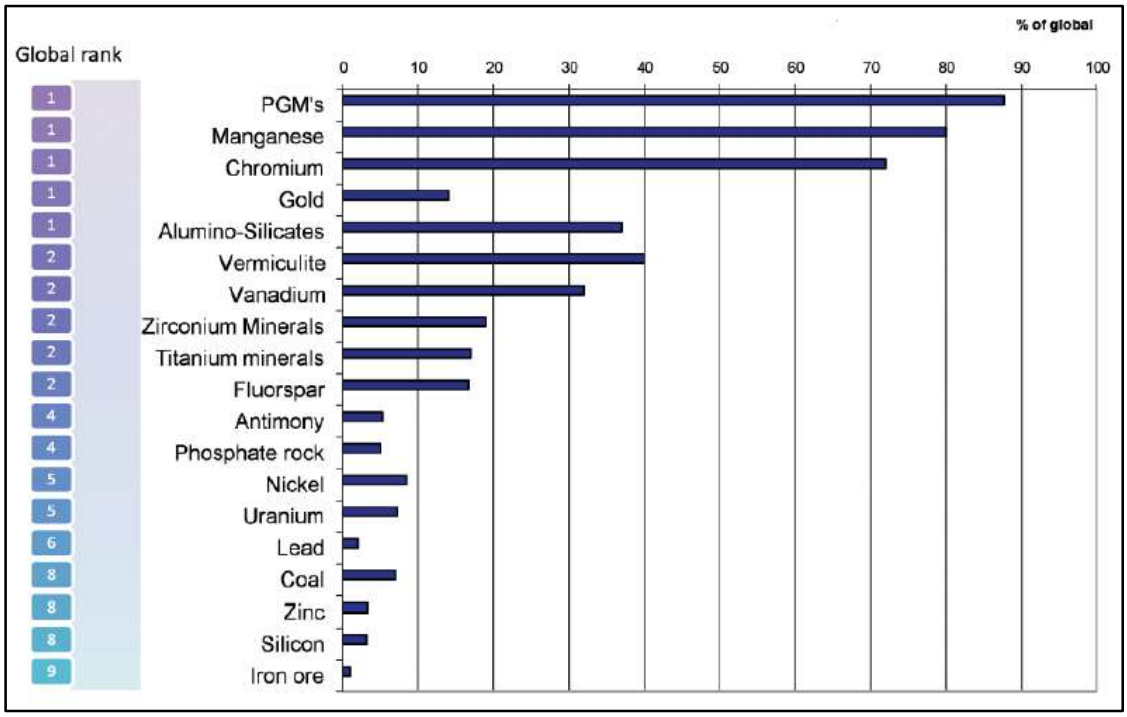


Figure 1.1: South Africa's mineral resources endowment as in the year 2008 (Rossouw and Baxter, 2011)

The mining methods that are utilised to extract mineral resources in South Africa can be broadly categorised into two types namely, surface and underground mining (Figure 1.2). Surface mining is utilised to extract mineral commodities that are near the earth's surface and variants of surface mining methods include open pit mining, quarrying, open-cast mining and dredging. Underground mining is used to extract deep and steep dipping orebodies, which cannot be economically extracted using surface mining methods. Examples of underground mining methods used in the SAMI include room and pillar mining, sub-level stoping, sub-level caving, block caving and longwall mining.

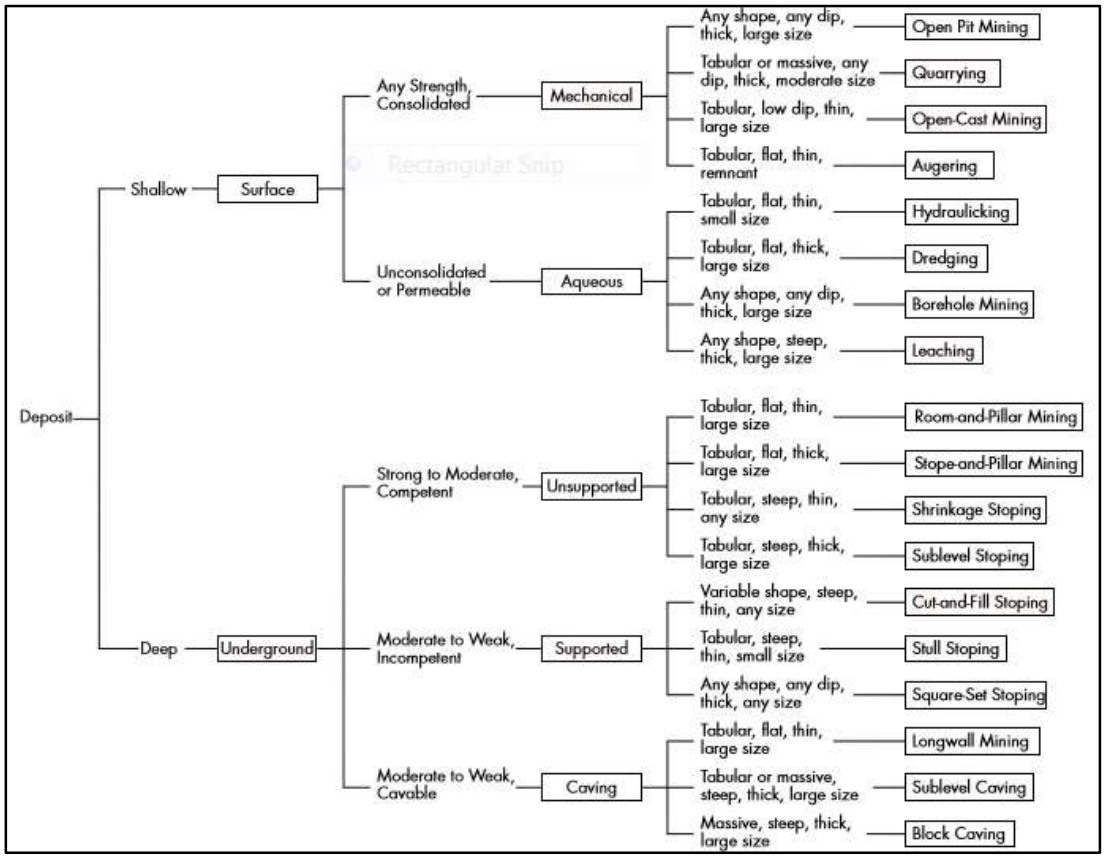


Figure 1.2: Mining methods (Hartman, 1987)

Most surface mines (unlimited headroom), underground mines with massive orebodies (typically 4 to 6 m headroom) and underground mines with flat-dipping narrow orebodies (down to about 1.5 m headroom) are fully mechanised (Fraser, 2017). Associated benefits of mechanised mining include improved OHS (due to reduction of the number of people exposed to risk), reduced operating costs and improved productivity and mining efficiencies. However, most hard rock underground mines with steeply dipping narrow orebodies (headroom less than 1.5 m and dips greater than 11˚), are still using labour-intensive conventional mining methods and rudimentary equipment such as hand-held pneumatic powered rock drills and scraper winches (Fraser, 2017). The labour-intensiveness of conventional mines mean that an increased number of workers are exposed to various OHS risks as compared to mechanised operations.

1.3 Significance of the South African mining industry

For more than a century, the mining industry has been one of the cornerstones of the South African economy and remains one of the country's socio-economic development strategic tools (Corrigan, 2019), providing both direct and indirect benefits such as:

- Employment creation.
- Foreign currency from export of mineral commodities.
- Contributing to the gross domestic product (GDP) of the country.
- Revenue generation for the government in the form of taxes and royalties.
- Promoting economic development in downstream and upstream industries.
- Infrastructural development (schools, health facilities, roads, mining towns, etc.) in communities surrounding mining operations.
- Training and skills development opportunities to the workforce.

For example, in 2019, the mining sector made the following contributions to the South African economy (Minerals Council South Africa (MCSA), 2020):

- R360.9 billion direct contribution to the GDP representing a total of 8.1%.
- R94.7 billion direct contribution to fixed investment.
- R538.9 billion total in primary mineral sales.
- R8.6 billion in royalties.
- R24.3 billion in company taxes.
- Employed about 454 861 people.

However, mining remains a risky occupation which is performed in challenging, continuously changing, strenuous and hazardous environments. Hermanus (2007) described mining as one of the most hazardous industrial sectors, which is characterised by rapidly changing harsh environments. Kejriwal (1994) argued that mining is a continuous struggle against the forces

of nature, where fresh ground is exposed every moment and every day the miner works in an area where no other person has been ever before.

The number of fatalities, lost-time injuries and illnesses that occur in the SAMI annually results in significant financial costs to mining companies and negative social impacts to the affected employees and their families. OHS incidents are estimated to cost between 1.8 and 6% of the gross domestic product (GDP) in a number of countries (Takala et al., 2014). Table 1.1 highlights some of the costs that are associated with OHS incidents. The maintenance of sound OHS standards in the mining industry, in order to safeguard the health, safety and wellbeing of the employees, is critical for the continued sustainability of the mining sector.

Table 1.1: Some of the costs associated with OHS incidents

Item	OHS incident cost description	Examples
1.	Employee related costs	• Compensation for fatalities, injuries and ill-health • Costs associated with replacing injured, deceased, incapacitated and sick employees • Reduced employee productivity due to low morale • Paying premium wages to employees for the high-risk work
2.	Fines	• Fines to the regulator as provided for by the Mine Health and Safety Act (MHSA)
3.	Response to OHS incidents	• Emergency response related activities • OHS incident investigation costs • OHS incident meetings and interviews • OHS incident reports and paperwork • Corrective actions
4.	Loss of production and repairs	• Repairing and replacement of damaged infrastructure and equipment • Stoppages and delays of mine operations • Loss of workdays • Loss of production, sales and revenue • Rehabilitation of work site

5.	Medical, insurance and legal costs	• Medical expenses • Insurance related costs • Legal fees
6.	Poor reputation and corporate image	• Loss of shareholder value and market distrust

1.4 The OHS legislative framework in the SAMI

The United Nations (UN)'s Universal Declaration of Human Rights recognises the right to safe and healthy working conditions as a fundamental human right (UN, 1948). Failure to provide a safe and healthy working environment, could result in the erosion of other fundamental human rights, such as the right to life, health and the right to dignity (Zungu, 2014). The SAMI subscribes to the supreme law, the Constitution of the Republic of South Africa of 1996. The following provisions of the constitution apply directly to OHS in the SAMI (Constitution of the Republic of South Africa, 1996):

- Section 1 (a) The Republic of South Africa is one, sovereign, democratic state founded on human dignity, the achievement of equality and the advancement of human rights and freedoms.
- Section 10: Everyone has inherent dignity and the right to have their dignity respected and protected.
- Section 11: Everyone has the right to life.
- Section 24 (a): Everyone has the right to an environment that is not harmful to their health or well-being.

Simply put, the constitution calls for high OHS standards that ensures that the workforce is protected from injury, ill health and death, that could result from OHS incidents.

The Minerals and Petroleum Resources Development Act (MPRDA), number 28 of 2002, seeks to promote equitable access to and sustainable development of South Africa's mineral

and petroleum resources. Sustainable development in the mining industry can only be achieved if high safety, health and environmental standards are maintained at the mining operations, for the benefit of the present (workforce and communities) and future generations. Hermanus (2007), argued that healthy and safe working conditions is one of the prerequisites for sustainable development, noting that OHS risks at the workplace must not deprive the employees of their livelihoods or of their quality of life. The negative consequences of OHS incidents are so enormous, thus, OHS management must be on top of the list of the wider social agenda for sustainable development (Hermanus, 2017).

To ensure that employees work in an environment that is not harmful to their health or well-being as required by the constitution, South Africa has developed significant OHS-related legislations. The Occupational Health and Safety Act (OHSA), number 85 of 1993, is the universal legislation for all workplaces except mining, which has its own dedicated legislation, the Mine Health and Safety Act (MHSA), number 29 of 1996. The OHSA is administered by the Department of Employment and Labour. However, under certain circumstances, some provisions of the OHSA can be made applicable to the mining sector as provided for by section 80 of the MHSA.

The MHSA constitutes the main body of legislation regulating OHS in the SAMI. Mines and other mining locations, such as quarries, fall under the auspices of the MHSA, which is administered by the Mine Health and Safety Inspectorate (MHSI), which falls under the Department of Mineral Resources (DMR). The mining industry is characterised by unique OHS risks, thus appropriately tailored legislative interventions are warranted in order to appropriately manage the risks. The main objectives of the MHSA are (MHSA, 1996):

- To protect the health and safety of persons at mines.
- To require employers and employees to identify hazards and eliminate, control and minimise the risks relating to health and safety at mines.

- To give effect to the public international law obligations of the Republic that concern health and safety at mines.
- To provide for employee participation in matters of health and safety through health and safety representatives and the health and safety committees at mines.
- To provide for effective monitoring of health and safety conditions at mines.
- To provide for enforcement of health and safety measures at mines.
- To provide for investigations and inquiries to improve health and safety at mines.
- To promote a culture of health and safety in the mining industry.
- To promote training in health and safety in the mining industry.
- To promote cooperation and consultation on health and safety between the tripartite stakeholders (State, Employers and Employees).

The MHSA articulate key OHS responsibilities of employers (mine owners) such as ensuring a healthy and safe working environment, provision of safety equipment, establishment of OHS policy, appointment of staff to drive OHS performance improvement, provision of OHS training and management of OHS risks. Other notable aspects of the MHSA include (MHSA, 1996):

- Section 22 that requires the workforce to take responsibility for their own OHS and that of fellow workmates.
- Section 23 that empowers all employees to refuse dangerous work and leave a dangerous workplace. In other words, Sections 22 and 23 of the MHSA place primary responsibility for OHS on the workforce.
- Section 54 that empowers the MHSI to issue instructions to halt work until the identified dangerous OHS conditions are rectified.

Pre the MHSA era, effective management of OHS was not prioritised by most South African mining operations. The MHSA spelt the responsibilities of employers for OHS and how these were to be exercised. As a result, mining companies made considerable investments in order

to improve OHS through interventions such as engineering controls, protective equipment, safer machinery and processes, adherence to OHS regulations and standards, OHS risk management and introduction of occupational health and safety management systems (OHSMS). The employees were capacitated to effectively deal with OHS matters through measures such as training, education, communication and coaching. As a result of this transformation, the total number of recorded fatalities on mines were reduced from hundreds (about 615 in 1993) to tens (about 51 in 2019) and occupational diseases decreased from 10344 in 2008 to 3458 in 2018 (DMR, 2020; Stewart and Nite; 2017). However, Hermanus (2007) argued that while OHS performance in the SAMI has improved, the rate of improvement has been slow. Thus, there is need for further effort to improve OHS performance, in order to attain and sustain zero harm.

It is noteworthy that the MHSA recognises the importance of OHS culture as one of the vehicles for continued OHS performance improvements in the SAMI. Moreover, the MHSA requires the establishment of tripartite entities under the chairmanship of the Chief Inspector of Mines, namely the Mining Qualifications Authority (MQA) and the Mine Health and Safety Council (MHSC). The mandate of the MQA is to ensure that the SAMI has sufficient competent people who will improve OHS, employment equity and increase productivity (MHSA, 1996). On the other hand, the mandate of the MHSC is to advise the Minister of Mineral Resources on OHS legislation and research outcomes focused on improving and promoting OHS in South African mines (MHSA, 1996). The MHSC also oversees the activities of its committees; promotes OHS culture in the mining industry; arranges an OHS summit every two years to review the state of OHS at mines; and liaises with MQA and any other statutory bodies about mining health and safety (MHSC, 2020). The MHSC comprises a tripartite board represented by State, Employer, and Labour members under chairmanship of the Chief Inspector of Mines (MHSC, 2020). The Culture Transformation Advisory Committee (CTAC) is one of the committees of the MHSC that is mandated to champion the implementation of OHS culture improvement interventions designed to improve OHS in the SAMI. This reflects the increasing acknowledgement and focus of the SAMI on improving OHS by cultivating and maintaining positive OHS culture.

1.5 OHS performance in the SAMI

As shown in Figure 1.3, the mining sector attained step change reductions in the number of fatalities and injuries between the years 1993 to 2009, after which, the safety performance plateaued between the years 2010 to 2018. The plateauing trend is a clear indication that some completely different interventions are required to change the status quo. However, the SAMI achieved a step change improvement in safety performance during 2019, recording about 37% less fatalities during 2019 as compared to 2018 (DMR, 2020). This significant improvement could be due to a number of factors such as continued collaboration by the SAMI stakeholders on OHS matters (DMR, 2020; MCSA, 2020) and decline in employment, hence risk exposure rates, in the SAMI's most high risk and labour-intensive deep level gold and PGM mines (MCSA, 2020).

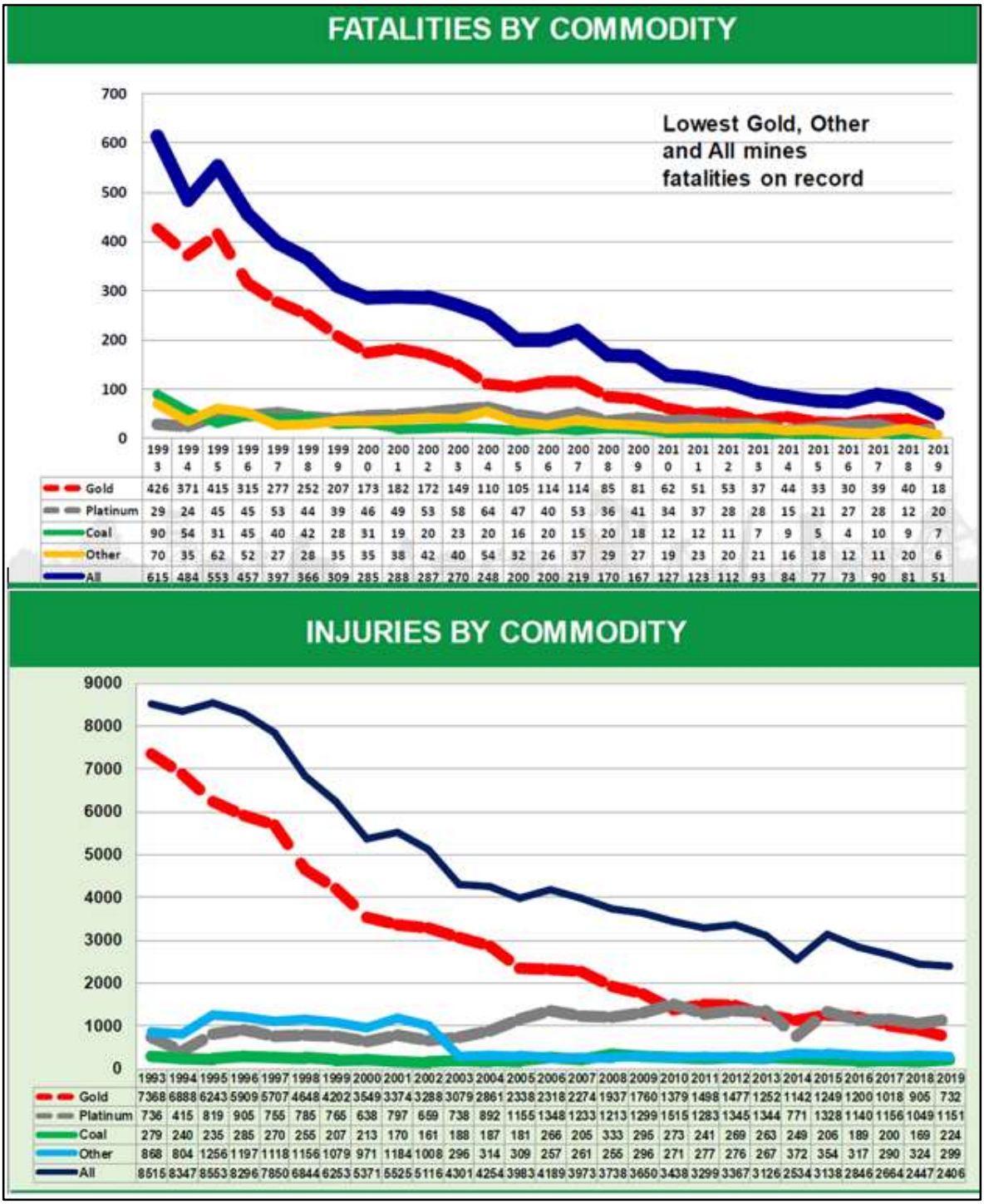
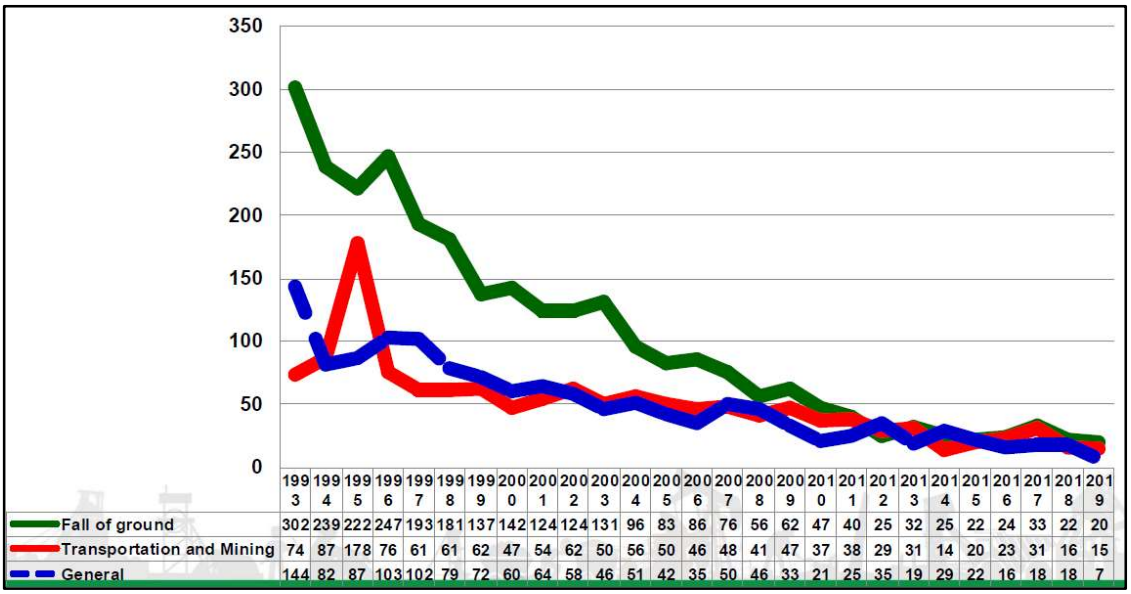


Figure 1.3: A comparison of the total number of fatalities and injuries by commodity (DMR, 2020)

Analysis of Figure 1.4 shows that over the past 20 years, the major contributors of fatalities have been causes under the falls of ground, transportation and mining, and general categories. The general category includes causes such as struck by object; dust, gas and fumes; caught between objects; mudrush; inundation; and burning and scalding. The reporting of more than five causes under the general category is problematic, as it does not readily give an indication of the exact causes. Thus, a review is required in the reporting of OHS incidents to generate robust and meaningful data that can allow decision makers to formulate appropriate interventions to improve OHS.



	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Fall of ground	302	239	222	247	193	181	137	142	124	124	131	96	83	86	76	56	62	47	40	25	32	25	22	24	33	22	20
Transportation and Mining	74	87	178	76	61	61	62	47	54	62	50	56	50	46	48	41	47	37	38	29	31	14	20	23	31	16	15
General	144	82	87	103	102	79	72	60	64	58	46	51	42	35	50	46	33	21	25	35	19	29	22	16	18	18	7

Figure 1.4: Major contributors of fatalities from 1993 to 2019 (DMR, 2020)

The mining sector also made significant strides in reducing the number of reported occupational diseases between the years 2008 and 2018 (Figure 1.5). Like safety, the health performance also showed a plateauing trend between the years 2012 and 2018. The major occupational diseases in the SAMI are tuberculosis (TB), noise induced hearing loss (NIHL) and silicosis (MCSA, 2020). It is also notable that at the time of writing this report, the health data was only available up to the year 2018, due to delays in reporting of health-related information by the mining sector (MCSA, 2020).

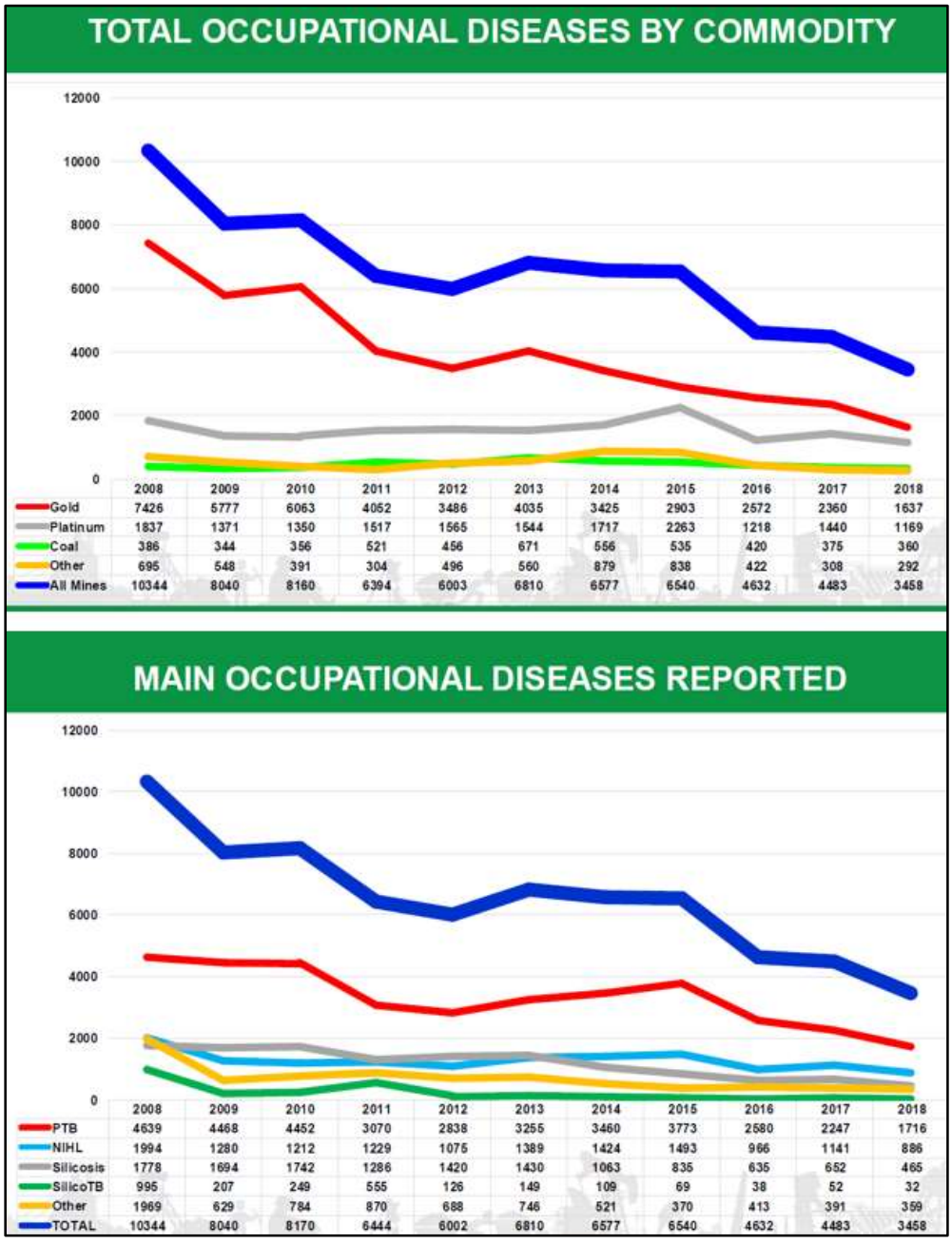


Figure 1.5: Occupational diseases from 2008 to 2018 (DMR, 2020)

Although there has been a marked reduction in the number of injuries, fatalities and occupational diseases in the SAMI over the last decade, fatalities, injuries and occupational

diseases continue to occur. The gold and PGM mines continue to have a relatively higher prevalence of fatalities, injuries and occupational diseases. In the MHSI report for the 2016/2017 financial year, the DMR reported that most accidents in the SAMI occur in underground mines, mainly in the stope, crosscuts, draw points and haulages (DMR, 2017). Evidently, these are the areas in which there is excessive production pressures as the mineral must be broken and transported to the main shaft. Underground mining, in particular, is an endeavour that is associated with high risks.

Most of the South African gold and PGM mines are conventional and highly labour intensive (about 80% of employees work underground), presenting significant organisational and logistical challenges (DMR, 2017). Across the mining industry as a whole, about 60% of employees are underground workers (DMR, 2017). Moreover, a number of South African gold and PGM mines are by far the deepest in the world (Perold, 2013), with most mines operating at depth greater than 1.5km (Wagner, 1986). It can be deduced that approximately half of the entire mining workforce in the SAMI is employed in deep mines (at depths greater than 1.5km) and is consequently exposed to high OHS risks.

Fairhurst (2017) argued that the occupational environment becomes progressively unconducive as mining depth increases. Associated with these depths is increased risk of falls of ground, rock bursts and seismic activities due to pressure built up in the rock mass (Fairhurst, 2017). The working faces on most of these mines have progressed far from the shafts and the workforce now have reduced available face time as they spend a lot of time travelling to and from the working face (Pelders et al., 2019). The available face time is also impacted on by stringent OHS requirements such as safety talks, early entry examination and making safe as well as identification and mitigation of OHS hazards throughout the shift (Pelders et al., 2019). It appears logical that most of the time, the workforce will be under pressure to deliver on their production targets at the backdrop of limited available face time. The increased production pressures will potentially make the workforce more vulnerable to committing shortcuts and oversights, resulting in OHS incidents. Moreover, the unconducive working conditions could

increase the workforce's fatigue levels potentially resulting in increased OHS incidents (MHSC, 2016).

Furthermore, the management of underground environmental conditions such as temperature, humidity and ventilation (air quality), becomes more difficult with increased depth (Wagner, 1986). The OHS challenges are complicated by the geology of South African deposits which have relatively higher silica composition (MHSC, 2016). Additionally, most conventional underground mines are still using conventional mining equipment such as pneumatic rock drills and scraper winches that emit relatively higher sound pressure levels. Consequently, the workforce is exposed to relatively higher occupational hygiene exposures particularly excessive heat, dust and noise; resulting in relatively higher prevalence of occupational diseases such as thermal stress, silicosis, TB and NIHL (MHSC, 2016). These challenging conditions suggest that high standards of OHS management are required to protect the health and safety of the workforce.

1.6 The health and safety dilemma

Globally, the estimated number of occupational diseases far exceeds that of occupational fatalities and injuries (Hämäläinen et al., 2017). Similarly, analysis of OHS data for the SAMI between the years 2003 to 2014 revealed that the number of deaths occurring as a result of respiratory illnesses far exceed those occurring as a result of mine accidents (Figure 1.6). However, it is worrying to note that fatalities and injuries resulting from accidents tend to attract more attention than those resulting from occupational diseases. The impact of fatalities resulting from mine accidents are realised immediately after the incident, thus the mining sector has been proactive in mitigating the related risks. On the contrary, the effects of respiratory diseases will be realised at a later stage as there is a latency period between exposure and manifestation of respiratory disease; thus, the sector tends to be less proactive (Hermanus, 2007). The Institution of Occupational Safety and Health (IOSH) (2015) added that the links between poor workplace practices and resulting ill health can be less clear and enforceable than those relating to poor safety conditions and resulting injuries. Hermanus (2007) added that

OHS legislation is skewed towards safety and physical hazards, since safety risks are more manifest in the workplace than occupational health risks. It is important for the SAMI to realise that the sustainability of the sector requires sound and holistic management of both health and safety.

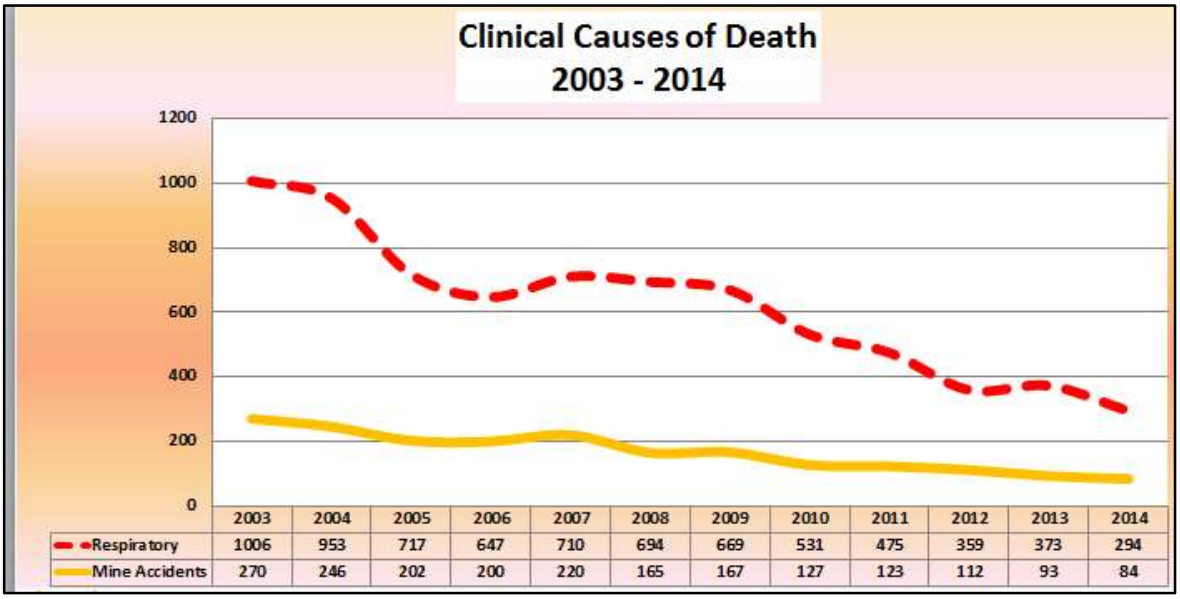


Figure 1.6: Causes of death for all mines (DMR, 2018)

1.7 The culture transformation framework (CTF)

The SAMI has a history of command and control management style, racism, unfair discrimination and violence and continues to face injuries, ill-health and deaths as result of occupational accidents and diseases (Stewart and Nite, 2017). During the apartheid era, black mineworkers were forced to work in unsafe conditions in order to meet production targets (prioritisation of production over OHS), victimised for reporting unsafe OHS conditions and blamed for causing OHS incidents (Stewart and Nite, 2017). Racism and poor working conditions in the SAMI during the apartheid era resulted in the workforce becoming more unionised. Subsequent OHS improvements were realised in the SAMI, as a result of interventions such as demand for better OHS conditions, refusing dangerous work, and increased representation and participation of the workforce on OHS matters (Stewart and Nite,

2017). Leger (1985) identified racism, culture of blame, production pressures, inadequate training, production-based bonuses, insufficient personal protective equipment, lack of workforce participation on OHS matters, incompetent OHS leadership and non-existence of the right to refuse dangerous work and leave dangerous workplaces as some of the causes of OHS incidents in the SAMI. The attainment of democracy in 1994 resulted in the introduction of modern outcomes and risk management based OHS legislation (MHSA). Notable aspects of the MHSA that resulted in improved OHS in the SAMI include granting the workforce the right to refuse dangerous work, and requirement for collaboration, inclusivity, co-creation, consultation, engagement, participation and representation of the workforce on OHS matters (Stewart and Nite, 2017).

The 2008 Republic of South Africa's Presidential Mine Health and Safety audit report recommended the Mine Health and Safety Council (MHSC) to develop and implement some interventions that will assist the mining industry to deal with human factors, in order to enable continued improvement in OHS (DME, 2008). At the Tripartite Stakeholder Leadership Summit that was held in 2008, the SAMI principals approved an OHS improvement action-driven plan, which aimed to enhance OHS culture, promote continuous OHS improvements and supporting capability development (MHSC, n.d.). As part of implementing the Presidential Mine Health and Safety audit report recommendation and the Tripartite Stakeholder Leadership Summit action plan, it was necessary to develop a CTF that will facilitate continuous improvement of OHS culture in the SAMI. The CTF was envisaged to enhance the industry's focus on human and organisation factors, thus complementing OHS improvement initiatives in the sector, which were primarily based on improvement of OHSMS and engineering controls (MHSC, n.d.). To this end, the MHSC commissioned the project *"Changing Minds, Changing Mines"* in 2010, with the aim of developing a framework that would assist the SAMI to cultivate positive OHS culture, thus enabling significant OHS improvements (Hermanus et al, 2015; MHSC, n.d.). This project developed the culture transformation framework (CTF) for the mining sector and the CTF included guiding principles, commitment and action points (Appendix 1). Table 1.2 provides a summary of the 11 pillars of the CTF for the SAMI (MHSC, n.d.). It is noteworthy that the CTF includes both hard elements such as implementation of technology and soft elements such as culture and organisational change.

Table 1.2: Summary of the 11 pillars of the CTF for the SAMI (MHSC, n.d.)

CTF Pillar		Purpose
1	Integrated mining activities	Basing mining activities on the recognition that health, safety and production are not competing objectives. Safety and health are the outcomes of work well done
2	Risk management	Eliminating risks at their source and investigate the root causes of incidents
3	Technology	Adopting mechanisation and technology as a key method of eliminating health and safety risks to mine employees
4	Leading practice	Taking a common approach to identifying and facilitating the adoption of leading OHS practices and research outcomes
5	Elimination of discrimination	Eliminating racism, genderism and any forms of unfair discrimination
6	Bonuses and performance incentives	Ensuring that zero harm is prioritised ahead of production
7	Tripartism	Providing a platform for government, labour and employers to engage to pursue common objectives and goals for the mining industry
8	Regulatory framework	Developing clear, concise and understandable legislation that includes enforceable minimum standards
9	Inspectorate	Creating an effective, well-resourced inspectorate that can protect people at and around mines with integrity and job pride
10	Data	Establishing a data system that allows effective and timely collection, capture, analysis, communication, dissemination and use of OHS information by the industry
11	Leadership	Ensuring leadership walks the zero harm talk

1.8 The OHS summit milestones

At some of the OHS summits, the SAMI stakeholders set some OHS milestones for the mining sector. The OHS milestones provide a roadmap for the attainment of zero harm as well as an important tool for monitoring and evaluating the OHS performance of the mining industry. The first OHS summit milestones for the sector were set in 2003 (Table 1.3). Hermanus et al. (2015)

noted that the accomplishment of the 2003 OHS summit milestones was a significant challenge for the SAMI that was expected to result in significant OHS improvements.

Table 1.3: 2003 OHS summit milestones for the South African Mining Industry (MHSC, 2014)

ITEM	INDUSTRY TARGET	MILESTONE
1	Zero rate of fatalities and injuries	In the gold sector: By 2013, achieve safety performance levels equivalent to at least current international benchmarks for underground metalliferous mines
		In the PGM, coal and other sectors: By 2013, achieve constant and continuous improvement equivalent to at least current international benchmarks
2	Elimination of silicosis	By December 2008, 95% of all exposure measurement results will be below the occupational exposure limit for respirable crystalline silica of 0.1mg/m^3 (these results are individual readings and not average results)
		After December 2013, using present diagnostic techniques, no new cases of silicosis will occur amongst previously unexposed individuals (Previously unexposed individuals = individuals unexposed prior to 2008, i.e. equivalent to a new person entering the industry in 2008)
3	Elimination NIHL	After December 2008, the hearing conservation programme implemented by the industry must ensure that there is no deterioration in hearing greater than 10% amongst occupationally exposed individuals
		By December 2013, the total noise emitted by all equipment installed in any workplace must not exceed a sound pressure level of 110dB(A) at any location in that workplace (includes individual pieces of equipment)

At the OHS summit that was held in November 2014, the SAMI stakeholders reviewed the OHS milestones for the sector (Table 1.4).

Table 1.4: 2014 OHS Summit Milestones for the South African Mining Industry (MHSC, 2016)

ITEM	INDUSTRY TARGET	MILESTONE
1.	Elimination of fatalities and injuries	Every mining company must have a target of zero fatalities by December 2020
		Every mining company must achieve a 20% reduction in serious injuries per year by December 2016
		Every mining company must achieve a 20% reduction in lost time injuries per year from January 2017
2.	Elimination of occupational lung diseases (silicosis, pneumoconiosis and coal workers' pneumoconiosis)	95% of all exposure measurement results must be below 0.05mg/m^3 for respirable silica dust by December 2024
		95% of all exposure measurement results must be below 1.5mg/m^3 for respirable platinum dust by December 2024
		95% of all exposure measurement results must be below 1.5mg/m^3 for respirable coal dust by December 2024
		No new cases of occupational lung diseases should occur amongst previously unexposed individuals.
3.	Elimination of NIHL	Noise emitted by equipment should not exceed 107dB (A) by December 2024
		No employee standard threshold limit should exceed 25dB from the baseline by December 2024
4.	Reduction and prevention of TB, HIV and AIDS	The TB incidence rate should be at or below the National TB incident rate by December 2024
		100% of employees offered HIV Counselling and Testing (HCT) annually with all eligible employees linked to an anti-retroviral treatment (ART) programme
5.	Implementation of the Culture Transformation Framework (CTF)	100% implementation of the leadership, risk management, data management, diversity management, leading practice, and bonus and performance incentive pillars of the CTF by December 2020

		Implementation of the integrated mining activity, technology, inspectorate, tripartism and regulatory framework pillars of the CTF after December 2020
6.	Establish Centre of Excellence for research, research implementation and capacity-building	Undertake quick win projects
		Technology and knowledge transfer of quick win projects
		Centre of Excellence operational by the 1st of April 2016

All the OHS summit milestones reflects the zero harm commitment by the SAMI, seeking to eliminate injuries, fatalities and occupational diseases. Furthermore, the inclusion of the CTF in the 2014 OHS summit milestones reflects the increasing focus of addressing human and organisational factors in an attempt to accelerate the attainment of zero harm production. In their presentation to reflect on the progress of implementation of the 2014 OHS summit milestones, Martin and Magampa (2018) noted that the OHS performance improvements in the SAMI were lower than the projected improvements required for the attainment of milestones for elimination of fatalities, injuries and occupational diseases. Martin and Magampa (2018) added that, the safety and health milestones were unlikely to be achieved by December 2020 and December 2024 respectively, unless if some radical interventions are implemented to achieve step change improvements in OHS.

1.9 Problem statement

As noted earlier, the OHS performance improvements in the SAMI have plateaued at levels which remain unacceptably high. The plateauing of the OHS performance improvements is a concern for the mining sector that is aspiring to attain zero harm. Reason (2000), Wipaki and Dodd (2000) and Kim et al. (2016), suggested that an emphasis on OHS culture is particularly important when OHS performance improvements have plateaued. For example, as shown in Figure 1.7, the introduction and enhancement of OHS culture in the employers, workforce and at community level in Hong Kong markedly improved OHS performance in the construction industry (Kim et al., 2016).

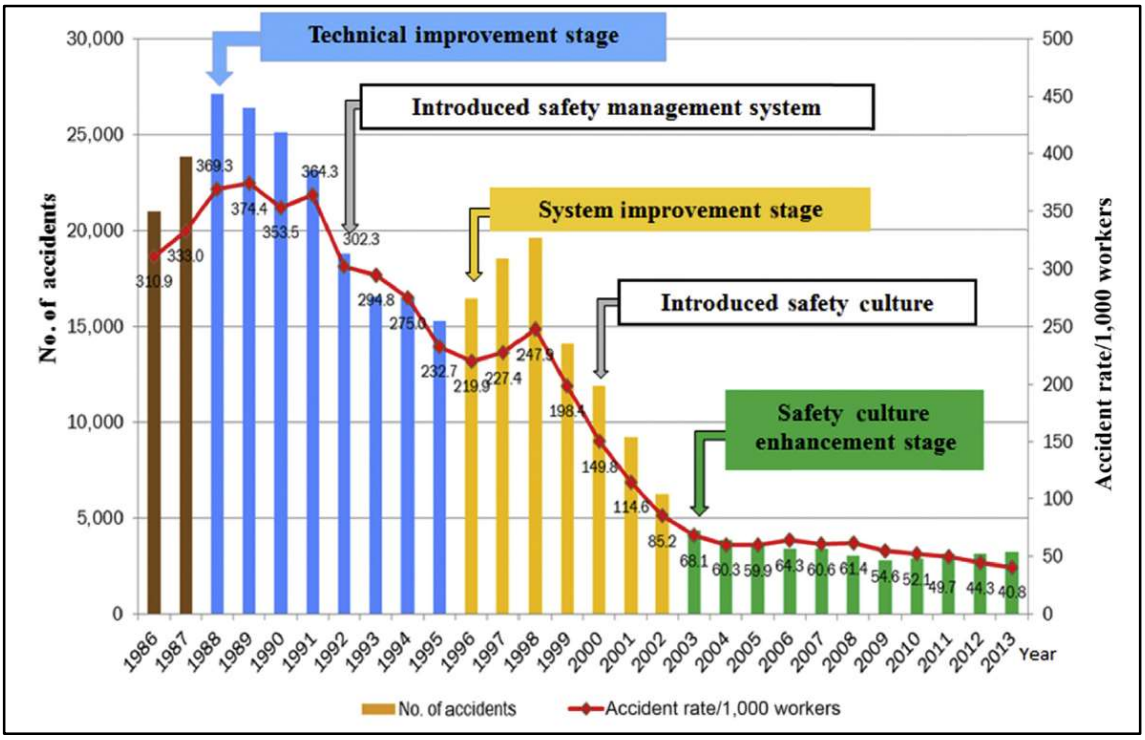


Figure 1.7: Accident statistics of the construction industry in Hong Kong (Kim et al., 2016)

Since its inception in 2010, the CTF provided a roadmap for cultivating a positive OHS culture in the mining sector, founded on a range of initiatives. However, the introduction of the CTF has not resulted in step-change OHS performance improvements, which have plateaued since 2009, apart from the notable improvement in safety performance in 2019. The impact of the CTF on OHS performance improvement appears to have been limited and this could be due to a number of reasons such as deficiencies in the CTF, and uneven and poor uptake of the CTF by the mining industry. The CTF was developed in 2010 and the subject of OHS culture in OHS management continues to evolve, as a result of increased focus and research on OHS culture. The need to ensure that the CTF remains an updated and adequate tool for driving OHS culture change, which is necessary for advancing towards zero harm production, has necessitated the review of the CTF.

1.10 The research question, hypothesis and objectives

This study seeks to answer the fundamental research question "is the CTF an adequate tool for cultivating positive OHS culture in the SAMI?" The research hypothesis is that the current CTF for the SAMI is an inadequate tool for developing positive OHS culture. In order to achieve the research aim and address the research question, the following objectives form the basis of this study:

a. Identify gaps in the CTF for the SAMI by examining experiences in implementing the CTF and reviewing current global best practices in OHS culture relevant to the SAMI.
b. Make recommendations to improve the CTF for the SAMI based on the findings of field research and review of the literature.

1.11 Outline of chapters in the report

Table 1.5 details the outline of this research report.

Table 1.5: Research report outline

Chapter number	Chapter description
1	Provides an overview of the SAMI (significance, OHS legislative framework, OHS performance and OHS summit milestones), supporting the rationale for formulating the research question, hypothesis and objectives
2	Outlines the research methodology that was followed in an attempt to answer the research question
3	Details the findings of the literature that was reviewed to understand global best practices in OHS culture relevant to the SAMI
4	Investigates the CTF against best practices in OHS culture management, in order to identify gaps and opportunities for improving the CTF
5	Presents the findings of the qualitative study
6	Examines the CTF against the findings of the qualitative study, in order to establish opportunities for improving the CTF
7	Concludes the research and suggests recommendations to enhance OHS management and recommendations on further work

CHAPTER 2 : METHODOLOGY

2.1 Research methodology

Figure 2.1 provides a schematic presentation of the research process that was followed, in an attempt to answer the research question. Figure 2.1 will be repeated in chapters 3, 4, 5 and 6 (with the step related to the particular chapter highlighted in blue) to help the readers to locate themselves in the report.

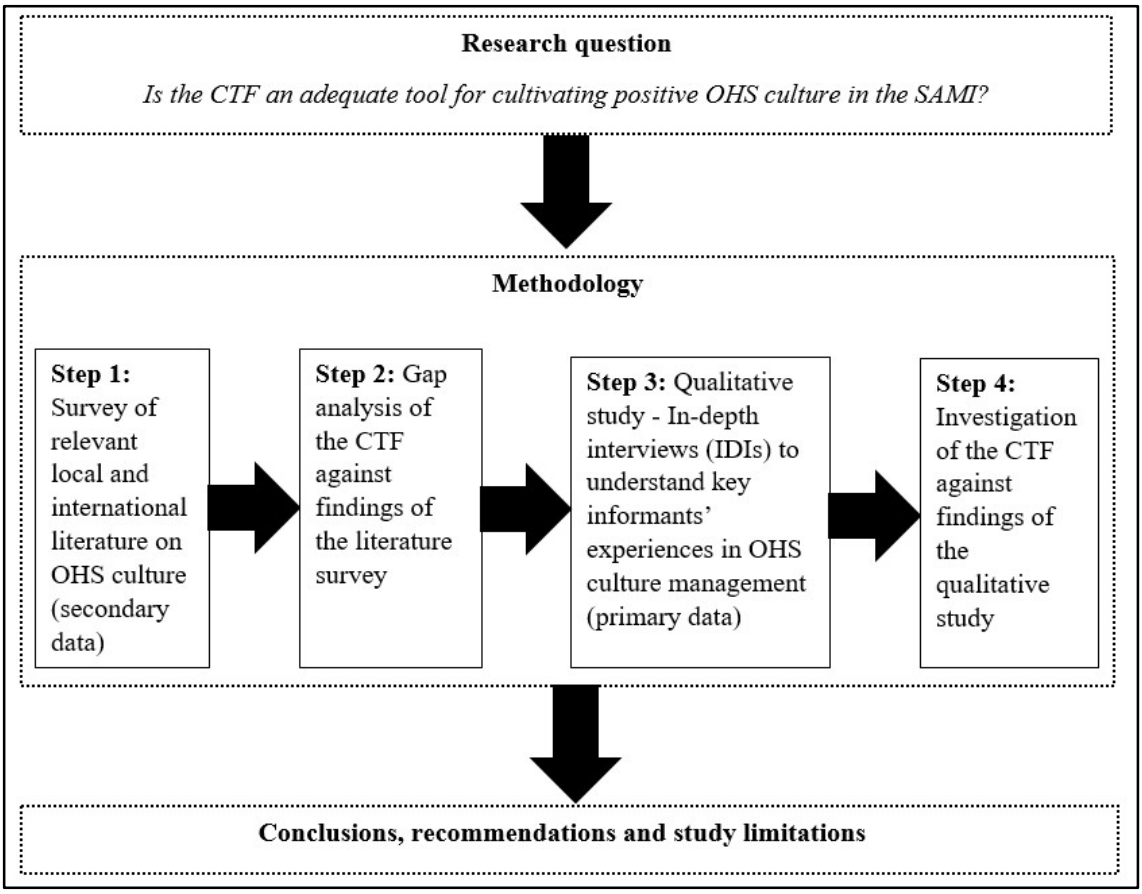


Figure 2.1: Summary of the research process

2.1.1 Survey of relevant local and international literature on OHS culture

A review of literature was conducted to understand the concept of OHS culture and identify global best practices in OHS culture management. Although the literature explicitly covered safety culture, the concept was extended to include health, hence the term OHS culture will be used in the report. This is in line with current global best practice in which health and safety at workplaces are managed using an integrated OHSMS and the best practice has been embraced by most industrial sectors including mining. The use of integrated management systems could result in streamlined organisational processes and subsequent savings in time, costs and required effort and resources (Tepaskoualos and Chountalas, 2017).

Moreover, all the tools that are used for managing safety culture are relevant and applicable for cultivation of positive health culture. For example, one of the identified best practice requires safety aspects to be incorporated in all operational aspects of the business and the requirement could also be extended to health issues. The incorporation of health and safety considerations into operational aspects of the business could be illustrated by factoring in the time required for the early entry examination and making safe procedure into shift scheduling during mine planning stages. The procedure includes both safety considerations such as checking and baring down loose rocks in the hanging wall and health requirements like testing and controlling mine environmental conditions like temperature, humidity and airborne pollutants (dust, noxious fumes, etc.). Moreover, other identified best practices such as the requirement for commitment, buy-in and effective participation by all stakeholders, walking the talk by all levels of leadership, good behaviour and effective risk management are critical for cultivating both positive safety and health cultures.

Table 2.1 illustrates how the literature review was structured.

Table 2.1: Illustration of the structure of literature review

Item	Objective	Discussion topics
1	Understanding OHS culture	• Definitions of human factors, safety (zero harm), culture and OHS culture • Characteristics (elements of OHS culture) • Impacts of OHS culture
2	The evolution of OHS culture within an organisation	• OHS culture evolution models • Assessment of OHS culture • Change management considerations during OHS culture change process
3	Critical success factors for establishing positive OHS culture	• Establishment of OHSMS • Effective OHS risk management • Learning from OHS incidents • Establishment of good OHS behaviour • OHS leadership • Effective participation of the workforce on OHS management • Technological innovation • Holistic consideration of potential threats to establishment of positive OHS culture

2.1.2 Gap analysis of the CTF against findings of the literature review

A desktop study was conducted in order to identify gaps between the CTF and global best practices in OHS culture management. The CTF was analysed against the concepts and elements of OHS culture identified in the literature survey. The gap analysis was important to identify deficiencies in the CTF in terms of factors such as definition, evolution, elements and impacts of OHS culture, and strategies to promote continuous improvement of OHS culture.

2.1.3 Qualitative study

Shaw et al. (2010) argued that OHS culture is an outcome of interpersonal interactions and organisational processes that can best be studied through qualitative as compared to quantitative research methods. Thus, due to the exploratory nature of the study, a qualitative research approach, comprising in-depth interviews (IDIs) was chosen to obtain an in-depth

understanding of people's experiences and perceptions on key parameters of OHS culture such as (refer to Appendix 5 for the complete research tools):

- Meaning of the OHS culture concept.
- Role of OHS culture in the practice of OHS management.
- OHS culture improvement initiatives in the mining sector.
- How the various OHS culture improvement initiatives have been implemented?
- Factors that could promote or obstruct the cultivation of positive OHS culture in the industry.
- Knowledge and relevance of the CTF pillars in different organisations' OHS management approach.

The research tools comprised two sets of related questions that were customised to accommodate mining industry stakeholders who were not employed by mining companies (section A of Appendix 5) and participants who were employed by mining companies (section B of Appendix 5).

A qualitative research approach was also chosen because the method lends itself to smaller sample sizes, thus enabling in-depth information to be obtained cost-effectively (Cassim, 2017; Family Health International, n.d.; Mason, 2010), and making the best use of the limited budget available for this study. Other advantages associated with qualitative research methods are that they allow study participants to provide their own in-depth responses, as compared to being confined to choose responses from a set of pre-defined options (Family Health International, n.d.). In addition, qualitative research methods are more interactive as they allow the study participants to ask clarity seeking questions as well as the researchers to ask some follow-up questions (Cassim, 2017; Family Health International, n.d.). However, qualitative research methods are also associated with drawbacks such as time intensiveness and subjectivity during data collection and analysis (Cassim, 2017).

A purposive sampling approach was adopted, targeting key informants of the SAMI who were knowledgeable in the subjects of OHS, training, human resources management, mine

management and change management. In-order to ensure that the study sample was representative, the study participants were drawn from the key mining industry stakeholder groupings such as mining companies, organised labour, Mandela Mining Precinct (MMP), MCSA, MHSC, academia, OHS consultants and MHSI. While the sample size fitted the budget, the sample composition was carefully designed to incorporate the perspectives of organisations and parties which shape policy and practice in the sector. At least two study participants from each of the identified stakeholder groupings participated in the study.

Due to resource constraints, pilot IDIs were contacted with only two study participants and the feedback obtained was utilised to review the IDIs questions. A total of thirty-six IDIs were conducted and the breakdown of interviews per stakeholder group are presented in (Table 2.2).

Table 2.2: Number of key informants interviewed per stakeholder grouping

Item	Stakeholder groupings	Number of IDIs
1	Mine Health and Safety Culture (MHSC)	3
2	Mine Health and Safety Inspectorate (MHSI)	3
3	Minerals Council South Africa (MCSA)	3
4	Organised labour	6
5	Mandela Mining Precinct (MMP)	2
6	Subject matter experts from mining companies	13
7	Universities	3
8	Occupational health and safety (OHS) Consultants	3
Total		**36**

The IDIs were either conducted in-person (face-to-face), over the phone, or virtually through electronic meeting platforms such as Zoom, Microsoft Teams and Skype. The IDIs were conducted in English and the duration of each interview was approximately 30 minutes. Moreover, the IDIs were recorded using a digital voice recorder and permission was obtained from all study participants prior to commencement of the recording process. Recording the

IDIs allowed the researcher to focus on listening, probing, following-up and maintaining eye contact with the key informants (for face-to-face and virtual interviews). The audio recordings were manually transcribed and written verbatim (exactly word-for-word), to generate transcripts for each study participant.

A deductive thematic analysis approach was followed to analyse the data. The thematic framework was pre-determined based on the insights of the critical drivers of positive OHS culture that were revealed by reviewing the literature and CTF. The thematic framework was updated with new themes that emerged from the data and were not covered by the existing themes (Linneberg and Korsgaard, 2019). Examples of themes that were identified include definition of OHS culture, existence of OHS goals and perceptions of the participants on importance of OHS culture, OHS leadership, collaboration, learning from OHS incidents, behaviour, incentive systems and OHSMS. The perceptions/views on each theme emerged from the data that was analysed.

The IDIs transcripts were reviewed, and the data was cleaned and re-arranged. The data was manually recorded on Microsoft Excel (Excel) as per the structure indicated in Table 2.3. An Excel file was created with one theme per tab and one perception/view row. The respondents were categorised into different stakeholder groups, namely government (A), employers (B), organised labour (C), academics and researchers (D), and OHS professionals (E). The number of times a view was mentioned by a particular stakeholder grouping was recorded and this was also converted as a percentage of the total number of participants within that stakeholder group. The index of qualitative variation (IQV) was calculated to determine the level of concurrence of the different stakeholder groupings on each perception. The process that was followed in the stratification of the study participants and how IQV was calculated are described in further detail in section 5.2.1. The findings from the qualitative study were compared against the CTF and findings from the review of the literature. These insights were then combined to provide one set of recommendations for enhancing the CTF. The data collected in the study can be regarded as of good quality as some saturation was observed during the analysis.

Table 2.3: Structure of the Excel spreadsheet that was used to record the participants' views for each theme

Participants perceptions regarding a theme	Number (%) per stakeholder group					Total	IQV
	A	B	C	D	E		
Perception 1							
Perception 2							
Perception 3							
Perception 4							

2.2 Ethical Considerations

Ethical clearance approval (Appendix 2) to conduct the study was obtained from the Human Research Ethics Committee (non-medical) of the University of Witwatersrand (protocol number H19/05/13), prior to collecting data. Permissions to conduct the study was requested and obtained from all the study participants. Information leaflet (Appendix 3) explaining the nature, aim and objectives of the study was provided to participants. Ethical issues were explained to participants, who were assured that they could withdraw from the study or refuse to answer any question(s), which might seem to be of discomfort to them with no penalties. A written informed consent (Appendix 4) was obtained from each participant prior to collecting data, after providing detailed information about the purpose and scope of the project. Confidentiality and anonymity of data obtained was highly maintained throughout the study and the identities of participating mines and study participants will not be disclosed in this report.

CHAPTER 3 : REVIEW OF HEALTH AND SAFETY CULTURE LITERATURE

3.1 Introduction

The purpose of the literature review (step 1 in Figure 3.1) was to identify global best practices in OHS culture management relevant to the SAMI. The concept of OHS culture could be completely understood in terms of what OHS culture is (definition, evolution and characteristics), why is it important to cultivate positive OHS culture and how can a positive OHS culture be established. The first part of the review focused on understanding OHS culture in terms of its definition, characteristics and impacts. To have a comprehensive understanding of the OHS culture concept, the definitions of related terms used in the practice of OHS management such as human factors, safety (zero harm) and culture were also explored. The second part of the review looked at understanding how OHS culture within an organisation can evolve from negative to positive OHS cultures (OHS culture evolution models). OHS culture assessment practices and change management considerations during the OHS culture change process were also investigated. The third part of the review explored some of the best practices for cultivating positive OHS (critical success factors for establishing positive OHS culture). The method for this literature review involved internet and library search and included books, scientific articles from journals and proceedings from conferences. Both South African and international literature were surveyed to gain a global understanding of best practices in the management of OHS culture.

It is noteworthy that an extensive and detailed review of OHS culture and OHS management literature was conducted to reflect the complexity of each subject and the linkages between them, premised on an understanding that effective OHS cultures cannot thrive in the absence of well-developed OHSMS. It is well-established in practice and reflected in the literature that strong cultures that support high quality outputs and sound social outcomes cannot emerge in organisations in which managerial systems are poor. Thus, the literature review put more emphasis on the OHSMS elements that go alongside the exploration of the aspects and construction of OHS culture.

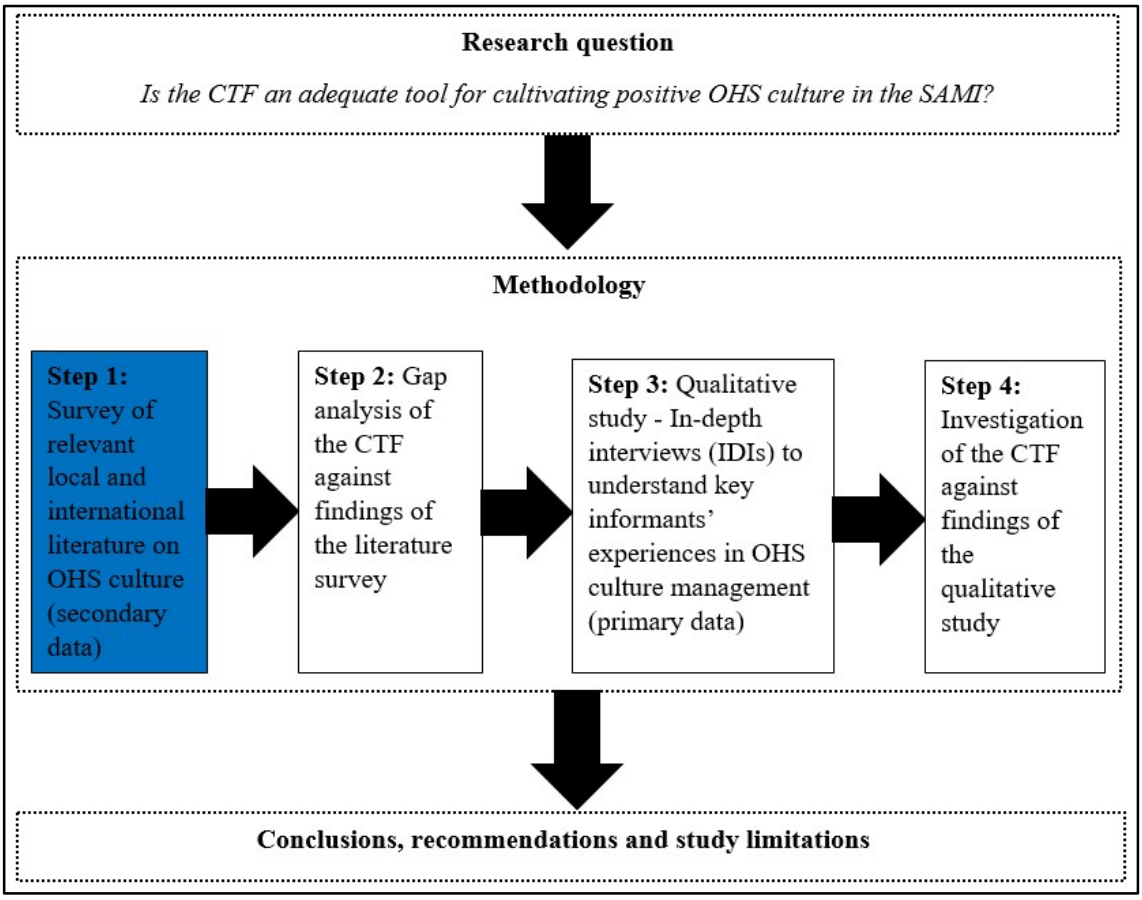


Figure 3.1: Summary of the research methodology

3.2 Understanding the OHS culture concept

Sparrius (1994) argued that "you cannot manage what you do not understand". The argument has some merit and can be regarded as a golden rule in most occupational areas, including OHS management. Thus, a holistic understanding of the OHS culture concept is fundamental for effective management, continuous improvement and sustaining of positive OHS culture. The concept of OHS culture is explored though:

- Understanding the meaning and rationality of zero harm.
- Recognising and understanding the importance of human factors in the attainment of zero harm.

- Understanding how organisational culture affects human factors and decisions made in the work environment regarding OHS, ultimately shaping OHS culture (i.e. the beliefs, value and practices that determine state of OHS).
- Understanding the meaning, characteristics and impacts of OHS culture.

Moreover, in order to enhance understanding of the meaning of OHS culture, it is critical to first understand the definitions of human factors, safety and culture. The following subsections discuss the meaning of human factors, safety, culture and OHS culture. Characteristics and impacts of positive OHS culture are also discussed.

3.2.1 Zero harm

The Cambridge dictionary defines the term safety as *"a state in which or a place where you are safe and not in danger or at risk."* Reason (n.d.) defined safety as *"the ability of organisations and individuals to deal with risks and hazards so as to avoid damage or losses and yet still achieve their goals."* Hudson (1999, p1) argued that OHS management is an active endeavour, continuously focusing on creating a safe working environment to *"allow dangerous activities to take place successfully, which means without harm or damage.*" In the context of OHS management, the definition of safety can be expanded to include health as "the successful execution of all work-related tasks without causing any harm (zero harm) i.e. injuries, death and ill-health to the workforce and damage to equipment and property."

Globally, most organisations have adopted a zero harm philosophy towards OHS (King, 2000), as a shared value, belief and goal. For example, the International Social Security Association (ISSA) Mining (a global initiative to promote OHS in the mining sector), embraced a *"vision for work environments in which nobody is injured or killed, or suffers from occupational diseases"* (Mohapi and Zarske, 2019). As reflected in the 2003 and 2014 OHS summit milestones, the SAMI has been aspiring to achieve a target of zero harm production, through elimination of injuries, fatalities and occupational diseases (MHSC, 2014; MHSC, 2016). King (2000) argued that the notion of zero harm is underpinned by the *"belief that all injuries and*

illnesses are preventable and therefore the only logical target is zero." King (2000) added that the adoption of the zero harm philosophy at any workplace is justifiable, since any other target would suggest that it is acceptable to cause harm to people as part of getting the job done.

The zero harm philosophy has sparked some debate within the OHS fraternity. On one hand, some authors argue that a zero harm target is impossible. For example, Geller (1996, p55), reasoned that only two of the three basic causes of injuries can be controlled (engineering factors and human behaviour), whilst the third one (mental lapses) was uncontrollable. Mental lapses can be illustrated by typical oversights which individuals commit often in their everyday lives such as being inattentive when they should be paying attention, missing a turn when driving, falling, forgetting and dropping things (Geller, 1996). According to Geller (1996), similar mental lapses at workplaces such as forgetting to put on the safety belt while working at height, may contribute to occupational harm, making the zero harm target unattainable. If so, can the unrealistic zero harm target be a de-motivator which can potentially hinder the establishment of positive OHS culture?

On the contrary, King (2000) argued that although there is no sure way of controlling or eliminating the human factor, all workplace injuries and illnesses, inclusive of those arising from human factors such as mental lapses, can still be prevented. King (2000) added that *"with hindsight, it is possible to identify at least one practicable preventative action for every injury or illness."* Mohapi and Zarske (2019, p4) concurred that *"all occupational accidents and occupational diseases are preventable because they always have a cause that can be eliminated."* For example, a potentially fatal collision between two mine vehicles, arising from a mental lapse of one of the drivers failing to observe the traffic rules, can be avoided by installing proximity detection systems on the vehicles, thus making the environment more "forgiving" (King, 2000). de Jager (2018) also noted that zero harm is a reactive approach that is underpinned by the belief that although OHS incidents are inevitable, sufficient mitigation measures could be put in place to prevent any harm.

King (2000) emphasised that when introducing and discussing the concept of zero harm at a particular organisation, it is important to demystify the contradictions over its meaning and validity. A clear understanding of the zero harm concept is likely to win people's hearts, minds and commitment. Moreover, in order for the zero harm commitment to be meaningful and credible, it must be backed by a specific, measurable, attainable, realistic and time bound (SMART) action plan that will translate the commitment into practice (King, 2000). King (2000) added that emphasis should be placed on zero harm production because both zero harm and production are critical for the sustainability of the business: meeting OHS targets at the expense of production goals will kill the business and meeting production targets at the expense of OHS will result in fatalities, injuries and illness.

3.2.2 Human factors

Stranks (2007) defined human factors as *"a range of issues including the perceptual, physical and mental capabilities of people and the interactions of individuals with their jobs and working environments, the influence of equipment and system design on human performance and those organisational characteristics which influence safety related behaviour at work".* The Safety Institute of Australia (2012) and The Human Factors and Ergonomics Society (2020) defined human factors as *"the scientific discipline concerned with the understanding of the interactions among humans and other elements of a system, and the profession that applies theoretical principles, data and methods to design, in order to optimise human well-being and overall system performance"*. Simply put, human factors in OHS management seeks to improve OHS performance through a holistic management of issues centred around people such as perceptions, behaviour, values, attitude, culture, leadership, competency, priorities and ergonomics.

Globally, there has been an increasing focus on human factors in the practice of OHS management. The literature reviewed suggested that human factors are the leading cause of most OHS incidents, contributing between 70% and 95% (Rimmington, 1989; Ikin, 2015; Simpson & Widdas, 1992 and Barnes, 1993). Rimmington (1993) and Buchanan (2000) highlighted that most industries have made notable strides in the implementation of technical

interventions to reduce OHS incidents, thus progressive improvements in OHS can only be possible by adapting a new paradigm, focusing on human factors. The Mining Industry Safety and Health Council (MISHC) (2005), noted that human error is unavoidable in the longer term, and improving the tolerance for the presence of human error offers the opportunity to reduce OHS incidents.

Ikin (2015) suggested four core human factor elements that could be considered for effective OHS risk management (Figure 3.2).

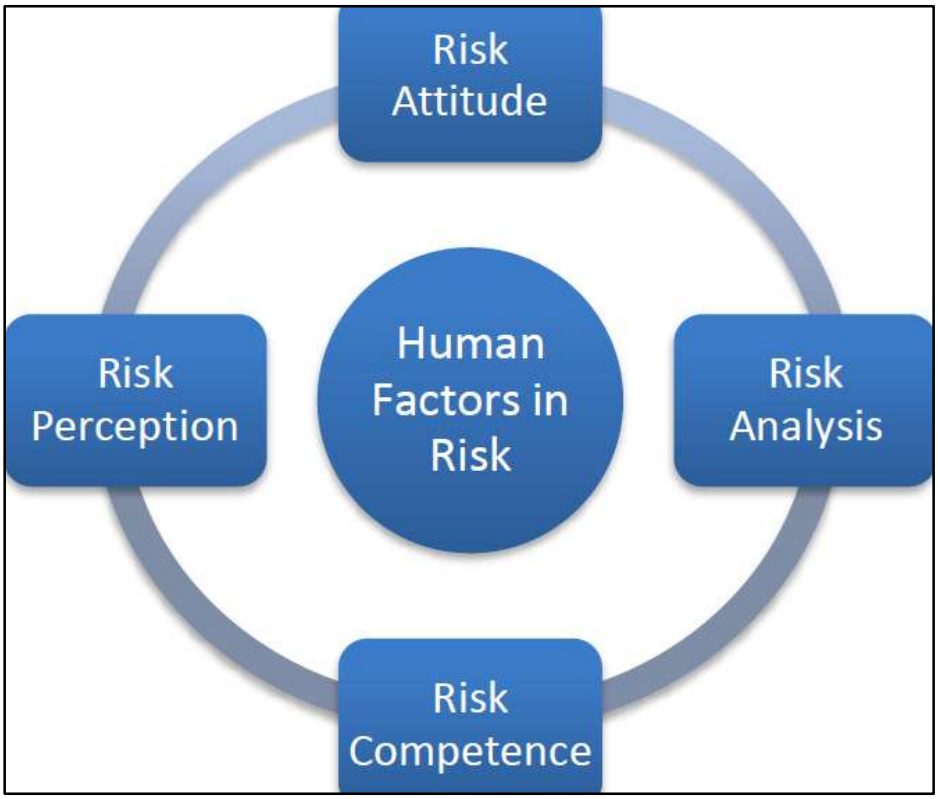


Figure 3.2: Core human factor elements in OHS risk management (Ikin, 2015)

Ikin (2015) unpacked the core human factor elements as follows:

- ***Risk attitude*** – individual and organisational attitudes towards OHS risks, and associated impacts on behaviours and decisions on OHS risk management.
- ***Risk perception*** – extend of acknowledgement and conscious awareness of OHS risks.
- ***Risk analysis*** – effective risk assessment to determine the likelihood of an OHS incident.
- ***Risk competence*** – the ability to effectively manage OHS risks.

3.2.3 Culture

Schein (1992) defines culture as "*a pattern of shared assumptions that has worked well enough to be considered to be taught to new members as the correct way to perceive, think and feel.*" Heskett and Kotter (1992) suggested that culture was influenced by behaviour (what people do every day, or the patterns that new recruits are automatically encouraged to follow) and values (notions about what is important and something that can vary greatly in different companies). Stranks (2007) defined culture as "*a state of manners, taste and intellectual development at a time or place; refinement or improvement of mind, tastes, etc. by education and training*". Hopkins (2006) defined culture as *"the way we do things around here"*, i.e. *"the right, or appropriate or accepted way to do things"*. Hopkins (2006) argued that organisational culture is influenced by several factors such as values, perceptions, attitudes, beliefs and behaviour. Stephan and Soto (2015) suggested that organisational culture is influenced by a number of factors such as shared values, beliefs and assumptions, emotions, feelings, knowledge, skill, language, actions and structural components. Structural components include systems, communication, technology, work design, and policies and procedures (Stephan and Soto, 2015). Simply put, culture can be described as a set of shared values, beliefs, perceptions, attitudes, behaviour and practices that symbolise a particular segment of the society, such as a mining company.

3.2.4 OHS culture

Attempts to reduce workplace incidents, injuries and the occurrence of ill-health have progressed through distinct phases. Kim et al. (2016), reported that the appearance of the

concept of "safety culture" in literature can be traced back to the 1986 Chernobyl accident summary report by the International Atomic Energy Agency. The accident summary report identified poor safety culture (thinking and behaviours of people in the organisation) as the major cause of the accident. The 1993 investigations of disasters such as Chernobyl meltdown, the Kings Cross fire, the Piper Alpha explosion, and the train crash at Clapham Junction, by the Advisory Committee on Safety of Nuclear Installation (ACSNI), further identified poor safety culture as the major cause of the disasters (Kim et al., 2016). Similarly, Hale and Hovden (1998) suggested the concept of OHS culture in the practice of OHS management originated in the 1980s as shown in Table 3.1.

Table 3.1: Evolution of OHS management (Hale and Hovden, 1998)

Item	Period	Description
1	The 'technical' age (spanning the 19th century until after the second world war)	Focused on technical measures for guarding machinery, stopping explosions and preventing structures from collapsing
2	The 'human factors' age (spanning the 1960s and 1970s)	Considered that the main source of OHS incidents was human error arising from the interaction between human and technical factors. The merging of two fields that influenced OHS (probabilistic risk analysis, and ergonomics), saw the focus shifting to human error and human recovery or prevention
3	The 'safety culture' age (from the 1980s onwards)	The safety culture age evolved as it became apparent that matching individuals to technology did not resolve all safety problems, thus the main focus of OHS development and research shifted to organisational and social factors

Hudson (2007) suggested a slightly different origination model reflecting sequential emphasis on technology, OHSMS and OHS culture, after cycles of performance improvements and plateauing on each stage (Figure 3.3). Hudson (2007) argued that the concept of OHS culture evolved as a way of breaking the plateau of further OHS improvements, post the implementation of engineering controls and OHS management systems. The emphasis on OHS culture is against the recognition that the people within the organisation are the missing part in

the OHS management process, and aims to cultivate a culture of OHS, thus making OHS a lifestyle (habit) at all levels within a workplace (Hudson, 2007).

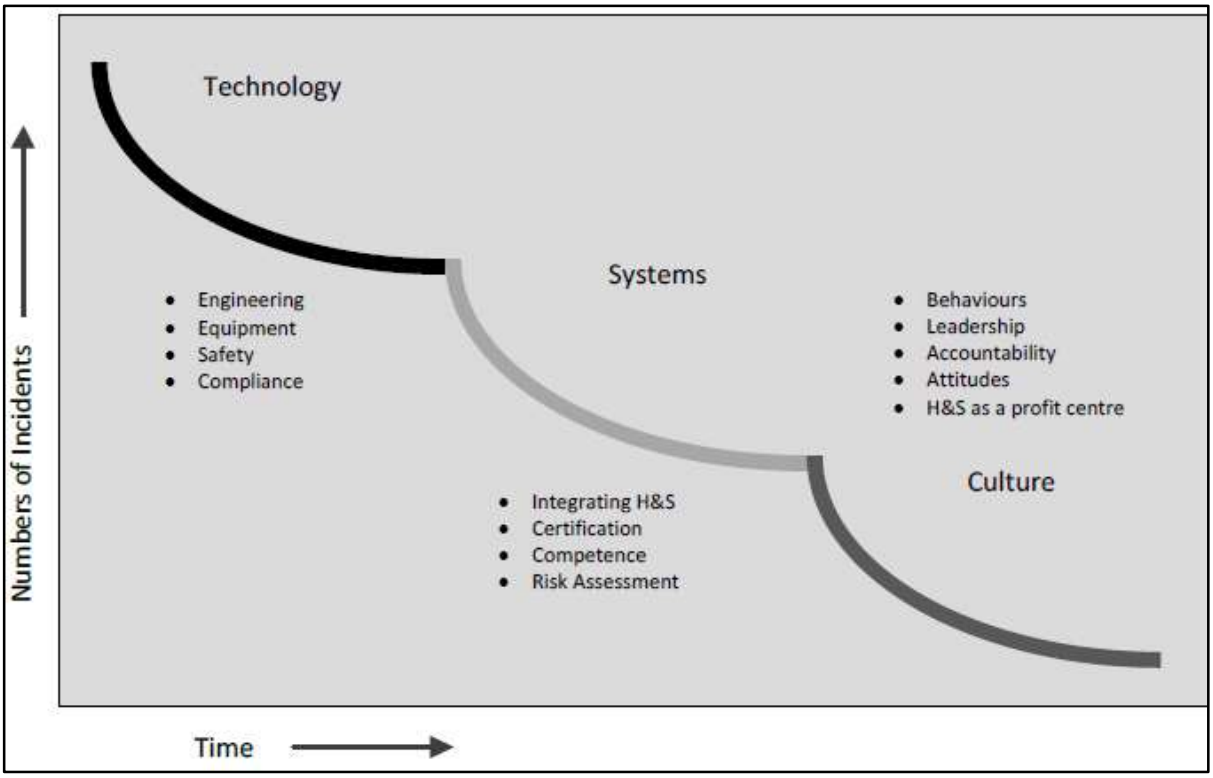


Figure 3.3: The progression of OHS management (Hudson, 2007)

The two OHS culture origination models are in agreement on the first (technology) and third (OHS culture) stages, contradicting on the second stage. The origination model proposed by Hudson (2007) appears more logical due to the inclusion of the "OHSMS" stage, which remains a fundamental stage in the practice of OHS management.

Hudson (1999) defined OHS culture as a culture in which in which OHS is valued in the concerns of all people at all levels within an organisation. Mohammadfam et al. (2013), used the term OHS culture to describe companies' atmosphere in which OHS is understood to be the number one priority. Reason (1998) described OHS culture as the 'engine' that drives the

organisation towards the goal of sustaining the maximum resistance towards OHS hazards. IOSH, MHSC, International Chamber of Shipping (ICS) and ACSNI described organisational OHS culture as a combination of shared values, beliefs, feelings, attitudes and perceptions that determine the approach and commitment to OHS management (IOSH, 2015; ICS, 2013; MHSC, 2005; HSC, 1993; Stranks, 2007).

Hudson (n.d.) and Hudson (1999) described OHS culture in terms of four organisational components, namely OHS values, OHS beliefs, common problem-solving methods and common working practices (Table 3.2). It is noteworthy that in a positive OHS culture, the emphasis is placed on making OHS an integral part of all the organisation's designs and operational aspects.

Table 3.2: OHS culture defined in terms of the organisational components (Hudson, n.d. and Hudson, 1999)

Organisational component	**Description**
OHS values	OHS is regarded inviolable and licence to operate
OHS beliefs	All levels within the organisation strongly believe that OHS makes commercial sense, absence of a culture of blame and that all OHS incidents can be prevented
Common problem-solving methods	Continuous and proactive risk management, cost benefit analysis, OHS incident investigation and analysis
Common working practices	OHS is considered as a top priority and is a compulsory agenda item of all meetings and is an integral part of all designs and operational aspects of the organisation

Kim et al. (2016) described OHS culture in terms of psychological, behavioural, and situational aspects (Figure 3.4). The psychological component comprises shared beliefs, attitudes, values and perceptions that influence OHS practices and behaviour. The behavioural element consists of approaches to OHS management, while the situational component covers factors such as OHSMS, organisational structures, and OHS legislation, policies, standards and procedures.



Figure 3.4: Illustration of OHS culture in terms of behavioural, situational and psychological elements (Kim et al., 2016)

3.2.5 Characteristics of positive OHS culture

In order to gain a comprehensive understanding of the concept of OHS culture, it is important to describe the characteristics of sound OHS culture. Reason (1997) (also cited in Hudson, n.d.; Hudson, 1999; Hopkins, 2006; Stephan and Soto, 2015), identified the following as the key characteristics of a positive OHS culture (Figure 3.5):

- ***Informed culture*** – all levels within the organisation have a robust understanding of all factors (human, technical, organisational, social, environmental, etc.) that affect OHS of the entire system. Timeous communication of OHS information to all levels within the organisation is crucial in an informed culture. Reason (2000) added that an informed culture can only be built on the foundations of a reporting culture and is only possible if people have trust in their leaders.
- ***Reporting culture*** – all incidents, errors and near misses are reported freely.
- ***Just culture*** – an atmosphere of trust is present (no culture of blame) and the workforce is motivated to provide essential OHS information. However, there should be a clear line between acceptable and unacceptable behaviour.
- ***Flexible culture*** – transformation from the conventional hierarchical mode to a flatter professional structure.

- ***Learning culture*** – the preparedness and capability to draw insights from OHS information and formulate and implement appropriate mitigation measures. The organisation should also strive to learn from both internal and industry-wide OHS incidents.

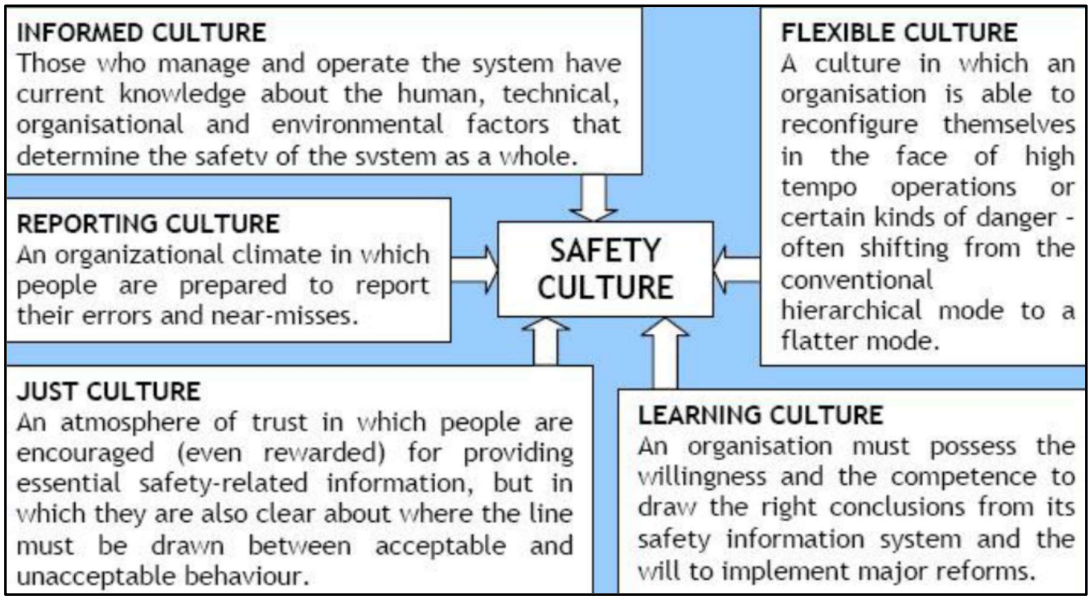


Figure 3.5: Features of a positive OHS culture (Reason, 1997)

The literature identified the following common key elements of a positive OHS culture (Fleming, 2001; International Atomic Energy Agency, 2006; ICS, 2013; Stranks, 2007; Hopkins, 2006; Coghlan, 2016):

- Shared values on OHS and commitment to zero harm production by all levels within the organisation. OHS is recognised as a top priority that cannot be traded off for any other values. OHS is also integrated in all operational aspects of the organisation.
- Availability of clear OHS roles and responsibilities, and decentralisation of OHS decision making and accountability at all levels within the organisation.
- All levels within the organisation are capacitated to effectively manage OHS risks. Capacitation could include training, coaching and provision of adequate resources such as time, human resources and funding.

- Availability of robust OHSMS, standards, policies and procedures to enable effective management of OHS.
- OHS risk management is highly regarded and there is constant focus on improving OHS performance.
- Collaborative culture – adequate engagement, involvement and consultation, in order to secure buy-in of all stakeholders.

Stranks (2007) highlighted that in a positive OHS culture environment, all employees will assume responsibility for OHS and will mutually strive to create a zero harm workplace. The environment will be conducive for employees to walk the extra mile in the identification and mitigation of OHS risks, unsafe acts and behaviours. For instance, in a strong OHS culture environment, any employee can freely remind a senior manager of the need to put on safety eye protection in an area with flying objects (Stranks, 2007).

Hopkins (2006) suggested an additional important feature relating to the organisation's commitment to redundant systems. Redundant systems make use of buffers and contingency planning, as a mitigation against unforeseen events. Contingency planning can be incorporated into a number of activities such as budgeting, number of equipment, crew sizes and consumables. The major advantage of contingency planning is that it ensures the availability of the required resources at the right place and right time, making sure that teams have adequate resources to attain zero harm production (Hopkins, 2006).

In order for the characteristics of positive OHS culture to be fully understood, it is critical to describe its converse, "characteristics of negative OHS culture". The literature reviewed identified the following as some of the characteristics of organisations with poor OHS culture (Stranks, 2007; Hopkins, 2006):

- There is a general lack of OHS commitment by the leadership and there are no clear definitions of individual OHS responsibilities.

- There are deficiencies in the OHS management system, risk management, policies and procedures. Hopkins (2006) added that there is a risk-blind and risk-denying culture.
- There is prioritisation of production over OHS and the importance of OHS is only acknowledged post an OHS incident (reactive OHS philosophy). There is poor planning of work, inadequate resources and unconducive environmental working conditions (extreme temperatures, airborne pollutants, humid, noisy, etc.).
- Culture of blame always inhibits the reporting of OHS incidents and distracts the organisation from identifying the root causes of OHS incidents, hence the formulation of appropriate mitigation measures to avoid repeats. The environment is also usually not conducive for the workforce to freely raise OHS concerns with the leadership.
- The organisation is not willing to walk the extra mile in order to continually improve OHS through interventions such as surpassing legislative requirements, training and learning from OHS incidents.
- There is little stakeholder buy-in on OHS matters as result of insufficient engagement and poor communication.
- The command and discipline culture that is dominant in most workplaces prohibit the workforce from exercising their right of refusing dangerous work.
- Culture of silos (organisationally and occupationally fragmented organisations).
- Culture of excessive regulations and rules tend to hinder progressive OHS improvements.
- Increase in the number of OHS incidents as a result of increased non-compliance and violations of OHS provisions and increased active failures such as inadequate training, poor communication and inadequate procedures.

3.2.6 Impacts of OHS culture

Globally, most industries have made significant strides in establishing engineering controls and OHSMS, in an attempt to improve OHS performance (Mohammadfam et al., 2013; Kim et al., 2016). Mohammadfam et al. (2013) and Kim et al. (2016) argued that the application of technical safety measures, without due consideration of soft issues such as unsafe behaviours, poor OHS culture, non-compliance and organisational issues, will not result in zero harm production. Mohammadfam et al. (2013), Stephan and Soto (2015), Hudson (n.d.) and Kim et

al. (2016) suggested that sustainable management of OHS incidents requires a combination of appropriate engineering controls, OHSMS and a strong OHS culture. ICS (2013) highlighted that in order to eliminate fatalities and injuries at workplaces, OHSMS must embrace effective OHS culture. Stranks (2007) concurred that developing strong OHS cultures is critical for continued OHS improvement and must be prioritised at all levels within the organisation. Mohammadfam et al (2013) added that negative OHS culture within the workforce will negatively affect the OHSMS, whose effectiveness and success depends on buy-in and commitment of the workforce.

The prevailing organisational OHS culture has a substantial influence on OHS performance as it dictates the following (Stranks, 2007):

- The effectiveness of an organisation's OHSMS.
- The commitment and priority given to OHS in the organisation.
- The ability to continually improve OHS performance through learning from OHS incidents, creating OHS awareness and training to improve the competency and skills of the workforce in dealing with OHS matters.

Stranks (2007), Hopkins (2006), Hudson (1999) and Hudson (n.d.), noted that organisations with strong OHS cultures experience few examples of risky behaviour. As a result, they achieve low accident rates, low labour turnover, low absenteeism, high productivity and more profitability. Hudson (n.d.) and Hudson (1999) elaborated that positive OHS culture is beneficial to organisations in a number of ways. Firstly, improved trust and communication will result in performance improvement at all levels within the organisation. Secondly, in a positive OHS culture environment, there is a significant reduction in time spent on checking compliance with elementary safety requirements, allowing more effort and resources to be channelled towards zero harm production. Hudson (1999) also argued that although the process of establishing a positive OHS culture is difficult, the associated benefits often outweigh the costs of attaining it.

Sound OHSMS are likely to result in improved productivity, because work procedures are improved throughout the organisation (Hopkins, 2006). Less prevalence of OHS incidents will minimise production disruptions, reduce insurance costs, workers' compensation costs and emergency response costs (Stranks, 2007). It will also minimise loss of sales and shareholder value. Sound management of OHS and environment, as well as good social corporate responsibility will assist the organisation to maintain a good reputation to stakeholders such as communities, potential investors, employees and potential employees (Stranks, 2007).

A study by Kotter and Heskett (1992) on companies in the United States of America (USA), found that the strength of work culture is correlated positively with economic performance measures. A study by Randolph (1989) showed some strong links between production efficiency and safety performance in coal mines in the USA. IOSH (2015) argued that poor OHS culture may lead to non-compliance to all processes, procedures and regulations, subsequently resulting in poor OHS performance, poor quality work, poor productivity and wastage of time and resources. After studying several companies over their entire histories, Collins and Parras (1994) noted that *"companies with a strong positive OHS culture outperformed similar companies by a factor of six and the general industry by a factor of fifteen"*.

3.3 The evolution of OHS culture within an organisation

Sound understanding of OHS culture evolutionary stages and how OHS culture evolves from negative OHS culture to positive OHS culture, could enhance understanding of the OHS culture concept. Moreover, it allows organisations to determine the prevailing OHS culture and develop strategies to continually improve OHS culture. The following section discusses the different OHS culture evolutionary models, OHS culture assessment tools and change management considerations.

3.3.1 OHS culture evolution models

Westrum (1993) proposed an OHS culture evolution model comprising three levels, namely pathological, bureaucratic and generative levels. At the pathological level, communication on OHS matters is limited, there are no clear OHS responsibilities, continuous OHS improvement initiatives are not embraced and there is no culture of reporting OHS incidents (Westrum, 1993). The bureaucratic stage is characterised by a reactive approach on OHS matters, compliance to OHS regulations, reporting of OHS incidents and limited appetite to continually improve OHS (Westrum, 1993). The generative phase is characterised by a proactive approach to OHS matters, willingness to continuously improve OHS, and reporting, learning and just cultures (Westrum, 1993).

Kim et al. (2016), Hudson (1999) and Hudson (n.d.) suggested a related five stage OHS culture evolutionary model (Figure 3.6), comprising the following stages:

- ***Pathological (no-care) OHS culture*** – OHS is not valued within the company and the workforce usually violates OHS provisions as long as they are not caught.
- ***Reactive (blame) OHS culture*** – OHS only becomes important after an OHS incident.
- ***Calculative (planned) OHS culture*** – OHSMS are available and there is a general recognition of the importance of effective OHS management. Characterised by cost benefit analysis, and quantitative risk assessment and problem-solving techniques. Hudson (1999) added that this stage also takes a reactive approach, utilising lessons learnt to predict future behaviour.
- ***Proactive OHS culture*** – continuous OHS improvement initiatives.
- ***Generative (dynamic) OHS culture*** – OHS is an integral part of all aspects of the business. An intense internalised model of good practise drives this culture and all levels within the organisation freely discuss continuous OHS improvement opportunities. There is absence of complacency behaviour on OHS matters even if the OHS performance is good. Moreover, people are perceived as a valuable resource that can develop solutions for the OHS challenges faced by the organisation, rather than a source of problems.

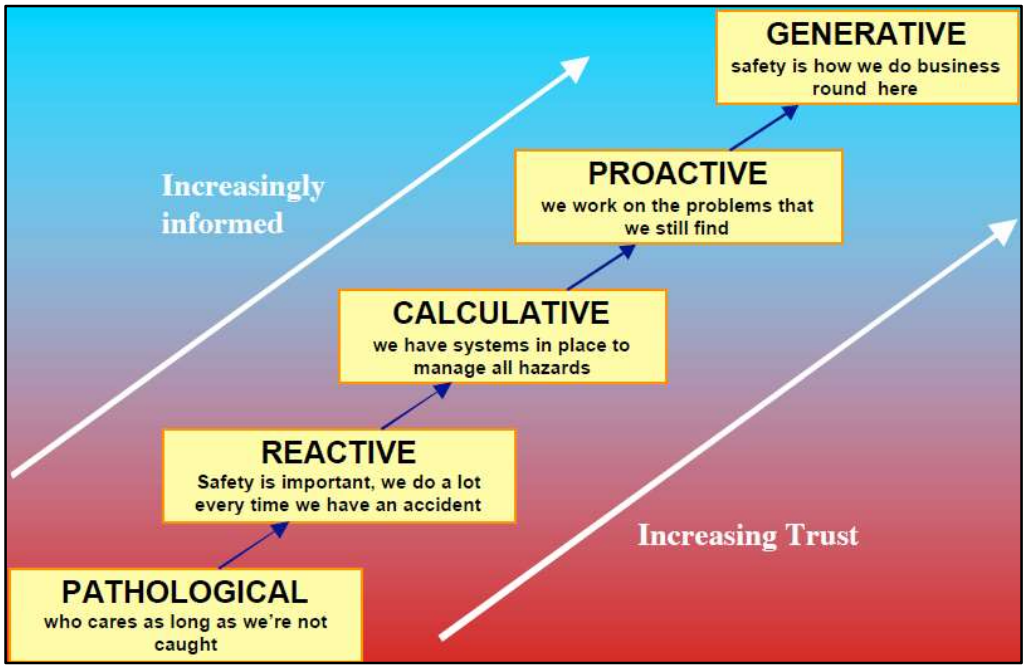


Figure 3.6: The evolution of OHS culture within an organisation (Hudson, n.d.)

Hudson (n.d.) and Hudson (1999) argued that positive OHS culture starts after the calculative stage, when the organisation has an operational OHSMS (Figure 3.7). The calculative stage offers a footing where the conducive environment is created to facilitate internalisation of OHS as an organisational value (Hudson, 1999). Positive OHS culture will only start to prevail when the OHS values are fully internalised within the organisation and individual beliefs and attitude on OHS will be aligned with the organisational values (Hudson, n.d.; Hudson, 1999). Hudson (1999) reasoned that in order to cultivate positive OHS culture, an organisation should undergo through a managed and structured process of sequential cultural change (note that none of OHS culture evolutionary stages can be omitted).

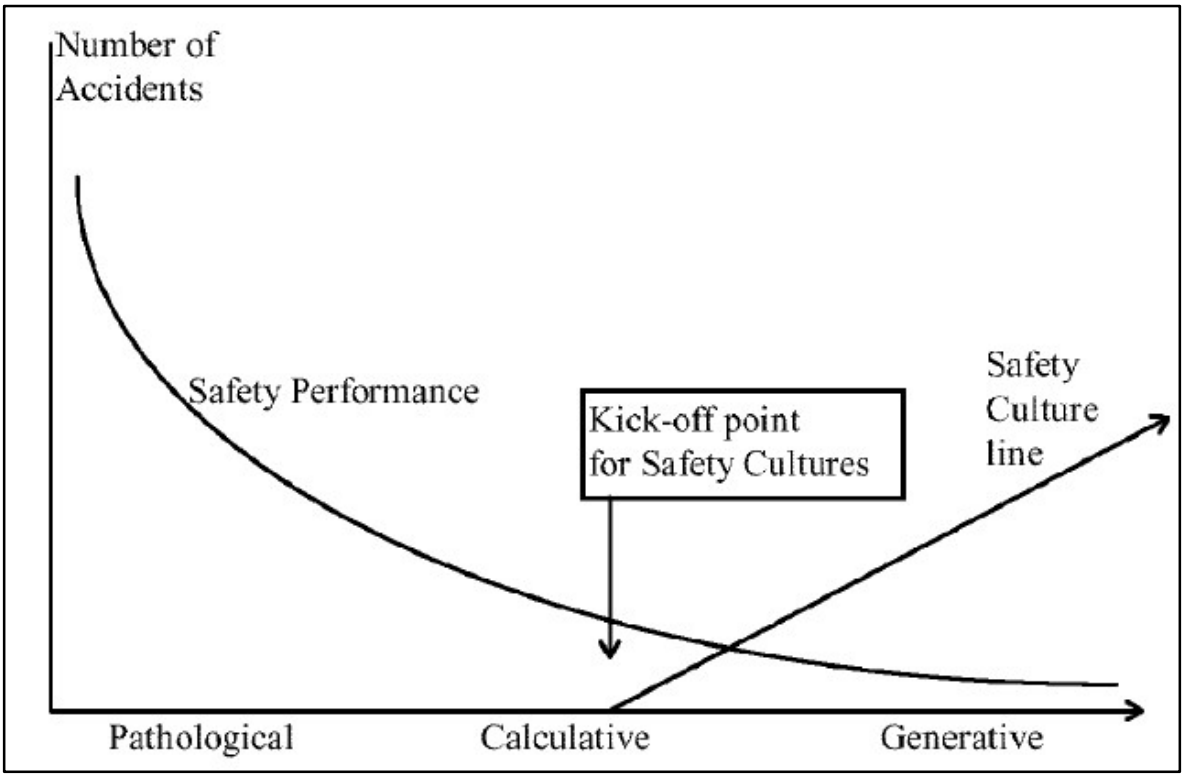


Figure 3.7: Relationship between OHS performance and OHS culture maturity (Hudson, 1999)

Ryan (2000) proposed three evolutionary stages of OHS culture (Table 3.3), namely basic (passive) compliance, self-directed safety (active) compliance and behavioural safety. Ryan (2000) argued that an organisation wishing to establish a positive OHS culture should undergo sequential transformation through these stages.

Table 3.3: Evolutionary stages of OHS culture (Adapted from Ryan, 2000)

Item	OHS culture evolutionary stage	Description of the evolutionary stage
1.	Basic (passive) compliance	Ensures that safety training programs, work conditions, procedures, and processes comply with the prevailing OHS legislative regime. This passive compliance does not address employee specific actions
2.	Self-directed safety (active) compliance	The workforce is encouraged to take personal responsibility for OHS and participates in the efforts of ensuring compliance to legal requirements
3.	Behavioural safety	In this phase, the employees are empowered to manage OHS. Safe behaviour is recognised as an important vehicle of improving OHS

Walter (2012) suggested that the DuPont Bradley Curve (Figure 3.8) could be used for establishing the prevailing OHS culture, thus enabling the development of an informed OHS culture improvement action plan. Walter (2012) unpacked the respective OHS culture evolution stages on the DuPont Bradley Curve as follows:

- ***Reactive OHS culture*** – OHS is led by natural instincts, changes are usually made after OHS incidents and there is no close involvement of senior leadership.
- ***Dependent OHS culture*** – this is characterized by a culture of command and control. However, the system is also characterized by management commitment to OHS, availability of comprehensive OHS rules and procedures, holding all people accountable for OHS performance and interventions to improve OHS competency and behaviour.
- ***Independent OHS culture*** – OHS is valued at personal level and employees consistently care for their own OHS.
- ***Interdependent OHS culture*** – the environment is characterized by non-existence of hierarchy on OHS matters and all the people walk the extra mile from caring about their personal OHS to caring about other people's OHS. Moreover, there is a culture of care and teamwork, going beyond behaviour based OHS.

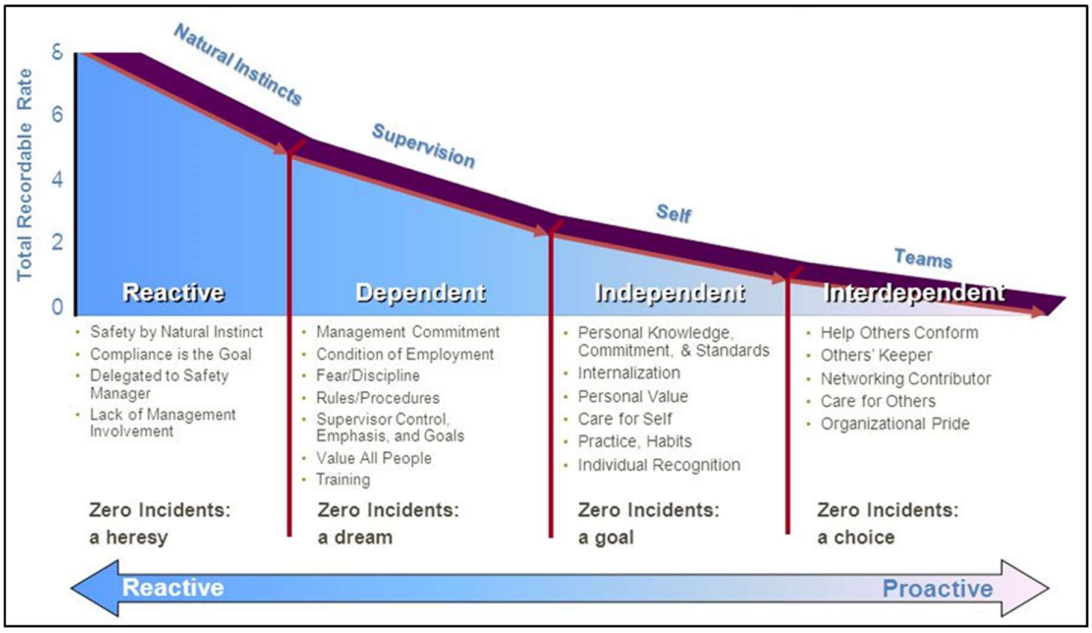


Figure 3.8: DuPont Bradley Curve illustrating how OHS culture evolves from reactive to interdependent OHS culture (DuPont, 2020)

Fleming (2001) also suggested that the Keil Centre Safety Culture Maturity Model (SCMM) (Figure 3.9) could assist organisations to understand their current OHS culture maturity level, enabling them to develop a strategy to sequentially progress to better OHS culture levels. Table 3.4 describes the five levels of the SCMM.

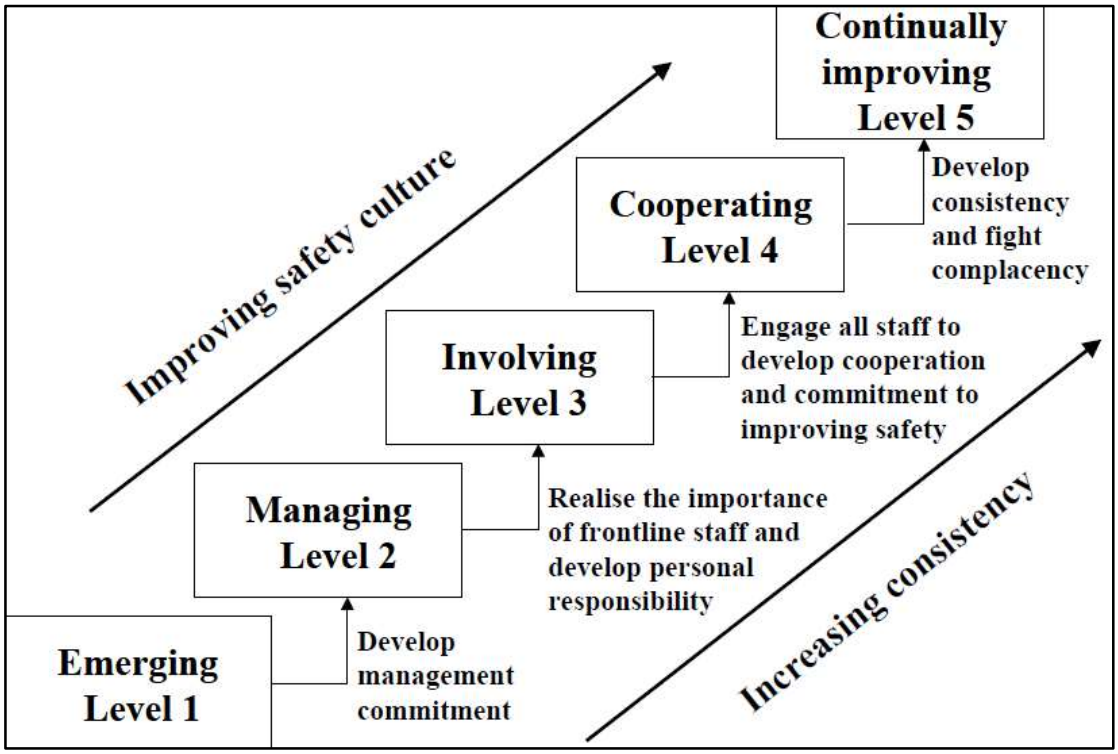


Figure 3.9: Keil Centre SCMM (Fleming, 2001)

Table 3.4: Description of the SCMM levels

SCMM level	Description of SCMM level
Level 1: Emerging	OHS management consists of compliance to OHS provisions and use of OHSMS and technical measures. OHS management is considered as the primary responsibility of the OHS department, OHS incidents are accepted as part of the work and are not perceived as a major business risk
Level 2: Managing	OHS incidents are perceived as a business risk and efforts are directed towards incident prevention. There is a culture of blame, reactive approach to OHS, use of lagging indicators like lost time injuries and OHS incentives
Level 3: Involving	OHS performance is better but appears to have plateaued. There is a culture of collaboration on OHS matters, non-blaming culture, and culture of reporting and learning. All stakeholders take responsibility for their own OHS

Level 4: Cooperating	OHS is recognised as a matter of enlightened self-interest. All stakeholders accept responsibility for their own and others' OHS. There is strong emphasis on proactive risk management. Health and safety are promoted as a value at societal level
Level 5: Continually improving	Zero harm is embraced as value both at work and in society, there is no complacency and there is a consistent focus to continually improve OHS

Analysis of the different OHS culture evolution models revealed that the OHS culture change is a gradual, multi-faceted and complex process. The OHS culture evolution models are critical tools that can provide insights on the prevailing OHS culture (OHS culture level), allowing organisations to develop an informed strategy to continuously improve OHS culture. The following commonalities were also noted from the examination of the OHS culture evolution models:

- Effective participation of both leadership and workforce is critical for cultivation of positive OHS culture.
- Mutual trust between leadership and workforce is the cornerstone of a strong OHS culture. Trust is a prerequisite for establishment of collaborative, informed, reporting and just cultures.
- Management commitment to OHS, accountability to OHS and availability of adequate resources are critical for establishment of a strong OHS culture.
- Chronic unease, appetite for continuous OHS improvement and extension of health and safety values beyond the workplace are key features of advanced OHS culture.

3.3.2 Assessment of OHS culture

The departure point in developing a strategy to cultivate positive OHS culture is to have a holistic insight of the prevailing OHS culture. According to Ryan (2000), the prevailing organisational OHS culture defines the workforce's perceptions about OHS matters. Thus, a consideration of the workforce's perceptions is critical in the formulation of the OHS culture change strategy, noting that perceptions influence behaviour, and recurring behaviours become the accepted way of doing things (Ryan, 2000).

Hudson (n.d.) unpacked organisational cultures in terms of what is said (talk) and action (walk). The original illustration by Hudson (n.d.) classified communication and organisational attitude under talk, however it can be argued that organisational attitude is more of an action (walk) rather than a talk. For this reason, the original illustration was slightly modified (Table 3.5). The illustration can provide useful insights on the status and gaps within the prevailing OHS culture.

Table 3.5: OHS culture dimensions and internal structure (adapted from Hudson, n.d.)

TALK	**WALK**			
Communication	**Organisational Attitudes**	**OHS**	**Organisational Behaviour**	**Working Behaviour**
Flow of OHS data and information	Workforce attitudes to management	Organisational status of OHS department	Management style and behaviour	Priority setting between production and OHS
Management awareness on OHS matters	Management attitudes about the workforce	Incentives for good OHS performance	Level of care for stakeholders	Risk appreciation by those at personal risk
Workforce awareness on OHS matters	Collective efficacy – the belief that people can get things done	Procedures and the use of initiative	Change management	Workforce and management behaviour

The literature review identified interviews, workshops and surveys with a representative sample of the workforce as some of the techniques that can be used for assessing OHS culture. The techniques are discussed as follows:

Interviews with the leadership and workforce

One-to-one interviews are an effective tool for assessing the state of the organisational OHS culture, cultivating individual commitment to OHS and identifying opportunities for continuous improvement (Stranks, 2007). The purpose of the interviews must be clearly

communicated to the participants and the interviews must be strictly confidential (Stranks, 2007). Timeous feedback on the interviews outcomes and development and implementation of an action plan are critical (Stranks, 2007).

Workshops for leaders and workforce

Separate workshops could be held with the leadership and workforce in small groups in order to access the prevailing state of organisational OHS culture, identify opportunities for improvement and develop an action plan to close the identified gaps (Stranks, 2007). Delegates must be made aware of the objectives of the workshop and must be encouraged to participate and complete the questionnaires. Outcomes of the OHS culture surveys and interviews could also be discussed at the workshop (Stranks, 2007).

OHS culture surveys

OHS culture surveys may assist to identify bottlenecks in the organisation's OHS culture, thus allowing the organisation to close the identified gaps, allocate resources appropriately and promote progressive improvements in OHS (IOSH, 2015). OHS culture surveys tools could be administered to a representative sample of the workforce and the success of the technique is heavily dependent on the level of trust, commitment and buy-in by all stakeholders, and the clarity and user-friendliness of the questionnaire (Stranks, 2007). The survey outcomes and feedback should be appropriately communicated to all stakeholders. An action plan must be developed, agreed and implemented in consultation with all stakeholders (Stranks, 2007).

The literature survey identified the following as some of the variables that could be incorporated into OHS culture assessment tools (Stranks, 2007; IOSH, 2015):

- Leadership commitment to zero harm production and their willingness to walk the zero harm talk.
- The availability and implementation of OHS risk management, practices, policies and procedures.

- Evidence of how employees perceive risk and of personal risk taken by employees which may have been noted.
- The responsibility which employees show for their own and other people's OHS.
- Effective engagement and communication with all stakeholders on OHS matters.
- Willingness of the organisation to invest in various aspects of OHS such as training, technology and OHSMS.
- Leadership and employee competency in dealing with OHS matters.
- How well good OHS performance is measured and reinforced.
- The arrangements for periodic reviews of OHS culture and for implementing improvement plans.

The review revealed that comprehensive knowledge of the prevailing OHS culture is critical to inform the development of an OHS culture improvement strategy. The OHS culture assessment tools could be used in combination with OHS culture evolution models to determine the prevailing OHS culture level and gaps.

3.3.3 Change management considerations

The process of cultivating a positive OHS culture is a fundamental change within the organisation, requiring proper evaluation, planning and a change management strategy. KPMG (2015) suggested that proper change management becomes a key differentiator in the usually conservative mining industry, where the uptake of change initiatives is usually slow. Proper attention to change management will mitigate potential threats that may result in failure to establish positive OHS culture, such as resistance to change by the stakeholders, poor productivity, and poor OHS performance.

Several authors have cautioned that the process of establishing positive OHS culture is gradual and must be properly planned, fostered, steered, demonstrated and managed (IOSH, 2015; Ryan, 2000; ICS, 2013; CBI, 1991). The ICS (2013) and Kim et al. (2016) added that cultivation of a positive OHS culture is a challenging, time consuming and long-term process

which requires a lot of effort. IOSH (2015) agreed that OHS culture change is gradual and any continuous improvement plans must acknowledge that the prevailing OHS culture had evolved over a long period of time.

An organisation's OHS culture is a collection of individual OHS cultures, thus it is important to cultivate positive OHS cultures in individuals, in order to enable a positive organisational OHS culture (IOSH, 2015). The departure point is to define the desired organisational OHS culture and subsequently develop a SMART implementation plan (ICS, 2013; IOSH, 2015). IOSH (2015) argued that a blanket approach will not necessarily work on different organisations due to differences in OHS culture maturity levels.

IOSH suggested that the OHS culture evolution models could be combined with the principles of quality management to build an OHS culture change process, based on the Assess-Plan -Do-Monitor management model (Figure 3.10), to facilitate progressive improvements to advanced OHS culture levels as follows (IOSH, 2015):

- ***Assess -*** gap analysis of the current OHS maturity level.
- ***Plan -*** developing a plan to move to the next maturity level(s).
- ***Do -*** implementing the plan.
- ***Monitor -*** monitoring the implementation of the plan.
- ***Re-assess*** - re-assessing the level of maturity to evaluate success and identify more actions, and aim for continuos improvement.

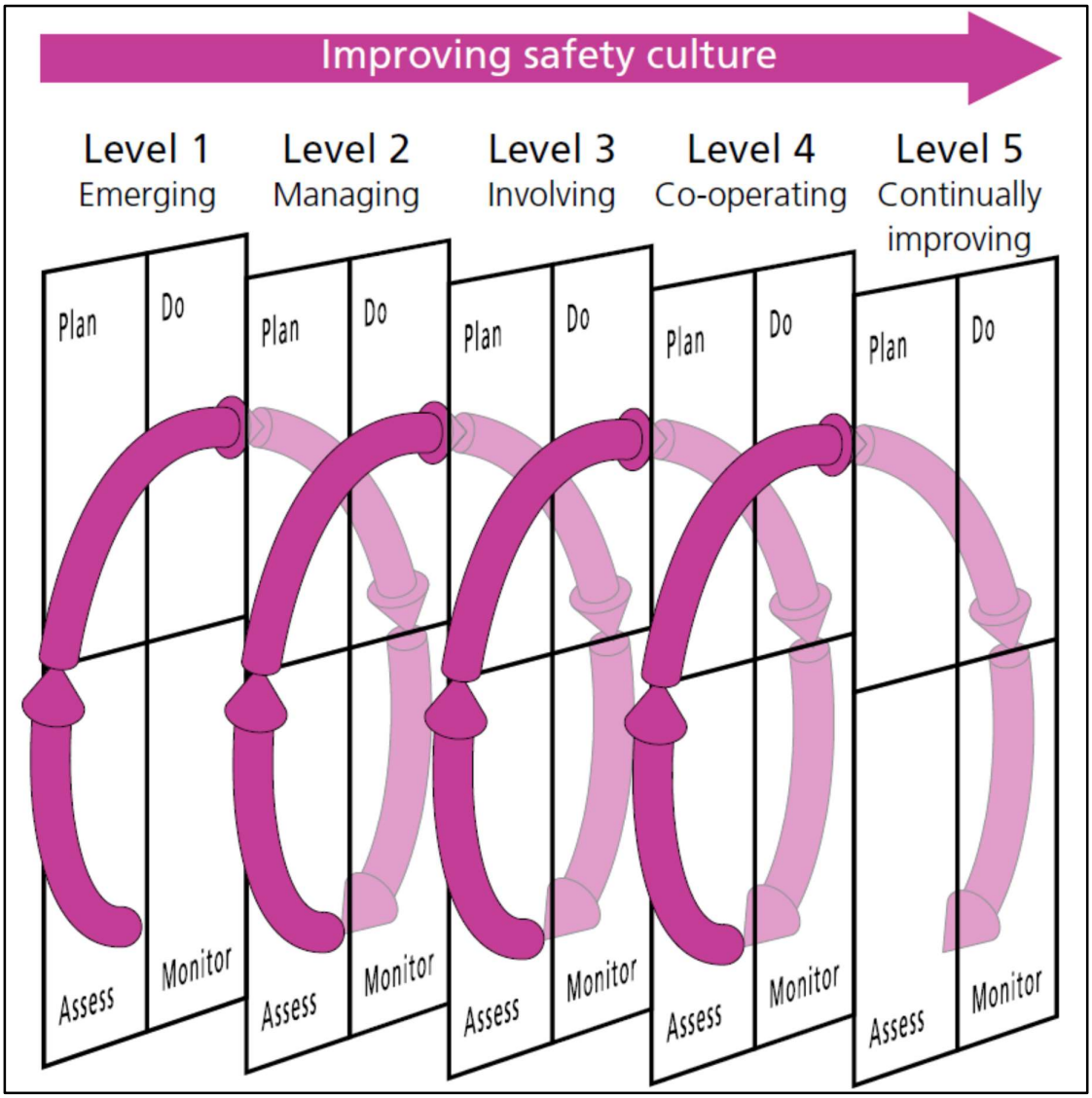


Figure 3.10: OHS culture change process (IOSH, 2015)

Kim et al. (2016) suggested that Lewin's unfreeze-change-refreeze model could be used to facilitate OHS culture change in organisations. The model stipulates that for any successful change to occur, an old system must transform via the three stages of unfreeze-change-refreeze, into a stable improved system (Kim et al., 2016). In the context of cultivating positive OHS culture, the unfreezing stage involves discarding of poor OHS culture to pave way for adoption of positive OHS culture. The changing stage allows the organisation to shift from poor to positive OHS culture and this can be accomplished through interventions such as motivation,

training and coaching. Refreezing represents the final stage where the positive OHS culture is internalised and sustained (Kim et al., 2016). Kim et al. (2016) emphasised that sustainable culture change must be underpinned by continuous improvement initiatives to prevent regression to poor OHS culture.

In an attempt to understand the process of OHS culture change, Kim et al. (2016) examined changes that occurred over 40 years in one company's hearing conservation program (HCP). The study identified leadership and action learning as the two critical culture change drivers. Leadership, including leaders' attitude on OHS matters triggered unfreezing, whilst culture transformation was accomplished through action learning involving the entire workforce. Revans (1980) defined action learning as a problem-solving technique involving studying personal actions and experiences to improve operational performance. Revans (1980) argued that action learning was a better tool of influencing culture change compared to the conventional method of influencing culture change through commands. According to Revans (1990), action learning can be described by the equation, $L = P + Q$, where:

- L is learning.
- P is programmed knowledge.
- Q is questioning, necessary for creating insights about people's experiences.

Kim et al. (2016) suggested that effective learning process should involve acquiring programmed knowledge, co-learning in groups, learning through experiences and implementation of practical solutions.

Hudson (n.d.) suggested that the Prochaska and DiClemente's change model can be utilised to facilitate sequential improvements in OHS culture. Prochaska and DiClemente's change model comprise five stages, namely (Hudson, n.d.):

- ***Pre-contemplation*** – organisation at complacent (no need for change) stage, characterised by the belief that no further OHS are possible.

- ***Contemplation*** – stage at which organisation starts to accept that further OHS improvement can be possible, however this will not be supported by any behaviour change or action.
- ***Preparation*** – active steps are taken to prepare for change and often characterised by a lot of regressing.
- ***Action*** – this is the stage where the plan developed in the preparation stage is implemented. Adequate support is critical to avoid any regression.
- ***Maintenance*** – this is the final stage that is crucial for sustaining the new OHS culture.

Figure 3.11 depicts the schematic presentation of the Prochaska and DiClemente's change model. The dotted lines show possible ways to fall back, noting that falling back to the pre-contemplative stage will unlikely happen because the values are likely to remain intact. It is noteworthy that the success of the implementation of the model is dependent on the recognition of the current stage and availability of methodologies to facilitate sequential transitions (Hudson, n.d.).

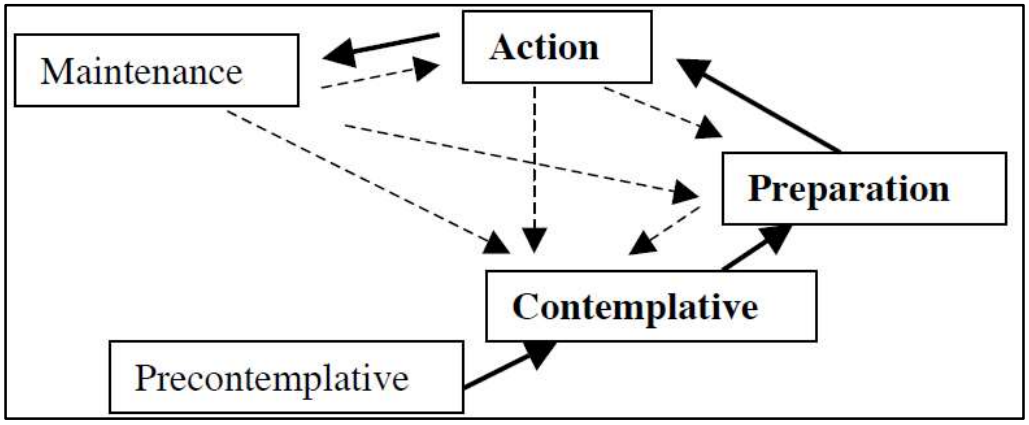


Figure 3.11: Schematic presentation of the Prochaska and DiClemente's change model (Hudson, n.d.)

Hudson (n.d.) developed a change model based on the Prochaska and DiClemente's change model (Table 3.6). The model aims to manage sustainable change within organisations by changing both individuals and the organisations they belong to, with a holistic consideration of factors such as creation of awareness, personal need and belief, and the active participation of all interested and affected parties throughout the entire process (Hudson, n.d.). Hudson (n.d.) suggested that sustainable change will only occur when the organisation and individuals have internalised and embraced the beliefs and values associated with the change.

Table 3.6: Change model (Hudson, n.d.)

Change management stage	**Activities involved**
Pre-contemplation to Contemplation (Awareness creation)	• Create awareness about the motivation (value proposition) for the change • Establish individual desire and commitment for change • Instil some belief in the change in all stakeholders • Develop a SMART process for attaining the change • Communicate success stories to all stakeholders • Gather and disseminate positive personal perspectives about the change
Contemplation to Preparation (Planning)	• Develop the action plan in collaboration with all stakeholders • Define key performance indicators • Obtain the buy-in (commitment) and support of all stakeholders on the action plan
Preparation to action (Implementation)	• Implementing action plan • Review progress and identify opportunities for continuous improvement
Maintenance (Aim for continuous improvement)	• Review the process at regular defined intervals • Monitor internalisation of values and beliefs in outcome state • Continuous gap analysis and development and implementation of corrective actions

3.4 Critical success factors for establishing positive OHS culture

3.4.1 Establishment of an occupational health and safety management system (OHSMS)

The International Labour Organisation (ILO) defined OHSMS as *"a set of interrelated or interacting elements to establish OHS policy and objectives, and to achieve those objectives"* (ILO, 2001). Kale et al. (2013) defined OHSMS as *"a combination of planning and review, the management organisational arrangement, the consultative arrangement, and specific program elements that work together in an integrated way to improve OHS."* de Jager (2018) defined an OHSMS as *"a set of plans, actions, and procedures to systematically manage OHS."*

Zungu (2016), argued that the negative consequences of OHS incidents at workplaces undeniably offers sufficient motivation for organisations to invest in effective OHSMS. Although the MHSA does not specifically mention the OHSMS model to be used by the mines, the act sets out the framework for OHSMS, including the following (Zungu, 2016; de Jager, 2018; Hermanus et al, 2015):

- Requirements for mandatory appointments of both employer and worker OHS representatives.
- Ensure the OHS of employees and contractors, and prevent damage of equipment.
- Foster collaboration and consultation on OHS matters by all stakeholders (managers, frontline supervisors, workforce and contractors).
- Proactively and effectively managing OHS risks (hazard identification, risk assessment and mitigation).
- Learning from OHS incidents (report, investigate, document and prevent future incidents from happening).
- Empowering all stakeholders to effectively manage OHS through training and communication.
- Continuously improve OHS performance through interventions such as OHS audits, inspections and feedback.

- Provision of adequate OHS equipment.

Zungu (2016) highlighted that most OHSMS are based on the Plan-Do-Check-Act (PDCA) systematic management model, incorporating the concept of continuous improvement of OHS. Examples of OHSMS used by different companies globally include (Zungu, 2016):

- Managing for Health and Safety (HSG65) - mainly used in Britain.
- OHSAS 18001: 2007 revised 2015 Occupational Health and Safety Assessment Series – mainly used by most large-scale companies globally.
- International Labour Organisation (ILO) Guidelines on Occupational Safety and Health (OSH) Management Systems (ILO-OSH 2001) – also used throughout the world.

Figure 3.12 provides a schematic presentation of a generic OHSMS.

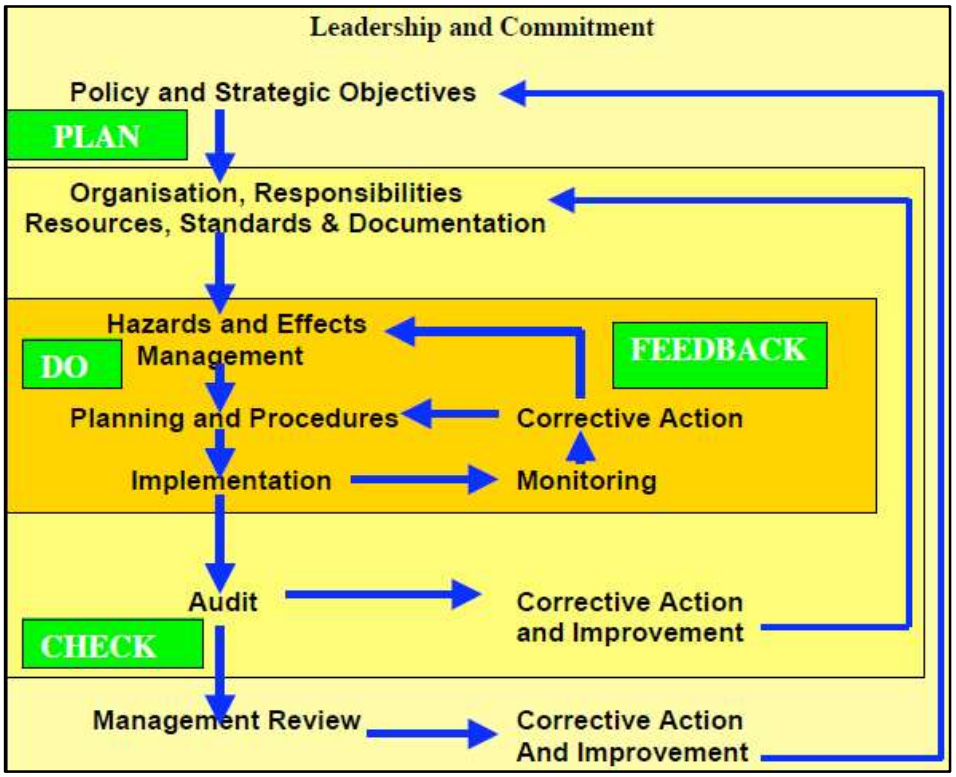


Figure 3.12: Illustration of generic OHSMS (Hudson, n.d.)

Kale et al. (2013) noted that most organisations have realised significant OHS improvements, productivity and cost savings as a result of implementation of OHSMS. ICS (2013) reasoned that development, implementation and continuous improvement of OHSMS modifies the workforce's behaviour so that they *"believe in safety, think safety and are committed to safety"*. Ryan (2000) concurred that in order to cultivate positive OHS culture, it is crucial to establish a robust OHSMS and empower the workforce (through training, communication etc.) to comply with OHS standards and regulations. A poorly designed or implemented OHSMS negatively affects OHS culture (Ryan, 2000).

Hermanus (2007) defined a system as *"a dynamic aggregate of interrelated components that have an overarching purpose"*. In systems, both the components and dynamics (within the components and between components) are important (Hermanus, 2007). In the context of OHS management, the components may include different stakeholders, OHS working groups, legal framework, roles and responsibilities, institutions, people, machinery, environment and monitoring and evaluation practices (de Jager, 2018; Hermanus, 2007). System dynamics refers to the interactions of different system components such as involvement of all stakeholders, buy-in, planning, engagements, and reaction to challenges (Hermanus, 2007). In other words, in a system, all the system elements are interrelated, and nothing is absolutely isolated.

Effective OHS management requires a systematic approach, aiming to optimise the entire OHSMS, rather than focusing on individual system elements (Shorrock et al., 2014; Geller, 1996). Shorrock et al., 2014 added that systems thinking in OHS management is critical as the majority of the OHS challenges and opportunities for improvement are system based. de Jager (2018) argued that effective OHS management should be underpinned by a holistic understanding of the interdependencies and interaction of the different components of the OHSMS such as environment, machines and humans. Hermanus (2007) argued that a properly crafted OHSMS will result in marginal OHS improvements in the absence of a holistic consideration of all systems elements. Hermanus (2007) added that in systems thinking, OHS incidents could be regarded as "*flawed processes involving interactions among system*

components including people, societal and organisational structures, engineering activities and physical system components".

IOSH (2015) argued that effective OHS management should holistically consider interactions between the working environment, OHSMS, and the organisation and its people (Figure 3.13). IOSH (2015) added that putting in place all the other interventions to improve OHS such as safe equipment, systems and procedures, will not result in optimum OHS performance, in the absence of a positive OHS culture. The following examples illustrate how the interaction between individual systems elements could affect OHS performance (IOSH, 2015):

- Quality of the risk management is affected by behaviour and competence of the workforce.
- Unsafe work behaviours could be exacerbated by factors such as unergonomic equipment, poorly maintained equipment, poor planning, poor systems, production pressures and unconducive working environments.
- The organisation's attitude and values regarding zero harm production and unsafe acts and behaviour influences OHS performance.

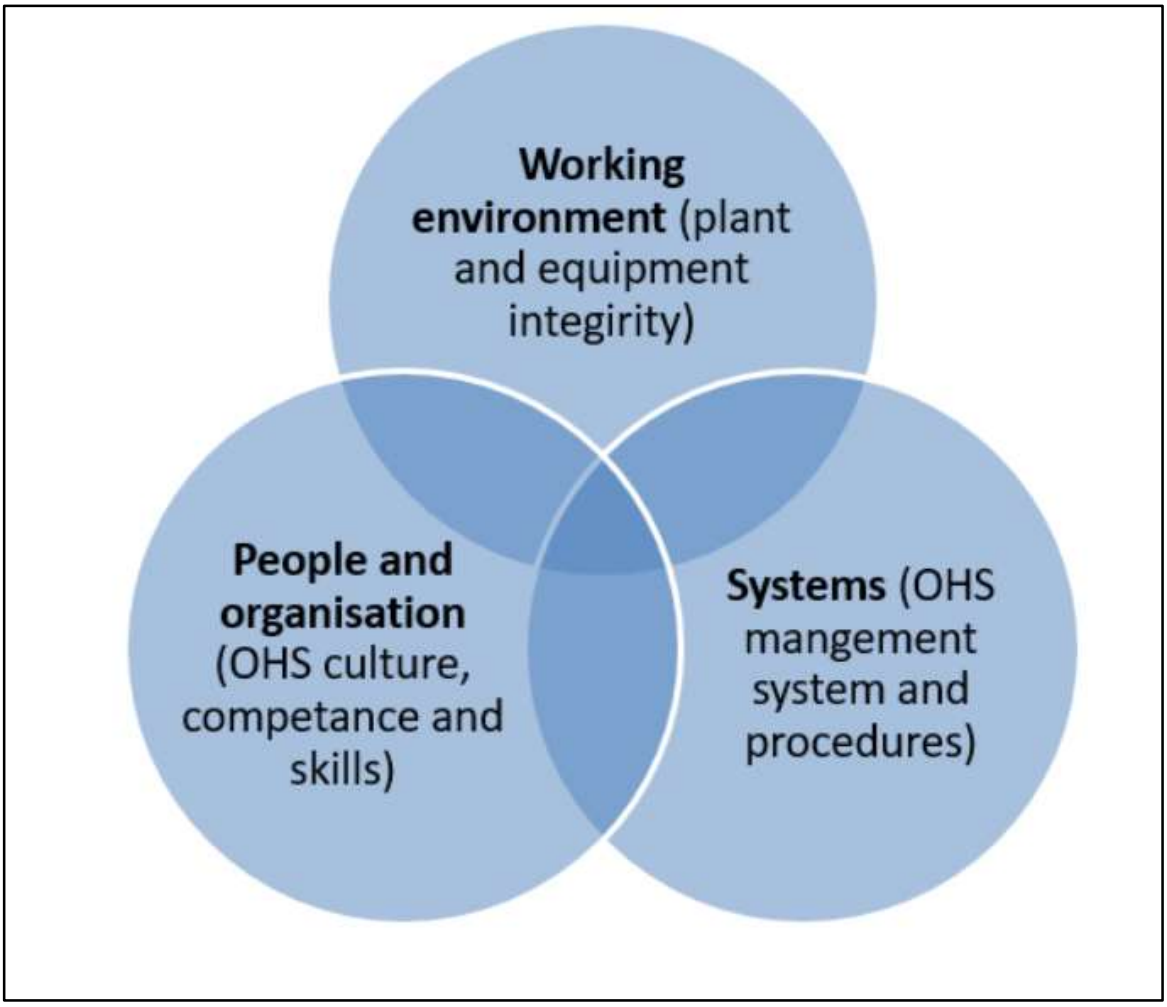


Figure 3.13: Systematic approach in OHS management (IOSH, 2015)

Ikin (2015) provided a related but different model of how aspects of the organisation, job and individual interact, with subsequent effects on human reliability and OHS incident causation (Figure 3.14). Ikin (2015) argued that these complex human factors-centred issues present some challenges with effective management of OHS.

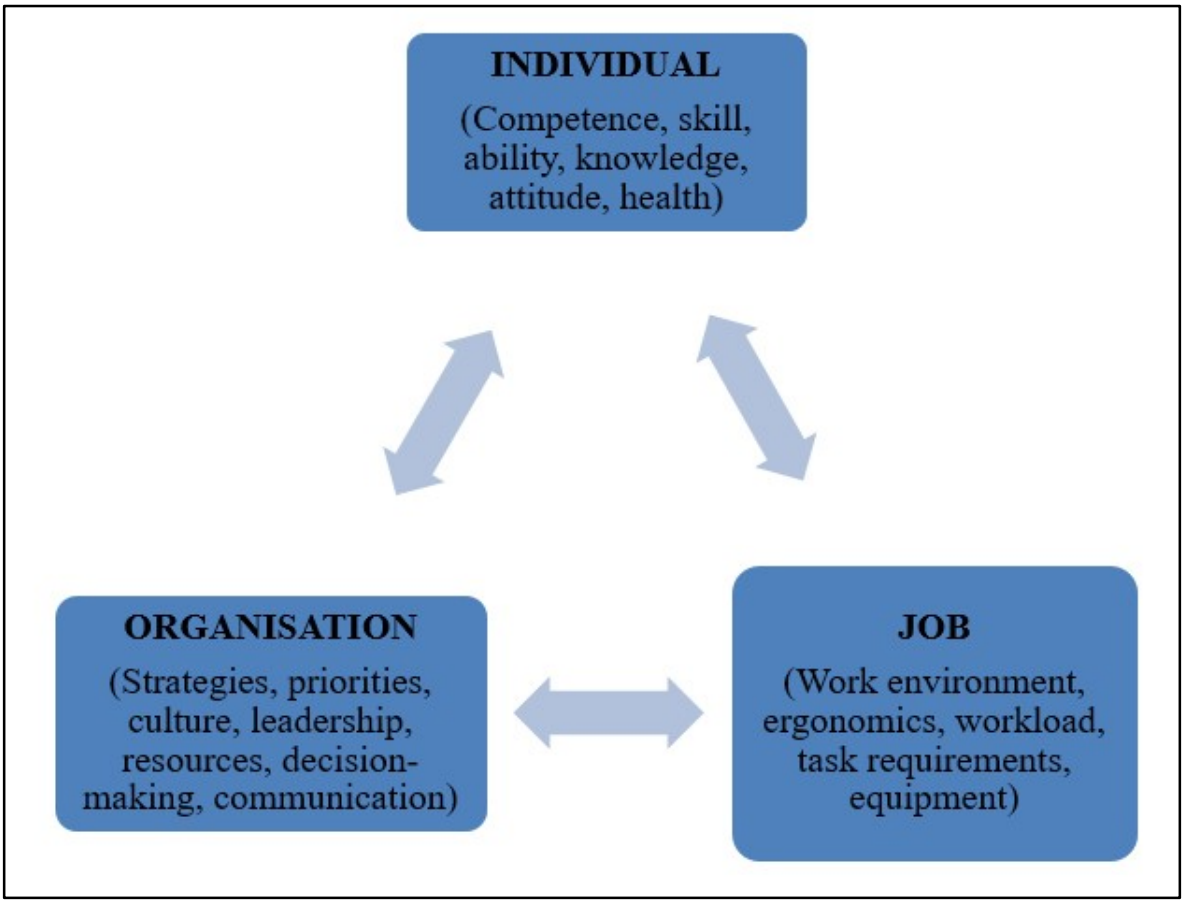


Figure 3.14: Holistic consideration of human factors elements (Ikin, 2015)

Mohapi and Zarske (2019) described ISSA Mining's framework that is designed to prevent OHS incidents, through a holistic consideration of individual systems elements such as leadership, risk management, OHSMS, technology and people (Figure 3.15).



Figure 3.15: ISSA Mining's OHS management framework (Mohapi and Zarske, 2019)

3.4.2 Effective OHS risk management

Effective management of OHS risks is the cornerstone of any successful OHSMS. Section 11 of the MHSA requires the mines to appropriately manage all OHS risks: identify hazards, assess their risks and put in place measures to remove or reduce the risks (MHSA, 1996). Simply put, OHS risk management can be defined as the systematic approach of managing OHS risks in order to prevent OHS incidents from occurring. The fundamental principle of OHS risk management is that improvements in OHS can be attained through proper OHS risk management (Zungu, 2016; de Jager, 2018). Effective risk management should focus on eliminating OHS risks at source, circumventing OHS risks, use of alternative and safer approaches such as technological innovation and adaptation of work to the individual (Jager, 2018). The OHS risk management process may include the following (Zungu, 2016):

- Identification of potential OHS hazards.
- Risk assessment to determine the level of the risk.
- Risk mitigation (development, implementation and review of controls necessary to eliminate or reduce the risk to an acceptable level).
- Monitoring of the effectiveness of controls.
- Assessment and monitoring of the level of residual risk.
- Continuous improvement initiatives.

Hudson (n.d.) described the Hazards and Effects Management Process (HEMP) that was developed and implemented by a global oil and gas company, to manage OHS hazards. HEMP comprise the following four steps:

- ***Hazard identification*** – a register of OHS hazards was created based on brainstorming and analysis of OHS incidents statistics. The hazard register was also updated as and when new hazards were identified.
- ***Assessment of the identified hazards*** through the use of a risk potential matrix (Figure 3.16), in order to determine the importance of the risk based on risk consequence and probability of occurrence.
- ***Managing*** – controlling hazards through use of defences (barriers and controls).
- ***Recovery*** – putting in place measures to contain or mitigate potential events in situations where defences were breached, or controls fail.

Consequence				Increasing Probability				
				A	B	C	D	E
Rating	*People*	*Assets*	*Environment*	Never heard of in industry	Incident heard of in industry	Incident heard of in company	Incident happens several times per year in company	Incident happens several times per year in a location
0	No injury	No damage	No effects	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk
1	Slight injury	Slight damage	Slight effect	Low Risk	Low Risk	Low Risk	Med/low Risk	Med/low Risk
2	Minor injury	Minor damage	Minor effect	Med/low Risk	Med/low Risk	Med/low Risk	Med/low Risk	Med/low Risk
3	Major injury	Local damage	Localised effect	Med/low Risk	Med/low Risk	Medium Risk	Medium Risk	**High Risk**
4	Single fatality	Major damage	Major effect	Medium Risk	Medium Risk	Medium Risk	**High Risk**	**High Risk**
5	Multiple fatality	Extensive damage	Massive effect	Medium Risk	**High Risk**	**High Risk**	**High Risk**	**High Risk**

Figure 3.16: Illustration of risk probability matrix

Stewart and Nite (2017) argued that the right to refuse dangerous work and leave a dangerous workplace, as required by Section 23 of the MHSA, is a critical provision of the act, seeking to promote OHS self-regulation by the workforce. The provision requires the workforce to continuously conduct OHS risk assessments and manage the risks (eliminate, control, minimise, etc.), as far as reasonably practicable. In cases where significant imminent risk remains despite the implementation of the aforementioned controls, the provision further empowers the workforce to exercise the right to refuse dangerous work and leave a dangerous workplace. The guideline for the compilation of a mandatory code of practice for the right to refuse dangerous work and leave dangerous working places, issued by the MHSI in 2016 seeks to strengthen and operationalise the fundamental right to refuse dangerous work.

Coulson et al. (2019) reported that the workforce in the SAMI exhibited a high level of knowledge, awareness and experience in the formal implementation of the right to refuse dangerous work and leave dangerous workplaces. However, in cases where certain factors inhibited the employees to exercise the right to refuse dangerous work, the workforce and

frontline supervisors have resorted to informal work refusals, non-confrontational consultation, cooperation, and collaboration (Coulson et al., 2019). Coulson et al. (2019) noted that contract workers were unlikely to exercise their right to refuse dangerous work, while the majority of the workforce directly employed by the mines were likely to exercise the right following instructions from the OHS representatives or frontline supervisors. Coulson et al. (2019) argued that impartiality exercising of the right to refuse dangerous work (hence right to healthy and safe workplace), will significantly contribute to OHS improvements in the sector. Thus, it is critical for mining companies to put in place interventions to encourage the workforce to fairly exercise the right to refuse dangerous work and leave a dangerous workplace.

The Mining Industry Occupational Safety and Health (MOSH) has a leading practice called triggered action response plan (TARP). TARP is derived from the mine's major hazard management plan and is a tool which can be used for effective OHS risk management: risk identification and subsequent triggering of a remedial action, which is escalated to the level of responsibility that is required to deal with that risk in terms of the definition of the process. In the SAMI, TARP is mainly used for managing falls of ground related risks (MOSH, n.d.). There is a need to consider the potential use of TARP as a tool to manage all OHS risks at the workplaces.

Sound OHS risk management should incorporate a holistic consideration of human factors (Ikin, 2015). Ikin (2015) argued that risk management requires a thorough analysis of multi-faceted and interconnected factors within the work environment, and the effectiveness of the process is dependent on factors such as knowledge, skills, abilities and experiences of the employees. Hermanus (2007) suggested that modern risk management in the mining sector should consider gender implications, due to an increasing number of women employed in the historically male dominated sector.

Hermanus (2007) argued that although sound OHS risk management is a crucial pillar of any OHSMS, the SAMI has no standard risk management protocol and risk management training

is not well established. The following key learnings from the OHS risk management practice are noteworthy (Hermanus, 2007):

- Sound technical designs and work systems are critical for proper OHS risk management.
- Comprehensive understanding of the impact of control strategies is important for both contingency planning and continuous improvement of controls.
- Delays in conducting risk assessments reduces the effectiveness of the risk management process, hence the avoidance of OHS incidents.
- Complex work process, characterised by a number of interdependent activities and levels of supervision, accelerate the risk of human error and systems failure.
- Human beings are always fallible, and designs should be tolerant of human failure and error.
- Proper management of factors that shape unsafe OHS behaviour is critical for continuous improvement in OHS.
- Recurrence of OHS incidents can be prevented by learning from previous incidents.
- Stranks (2007) added that it is important to put in place mechanisms of tracking hazard correction, say through the use of work order system.

3.4.3 Learning from OHS incidents

IOSH (2015) stated that three key elements (effective OHS risk management, learning from OHS incidents, and positive attitude towards risk management and compliance with OHS requirements), should core exist to enable successful establishment of a positive OHS culture (Figure 3.17). For instance, the gains realised from an effective OHS risk management and compliance with OHS requirements, will be marginal if the organisation does not learn from OHS incidents (including near misses) and develop feasible mitigation measures to prevent repeats (IOSH, 2015). Ryan (2000) suggested that a condusive environment should be created to encourage the workforce to report all OHS incidents and near misses.

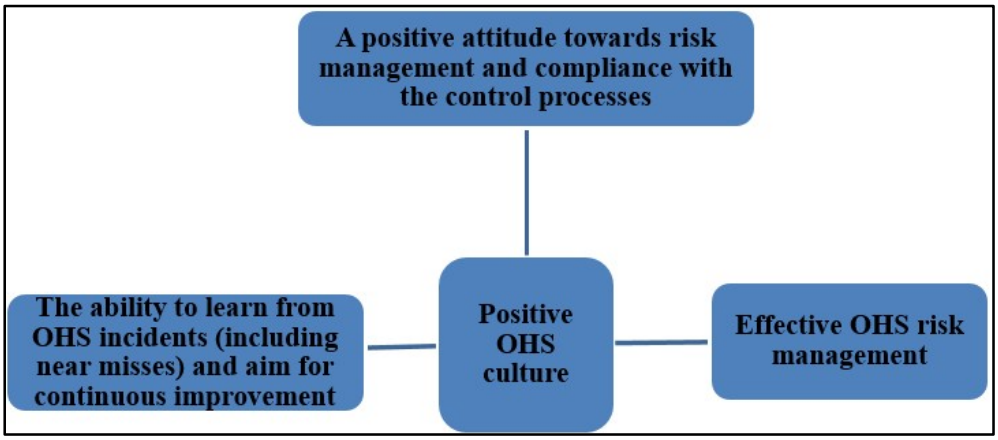


Figure 3.17: Key elements of a positive OHS culture (IOSH, 2015)

CBI (1991) suggested that in order to establish a positive OHS culture, it is important to timeously investigate all OHS incidents and act upon all gaps identified by OHS audits and investigations. OHS incident reporting culture can be enhanced by interventions such as removal of the blame culture and removal of incentives systems (such as production bonuses) that discourages OHS incident reporting (Ryan, 2000; ICS, 2013). ICS (2013) described a non-blaming culture as an environment in which the reporting of all OHS incidents is perceived as opportunity to identify and mitigate against bottlenecks within the OHSMS to avoid repeats. ICS (2013) argued that elimination of a culture of blame offers an opportunity to investigate all OHS incidents, identify roots causes and implement corrective actions to prevent repeats.

Ryan (2000) argued that OHS incident reporting could also be enhanced if OHS performance evaluations focus on process accomplishments such as percentage of observed positive observations, rather than outcomes such as number of fatalities and injuries. Stranks (2007) concurred that the use of positive OHS performance indicators such as the number of risk assessments conducted could result in improved OHS incident reporting. CBI (1991) and ICS (2013) added that robust OHS data will empower the organisation to scrutinise OHS performance trends and accordingly direct resources and efforts where they are required most

in-order to continually improve OHS. It is also critical that OHS incidents reports are disseminated within the organisation in-order to complete the learning process (ICS, 2013).

IOSH (2015) recommended that it is important to strike a balance in the apportionment of blame, noting that culture of blame will encourage very little reporting, while a completely blameless culture is not acceptable. IOSH (2015) described a completely blameless culture as a culture allowing all mistakes (including negligent ones) to go unpunished. ICS (2013) argued that there should be consequences for non-acceptable behaviour, otherwise lawlessness will prevail. Striking the balance will ensure that most OHS incidents excluding those resulting from gross negligence can be reported without fear of being punished (IOSH, 2015). ICS (2013) concurred that adoption of a just culture on apportionment of blame could encourage reporting of OHS incidents. ICS (2013) added that the organisation's just culture approach should be clearly defined (i.e. distinguish between acceptable and non-acceptable behaviour), and should be sufficiently disseminated within the organisation.

IOSH (2015) suggested that the substitution test could serve as an important tool to aid fair blame apportionment. In a substitution test, a small group of employees (who are not involved in the incident) are given information about the incident and what led up to it, and are asked to discuss it. If this group of people decide that they would have acted in the same manner as the person involved in the incident, this may indicate that it is not appropriate to allocate blame and other corrective measures like process reviews and training will be ideal. However, if the test suggest that it was possible to act differently under the circumstances, then apportioning of blame and punishment may be considered (IOSH, 2015).

In order to reveal the root causes of OHS incidents, the OHS incident investigation process should follow a systems approaches, taking into consideration all systems elements (organisational, social, human factors, etc.). Reason (1990) argued that latent failures that predispose the potential for error occur at all levels within an organisation, leading to OHS incidents (Figure 3.18). Thus, the identification of predisposing factors is not only crucial in

the understanding of human error, but it is also important in the formulation of appropriate interventions to avoid recurrence of OHS incidents.

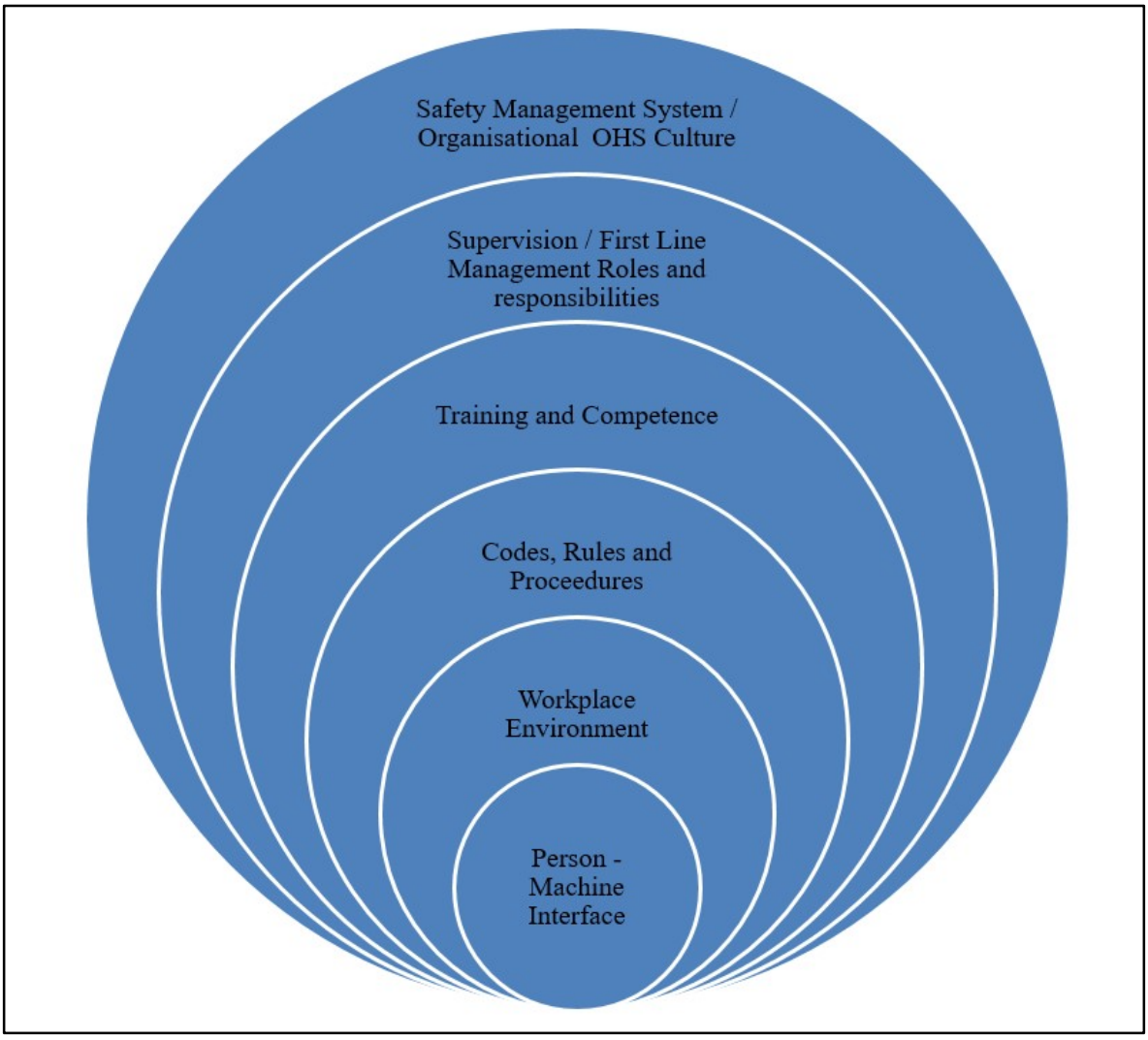


Figure 3.18: Illustration of levels for potential occurrence of human error (Reason, 1990)

The Swiss Cheese Model of OHS incident causation (Figure 3.19), illustrates that in a complex changing hazardous environment, such as a mine, no single control is completely effective (Stephan and Soto 2015). The interaction between the different system elements can affect all

the “cheese slices” and their associated “holes”, resulting in OHS incidents (Stephan and Soto 2015). From the model it can be argued OHS incidents occur as a result of shortcomings at different levels in an organisation, thus multiple layers of OHS incidents defence are critical to enhance the effectiveness of the OHSMS. Hermanus (2007) and Stephan and Soto (2015) reasoned that OHS incidents seldom have a single cause, and no single person should be blamed for OHS incidents. Dekker (2006) and Stranks (2007) concurred that human error was more of a symptom of system failure rather than a cause of failure, hence OHS incidents investigations should focus on identifying the root causes of incidents (system failures) instead of symptoms (human errors) and apportioning of blame.

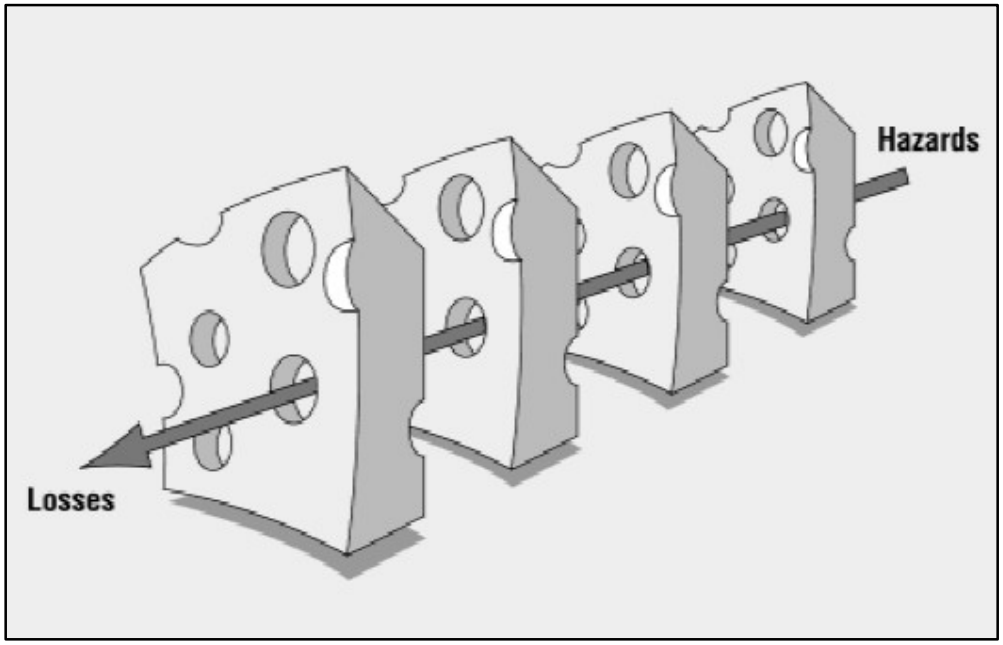


Figure 3.19: Illustration of the Swiss Cheese Model (Reason, 2000)

Reason (2000) suggested that the problem of human error can be analysed in two approaches, namely the person approach (focusing on errors of individuals such as forgetfulness, inattention and moral weakness) and system approach (incorporating defence mechanisms on the operational environment to mitigate errors). A holistic approach, focusing on individual

analysis of "system error" and "individual error" will enable full understanding of OHS incidents and development of suitable mitigation measures.

de Jager (2018) described an OHS incident causation model (Figure 3.20) that can be used for systematic investigation of probable multiple causes of OHS incidents. The model depicts "risk management against emergency management", "proactive approach versus reactive approach" and human factor related elements such as behaviour, errors and leadership.

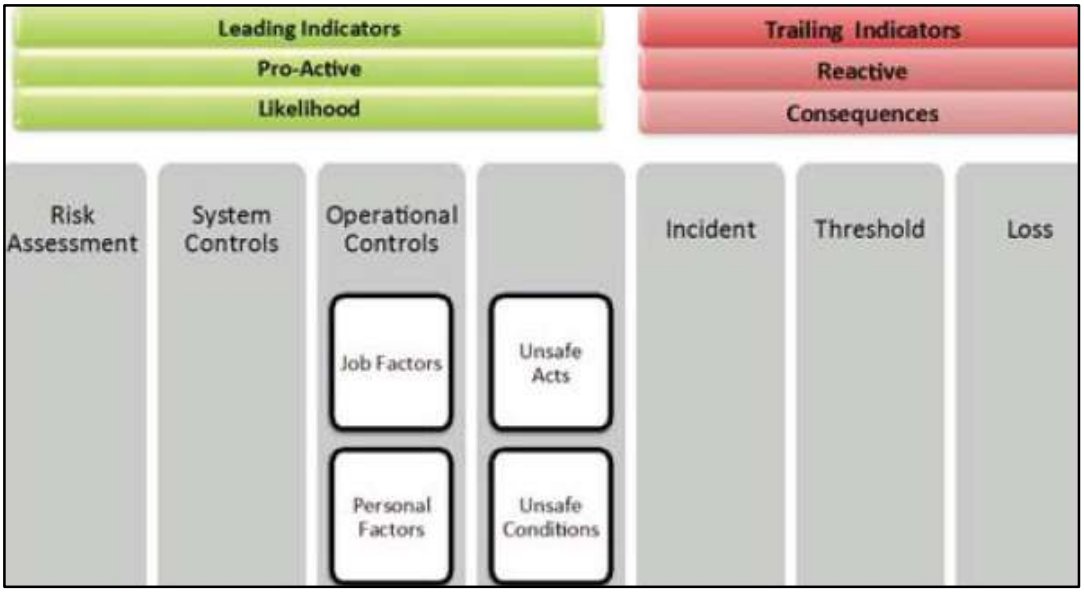


Figure 3.20: OHS incident causation model

The literature review found that learning from OHS incidents is critical to enable the development of preventative measures to avoid recurrence of similar OHS incidences. Thus, organisations need to create an environment which encourages the workforce to report all OHS incidents (including near misses). Moreover, the OHS incident investigation system should focus on identifying the root causes, rather than apportioning blame.

3.4.4 Establishment of good OHS behaviour

As noted earlier, several factors such as organisational attitude and values towards zero harm production and work-related environmental conditions, drive behaviour, hence the appetite for unsafe acts and non-conformities. Studies by Augusta et al (2015), de Jager (2018), ICS (2013) and Seokho et al. (2013) showed that there was a significant correlation between unsafe acts (unsafe behaviour), unsafe conditions and OHS incidents. Thus, effective management of OHS should focus on reducing occurrence of OHS incidents through eliminating unsafe acts (unsafe behaviour) and unsafe conditions. de Jager (2018) suggested that cultivating good OHS behaviour is a key part of the OHSMS that translates systems and procedures into practice.

Ikin (2015) argued that human attitude influences behaviour and any attempts to improve OHS through changing behaviour of the workforce must focus on changing values, beliefs and "hearts and minds" of employees, and the work environment, systems and practices. Ryan (2000) added that in order to establish positive OHS culture, it is important to understand the attitudes that drive certain OHS behaviour. Sustainable cultivation of positive OHS behaviour should also be supported by good organisational and management practices, favourable incentive schemes and holistic consideration of all system (de Jager, 2018). CBI (1991) suggested that good OHS behaviour must be made a condition of employment and organisations must define good OHS behaviour as well as establishing some behaviour monitoring and evaluation mechanisms.

Reason (2000) argued that although the employees are aware that the mining industry is extremely risky, it is difficult for the workforce to remain resilient with regards to OHS risk management. Reason (2000) explained that high-reliability organisations have better OHS performance, utilise a holistic approach focusing on individual analysis of system and individual errors, always acknowledge that fatal incidents can happen any time (chronic uneasiness) and develop appropriate mitigation strategies across all organisational levels. Reason (2000) added that the positive organisational OHS culture in these organisations is critical for continuous improvement and resilience of the OHSMS, against the backdrop of human and operational hazards. Ikin (2017) concurred that resilience in OHSMS could be

enhanced by adopting a holistic consideration of human factors in all aspects of the OHSMS such as risk management, equipment and engineering designs, shift designs, OHS improvement initiatives. Ikin (2017) added that it is important to integrate psychosocial safety interventions into existing OHS management practices. For example, undesirable factors such as fatigue, stress, sexual harassment, racism and workplace bullying could distract OHS improvement initiatives.

Stewart and Nite (2017) highlighted that the workforce's tacit knowledge; practical mining knowledge, experientially based sense; skills and mining wisdom remains a critical pillar of good OHS performance in the SAMI. The Wikipedia defines tacit knowledge as implicit knowledge that is difficult to transfer to another individual. For example, underground miners have developed tacit knowledge and skills overtime to identify potential warnings of imminent falls of ground incidents such as squeaking sound generated by the rocks, dust, small rocks falling and broadening of cracks in mine faces. Stewart and Nite (2017) added that the informal tacit knowledge and skills that is orally transferred and mastered during the execution of different work-related tasks is critical for moulding the right OHS behaviour in the workforce and complementing formal knowledge that is gained through interventions such as training, education and coaching. Leger (1992) reasoned that recognition and learning from the workforce's tacit knowledge and skills could result in improved OHS performance in the mining sector.

Ryan (2000) reasoned that safe behaviour catalyses the cultivation of positive OHS culture and the impact of safe behaviour on OHS performance will be marginal in the absence of a strong OHS culture. Ryan (2000) suggested the following practices could facilitate in moulding safe behaviours and subsequent establishment of a strong OHS culture:

- Conducting regular behaviour-based safety (BBS) observations on the workforce and providing coaching, mentoring and timeous feedback on the observations.
- Increased awareness, communication and regular feedback on OHS matters encourages safe behaviours.
- Rewarding OHS achievements.

- Educating and training all employees on human factors, noting that a sound understanding of human factors and limitations of human performance will influence worker attitudes towards OHS practices that are designed to mitigate the limitations. This will also enhance the ability of leaders to influence the desired OHS behaviours within the workforce.

King (2000) suggested that BBS programs could facilitate moulding of the correct behaviours to promote cultivation of positive OHS culture. The BBS program could be driven by the behaviour observation team that will be responsible for peer-to-peer observation, coupled with immediate feedback and discussion of observed safe and at-risk behaviours (King, 2000). King (2000) added that the team should comprise a senior manager (chairperson), OHS practitioner (technical advisor) and behaviour observation team drawn from the workforce. Moreover, the team should meet regularly to review the data coming out of the observation process, in order to identify constraints to safe behaviour as well as formulating recommendations for improvement (King, 2000).

The MOSH behaviour change model is based on the premise that poor appreciation of OHS risks and controls, and misconceptions such as potential negative impact of OHS initiatives on productivity could hinder the adoption of leading OHS practices (MOSH, n.d.). Thus, the model seeks to cultivate positive OHS behaviour and enhance commitment and buy in through interventions such (MOSH, n.d.):

- Behavioural communication plan to create better understanding of the OHS risks, risk management and requirements for sustainable adoption of OHS leading practices.
- Leadership behavioural plan to address leadership support, training and behavioural requirements.

The MOSH behaviour change model has been successfully used in the SAMI to facilitate the adoption of leading OHS practices and the model could be tailored to nurture the behaviour that promotes the establishment of positive OHS culture.

The literature study revealed that the establishment of good OHS behaviour at all levels within the organisation is critical for continuous improvement of OHS and establishment of positive OHS culture. The importance of holistically incorporating human factors in all aspects of the OHSMS was also noted. Good OHS behaviour could be enhanced through interventions such as developing and implementing OHS behaviour-based programs, incentivising OHS achievements, education and training, and increasing awareness, communication and regular feedback on OHS matters.

3.4.5 OHS leadership

One of the objectives of the MHSA is to promote positive OHS culture in the SAMI (MHSA, 1996). ICS (2013) argued that the key to establishing and sustaining a strong OHS culture is for all levels within the organisation to recognise that OHS is a matter of enlightened self-interest. Thus, the employees will be less likely to be the victims of accidents, and the company can use positive OHS culture as a means of maximising the financial benefit and cost savings that may be derived from implementing effective OHSMS (ICS, 2013).

OHS leadership can be defined as the process of championing a number of OHS related activities such as setting OHS goals, defining OHS values, desired OHS behaviour and culture, providing the required support and resources, and engaging, influencing and motivating all stakeholders, in order to enable the organisation to attain its OHS goals (de Jager, 2018). In other words, OHS leadership applies to the behaviour of people with positional, relational and expert authority. The different levels of leadership within the organisation can be categorised into corporate, management and supervisory levels. OHS committees mandated with driving OHS improvement initiatives also form part of OHS leadership. However, in the SAMI, the term leadership is usually used to refer to management. As a result, corporate leadership, frontline supervisors and OHS committees are discussed separately in subsequent subsections for emphasis purposes.

Hermanus (2007), de Jager (2018) and Mohapi and Zarske (2019) argued that sound OHS leadership should be focused on the role of leadership in setting clear OHS expectations, aligning business and OHS goals, effective OHS risk management, encourage all levels of leadership to walk the zero harm talk, establish climate of trust, and enhance open communication, contribution and participation of all employees. Stranks (2007), de Jager (2018) and CBI (1991) added that leaders at all levels should be made accountable for OHS, have a shared vision of zero harm, take an active role in OHS continuous improvement initiatives and influence a positive OHS culture through interventions such as enforcing compliance with OHS legislation, standards and procedures, planned task observations, coaching and training.

Hopkins (2006) suggested that the establishment of a safe and healthy work environment and the cultivation of high performance organisational OHS culture requires maximum buy-in, support, approval and commitment from all levels of leadership within the organisation. According to ICS (2013) and Stranks (2007), a properly crafted cost-benefit analysis of the social and economic impacts of OHS incidents can be utilised as an important tool to secure some buy-in to invest in OHS improvement initiatives across all levels of leadership. King (2000) added that holding workshops with all levels of leadership could assist to secure the leaders' buy in and commitment to the goal of zero harm production. At these workshops, SMART OHS action plans are developed, and the leaders are also empowered to lead safely, and effectively engage and empower the workforce on OHS matters (King, 2000).

IOSH (2015) argued that if all levels of leadership within the organisation lead safely, then the entire workforce was likely to act and think safely. Leading by example, integrity, active participation and commitment are some of the critical drivers of trust, confidence and positive OHS culture (de Jager, 2018). Stranks (2007) concurred that the active participation of top leadership (directors, partners, senior managers, etc.) in the OHS performance improvement initiatives will catalyse the cultivation of positive OHS culture in middle managers, supervisors and the entire workforce. IOSH (2015), ICS (2013) and CBI (1991) added that in-order to establish a positive OHS culture, leaders must always demonstrate genuine and visible

commitment to OHS and they must walk the zero harm talk. The leaders should commit and accept the responsibility to continually improve OHS performance and this vision must be cascaded down to all levels of the organisation (de Jager, 2018; IOSH, 2015; ICS, 2013). In other words, if the organisation's values encourage zero harm production and the leadership always walk the zero harm production talk, then zero harm production will likely become a culture at the organisation.

The South African hard rock conventional underground mines have been struggling to remain viable due to a number of challenges such decreasing productivity, increasing operational costs and poor OHS performance (Pelders et al., 2019). The continually increasing mining depth and horizontal distances from the shafts to workplaces have also significantly reduced the available face time to complete the different mining cycle activities (Pelders et al., 2019). In an attempt to remain viable, mines have implemented a number of interventions to reduce operational costs, improve productivity and increase profitability (Phakathi, 2002; Phakathi, 2009). For example, in order to reduce operational costs some mining companies resorted to measures such as "doing more with less" by reducing the size of the workforce and cutting on mining consumables.

Determined to meet production targets and qualify for production bonuses, frontline supervisors and the workforce have resorted to short-cuts and violations of standard working procedures, through informal working practice known as 'planisa' (make a plan) (Phakathi, 2002; Phakathi, 2009). Stewart and Nite (2017) noted that although the culture of blame is gradually changing, the prioritisation of production (production pressures) over OHS remains a serious OHS challenge, particularly in underground mines. In this case, the prioritisation of production over OHS is cascaded down across all levels of leadership, resulting in shop-floor workers taking short-cuts and dis-regarding working standards in order to meet production targets, hence increased risk of OHS incidents. Phakathi (2002) and Phakathi (2009) argued that 'planisa' is a risky informal work practice that exposes the workforce to increased OHS risks. It can be argued that commitment to OHS by all levels of leadership and provision of adequate resources (labour, equipment, consumables, time, etc.) will significantly reduce the

prevalence of the 'planisa' practice in the sector, subsequently resulting in improved OHS and productivity.

Casey (2012) (cited in Cronje and Rajan, 2015) proposed an OHS leadership behavioural framework (Figure 3.21), comprising eight behavioural dimensions (supporting, recognising, actively caring, collaborating, vision, inspiring, role modelling and challenging). The framework could assist organisations to develop credible OHS leadership that is capable of planning, organising, leading, controlling, motivating, influencing and making decisions based on OHS values (Cronje and Rajan, 2015). Moreover, a study by Zungu (2014) found that increasing the number of women employed in the South African mining sector and in different OHS leadership roles could have a positive effect on OHS and productivity.



Figure 3.21: Dimensions of OHS leadership (Casey (2012) (cited in Cronje and Rajan, 2015))

3.4.5.1 OHS leadership at corporate level

Stranks (2007) and CBI (1991) suggested that the departure point for sound OHS management is for the organisation to develop and disseminate an OHS mission statement detailing the organisation's intentions, expectations and beliefs in relation to OHS. The OHS mission statement must be backed up by a robust OHSMS, adequate resources (time, budget, and expertise), right incentive systems and a SMART implementation plan (Stranks, 2007; CBI, 1991). Moreover, OHS leadership at corporate level should embrace zero harm as a top priority and non-negotiable value of the organisation (de Jager, 2018).

King (2000) highlighted that it is critical for the organisation to establish a corporate OHS leadership team, responsible for championing OHS policy and strategy. King (2000) added that the corporate OHS leadership team should include site representation to direct the focus to real OHS issues faced by the people at the coal face. Ikin (2017) added that there could be a need to review the organisational structure in order to create a conducive platform for OHS culture change. Stranks (2007) also suggested that it is also important for the organisation to clearly define OHS responsibilities for all levels within the organisation, recognising that OHS is a line management function. The CBI (1991) concurred that OHS management should be made a line management responsibility in order to continually improve on OHS performance.

3.4.5.2 OHS leadership at supervisory level

Pitzer (2009) suggested that valued and credible OHS leadership at all levels, particularly first line supervisors, is critical for cultivating a positive OHS culture. Frontline supervisors are responsible for ensuring that the workforce deliver on the organisation's objectives (such as production, quality and OHS) and are the channel of communication between management and workforce (Weule, 2016). Weule (2016) argued that in most operations everything is channelled via the supervisor (Figure 3.22), thus the supervisor must have the capability, time and support to ensure that the transmission channels are not blocked. It is important for organisations to focus on providing adequate frontline supervision, with the right behaviour, competency and skills, to influence zero harm production.

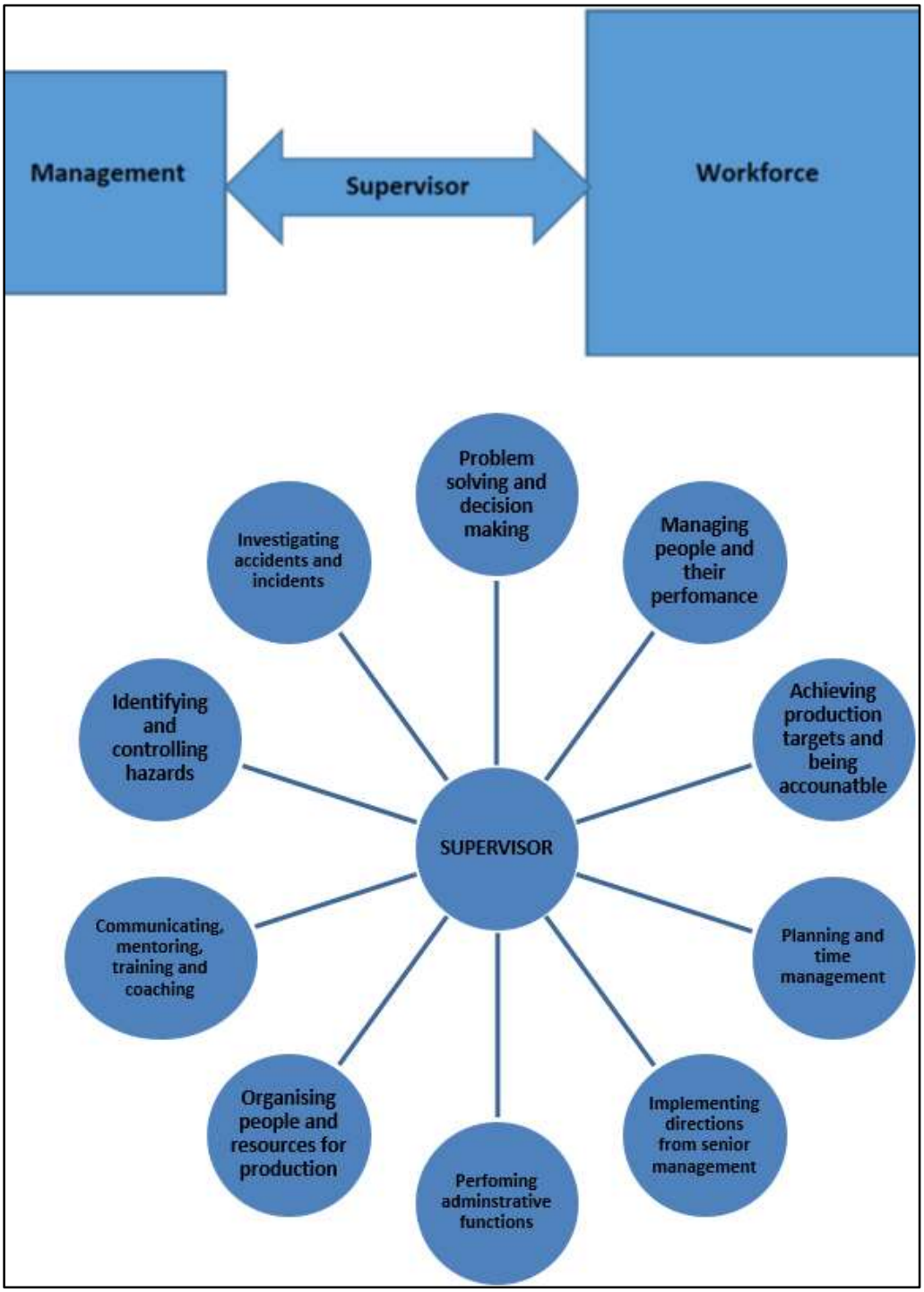


Figure 3.22: Illustration of the role of supervisors (adapted from Weule, 2016)

3.4.5.3 Establishment of OHS culture improvement committee

Stranks (2007) and Ryan (2000) suggested that an OHS culture improvement committee should be established in order to champion, facilitate, support, direct, evaluate and monitor the OHS culture improvement initiatives. The committee will also be charged with management of OHS compliance and providing feedback to all stakeholders. The committee (chaired by a senior manager) should comprise management and workforce representatives, and the OHS practitioner could provide secretarial services and technical advice to the committee (Stranks, 2007). According to Stranks (2007), the credibility of the committee could be enhanced through measures such as timeous implementation of recommendations, regular progress updates and timeous feedback, including reasons why certain recommendations could not be implemented. Stranks (2007) added that the committee should be adequately empowered and resourced to allow it to effectively deliver on its mandate. The communication can be done through posters, notice boards, newsletters and progress updates at pre-shift and departmental meetings (Stranks, 2007; Ryan, 2000).

King (2000) suggested that the establishment of a "zero harm team" could also facilitate cultivation of positive OHS culture. The team should be chaired by a senior manager and should have representation from middle management and crew. The team could focus on proactive OHS risk management and continuous OHS improvement initiatives (King, 2000). King (2000) added that the composition of the team enables effective identification of real OHS challenges faced at the mine face as well as expedite decision making and implementation of corrective measures. The team should also provide timeous and clear communication of their activities, in terms of ideas raised and rejected, ideas implemented, and work in progress (King, 2000).

From the literature reviewed, it can be concluded that establishing and sustaining a positive OHS culture in the workforce is dependent on leaders: their commitment, buy in and support to the zero harm production, leadership style and approach (effective communication and engagement with the workforce).

3.4.6 Effective participation of the workforce on OHS management

Section 25 (Chapter 3) of the MHSA requires the workforce to participate in OHS management (MHSA, 1996). The MHSA recognises that in-order to establish an effective OHSMS, it is critical to put in place some innovative strategies to win the hearts and minds of the workforce, thus ensuring their maximum buy-in, cooperation and participation on OHS matters. Hermanus (2007) and Smith and Summer (2014) argued that the employees have a major interest in OHS since they are the ones who are directly exposed to most of the OHS risks. Stranks (2007) added that any organisational initiative, such as OHS management, which is valued and genuinely pursued by all levels within the organisation can potentially strengthen organisational culture. OHS management evidently offers competitive benefits to the entire workforce compared to other initiatives such as quality management and productivity, thus there is a relatively higher potential for buy-in by the workforce on OHS matters than on other initiatives (Stranks, 2007).

According to Smith and Summer (2014), successful implementation of any initiative at a particular workplace is reliant on the workforce's level of understanding of the initiative and eagerness to implement. Smith and Summer (2014) added that the workforce is always at the mine face and has hands-on appreciation of all the OHS risks. Thus, the workforce must be sufficiently involved in the entire OHS management value chain (development and implementation of OHS system and procedures, risk management, continuous improvement initiatives, etc.). Ikin (2017) added that is crucial to enable engagement on OHS matters at all levels through practices such as making OHS matters a standing agenda item for all meetings, creating times for leaders to engage with the workforce and setting the engagement criteria.

Hermanus (2007) highlighted that evidence from research and OHS incidents investigations indicate that the employees are not sufficiently engaged on OHS matters in the SAMI. Resultantly, organisations tend to miss some critical information on OHS issues which are faced by the workforce at the mine face as well as practical inputs on management and continuous improvement on OHS. Hermanus (2007) noted that effective engagement was complicated by the SAMI's negative legacies such as lack of trust, poor labour relations,

racism, genderism, ethnicity, illiteracy and language barriers. Hermanus (2007) added that the increased use of contractors in the mining sector could be negatively impacting on OHS performance in the absence of a proper contractor management guidelines.

Hermanus (2007) argued that although some managers tend to believe that effective employee engagement could threaten effective management at operations, evidence reveal that effective engagement of all stakeholders (including the workforce) on OHS matters results in improved OHS performance. Hermanus (2007) suggested that management's ability to listen to the workforce's OHS concerns and the acknowledgement by the workforce of how management value OHS, is a critical driver of positive OHS culture. Smith and Summer (2014) added that OHS performance could be improved through use of innovative targeted communication and training, taking cognisance of factors such as literacy levels and language barriers.

Wipaki and Dodd (2014) described the "Switch on" program, which was developed and implemented at Glencore's Mount Isa Mines. The programme was tailored to win the hearts and minds of the workforce: hence secure the buy-in, commitment, support and establishment of sustainable positive OHS behaviours to enable sustainable improvement in OHS (Wipaki and Dodd, 2014). According to Wipaki and Dodd (2014), the objectives of the "Switch on" programme were achieved through improved engagement, open communication, ownership/accountability and teamwork at all levels within the organisation, and continuous improvement of the OHSMS. Post implementation of the program, there was evidence of improvement in OHS culture, and health and safety awareness both at and outside the workplace (Wipaki and Dodd, 2014). King (2000) examined Bechtel Australia's strategy of promoting commitment to zero harm production at all levels within the organisation. The strategy was mainly underpinned by the ability to effectively communicate, consult and engage with all levels within the organisation in order to create ownership, buy-in and commitment (King, 2000).

Stranks (2007) proposed a culture change framework illustrating how an organisation can manage the culture elements (cooperation, consultation and competence) to create a common

understanding, commitment, ownership and cooperation on OHS matters at all levels within the organisation (Figure 3.23).

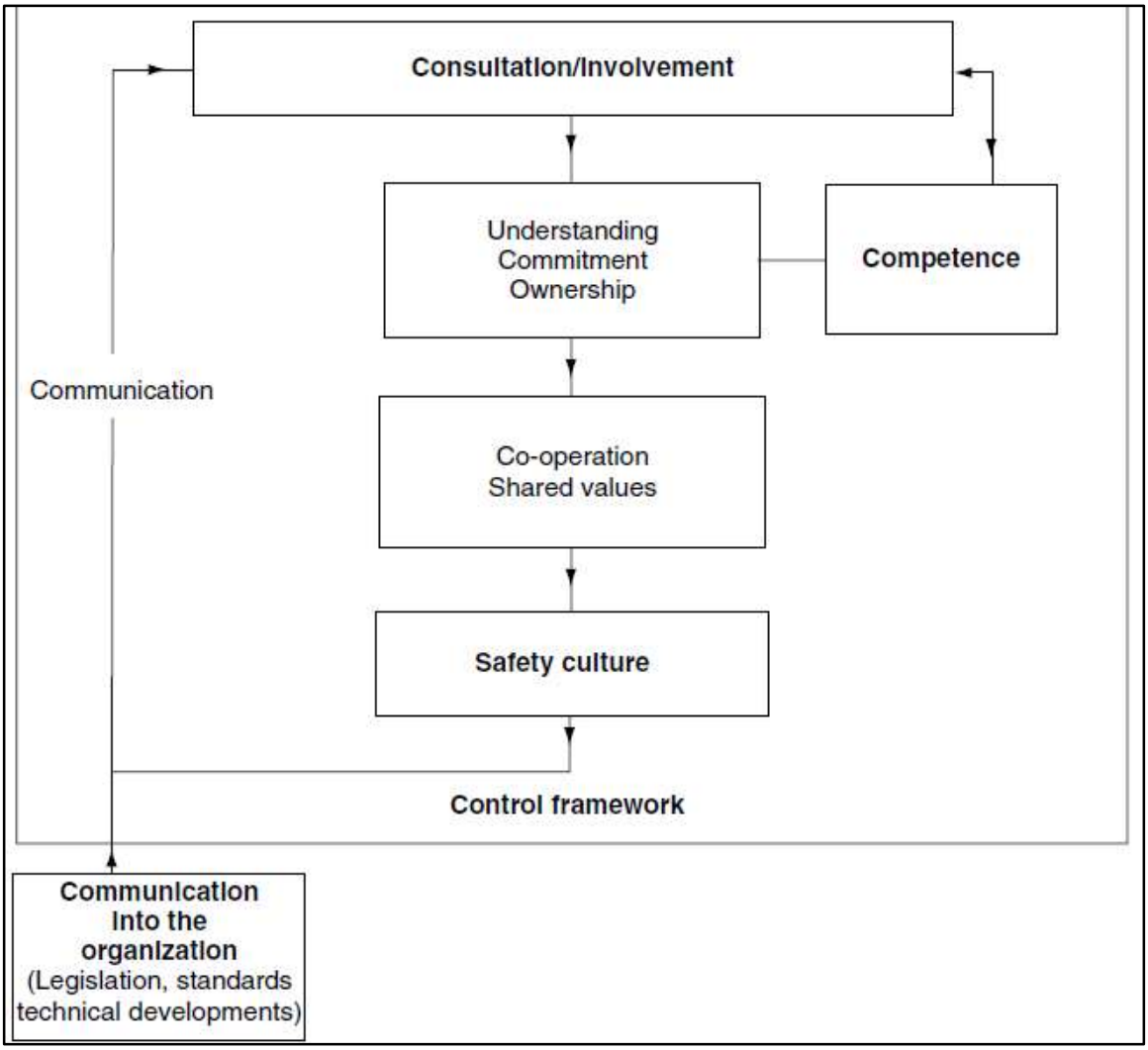


Figure 3.23: OHS culture change framework through involvement of workforce (Stranks, 2007)

The literature reviewed identified the following as some of the enablers of effective workforce participation on OHS matters (IOSH, 2015; Stranks, 2007; CBI, 1991; Hopkins, 2006; Ryan, 2000):

- Establish mechanisms to facilitate effective engagement, consultation and participation of the workforce on OHS matters.
- Timeous and effective communication with the workforce on all OHS matters. The workforce are the implementors and vehicles for change, thus they must have a thorough understanding of all OHS matters. Efforts must be made to ensure that all communication is appropriately tailored to suite the target audience. It is also critical to create an environment where the workforce freely and openly communicate about OHS matters.
- All levels within the organisation should always demonstrate commitment to comply with OHS legistlation, standards and procedurees. Compliance with OHS legistlation, standards and procedurees should also be made a condition of employement.
- The workforce should be given a clear responsibility of ensuring zero harm production.
- Recognition that improving OHS culture is a gradual process which requires proper planning, implementation and continuos improvement. Trying to change the culture haphazardly might generate some resistance from the workforce.
- Influential members within the workforce can be usefull vehicles to champion the OHS culture change process.
- Establishment of mutual trust, respect and confidence between management and the workforce, at all levels within the organisation is critical for cultivation of positive OHS culture.
- All levels within the organisation should be empowered in areas such as OHS risk management, legal requirements, OHS procedures, communication and team building, through interventions such as education, training, coaching and workshops.
- Recognising outstanding OHS performance, for example through the estalishment of OHS awards (such as best OHS team, best OHS representative etc), could enhance the OHS culture improvement initiative.

King (2000) suggested that having regular employee focused OHS meetings, fostering high performing teams capable of working collaboratively and communicating effectively could enhance the effectiveness of the risk managment process, resulting in improved OHS culture and performance. During the focused OHS meetings with the workforce, the crew should be

challenged to continually look for innovative ways of improving OHS and the leaders must objectively consider the new ideas and provide timely feedback to the workforce (King, 2000).

The literature study revealed that effective participation of all stakeholders (including the workforce) on OHS matters was critical for continuos improvement of OHS and establishment of a strong OHS culture. Effective participation of the workforce could be enhance by interventons such as training, two-way communication, effective consultation and egagement, and establishing mutual trust and defining clear OHS roles at all levels.

3.4.7 Technological innovation

The SAMI shares a common goal of attaining zero harm and technological innovation could result in improved OHS and improved efficiency of the risk management process. Hermanus (2017) suggested that the use of technology such as wearables with embedded sensors for monitoring fatigue, location and proximity detection, and systems for executing demand-based allocation of mine services such as water, energy and ventilation to specific parts of a mine, will improve OHS. Technological innovation could facilitate removal of workforce from high risk and hazardous areas of the mine (allowing workforce to remotely operate equipment from safe locations) and reduction of manual labour and labour intensity, resulting in improved OHS (Willis et al., 2004). However, modernisation could introduce new OHS, environmental and social risks (Lynas and Horberry, 2011), and it is important to conduct research to understand risks and other shortcomings, and develop appropriate mitigation strategies.

Most operations in the mining sector are dependent on electricity and diesel as the major energy source, and the sector has been battling with challenges such as increasing energy cost and shortages (Griffith, 2019). Innovation could offer an opportunity for the development of alternative green energy sources such as fuel cells, hydropower, solar power and hydraulic power, resulting in significant environmental improvements such as reduced air, noise and water pollution, reduced energy costs and increased production (Abrahamsson and Johansson, 2008). For instance, Evans (2019) reported that the construction of a fully electric mine by a

Canadian mining company eliminated the need for around two million litres of diesel per year, resulting in reduction of greenhouse gas emissions by 70%.

3.4.8 Holistic consideration of potential threats to establishment of positive OHS culture

Hudson (n.d) and Stephan and Soto (2015) argued that a number of barriers such as bureaucratic culture, prevailing legislative regime, prevailing social, political and economic environment, prevailing national OHS culture, leadership deficiencies and lack of a proper change management strategy, could inhibit the cultivation of postive OHS culture in organisations. Stephan and Soto (2015) added that any workforce that is exposed to adverse social, political and economic conditions, such as political instability, war, inflation, and job insecurity, could be psychologically strained. This could result in increased occurrence of mental lapses and OHS incidents. Thus, sound management of OHS should also take into consideration these factors.Some of the barriers to establishment of positive OHS culture are elaborated as follows:

- ***The prevailing OHS culture at the organisation***: pathological organisations do not care for OHS improvement, while reactive organisations believe that further OHS performance improvement is not feasible. Calculative organisations are usually bureaucratic and tend to be more comfortable in maintaining the status quo (Hudson, n.d.).
- ***The size of the organisation*** – advanced OHS cultures (proactive or generative) are easier to establish in smaller as compared to larger and often bureaucratic, complex and inflexible organisations. However resistance to change and failure to correctly quantify the correct benefits associated advanced OHS cultures might inhibit change in smaller organisations (Hudson, n.d.).
- ***Prevailing regulatory regime*** – Hudson (n.d.) argued that although a sound regulatory framework may promote the transition from pathological to reactive and calculative cultures, it can inhibit further progression to advanced OHS cultures. Establishment of advanced OHS cultures may require some adjustments of specialised OHS staff, OHSMS, and usually involve experimental improvement which is not supported by law. Potential remedies include promoting goal-setting regulatory regimes, reducing

audit frequencies in organisations with better OHS performance and improved focus on auditing the culture rather than activities (Hudson, n.d.).

- ***Leadership deficiencies*** - leadership changes, change of priorities and lake of management commitment may hinder sequencial improvements in OHS culture. In most cases management tend to become complacent once significant improvements in OHS have been attained, or revert back to old methodologies, in cases where culture change initiatives fails to yield intended results. Thus, it is critical for management and the workforce to avoid regression, sustain and continuously improve OHS culture (Hudson, n.d.).
- ***Resistance to change*** – prevailing beliefs and values may inhibit improvement in OHS culture (Hudson.nd).

Globally, the dynamics of many wokplaces are rapidily changing, and are characterised by technological innovations, job losses, increased use of contractors, new shift schedules, increasing inequality, prevalance of migrant workers and new OHS challenges (Kim et al., 2016; Hermanus, 2007). Sustainanble management of OHS, in the presence of these new and emerging challenges requires the adoption of a robust prevention culture at the national level (Hopkins, 2006; Kim et al., 2016; ILO, 2009). In its Promotional Framework for OHS Convention No. 187, the International Labour Oganisation (ILO) (2006), defined a national preventative OHS culture as one in which "*the right to a safe and healthy working environment is respected at all levels, where governments, employers, and workers actively participate in securing a safe and healthy environment through a system of defined rights, responsibilities, and duties, and where the highest priority is accorded to the principle of prevention*". The ILO Convention No. 187 provides a national framework for dealing with OHS matters, with a focus on establishment of national health and safety management system, implementation and review of policies, enforcement of regulations and fostering of effective collaboation between all key stakeholders. Thus, it is critical for organisations to appropriately manage potential threats that may hinder the cultivation of positive OHS culture. Moreover, OHS culture and prevention culture can be attained and sustained when the society in its totality takes responsibility for health and safety, including promoting and incorporating health and safety in broad national agendas (Kim et al., 2016).

The study showed that a holistic consideration of potential threats to establishment of positive OHS culture is crucial. The establishment of positive OHS culture could be affected by issues such as prevailing national health and safety culture, and prevailing legislative, social, political and economic environment.

3.5 Conclusion

The literature review explored the concept of OHS culture in terms of what OHS culture is (definition(s), characteristics and impacts), how OHS culture can evolve within an organisation and critical success factors for cultivating positive OHS culture. Some authors have contributed to developing the concept of OHS culture by recognising the effect of organisational culture and human factors on decision-making about OHS. OHS culture can be defined as the way in which OHS matters are dealt with at a particular organisation (pattern of shared assumptions on OHS matters). OHS culture is influenced by factors such as behaviour (daily activities), shared values (beliefs about what is important), perceptions, attitudes and feelings. Although most of the literature that was reviewed explicitly covered safety culture, similar concepts could be applicable to health culture. As a result, the term OHS culture was adopted in the report. This is aligned to the current global best practice of integrated OHSMS that has been adopted by most organisations, including the mining industry. The use of integrated OHSMS result in simplified processes and reduction in time, costs and required resources and effort.

Some authors have described OHS culture in terms of elements (characteristics) such as informed, reporting, learning, just, flexible, collaborative and compliance culture. Additional elements include existence of shared OHS values, OHS goals (for example zero harm), OHSMS and clear OHS roles and responsibilities, commitment to zero harm, recognition of OHS as top priority, decentralisation of OHS decision making, and empowering all employees to effectively manage OHS risks.

Evidence from the literature that was reviewed suggests that cultivating and sustaining positive OHS culture will potentially enhance the effectiveness of OHSMS, increase commitment and

prioritisation of OHS, and enable progressive OHS improvements in the mining sector. Benefits of nurturing a strong OHS culture (hence sound OHS management) include reduced OHS incidents, absenteeism, labour turnover, production disruptions, insurance costs, workers' compensation costs and emergency response costs. This will have a positive effect on productivity, profitability (hence increased shareholder value) and the organisation's reputation (social corporate responsibility).

The concept of OHS culture evolved as organisations explored alternative ways of breaking the OHS performance plateau, after the implementation of OHSMS and technical interventions. The prevailing OHS culture could be determined using a combination of OHS culture assessment tools and OHS culture evolution models. OHS culture evolution models could also provide insight into the development of a strategy to progressively improve OHS culture. The process of changing OHS culture is gradual, and the use of a structured change management process could mitigate threats that could obstruct the cultivation of positive OHS culture.

The critical success factors for cultivation of a strong OHS culture that were revealed by the literature study include establishing a comprehensive OHSMS, effective OHS risk management, learning from OHS incidents, cultivating and sustaining desired OHS behaviour, and nurturing and sustaining desired OHS leadership. Additional factors include promoting effective participation of all stakeholders (including the workforce) on OHS matters, use of technological innovation to improve OHS and taking a holistic consideration of potential threats to establishment of positive OHS culture. Figure 3.24 provides a summary of the main findings from the literature study.

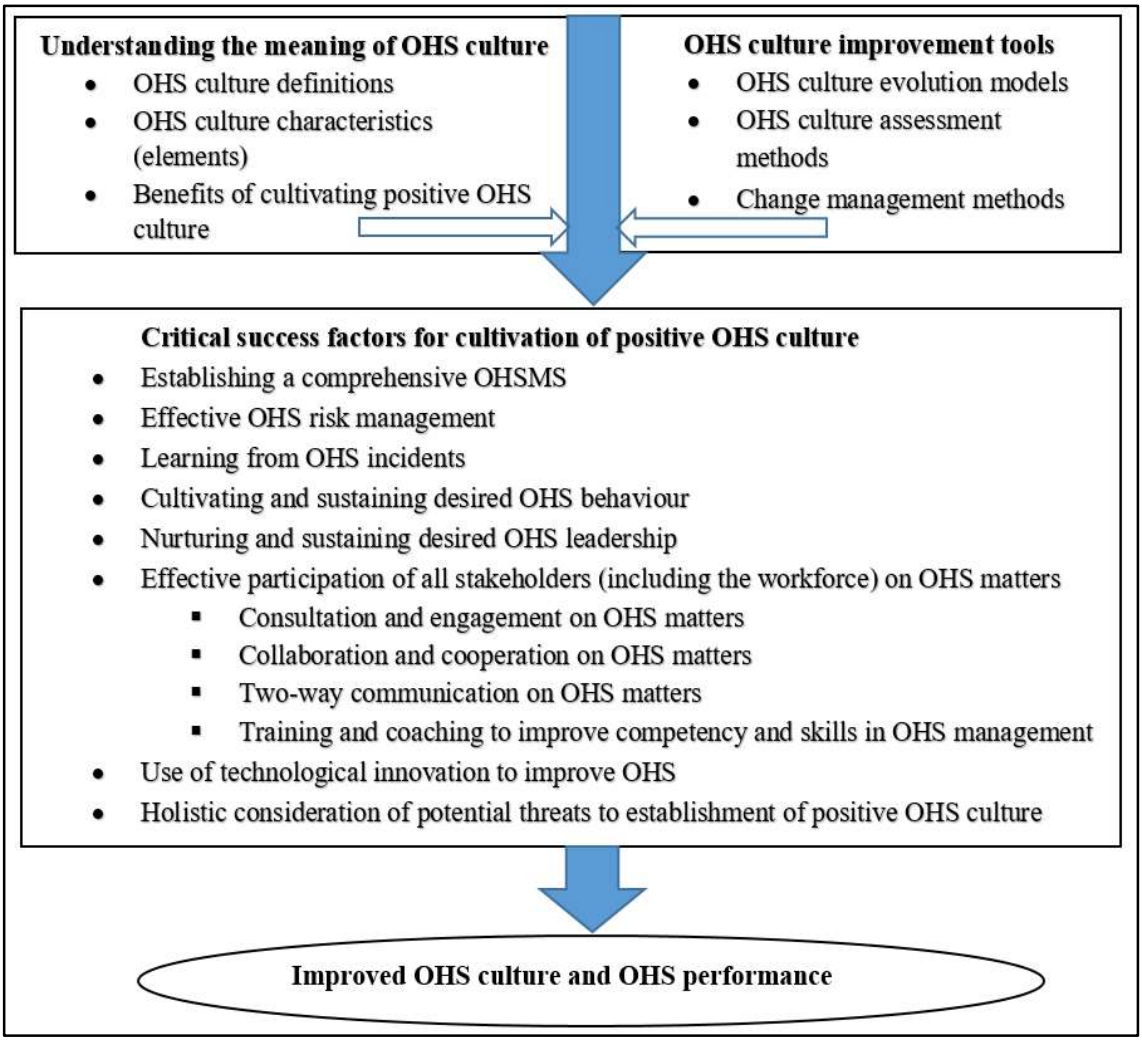


Figure 3.24: Summary of the main findings from the literature study

CHAPTER 4 : ANALYSIS OF THE CTF AGAINST BEST PRACTICE

4.1 Introduction

Gap analysis can be broadly defined as a structured process of comparing the actual performance of a system against the potential or envisaged performance (Aksorn and Hadikusumo 2007). In the context of the current study, a gap analysis was undertaken in order to benchmark the CTF against global practices in OHS culture management (step 2 in Figure 4.1).

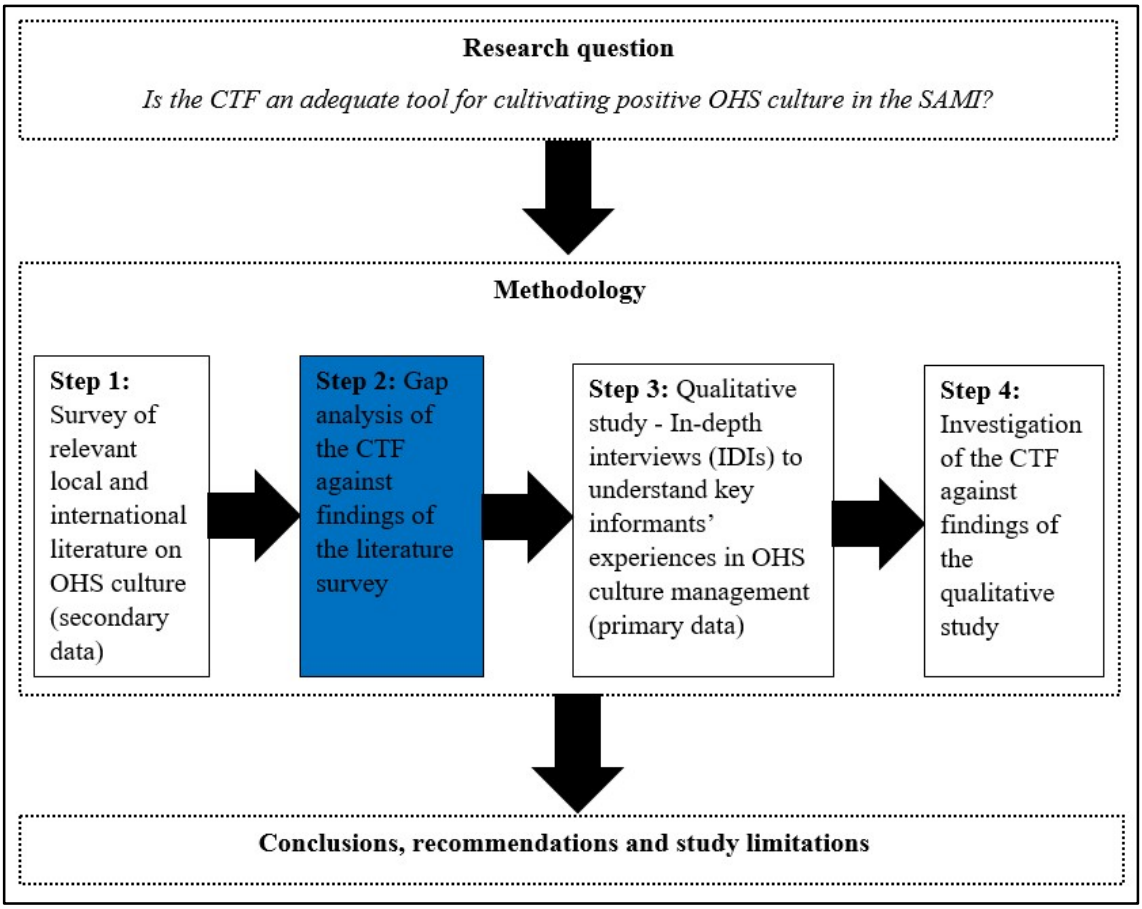


Figure 4.1: Illustration of the research methodology

The CTF was analysed to ascertain whether it provided adequate information to allow the end users to understand the OHS culture concept in terms of its definition, and characteristics and importance of cultivating positive OHS culture. The CTF was also reviewed to determine if it provided guidance on OHS culture evolution models, OHS culture assessment techniques and change management considerations during the OHS culture change process. Moreover, the different aspects of OHS culture in the CTF were analysed against the critical success factors for establishment of positive OHS culture that were identified by the literature study. The critical success factors include sound OHSMS, effective OHS risk management, learning from OHS incidents, right OHS behaviour, sound OHS leadership and fostering effective participation of all stakeholders (including the workforce) on OHS matters.

The gaps between the CTF and best practices in OHS culture management could constraint the effectiveness of the CTF as a tool for enabling continuous improvement in OHS culture and OHS performance in the SAMI. Thus, the gap analysis process was necessary to identify opportunities for improving the CTF, based on the identified gaps between the CTF and best practices in OHS culture that were revealed by the literature survey.

4.2 Understanding the OHS culture concept in the CTF

4.2.1 Definitions of OHS culture and zero harm in the CTF

In the CTF, the MHSC (n.d.) defined OHS culture in terms of some of the OHS culture elements as *"the extent to which individuals and groups will commit to personal responsibility for health and safety; act to preserve, enhance and communicate health and safety concerns; strive to actively learn, adapt and modify (both individual and organisational) behaviour based on lessons learned from mistakes; and be rewarded in a manner consistent with these values."* The definition is different from the definitions provided in literature (Hudson, 1999; IOSH, 2015; ICS, 2013; HSC, 1993; Mohammadfam et al., 2013). Although the CTF defines OHS culture in terms of some of the OHS culture elements, the definition limits a holistic understanding of the OHS culture concept. The concept of OHS culture could be better

understood if OHS culture is defined in terms of shared assumptions on OHS issues and factors that influence the assumptions. A robust understanding of the OHS culture concept offers a fundamental departure point towards developing a strategy for improving OHS culture. OHS culture should be understood in terms of the following:

- What is OHS culture (definition, evolution, elements, etc.)?
- Reasons for adoption of OHS culture (why)?
- How could OHS culture be improved?

Furthermore, the CTF aims to assist the mining sector to attain a future in which *"every mine employee shall return home unharmed every day"*, i.e. a future in which there shall be zero harm (MHSC, n.d.). In other words, the CTF advocates for adoption of zero harm as a value, belief and goal by the SAMI. However, the CTF does not discuss the meaning and rationality of the zero harm concept that is important to debunk any ambiguities and secure people's buy-in and commitment to the OHS culture improvement initiatives. Moreover, it is fundamental to acknowledge that whilst most of the OHS incidents can be practically prevented, there are still some challenges, such as rock mass behaviour in underground mines that are not yet fully understood, controlled or predicted.

4.2.2 Characteristics of positive OHS culture in the CTF

The literature revealed the following characteristics of positive OHS culture that are also addressed in the CTF (Fleming, 2001; ICS, 2013; Hopkins, 2006; Coghlan, 2016; Reason, 1997):

- Shared values on OHS and commitment to zero harm production by all levels within the organisation.
- Recognition of OHS as a top priority that should be integrated in all operational aspects of the organisation.
- The requirement for clear OHS roles and responsibilities.
- Collaborative, just and learning cultures.

However, the CTF does not address the following OHS culture elements that were revealed by the literature study (Hudson, 1999; Hopkins, 2006; Fleming, 2001; ICS, 2013; Stranks, 2007; Coghlan, 2016):

- Decentralisation of OHS decision making and accountability at all levels within the organisation on OHS matters.
- The need to capacitate all levels within the organisation to effectively manage OHS risks. Capacitation could include training, coaching and provision of adequate resources such as time, human resources and funding.
- The importance of robust OHSMS, standards, policies and procedures to enable effective management of OHS.
- Reporting, flexible and informed culture.

Moreover, the CTF also covers the following elements that were not explicitly addressed by the literature review:

- Improvement of OHS through implementation of technological innovation, research outcomes and leading practices.
- Elimination of any form of unfair discrimination such as genderism and racism. This is relevant to correct some of the negative legacies of the SAMI.
- The requirement for a robust regulatory regime comprising clear and enforceable minimum standards and sound enforcement mechanisms.

It is important to update the CTF to ensure that it addresses all relevant OHS culture elements that were identified by the literature. A holistic understanding of OHS culture elements allows the organisation to develop an informed, comprehensive and SMART OHS culture improvement strategy.

4.2.3 Impacts of OHS culture in the CTF

The literature reviewed suggested that organisations with strong OHS culture have relatively better OHS performance and high productivity compared to organisations with poor OHS

culture (Kotter and Heskett, 1992; Randolph, 1989; Collins and Parras, 1994; Hopkins, 2006; Hudson, 1999). Furthermore, the literature study revealed that effective management of OHS was a matter of enlightened self-interest for all stakeholders. All the stakeholders will benefit from improved OHS, whilst the business will realise associated benefits such as improved productivity, good cooperate image and reduction in costs associated OHS incidents such as insurance, compensation and litigation costs (Stranks, 2007; Hopkins, 2006; Hudson, 1999; Hudson, n.d.). However, the CTF does not provide a motivation for organisations to invest in OHS culture improvement initiatives. In order to entice mining companies to develop and implement OHS culture improvement initiatives, the CTF should articulate the benefits associated with positive OHS culture and debunk the notion that "improving OHS" is a cost centre.

4.3 OHS culture evolution, assessment, reporting and change management in the CTF

4.3.1 The evolution, assessment and reporting of OHS culture in the CTF

The CTF does not elaborate on the characteristics of the different OHS culture evolution stages and how OHS culture evolves from the poorest (pathological) OHS culture to the strongest (generative) OHS culture. Moreover, the CTF does not provide guidance on techniques that could be used to continually assess the prevailing OHS culture within an organisation. A comprehensive understanding of the prevailing OHS culture and the different OHS culture evolution stages will allow the organisation to develop an informed OHS culture improvement strategy (Westrum, 1993; Kim et al., 2016; Hudson, 1999; Hudson, n.d.; Ryan, 2000; Walter, 2012; Fleming, 2001).

The performance indicators for the progress of implementation of the CTF pillars are defined in terms of the status of the programme to meet the requirements of each CTF pillar. The performance indicators are based on whether such a programme is available, planned, developed, implemented or has been reviewed for suitability. The OHS culture performance indicators in the CTF are not aligned to the performance indicators identified by the study and

they do not provide a true reflection of the state of OHS culture, hence effectiveness of OHS culture improvement initiatives. Moreover, the CTF requires the mines to report the progress on the implementation of the CTF pillars as part of the Mining Charter commitments. The current CTF reporting requirements could dilute the importance of promoting OHS culture in the practice of OHS management. The need to cultivate positive OHS culture is a MHSA requirement that should be enforced and reported like any other OHS performance indicators such as fatalities, injuries, occupational exposures and occupational diseases.

4.3.2 Change management considerations in the CTF

The literature review found that a structured change management process will mitigate threats that could obstruct successful establishment of strong OHS culture (IOSH, 2015; Ryan, 2000; ICS, 2013; CBI, 1991; Kim et al., 2016). The OHS culture change process is gradual and cumbersome. The CTF does not recommend a change management process that could be followed by the mines to aid successful establishment of a strong OHS culture. The inclusion of change management guidelines could facilitate successful establishment of positive OHS culture at mines, enabling progressive OHS improvements.

In terms of implementation, the 2014 OHS summit milestones require the SAMI to implement the CTF pillars in two phases as follows:

- Phase 1 - implementation of the leadership, risk management, data management, diversity management, leading practice and bonus and performance incentive pillars by December 2020.
- Phase 2 - implementation of the integrated mining activity, technology, inspectorate, tripartism and regulatory framework pillars after December 2020.

Although the phased implementation approach of the CTF pillars could make the implementation process easier, the approach could also result in marginal OHS culture change and OHS performance improvement. As revealed by the literature, the individual OHSMS

elements are interrelated and interact with different components of the OHSMS (Shorrock et al., 2014; Geller, 1996; Hermanus, 2007; IOSH, 2015). Resultantly, a holistic approach, in which all the CTF pillars are concurrently implemented and managed will potentially result in optimum OHS culture change and OHS performance improvement.

4.4 Critical success factors for cultivating positive OHS culture in the CTF

4.4.1 Establishment of an occupational health and safety management system (OHSMS)

The literature review found that the establishment, implementation and continuous improvement of OHSMS is one of the critical drivers of positive OHS culture (Kale et al., 2013; Ryan, 2000; ICS, 2013). The requirement for OHSMS is not included in the CTF pillars, nor is it incorporated into one of the pillars. Moreover, the CTF does not address the importance of a holistic consideration of all systems elements (technological, human, and organisational) in OHS management. As revealed by the literature, a holistic systems approach was likely to result in optimum OHS performance as compared to an atomistic approach focusing on individual system elements (Shorrock et al., 2014; Geller, 1996; Hermanus, 2007; IOSH, 2015). The CTF could be enhanced by emphasising the importance of a holistic approach and including advice on OHSMS, noting that it is important for an organisation to have a sound OHSMS in place before embarking on OHS culture improvement initiatives. There is also a requirement for the SAMI to develop guidelines to assist the mines to develop, implement and continuously improve OHSMS.

4.4.2 Effective OHS risk management

The risk management pillar of the CTF aims to eliminate risks at their source and investigate the root causes of OHS incidents. The risk management pillar places emphasis on significance of improving the OHS incident investigation process, through adoption of a non-blaming culture, in order to promote the establishment of just and learning cultures, which are crucial for development of a positive OHS culture. However, the risk management pillar does not articulate how the mines can improve the effectiveness of the risk management process. The

literature also revealed that there is a need to develop standard risk management guidelines and training to improve the efficacy of the risk management process in the mining sector (Ikin, 2015; Hermanus, 2007).

4.4.3 Learning from OHS incidents

The literature review found that learning from OHS incidents is critical to enable the development of preventative measures to avoid recurrence of similar OHS incidence (IOSH, 2015; Ryan, 2000; CBI, 1991; ICS, 2013). Thus, it is essential for organisations to create an environment which encourages the workforce to report all OHS incidents (including near misses). The CTF discusses the requirement of a just and learning culture under the risk management pillar, rather than as a stand-alone pillar. The establishment of a just and learning culture are amongst the critical pillars that enable the cultivation of positive OHS culture and their inclusion under the risk management pillar could have an unintended consequence of diluting their importance.

Although the CTF acknowledges that OHS incident investigations should focus on identifying the root causes of incidents instead of symptoms and apportioning of blame, the CTF does not provide guidance on techniques that could be used to improve effectiveness of the OHS incident investigation process. Additionally, the CTF does not recommend strategies for establishing just, reporting and learning cultures.

4.4.4 Establishment of good OHS behaviour

The literature study revealed that the establishment of good OHS behaviour at all levels within the organisation was critical for continuous improvement of OHS and establishment of positive OHS culture (Augusta et al, 2015; de Jager, 2018; ICS, 2013; Seokho et al., 2013; Reason, 2000). The importance of holistically incorporating human factors in all aspects of the OHSMS was also noted. Good OHS behaviour could be enhanced through interventions such as developing and implementing behaviour based OHS programs, incentivising OHS achievements, education and training, and increasing awareness, communication and regular

feedback on OHS matters (Ryan, 2000; Ikin, 2017; Reason, 2000; MOSH, n.d.). However, the requirement, importance and methodologies of promoting good OHS behaviour is not addressed by the CTF.

4.4.5 OHS leadership

From the literature reviewed, it can be concluded that establishing and sustaining a positive OHS culture in the workforce is dependent on leaders: their commitment, buy-in and support to zero harm production, leadership style and approach, and the ability of leaders to effectively communicate and engage with the workforce (Hermanus, 2007; de Jager, 2018; CBI, 1991; Hopkins, 2006; King, 2000; IOSH, 2015; ICS, 2013). Although the CTF recognises the importance of leadership in cultivating and sustaining positive OHS culture, it falls short of providing a clear definition of OHS leadership, and the roles and responsibilities of the different levels of leadership such as corporate leadership, management, front line supervisors and OHS committees. Moreover, the CTF does not provide guidance on strategies that can be implemented by the SAMI to enhance OHS leadership. For example, Zungu (2014) noted that increasing the number of female employees in the mining sector, including in OHS leadership positions could result in improvements in productivity and OHS.

4.4.6 Effective participation of the workforce on OHS management

The literature study revealed that effective participation of all stakeholders (including the workforce) on OHS matters was critical for continuos improvement of OHS and establishment of a strong OHS culture (Smith and Summer, 2014; Ikin, 2017; Hermanus, 2007). The CTF acknowledges that collaborative action of all stakeholders could result in improved OHS performance. However, the CTF does not emphasise the importance of effective participaton of all stakeholders, particularly the employees, on attaining and sustaining zero harm. Moreover, the CTF does not provide guidance on methodologies that can be utilised by the industry to engage and secure buy-in and committment from the workforce, including enhancing effective participation on OHS matters.

4.4.7 Technological innovation

The technology and leading practice pillars of the CTF advocate for the adoption of technological innovation and leading practices, as a way of improving OHS performance by removing the workforce from dangerous workplaces. However, the pillar could be enhanced by unpacking the associated OHS benefits of technological innovation as shown by the literature study (Hermanus, 2017; Willis et al., 2004; Abrahamsson and Johansson, 2008; Evans, 2019).

4.4.8 Holistic consideration of potential threats to establishment of positive OHS culture

The literature study showed that a holistic consideration of potential threats to establishment of positive OHS culture is crucial. The establishment of positive OHS culture could be affected by issues such as prevailing national health and safety culture, and prevailing legislative, social, political and economic environment (Hudson, n.d.; Stephan and Soto, 2015; Kim et al., 2016; Hermanus, 2007; Hopkins, 2006; ILO, 2009). Although the CTF advocates for elimination of all forms of discrimination (racism, genderism, etc.) in the mining sector in order to promote progressive improvements in OHS, it does not take into consideration other potential threats that were identified by the literature. The identified potential threats include prevailing social, political and economic environment, national health and safety culture and leadership deficiencies.

4.5 Conclusion

A gap analysis was conducted to identify the gaps between the CTF and OHS culture management best practices that were revealed by the literature study. The gap analysis suggests that the CTF should contain sufficient detail or reference sufficient resources to enable successful implementation and progressive improvements in OHS culture and OHS performance. Some commonalities and differences were noted regarding the characteristics of OHS culture found in literature and the CTF. There were similarities in terms of shared values and commitment to zero harm, recognition of OHS as top priority, requirement for clear OHS roles and responsibilities and the importance of establishing collaborative, just and learning

cultures. Furthermore, the CTF included some aspects that were not explicitly addressed by the literature such as elimination of discrimination (including racism and genderism) and adoption of technology, leading practices and research outcomes.

Figure 4.2 provides a summary of the gaps between the CTF and best practices in OHS culture management that were found from the literature that was reviewed. The findings of the gap analysis provided insight into the formulation of IDIs questions guide that were designed to obtain an in-depth understanding of people's perceptions and experiences on different aspects of OHS culture such as:

- Understanding of the OHS culture concept and the importance of OHS culture in the attainment of OHS goals.
- Strategies that could be utilised to cultivate positive OHS culture and the implementation approach of the different OHS culture improvement initiatives.
- Factors that could promote or hinder the establishment of strong OHS culture.
- Awareness of the CTF and its relevance in OHS management strategies of different mining companies.

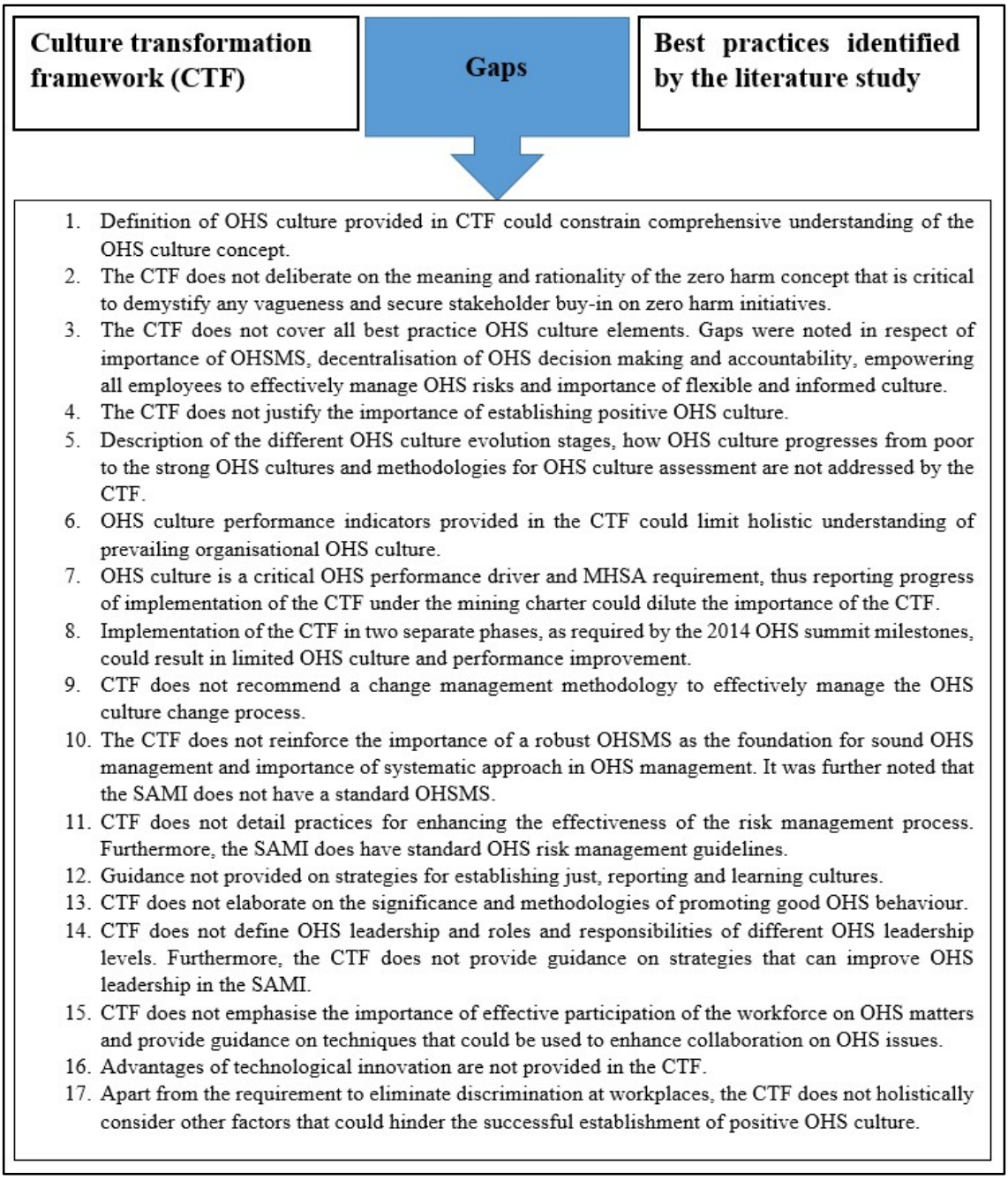


Figure 4.2: Summary of gaps analysis findings

CHAPTER 5 : DATA ANALYSIS AND FINDINGS

5.1 Introduction

This section details findings from the IDIs (step 3 in Figure 5.1), relating to the meaning of OHS culture, OHS goals for the SAMI and individual mining companies, and role of OHS culture in the attainment of organisational OHS goals. The critical success factors (OHSMS, OHS leadership, behaviour, communication, collaborative culture, learning culture, etc.) for cultivation of positive OHS culture, recommendations for successful implementation of OHS culture improvement initiatives and relevance of the CTF pillars in different organisations' OHS management approach are also explored.

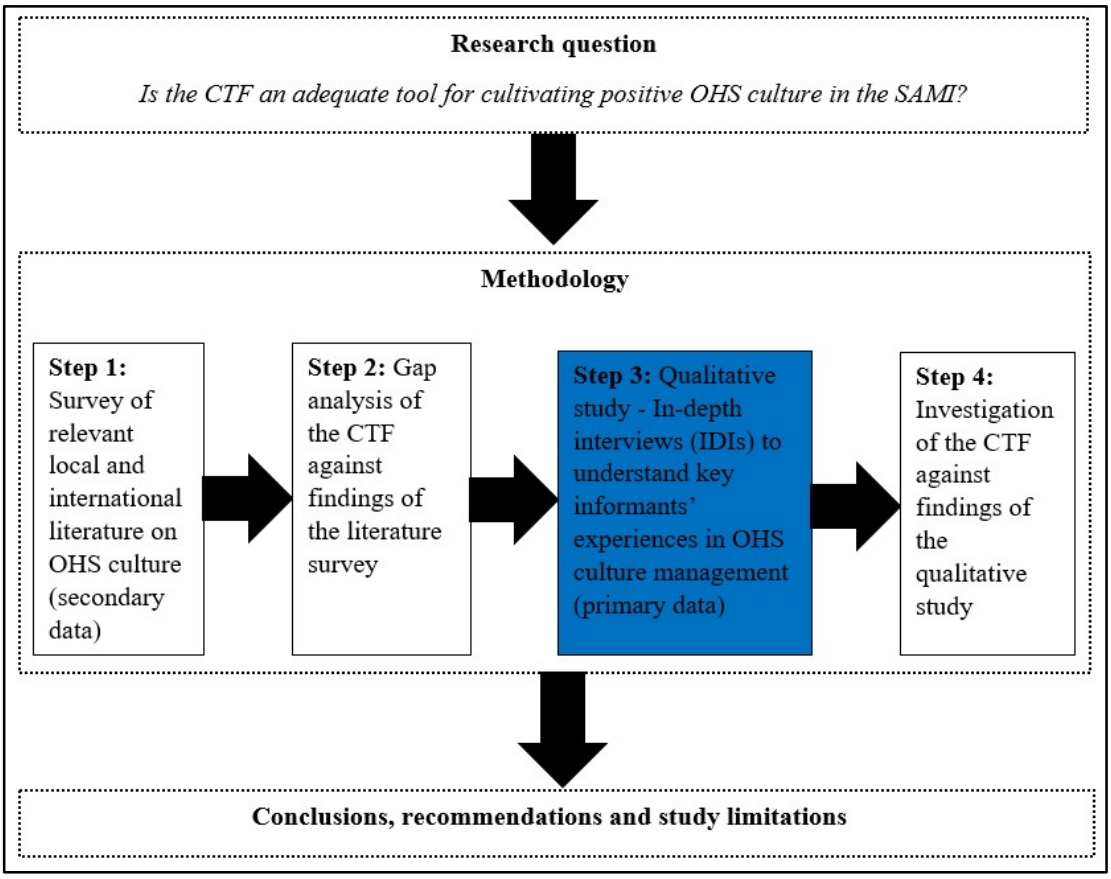


Figure 5.1: Schematic presentation of the research process

5.2 Results

5.2.1 Stratification of the qualitative study results

The study participants were drawn from the following stakeholder groupings:

1. Mine Health and Safety Council (MHSC).
2. Mine Health and Safety Inspectorate (MHSI).
3. Minerals Council South Africa (MCSA).
4. Subject matter experts from mining companies.
5. Organised labour.
6. Mandela Mining Precinct (MMP).
7. Universities.
8. Occupational health and safety (OHS) professionals.

The main categories of SAMI stakeholders are employers, organised labour and government. The three study participants from MHSC were all professionals from the MHSC office who are responsible for championing the various OHS improvement initiatives and providing technical advice to different MHSC tripartite committees, in support of government policy. Thus, all the participants from MHSC and MHSI could be classified as government (state) representatives. MCSA is a mining industry employers' organisation that supports and promotes the SAMI, thus participants from MCSA and subject matter experts from mining companies were combined and classified as employers. MMP is an initiative aimed at revitalising mining research, development and innovation in South Africa. The participants from MMP and universities were combined and categorised as "academics and researchers". The analysis of the results was stratified as per the categories shown in Table 5.1. The stratification was necessary in order to reflect whether different stakeholder groupings hold different views on certain issues and whether their views converge. Symbols were also arbitrarily assigned to each of the stakeholder categories as shown in Table 5.1, in order to simplify the tables providing summaries of stratified results.

Table 5.1: Stratification of the study participants

Item	Stakeholder categories	Assigned symbols	Number of study participants
1	Government	A	6
2	Employers	B	16
3	Organised labour	C	6
4	Academics and researchers	D	5
5	OHS professionals	E	3
Total			**36**

Numbers (quantitative information) were included in the analysis and reporting of qualitative data. The inclusion of numbers contributes to the generalisability of qualitative study findings and enables the reader to identify and correctly characterise the diversity of perceptions from the different stakeholder groupings (Sandelowski, 2001; Maxwell, 2010). Sandelowski (2001) and Maxwell (2010) added that the use of numbers (quantitative data) in qualitative studies can assist to identify patterns that are not apparent simply from the unquantified qualitative data.

The index of qualitative variation (IQV) was used to determine the level of concurrence of the different stakeholder groupings on certain issues. IQV is a measure of variability for qualitative data (Frankfort-Nachmias and Leon-Guerrero, 2009). IQV varies from zero (no diversity / concurrence) to one (maximum diversity / concurrence). In the context of this study, the level of concurrence amongst all the stakeholder groupings on a particular view was considered to be high when the IQV was closer to one and the view was raised by at least one key informant from each of the stakeholder groupings. IQV was calculated for each data set as an indicative measure of shared understanding (concurrence) between the different stakeholder groupings. IQV is partially a function of the number of categories (stakeholder groupings) and it is based on the ratio of the total number of differences in the distribution to the maximum number of possible differences within the same distribution (Frankfort-Nachmias and Leon-Guerrero, 2009). IQV is calculated following the following steps (Frankfort-Nachmias and Leon-Guerrero, 2009):

1. Construct a percentage distribution.
2. Square the percentages for each category.
3. Sum the squared percentages.
4. Calculate the IQV using the following formula:

$$\text{IQV} = \frac{\text{K}(100^2 - \sum \text{Pct}^2)}{100^2(\text{K} - 1)}$$

Where:

K = the number of categories

$\sum \text{Pct}^2$ = the sum of all squared percentages in the distribution

5.2.2 Qualitative themes on study participants' perceptions and experiences

The study findings are reported based on the fifteen deductive themes on perceptions and experiences of the study participants that emerged from the analysed data (Table 5.2). Most of the themes are distinct and aligned to the responses to specific questions that were posed to the study participants. Additional themes emerged from the reconsideration of responses which originally appeared to be part of a single theme but turned out to include a new theme entirely.

Table 5.2: Qualitative themes on study participants' perceptions and experiences

Number	Themes on participants' perceptions and experiences on OHS culture
1	Definitions of OHS culture
2	Existence of OHS goals at industry and operational (mine) levels
3	Perceptions about the role of OHS culture in the attainment of OHS goals
4	Monitoring, evaluation and continuous improvement of OHS culture
5	Change management considerations during the OHS culture change process
6	Occupational health and safety management systems (OHSMS)
7	Perceptions about learning from OHS incidents

8	Perceptions about OHS behaviour
9	Perceptions about OHS leadership
10	Perceptions about collaboration on OHS matters
11	Empowering all stakeholders to effectively manage OHS
12	Communication, feedback and awareness on OHS matters
13	Perceptions about use of innovation to improve OHS
14	Effect of external factors
15	Perceptions about the CTF

5.2.2.1 Theme 1: Definitions of OHS culture

The analysis under this theme showed the concept of OHS culture was understood in different but interrelated dimensions by the key informants. Nineteen of the participants defined OHS culture in terms of the organisation's approach to the management of OHS issues (the way we deal with OHS matters around here). A high level of concurrence amongst all the stakeholder groupings was observed in this perception. The following are examples of some OHS culture definitions that were suggested by the participants in terms of the approach to OHS management:

An organised labour representative defined OHS culture as follows: *"OHS culture can be described as "the way we handle OHS issues here" and determines how tasks are carried out to ensure the zero harm of all the employees and visitors."*

A participant from the state described OHS as follows: *"OHS culture is the inculcated way of doing business in relation to OHS issues. OHS culture determines how the organisation respects people and value their life and wellbeing at all levels within the organisation."*

One of the stakeholders from academia noted: *"OHS culture is a culture where OHS is regarded as a top priority, and part and parcel of the way people do business. This means that*

OHS is regarded as an integral part of good business practice. In other words, everyone in the organisation takes full ownership of OHS at a personal level with leadership playing a leading role."

Some stakeholders explained the OHS culture concept in terms of the factors that drives the establishment of positive OHS culture. Twelve of the key informants noted that OHS culture in a particular organisation is determined by a set of underlying assumptions, values and beliefs that shape perceptions, attitudes, behaviour, personalities and approach to OHS. With regards to factors that influence OHS culture, nine participants suggested commitment to OHS, leadership styles, priorities, workplace conditions, competencies, level of education, peer pressure, and socio-economic conditions. A high level of shared understanding between the different stakeholder groupings was noted in both views. The following are examples of definitions of OHS culture that were provided by the stakeholders in terms of factors that influence OHS culture.

A key informant from employers highlighted that *"OHS culture within a particular organisation refers to the set of underlying assumptions, values and beliefs that shape attitudes, perceptions, personalities, behaviour, commitment and approaches regarding OHS in an organisation."*

One of the OHS professionals remarked *"A positive OHS culture is enabled by having the right attitude, perceptions and behaviour; putting in place adequate systems, programmes, procedures and controls; and providing competent OHS leadership and workforce to continuously improve OHS."*

One of the researchers alluded *"OHS culture relate to the way people in an organisation feel, think and do about OHS. OHS culture is influenced by leadership styles and priorities, peer pressure, workplace conditions, and design and production logistics."*

Three of the participants described organisation OHS culture as a product and outcome of cumulative individual OHS cultures. There was no concurrence between organised labour and OHS professionals with the other stakeholder groupings on this perception.

Other participants described OHS culture in terms of the characteristics of positive OHS culture and a high level of concurrence amongst all the stakeholder groupings was observed in all instances. Eighteen stakeholders mentioned collaboration on OHS matters, fifteen noted existence of non-blaming culture and fifteen suggested commitment by all stakeholders to comply with OHS requirements. Fourteen felt OHS should be incorporated into the strategy and all operational aspects of the business and thirteen said OHS should be valued as an unparalleled top priority that should never compete with other business performance indicators such as productivity and costs. Additionally, twelve participants noted walking the OHS talk by all levels of leadership, nine stated existence of clear OHS roles and responsibilities for all people within the organisation and seven said all the people care for their own and fellow employees' OHS.

Stratified summaries of the findings on definitions of OHS culture and characteristics of OHS culture are presented in Table 5.3 and Table 5.4 respectively. The symbols are defined as follows: A=government, B=employers, C=organised labour, D=Academics and researchers, and E= OHS professionals.

Table 5.3: Summary of findings on definitions of OHS culture

OHS culture definition	Number (%) per stakeholder group					Total	IQV
	A	B	C	D	E		
Organisation's approach to the management of OHS issues (the way we deal with OHS matters around here)	3 (50%)	6 (38%)	4 (67%)	3 (60%)	3 (100)	**19**	**0.98**
OHS culture is determined by a set of underlying assumptions, values and beliefs that shape perceptions, attitudes, behaviour, personalities and approach to OHS	2 (33%)	3 (19%)	2 (33%)	3 (60%)	2 (67%)	**12**	**0.99**
OHS culture is influenced by factors such as commitment to OHS, leadership styles, priorities, workplace conditions, competencies, level of education, peer pressure, and socio-economic conditions	1 (17%)	2 (13%)	2 (33%)	2 (40%)	2 (67%)	**9**	**0.99**
Organisation OHS culture as a product of individual cultures	1 (17%)	1 (6%)	0 (0%)	1 (20%)	0 (0%)	**3**	**0.83**

Table 5.4: Summary of findings related to OHS culture elements

OHS culture element	Number (%) per stakeholder group					Total	IQV
	A	B	C	D	E		
Collaboration on OHS matters	4 (67%)	4 (25%)	3 (50%)	4 (80%)	3 (100%)	**18**	**0.99**
Existence of non-blaming culture	3 (50%)	5 (31%)	3 (50%)	2 (40)	2 (67%)	**15**	**0.97**
Culture of OHS compliance	4 (67%)	5 (31%)	2 (33%)	2 (40%)	2 (67%)	**15**	**0.96**

Incorporation of OHS into all operational aspects of the business	3 (50%)	4 (25%)	2 (33%)	2 (40%)	3 (100%)	**14**	**0.98**
Recognition of OHS as a top priority	2 (33%)	3 (19%)	3 (50%)	3 (60%)	2 (67%)	**13**	**0.99**
Walking the OHS talk by leadership	2 (33%)	3 (19%)	2 (33%)	2 (40%)	3 (100)	**12**	**0.99**
Existence of clear OHS roles and responsibilities for all people	1 (17%)	3 (19%)	1 (17%)	2 (40%)	2 (67%)	**9**	**0.96**
All the people caring for their own and fellow employees' OHS	1 (17%)	2 (13%)	2 (33%)	1 (20%)	1 (33%)	**7**	**0.97**

5.2.2.2 Theme 2: Existence of OHS goals at industry and operational levels

For this theme, the analysis showed that there was alignment in OHS goals in the SAMI at operational (mine) and industry levels. The participants indicated that the SAMI has complementary and aligned OHS goals that are set by the regulator (DMRE) and other mining industry organisations such as MHSC and MCSA.

Seventeen of the key informants highlighted that the overall industry OHS goal was attainment of zero harm, through elimination of injuries, fatalities and occupational diseases. Thirteen participants specifically mentioned the industry OHS targets that were set by the MHSC (2014 OHS summit milestones). The 2014 OHS summit milestones embrace the attainment of zero harm by the sector through elimination of fatalities, injuries, occupational diseases and implementation of the CTF. Eight participants highlighted the role of the regulator with regard to development and enforcement of the OHS legislative framework that is aimed to create healthy and safe workplaces. A high level of concurrence amongst all the stakeholder groupings was noted in all the aforementioned perceptions.

Three participants noted that MCSA and its member companies launched the Khumbul'ekhaya OHS strategy, to drive and sustain zero harm through putting emphasis for all levels within the organisation to acknowledge the negative consequences of OHS incidents on their families and communities. This view was only raised by a few stakeholders from employers and organised labour. Khumbul'ekhaya is a Nguni word meaning 'remember home' (MCSA, 2020).

Twenty-seven participants indicated the existence of the goal of zero harm at operational (mine) level and a high level of shared understanding between the different stakeholder groupings was noted on this perception. Some of the identified sub-objectives contributing to the attainment of the overall objective of zero harm include:

- Elimination of fatalities, injuries and occupational diseases.
- Reduction of occupational exposures in relation to dust and noise.
- Focusing on improving health, mental health, fatigue and general well-being of employees.
- Zero total recordable injury frequency rate (TRIFR).
- Zero disabling injury frequency rate (DIFR).
- Reporting of OHS hazards.
- Reporting and investigation of all OHS incidents, including near misses.
- Compliance to all OHS legal requirements and standards.
- Enhancing the competence of all people to effectively manage OHS through training and coaching.
- Taking a collaborative approach in all aspects of OHS.
- Effective communication and awareness on OHS issues.
- Identification and implementation of initiatives aimed to continuously improve OHS. This includes focusing on year-on-year improvements on leading and lagging indicators.
- Empowering and enabling all levels of OHS leadership to walk the zero harm talk.
- Continuous OHS risk management.
- Recognition of OHS as a top priority and core values that should be integrated into all operational aspects of the business.

- A recognition that investing in OHS improvement initiatives was likely to result in improvement in productivity.

The following are examples of remarks that were made by some of the study participants demonstrating existence of OHS goals at operational level:

One of the stakeholders from organised labour noted: *"The OHS goals are aligned to national statutes and internal OHS policies and procedures that are set at mine level. Our operation has a goal of zero harm that is aimed at ensuring that every mine worker return from work unharmed every day."*

A participant representing employers remarked: *"Our commitment to OHS as a top priority reflects the importance of safeguarding and promoting the safety, health and wellbeing of our employees and contractors, maintaining social licence to operate and protection of the organisation's reputation. Our vision is to ensure that every employee and contractor at our operations returns home unharmed after each day's work. Our fundamental value, "If we cannot mine safely, we will not mine", remains critical to the sustainability of our company. Our OHS goals include attainment of zero harm, reporting all OHS incidents and implementation of all recommended corrective actions."*

One of the employers' representatives stated: *"Our organisation strives to attain zero harm at its operations. The Company aims to eliminate the potential for accidents and injuries at the workplace and strives to minimise hazards inherent in the working environment in a reasonably practicable manner through implementation of the health, safety and wellbeing strategy and embracing the values of commitment, accountability, respect, enabling and safety."*

Moreover, the analysis revealed that there were different and non-concurrent perceptions in the SAMI pertaining to the achievability of the zero harm goal. Three participants (one each from employers, OHS professionals and researchers) believed that the zero harm target was not

achievable whilst three participants (one each from state, organised labour and researchers) believed in the contrary as illustrated by the following remarks:

A key informant from academia commented: *"Zero harm is an aspirational genuine desire of the mining industry. However, the target is not achievable, since there is always a chance of an accident, because we are dealing with fallible human beings in an uncertain environment."*

One of the OHS professionals said: *"I believe that zero harm should not be treated as an aspirational target. We understand the risk, we put in place all the controls and if it is unsafe to mine we will not mine and we do something different like introduction of technology."*

Table 5.5 provides a summary of qualitative findings related to existence of zero harm goals in the mining sector. The symbols are defined as follows: A=government, B=employers, C=organised labour, D=Academics and researchers, and E= OHS professionals.

Table 5.5: Summary of findings related to existence of zero harm goal

Participants views regarding to existence of zero harm goal	**Number (%) per stakeholder group**					**Total**	**IQV**
	A	**B**	**C**	**D**	**E**		
Existence of the goal of zero harm at mine level	4 (67%)	11 (69%)	5 (83%)	4 (80%)	3 (100%)	**27**	**0.93**
Overall industry OHS goal was attainment of zero harm	5 (83%)	4 (25%)	4 (67%)	2 (40%)	2 (67%)	**17**	**0.97**
Participants who specifically mentioned the 2014 OHS summit milestones	4 (67%)	5 (31%)	2 (33%)	1 (20%)	1 (33%)	**13**	**0.90**
Role of the regulator on development and enforcement of regulations to drive zero harm in the sector	3 (50%)	2 (13%)	1 (17%)	1 (20%)	1 (33%)	**8**	**0.94**
Participants who referred to the Khumbul'ekhaya zero harm	0	2	1	0	0	**3**	**0.56**

initiative that was driven by MCSA	(0%)	(13%)	(17%)	(0%)	(0%)		
Participants who believed that zero harm target was not achievable	0 (0%)	1 (6%)	0 (0%)	1 (20%)	1 (33%)	**3**	**0.83**
Participants who felt the target of zero harm was achievable	1 (17%)	0 (0%)	1 (17%)	1 (20%)	0 (0%)	**3**	**0.83**

5.2.2.3 Theme 3: Perceptions about the role of OHS culture in the attainment of OHS goals

An analysis for this theme showed that participants felt that OHS culture played a pivotal role in the achievement of OHS goals and a high level of concurrence amongst all the stakeholder groupings was noted on all the perceptions raised under this theme. Sixteen participants pointed out that OHS culture determines the organisation's approach to OHS management, twelve mentioned OHS values, nine said tolerance to unsafe acts and behaviours, seven noted effectiveness of communication on OHS matters and seven highlighted extent of collaboration on OHS matters. For example, two of the participants made the following sentiments:

One of the employers' representatives commented: *"OHS culture certainly have an impact on OHS because it crafts the framework to the way the organisation deals with OHS matters. OHS culture is the underpinning driver of attainment of OHS goals because OHS culture is key in shaping attitudes and behaviours towards OHS. A reactive culture will not yield any positive gains in OHS performance, whilst a proactive culture and teamwork culture result in significant improvement in OHS. If the OHS culture is negative or poor, then OHS will not be recognised as a major priority within the organisation and this could result in prioritisation of production over OHS. Moreover, this could promote the development of a culture of tolerance to OHS risks and poor OHS behaviour, resulting in increased violations of OHS provisions and subsequent increase in OHS incidents and poor OHS performance."*

A participant from state remarked: *"OHS culture plays a role in the achievement of OHS goals. Organisations with a positive OHS culture will have values, systems, practices, behaviours*

that create an enabling environment for the attainment of OHS goals. Organisational OHS culture tends to direct people towards the organisation's approach on OHS matters, OHS management, communication on OHS issues, stakeholder engagement on OHS matters and OHS guidelines and rules. Where the OHS culture is negative, there may be inadequate support of OHS goals. Organisations with good OHS culture value OHS and are more inclined to support OHS programmes and goals."

Twenty-eight participants felt that a strong OHS culture could result in better OHS performance and fifteen mentioned improved productivity and profitability. It was highlighted that effective OHS management was one of the pillars of sustainable development and social license to operate. It was further noted that OHS incidents were associated with enormous penalties such as production stoppages, closure of mines, bad corporate image, and negative socio-economic impacts on employees, families and communities. This is captured in the following comments that were made by some of the study participants:

An OHS professional stated: *"Organisations with a positive OHS culture usually have better OHS performance and better productivity. On the contrary, organisations with poor OHS culture tend to have poor OHS performance and poor productivity. In other words, if all levels within the organisation (workforce and leadership) have a positive OHS culture and work ethic, they are likely to comply with standard operating procedures, resulting in better OHS performance and productivity."*

A key informant representing employers said the following: *"We recognise that effective OHS management is not a cost centre, rather it is a profit centre. Experience has taught us that investing in OHS improvement initiatives was likely to result in improvement in productivity. OHS incidents have huge penalties such as production stoppages, closure of mines, bad corporate image, negative socio-economic impacts on employees, families and communities. Moreover, effective management of OHS is one of the pillars of sustainable development and social license to operate."*

Perceptions related to the impact of OHS culture on OHS performance are summarised in Table 5.6. The symbols are defined as follows: A=government, B=employers, C=organised labour, D=Academics and researchers, and E= OHS professionals.

Table 5.6: Perceptions related to impact of OHS culture on OHS performance

Perceptions on impact of OHS culture	**Number (%) per stakeholder group**					**Total**	**IQV**
	A	**B**	**C**	**D**	**E**		
Positive OHS culture could result in better OHS performance	4 (67%)	11 (69%)	5 (83%)	5 (100%)	3 (100%)	**28**	**0.94**
OHS culture determines the organisation's approach to OHS management	3 (50%)	6 (38%)	2 (33%)	3 (60%)	2 (67%)	**16**	**0.95**
Positive OHS culture could result in improved productivity and profitability	2 (33%)	5 (31%)	3 (50%)	3 (60%)	2 (67%)	**15**	**0.97**
OHS culture determines the organisation's OHS values	3 (50%)	3 (19%)	2 (33%)	2 (40%)	2 (67%)	**12**	**0.99**
OHS culture determines tolerance to unsafe acts and behaviours	2 (33%)	3 (19%)	1 (17%)	1 (20%)	2 (67%)	**9**	**0.96**
OHS culture determines effectiveness of OHS communication	1 (17%)	2 (13%)	1 (17%)	2 (40%)	1 (33%)	**7**	**0.97**
OHS culture determines extent of collaboration on OHS matters	1 (17%)	1 (6%)	2 (33%)	1 (20%)	2 (67%)	**7**	**0.97**

5.2.2.4 Theme 4: Monitoring, evaluation and continuous improvement of OHS culture

Under this theme, thirteen participants highlighted that once culture change has been successfully attained, it was key to continuously focus on sustaining and improving the new culture since there is a risk of reverting to the old culture. It was further noted that developing and implementing a process for continuous monitoring, evaluation and improvement of OHS

culture was crucial because culture was not static, rather it was a dynamic and ever-evolving phenomenon. At a typical operational mine, OHS culture could change as a result of changes in factors such as workforce profile, leadership, mining methods, technology and processes. Some level of shared understanding between the different stakeholder groupings was noted on the aforesaid views.

Five participants highlighted that identification and implementation of OHS continuous improvement initiatives could likely result in continuous improvement in OHS culture at all levels, as progressive improvement in OHS is realised. All the stakeholder groupings apart from organised labour concurred on the perception. Three stakeholders (one each from employers, researchers and OHS professionals) suggested that the use of continuous improvement tools such as the PDCA tool could be useful for continuous OHS culture improvement.

Eight participants from all stakeholder groupings concurred that OHS culture surveys could be used for determining the prevailing OHS culture, while only two employer representatives noted that the DuPont Bradley Curve's OHS culture transformation journey could save a similar purpose. Apart from assessing the effectiveness of OHS culture improvement initiatives, OHS culture assessments could also provide some insights on the gaps within the OHSMS, thus enabling the formulation of evidence based OHS culture continuous improvement strategies. Three participants (one each from employers, researchers and OHS professionals) suggested that OHS culture was an important performance indicator of the OHSMS that should be measured, monitored, evaluated and reported as a standalone item like OHS performance indicators such as fatalities and injuries. For example, one of the OHS professionals remarked: *"OHS culture should be continuously measured, monitored, evaluated and reported as a stand-alone performance indicator of the OHSMS. Focusing on continuous improvement of OHS culture will likely result in reduction of OHS incidents."*

Table 5.7 summarises the views of the interviewees on the importance of continually assessing and improving OHS culture. The symbols are defined as follows: A=government, B=employers, C=organised labour, D=Academics and researchers, and E= OHS professionals.

Table 5.7: Summary of views on OHS culture assessment and continuous improvement

Views on OHS culture assessment and continuous improvement	**Number (%) per stakeholder group**					**Total**	**IQV**
	A	**B**	**C**	**D**	**E**		
Importance of sustaining and continually improving positive OHS culture to prevent regression to old OHS culture	2 (33%)	5 (31%)	2 (33)	2 (40%)	2 (67%)	**13**	**0.95**
OHS culture surveys could be utilised for establishing the prevailing OHS culture	1 (17%)	4 (25%)	1 (17%)	1 (20%)	1 (33%)	**8**	**0.86**
Realisation of better OHS performance after implementation of OHS improvement initiatives could promote continuous improvement of OHS culture	1 (17%)	1 (6%)	0 (0%)	2 (40%)	1 (33%)	**5**	**0.90**
OHS culture should be continually measured and reported like OHS performance indicators such as fatalities, injuries and occupational diseases	0 (0%)	1 (6%)	0 (0%)	1 (20%)	1 (33%)	**3**	**0.83**
DuPont Bradley Curve's OHS culture transformation journey could be utilised for establishing the prevailing OHS culture	0 (0%)	2 (13%)	0 (0%)	0 (0%)	0 (0%)	**2**	**0.00**

5.2.2.5 Theme 5: Change management considerations during the OHS culture change process

For this theme, the analysis indicated that participants perceived that the development and implementation of a structured change management process was essential for successful OHS culture change. There was some consensus from eleven informants representing all stakeholder groupings that culture change was a slow, challenging and multi-faceted process requiring a proper change management strategy, and a multi-disciplinary and holistic approach. For example, one of the participants representing employers noted: *"Before starting the culture improvement process, it is key to recognise that changing OHS culture is a gradual and difficult process that requires proper planning and a structured change management process."*

Seven participants representing all stakeholder groupings concurred that the use of a structured change management process during the OHS culture change process could mitigate against potential threats that could obstruct successful cultivation of positive OHS culture. Examples of identified potential threats include resistance to change, lack of buy-in from the stakeholders, poor OHS performance and poor productivity. Seven stakeholders representing all stakeholder groups highlighted that in order to develop a SMART culture change strategy, it was key for companies to conduct OHS culture surveys to determine the prevailing OHS culture. Four interviewees (from employers, researchers and OHS professionals) suggested that the inclusion of credible leaders and influencers (employees whom a larger group of the workforce will listen to) into the OHS culture steering committees could facilitate successful culture change. For instance, one of the employers' representatives provided the following narration highlighting the OHS culture change process that was followed by a certain mine: *"To cultivate the desired OHS culture the organisation started by conducting a culture self-assessment in order to gain insight about the prevailing culture, based on the DuPont Bradley Curve's OHS culture transformation journey. A strategy to transform the OHS culture was developed in collaboration with representatives from all levels across the organisation. The strategy included programmes to enhance participation of all stakeholders and increasing OHS awareness through effective communication and activities such as drama, poetry, music and dance. The strategy also includes vibrant visible felt leadership (VFL) programme, strong BBS programme and revamping OHS incident investigation processes."*

The participants highlighted that successful culture change could be negatively affected by the following factors:

- Trying to start the culture change process without an understanding of the prevailing OHS culture and perceptions of the workforce regarding OHS matters, as highlighted by seven study subjects.
- Lack of a structured change management process, resulting in resistance to change and lack of buy-in and commitment from stakeholders, as mentioned by seven interviewees.

The perceptions of the stakeholders related to the significance of managing the OHS culture change process are summarised in Table 5.8. The symbols are defined as follows: A=government, B=employers, C=organised labour, D=Academics and researchers, and E= OHS professionals.

Table 5.8: Summary on perceptions related to change management

Perceptions of change management	**Number (%) per stakeholder group**					**Total**	**IQV**
	A	**B**	**C**	**D**	**E**		
OHS culture change was a gradual, challenging and complex process requiring a structured change management process	2 (33%)	4 (25%)	1 (17%)	2 (40%)	2 (67%)	**11**	**0.95**
Significance of change management process in mitigating potential threats to cultivation of positive OHS culture	1 (17%)	2 (13%)	1 (17%)	1 (20%)	2 (67%)	**7**	**0.97**
Importance of understanding prevailing OHS culture to enable development of an informed OHS culture change strategy	1 (17%)	2 (13%)	1 (17%)	1 (20%)	2 (67%)	**7**	**0.97**
OHS culture change process should be championed by	0 (0%)	1 (6%)	0 (17%)	1 (20%)	2 (67%)	**4**	**0.78**

credible leaders and influencers drawn from the workforce							

5.2.2.6 Theme 6: Occupational health and safety management systems (OHSMS)

The analysis of data for this theme showed that twenty-four informants representing all stakeholder groups concurred that putting in place a sound OHSMS and aiming for continuous improvement of the system were the backbone of effective management of OHS and cultivation of positive OHS culture. For example, one of the participants from the state noted: *"The departure point in effective management of OHS is development and implementation of a robust OHSMS. OHSMS could be developed based on international best practices such as ISO 45001 and OHSAS 18001. One common important feature of these OHSMS is that they are based on the PDCA model that put emphasis on the need to constantly identify opportunities for continuous improvement."*

Seventeen participants noted that a systematic and holistic approach to OHS, where the different system elements such as physical work environment, systems and people and organisational factors are managed as a system was key for effective OHS management. Twelve interviewees suggested providing adequate resources and proper planning, while ten noted creating a conducive working environment as important elements of the OHSMS. Ten study subjects suggested having a user-friendly set of OHS standards and procedures and compliance with OHS provisions, and eight noted reviewing internal and external OHS audit findings as also important. Six informants also highlighted sound maintenance practices and good housekeeping as important. There was a high level of shared understanding between all stakeholder groups on all the aforementioned views. Examples of related participant comments are:

An organised labour representative remarked: *"In order to effectively manage OHS, organisations should put in place proper technical interventions (proper workplace and equipment designs, and sound maintenance practices), practice good housekeeping and provide adequate resources (time, competent people, and budget for OHS improvement*

initiatives). It is also important to create a conducive working environment, addressing issues such as temperature, humidity, air quality, ergonomics and travelling times. Management can demonstrate their commitment to OHS by providing adequate systems, resources and conducive environment to support OHS improvement initiatives, and this will likely instil positive OHS culture within the organisation."

A key informant from the state said: *"Use of simple, clear, user friendly and non-negotiable OHS legislation, standards, policies and procedures that adequately address all OHS risks and enforce good OHS practices will likely instil a positive culture of OHS at all levels. Adoption of the "OHS first" culture, compliance culture, enforcement of the right to refuse dangerous work, non-tolerance to violations of OHS provisions and impartiality consequence management for OHS violations will improve OHS culture. Proper contingency planning and provision of adequate resources could also assist to ensure the attainment of zero harm production without choking the different system elements."*

Fifteen study subjects from all stakeholder groups agreed that effective OHS risk management was fundamental for enabling continuous improvement in OHS performance and development of a strong OHS culture. For example, one of the study participants representing employers noted: *"In an effort to prevent significant unwanted OHS events and fatal incidents, we implemented a four-layered approach to OHS risk management comprising baseline, issue based, task based and continuous risk assessments. This is supported by a proactive OHS culture, active leadership, training, refresher training and OHS campaigns. This is how a positive OHS culture has been cultivated and sustained in our organisation to ensure zero harm."*

The importance of empowering all the people across the organisation to enable them to effectively understand and identify OHS risks as well as to develop and implement necessary corrective actions was highlighted by thirteen participants. Ten participants suggested that all tasks (no matter how small) should be subjected to a pre-task risk assessment. Eight participants said that a holistic consideration of potential OHS risks from both the external and internal

environment and five interviewees noted that involvement of all stakeholders in the risk identification process could ensure that sufficient risk assessment is embedded into the business strategy. There was a general consensus amongst all stakeholder groupings on all the aforementioned views. Three study participants (one each from state, employers and organised labour) further highlighted that the risk management process should incorporate emerging issues such as the increasing number of female employees in the sector, diversity and socio-economic issues.

In addition, the participants noted that the establishment of a positive OHS culture could be obstructed by the following factors:

- Inadequate and poor OHSMS, ineffective risk management processes and inadequate control of OHS risks, as noted by twenty-four participants.
- Setting targets (production and OHS) that are not SMART, as suggested by nineteen key informants.
- Inadequate resources (funding on OHS improvement initiatives, time, skilled workforce, equipment and operating procedures) and inadequate equipment maintenance to support zero harm production, as mentioned by sixteen stakeholders.
- Lack of flexibility in mine designs and plans, particularly incorporation of contingency measures and buffers, as noted by fifteen study participants.
- Culture of non-compliance, in which unsafe acts and violations to OHS requirements are tolerated, as highlighted by thirteen participants.
- Inadequate legal framework and complex OHS procedures and standards could also frustrate efforts to cultivate a positive OHS culture, as indicated by ten stakeholders.
- Lack of proper monitoring and evaluation strategies, as said by seven study subjects.
- Not taking a systematic and holistic approach that takes into consideration the impact of different systems elements on the OHSMS, as noted by seven informants.
- Short term cost cutting, and short-term thinking, as suggested by four participants.

The stakeholders' views related to OHSMS are summarised in Table 5.9. The symbols are defined as follows: A=government, B=employers, C=organised labour, D=Academics and researchers, and E= OHS professionals.

Table 5.9: Summary of views related to OHSMS

Views related to OHSMS	**Number (%) per stakeholder group**					**Total**	**IQV**
	A	**B**	**C**	**D**	**E**		
Importance of a robust OHSMS	4 (67%)	12 (75%)	3 (50%)	3 (60)	2 (67%)	**24**	**0.86**
Significance of a systematic and holistic approach to OHS	3 (50%)	7 (44%)	2 (33%)	2 (40%)	3 (100%)	**17**	**0.93**
Importance of effective OHS risk management	3 (50%)	6 (38%)	2 (33%)	2 (40%)	2 (67%)	**15**	**0.93**
Importance of empowering all people to effectively manage OHS risks	2 (33%)	5 (31%)	2 (33%)	2 (40%)	2 (67%)	**13**	**0.95**
Providing adequate resources and proper planning was key	3 (50%)	3 (19%)	2 (33%)	2 (40%)	2 (67%)	**12**	**0.99**
Significance of pre-task risk assessment for all tasks	2 (33%)	4 (25%)	1 (17%)	1 (20%)	2 (67%)	**10**	**0.93**
Importance of creating a conducive working environment	2 (33%)	2 (13%)	2 (33%)	2 (40%)	2 (67%)	**10**	**1.00**
Importance having user friendly OHS legislation standards and procedures and culture of compliance with the same	3 (50%)	3 (19%)	2 (33%)	1 (20%)	1 (33%)	**10**	**0.95**
Holistic consideration of potential OHS risks from both the external and internal environment was crucial	2 (33%)	3 (19%)	1 (17%)	1 (20%)	1 (33%)	**8**	**0.94**

Significance of reviewing audit findings	2 (33%)	2 (13%)	1 (17%)	1 (20%)	2 (67%)	**8**	**0.98**
Sound maintenance and housekeeping practices as important	1 (17%)	2 (13%)	1 (17%)	1 (20%)	1 (33%)	**6**	**0.97**
significance of incorporating factors such as gender, diversity and socio-economic issues into risk management	1 (17%)	1 (6%)	1 (17%)	0 (20%)	0 (0%)	**3**	**0.83**

5.2.2.7 Theme 7: Perceptions about learning from OHS incidents

For this theme, the analysis showed that participants felt learning from all OHS incidents within the company and the industry as a whole were important to enable the development and implementation of corrective actions to avoid repeats of similar OHS incidents. Seventeen participants across all stakeholder groups concurred that it was important for companies to come up with some strategies to encourage the reporting of all OHS incidents, including near misses. For example, one of the study participants representing employers said: *"We endeavour to continuously learn from OHS incidents at our operations and across the sector and subsequently implement mitigating actions to prevent the risk of similar incidents at our operations. We encourage and educate all people on the importance of reporting all OHS incidents and near misses. We embrace a culture of leaning from all OHS incidents and this is supported by adoption of just and non-blaming cultures, which ensures that all OHS incidents are reported, investigated and corrective measures implemented to avoid repeats. It is also important for companies to continuously learn from OHS incidents, success stories and best practices from other companies within the industry."*

Nineteen participants noted that it was important to ensure that all OHS incidents are sufficiently investigated and all corrective actions emanating from the investigations are implemented to avoid recurrence of similar OHS incidents in the future. Fourteen stakeholders suggested that the OHS incident investigation system should focus on identifying the root causes of OHS incidents, rather than apportioning blame. Eight participants noted that unfair, unjust and blaming cultures where people will be afraid of being blamed and punished for

causing OHS incidents could obstruct the organisation from learning from OHS incidents. There was a shared understanding between the different stakeholder groupings on all the aforementioned insights. Two informants (one each from researchers and OHS professionals) recommended that the use of independent and competent OHS incident investigation teams in the sector could improve the effectiveness of the incident investigation process, thus allowing the identification of root causes and formulation of preventative measures to avoid repeats. This is illustrated in the following remarks by one of the OHS professionals: *"There is an opportunity to improve the effectiveness of the OHS incident investigation process. The desire to self-preserve and apportionment of blame which has been noted during some OHS incident investigations could prevent companies from identifying the root causes of OHS incidents, and subsequent development and implementation of corrective measures to prevent repeats of similar OHS incidents. The industry should consider the use of independent investigative teams, such as we see with the air crash investigations."*

Table 5.10 summarises the key informants' perceptions about learning from OHS incidents. The symbols are defined as follows: A=government, B=employers, C=organised labour, D=Academics and researchers, and E= OHS professionals.

Table 5.10: Summary of perceptions about learning from OHS incidents

Perceptions about learning from OHS incidents	**Number (%) per stakeholder group**					**Total**	**IQV**
	A	**B**	**C**	**D**	**E**		
It was important to investigate all OHS incidents, identify root causes and implement corrective actions to prevent repeats	4 (67%)	7 (44)	3 (50%)	2 (40%)	3 (100%)	**19**	**0.95**
It was crucial to develop and implement strategies to encourage the reporting of all OHS incidents, including near misses	4 (67%)	5 (31%)	3 (50%)	3 (60%)	2 (67%)	**17**	**0.98**
The OHS incident investigation system should focus on identifying the root causes of	3	4	3	2	2	**14**	**0.98**

OHS incidents, rather than apportioning blame	(50%)	(25%)	(50%)	(40%)	(67%)		
Unfair, unjust and blaming cultures could discourage OHS incident reporting	2 (33%)	2 (13%)	2 (33%)	1 (20%)	1 (33%)	**8**	**0.98**
The OHS incident investigation process could be enhanced by use of independent and competent OHS incident investigation teams	0 (0%)	0 (0%)	0 (0%)	1 (20%)	1 (33%)	**2**	**0.63**

5.2.2.8 Theme 8: Perceptions about OHS behaviour

There was consensus amongst all stakeholder groups on all the perceptions that were raised under this theme. Twenty-three participants felt that nurturing of the right OHS behaviour in individuals was important to enable the cultivation of a positive OHS culture and continuous improvement in OHS. Thus, it is critical for organisations to explore innovative ways of motivating people at all levels to develop positive OHS behaviour. The participants suggested that positive OHS behaviour could be encouraged by interventions such as:

- All levels of leadership taking an active role to model and encourage positive OHS behaviour within the organisation, as highlighted by eighteen informants. For example, one of the participants from organised labour suggested the following: *"In-order to cultivate positive OHS behaviour that promote continued OHS improvements, organisations should start by recognising OHS as the most important priority that should not compete with production. All people should be made to understand that OHS is a matter of self-enlightened interest that has unparalleled benefits to all the stakeholders and the organisation at large."*

- Demonstration of commitment to OHS as a top priority by mining companies, as suggested by fifteen stakeholders. For instance, one of the study participants from academia stated that *"If an organisation adopts the "if it is not safe to mine, we will not mine" principle, and if all levels of leadership consistently live this principle, then all people within the organisation are likely to embrace the principle and this will eventually transform into a way of life at the organisation."*

- Incorporation of OHS into the strategy and all operational aspects of the business, as noted by fourteen informants. For example, making OHS a standing item on the agendas of all meetings (such as production and planning meetings) within the organisation could emphasise the significance of OHS, thus facilitating the cultivation of positive OHS behaviour and culture.

- Developing and implementing programmes to mould the right OHS behaviour of all people within the organisation as mentioned by fourteen interviewees. Examples of suggested behaviour moulding programmes include BBS that allow peer to peer coaching and VFL that allows all levels of leadership to walk the OHS talk and provide coaching and support on OHS matters to the workforce.

- Designing the work environment and tasks in such a way that OHS and production are not competing activities as highlighted by thirteen participants.

- Developing and implementing programs and incentives to recognise, motivate and reward good OHS behaviour and OHS achievements, as said by thirteen study subjects. Typical incentives that were suggested by the participants include:

    - Use of incentive schemes that drive and promote zero harm production.
    - Use of OHS incentives such as prizes and OHS awards could motivate people to prioritise OHS.
    - Timeous celebration of OHS successes and achievements such as fatality free shifts celebrations and hosting of OHS days.

- Including OHS performance into the performance contracts of all the people as noted by ten interviewees. For example, one of the employers' representatives mentioned: *"At every level OHS is included as part of the performance contracts for teams and individuals. OHS forms an important component of performance management, and bonuses are paid based on OHS and production performance. Good OHS performance is recognised and rewarded, and OHS success is celebrated timeously and consistently within the organisation. This is achieved through practices such as fatality free shifts, OHS prizes and hosting OHS days."*

- Creating a conducive environment in which all the people can collaborate on OHS matters, voluntarily embrace positive OHS behaviour and participate in OHS

improvement initiatives, as highlighted by nine study participants. A typical conducive working environment is one in which there is trust at all levels within the organisation, the organisation consistently demonstrates the values of care and respect for all the people, there is just and non-blaming cultures, and favourable working conditions are provided to all the people.

Six participants suggested that the mining sector should consider making OHS behaviour screening a compulsory part of the recruitment process for all the personnel to be employed in the mining sector. OHS behaviour screening tests could include psychometric, psychological and risk tolerance testing. Two participants noted that organisational OHS culture could be diluted as a result of people changing jobs between different companies. Dilution of OHS culture could be minimised by conducting OHS behaviour assessments as part of employee selection process and use of comprehensive OHS induction programmes to instil the desired OHS behaviour in new employees. For example, one of the OHS professionals remarked: *"Dilution of OHS culture could be mitigated through use of OHS behaviour assessments as part of the employee selection process and intensive OHS induction programmes to mould the desired OHS behaviour of new employees."*

Moreover, some participants suggested that the cultivation of positive OHS behaviour could be inhibited by factors such as:

- Production pressures and prioritising production over OHS, as noted by twenty-seven study subjects. For instance, one of the participants from academia stated: *"Severe pressure on meeting production targets may undermine the cultivation of positive OHS culture."*
- Use of incentive systems that prioritise production over OHS could exacerbate a culture of non-compliance and risk-taking behaviour, as suggested by twelve participants. For example, one of the study participants from the state said: *"Cultivation of positive OHS culture could be constrained by risk taking behaviour that is naturally embedded in organisations that have bonuses that are attached to production performance alone."*

Table 5.11 provides a summary of the interviewees' perceptions about OHS behaviour. The symbols are defined as follows: A=government, B=employers, C=organised labour, D=Academics and researchers, and E= OHS professionals.

Table 5.11: Summary of perceptions about OHS behaviour

Perceptions about OHS behaviour	**Number (%) per stakeholder group**					**Total**	**IQV**
	A	**B**	**C**	**D**	**E**		
Cultivating the right OHS behaviour in employees was important	4 (67%)	9 (56%)	4 (67%)	3 (60%)	3 (100%)	**23**	**0.94**
Leadership should take an active role to influence positive OHS behaviour	4 (67%	5 (31%)	3 (50%)	3 (60%)	3 (100%)	**18**	**0.99**
Companies should demonstrate commitment to OHS as a top priority	3 (50%)	5 (31%)	2 (33%)	3 (60%)	2 (67%)	**15**	**0.97**
Organisations should incorporate OHS into all operational aspects of the business	2 (33%)	5 (31%)	1 (17%)	3 (60%)	3 (100%)	**14**	**0.94**
Mines should develop and implement programmes to mould the right OHS behaviour	2 (33%)	4 (25%)	3 (50%)	3 (60%)	2 (67%)	**14**	**0.98**
Companies should develop and implement programmes to recognise, motivate, reward and drive good OHS behaviour	3 (50%)	3 (19%)	2 (33%)	2 (40%)	3 (100%)	**13**	**0.99**
Importance of designing work in a manner that does not make OHS and production competing objectives	3 (50%)	4 (25%)	2 (33%)	2 (40%)	2 (67%)	**13**	**0.98**
Importance of incorporating good OHS behaviour and performance into key result areas (KRAs) of all employees	2 (33%)	3 (19%)	1 (17%)	2 (40%)	2 (67%)	**10**	**0.98**
It was key to create a conducive environment for collaboration	2	3	1	1	2	**9**	**0.96**

on OHS matters and cultivation of positive OHS behaviour	(33%)	(19%)	(17%)	(20%)	(67%)		
The sector should introduce compulsory OHS behaviour screening for all new employees	1 (17%)	1 (6%)	1 (17%)	1 (20%)	2 (67%)	**6**	**0.97**

5.2.2.9 Theme 9: Perceptions about OHS leadership

The analysis for this theme revealed that all levels of leadership (board of directors, management, front line supervisors, etc.) play a significant role in cultivating and sustaining positive OHS culture to enable progressive improvement in OHS. Twenty-seven participants felt that top leadership such as the board of directors and senior management should define the organisation's OHS values, vision, strategy, goals and desired OHS culture, and this should be cascaded down to all levels across the organisation. Twenty-four stakeholders mentioned that leadership should provide adequate resources to enable effective management and continuous improvement of OHS. Twenty-one informants noted that top leadership has a duty to create an environment in which OHS is recognised as a top priority that should never be traded off with other business performance indicators such as productivity. A high level of concurrence amongst all the stakeholder groupings was observed on all the aforementioned views. The following are examples of statements capturing some of the participants' views regarding the role of leadership in defining OHS goals, vision, strategy and required OHS culture:

One of the OHS professionals remarked: *"Leadership plays a pivotal role in driving organisational OHS culture. Leaders should support OHS improvement initiatives, adopt clear OHS targets, demonstrate commitment to OHS (walk the OHS talk), and define and cultivate the desired OHS behaviour."*

A key informant representing employers commented: *"In our organisation, top leadership has a role to define OHS values, goals, vision and strategy. OHS is a top priority and is non-negotiable. We strive for zero harm and we always take an unconditional approach where OHS consistently comes first throughout the organisation. The top leadership also provides the means for investing in appropriate resources that enable OHS goals to be achieved. Production*

pressures and other pressures should not compromise OHS values. We recognise that OHS is not a cost centre. Experience has taught us that all initiatives to improve OHS will have a positive effect on productivity. We embrace OHS accountability and we have clearly defined OHS roles and responsibilities at all levels within the organisation. Moreover, we invest in continuously building OHS leadership, a culture of OHS consciousness and operational discipline. All OHS leaders has a role to walk the OHS talk and drive OHS. We have group OHS leadership that is responsible for championing the development of a strategy to improve OHS, continually embed OHS as a line management responsibility, and promote the sharing of learnings and good practices. The strategy comprises three pillars, namely systems and processes, OHS leadership, and safe behaviour."

One of the employers' representatives noted: *"Sound management of OHS is an integral part of all operational requirements of our business and is recognised as the basis for improved operational performance (i.e. we genuinely pursue zero harm production. Maintaining safe and healthy working conditions is a critical compliance issue. We aim to eliminate fatalities, reduce injuries, reduce employee exposure to occupational health risks, including those associated with silicosis, TB, NIHL and diesel particulate matter (DPM). Management of occupational health risks become very critical particularly in South Africa due to increased health risks associated with deep level mining and poor socio-economic conditions. We have programmes in place to facilitate identification and management of chronic medical conditions within the workforce, to maximise labour productivity and reduce absenteeism due to ill-health. The OHS leadership forum developed and implemented a programme to align all employees to a common set of OHS beliefs and attitudes. We will also be rolling out positive OHS culture cultivation programme that was successfully piloted at our Australian operations to all our global operations."*

Nine participants spread across all stakeholder groupings suggested that companies should use an OHS risk-based approach in the design of all operational aspects of the business. In this case, companies will define acceptable risk levels for different mining tasks. Moreover, four participants (representing employers, researchers and OHS professionals) recommended that

companies should understand the impacts in the short, medium and long terms, when making decisions about investments in OHS improvement initiatives. This is because basing decisions on short-term cost considerations could result in the long-term destruction of value. For example, one of the participants from academia noted: *"Mining companies should use OHS risk as a criterion for design and operation. An additional criterion for all company decisions (including design, operation and investment decisions) could be that of value creation, in which OHS would be an important factor. Decisions are often made on short term cost considerations that may create short term value, but usually will result in long term destruction of value. An example, which had safety implications, was the development of the cone bolt for rock support in rockburst conditions. Cone bolts were never introduced significantly because they were too costly (costing about 4 times that of a conventional bolt). However, calculations that were done using mine costing showed that if the spacing of the bolts was increased by 50mm, the cost was going to be the same. Importantly, it was found that the energy absorbing capacity of the cone bolt support system was about 10 times that of conventional bolts. So, for the same cost, the mine would have had support that was very much more likely to contain rockburst damage, with subsequent safety benefits. Interestingly, modified cone bolts are now widely used in Canada. Spending more money wisely will have long term benefits and create substantial value."*

Twenty-five participants highlighted that top leadership also have the duty to define clear OHS roles and responsibilities for all levels within the organisation and eleven informants suggested that top management should provide adequate, competent and credible OHS leadership at all levels within the organisation. Seven participants recommended that integrating OHS performance with individual KRAs could enhance accountability on OHS matters. There was a shared understanding between the different stakeholder groupings on all the aforementioned insights. Furthermore, three participants (representing state, employers and organised labour) suggested that increasing the number of women in leadership positions could strengthen OHS culture as women are likely to use their natural motherly role to cultivate a culture of caring that is critical for cultivating OHS culture. The role of leadership in defining OHS responsibilities and providing competent OHS leadership is illustrated in the following statements that were made by two participants:

A key informant from academia noted: *"Top leadership should define the OHS roles and responsibilities at all levels within the organisation. Moreover, top leadership should develop strategies to hold all the people accountable for OHS. This could be achieved by incorporating a requirement for good OHS performance into the KRAs for all levels within the organisation."*

One of the OHS professionals remarked: *"Senior management has the responsibility to provide sufficient, competent and credible OHS leadership at all levels, including front line supervisors and OHS representatives. OHS leaders will be charged with the responsibility of championing the implementation of OHS improvement initiatives and leading by example. OHS leadership training and OHS strategic sessions could be held with leaders at all levels, including the OHS team, to enhance their OHS leadership capabilities. OHS leadership training should put emphasis on the importance of effective management of soft issues such as human behaviour, leadership styles, engagement, communication and leadership support."*

Thirteen participants suggested mining companies should appoint adequate number of OHS practitioners to provide technical advice on OHS management as well as to develop and champion the implementation of OHS improvement initiatives. Ten participants felt that the appointment of adequate, competent and dedicated OHS representatives was also important. There was some consensus across all stakeholder groups in both the aforesaid insights. Moreover, four participants (representing state, employers, organised labour and OHS professionals) recommended that the mining industry should consider giving OHS representatives authority to stop dangerous work, hazardous activities and unsafe behaviour.

Twenty-six stakeholders across all stakeholder groups concurred that all levels of OHS leadership have a duty to lead by example (walk the OHS talk) and demonstrate their commitment and high regard to OHS. This is reflected in the following statements that were made by two of the study participants:

One of the employers' representatives said: *"Leadership should take a leading role in driving OHS culture, creating a heathy and safe working environment and conduct regular OSH inspections and audits. All levels of leadership are required to coach different teams and individuals, walk the talk and demonstrate commitment to OHS through practices such as VFL. VFL gives leadership an opportunity to engage with the workforce and explain the rationality or importance of attainment of zero harm. Positive actions and utterances by the leadership of the organisation will also help to cultivate to cultivate OHS culture."*

An OHS professional commented: *"If the chief executive officer (CEO) sets fantastic OHS goals but you see him violating OHS provisions such as walking downstairs talking on the phone without holding handrails, coming out of bathroom not washing his hands and driving out of the workplace disregarding speed limits. How is that driving OHS culture? You say one thing, and you demonstrate something else, so it lies with you, with me, with all the people responsible. The leaders have a role to talk and then walk the talk."*

Twenty-four participants representing all stakeholder groupings agreed that securing commitment, buy-in and support at all levels of leadership was critical for the successful implementation of all OHS improvement initiatives. Transparency, timeous feedback and effective communication of OHS vision, goals, values and strategy were identified as key in securing buy-in and commitment from all leadership levels. This is captured in the following remarks that were made by two study participants:

A participant from the state remarked: *"The main ingredient for effective implementation of initiatives aimed at improving OHS culture in the mining sector is support and commitment from all levels of leadership. If top management believes that OHS is so important that no job can be done without first taking consideration of OHS, and this belief is communicated downward to the shop floor workers, then OHS improvement initiatives will be implemented effectively. There should also be a penalty/reward system for violation of OHS standards and/or achievement of OHS targets to discourage unsafe behaviour and reinforce positive behaviour."*

One of the OHS professionals said: *"Strong leadership participation and commitment in the OHSMS is important. In order to secure buy-in and commitment from all the stakeholders, the OHS vision and goal should clearly be communicated throughout the organisation. A properly crafted cost benefit analysis demonstrating the advantages of effective OHS management could assist to win the hearts and minds of all the stakeholders. Buy-in from top leadership is key as they are responsible for setting the tone and walking the OHS talk facilitating its widespread adoption throughout the entire organisation. Buy-in and commitment from the frontline supervisors and workforce is also critical as they are the final implementers of the OHS improvement initiatives."*

Regarding factors that could obstruct cultivation of positive OHS culture:

- Twenty-nine participants noted lack of management commitment, buy-in and support on OHS improvement programmes.
- Twenty-five mentioned leaders who do not always walk the zero harm production talk.
- Eighteen stated lack of adequate and competent OHS leadership, including frontline supervisors.
- Seventeen highlighted lack of clear OHS roles and responsibilities at all levels across the organisation.
- Eight suggested autocratic leadership styles and management systems.

Table 5.12 depicts a summary of the key informants' views regarding OHS leadership. The symbols are defined as follows: A=government, B=employers, C=organised labour, D=Academics and researchers, and E= OHS professionals.

Table 5.12: Summary of views on OHS leadership

Views on OHS leadership	Number (%) per stakeholder group					Total	IQV
	A	B	C	D	E		
Top leadership should define the organisation's OHS values, vision, strategy, goals and desired OHS culture	3 (50%)	13 (81%)	3 (50%)	5 (100)	3 (100%)	**27**	**0.87**
Leaders should always walk the OHS talk and demonstrate commitment to OHS	4 (67%)	13 (81%)	4 (67%)	3 (60%)	2 (67%)	**26**	**0.85**
Top leadership should define clear OHS roles and responsibilities for all employees	3 (50%)	14 (88%)	2 (33%)	4 (80%)	2 (67%)	**25**	**0.79**
Leadership should provide adequate resources to enable effective management and continuous improvement of OHS	3 (50%)	11 (69%)	4 (67%)	3 (60%)	3 (67%)	**24**	**0.89**
Securing commitment, buy-in and support on OHS matters at all levels of leadership was important	4 (67%)	10 (63%)	3 (50%)	4 (80%)	3 (100%)	**24**	**0.92**
Top leadership should create an environment in which OHS is recognised as a top priority	4 (67%)	9 (56%)	3 (50%)	3 (60%)	2 (67%)	**21**	**0.91**
Mines should appoint adequate number of OHS practitioners to provide technical advice on OHS management	2 (33%)	5 (31%)	2 (33%)	2 (40%)	2 (67%)	**13**	**0.95**
Top management should provide adequate, competent and credible OHS leadership at all levels	1 (17%)	3 (19%)	2 (33%)	3 (60%)	2 (67%)	**11**	**0.97**
Mines should appoint adequate, competent and dedicated OHS representatives	2 (33%)	3 (19%)	3 (50%)	1 (20%)	1 (33%)	**10**	**0.95**

OHS risks should be considered in the design of all operational aspects of the business	1 (17%)	2 (13%)	1 (17%)	3 (60%)	2 (67%)	**9**	**0.96**
Integrating OHS performance with individual KRAs could enhance accountability on OHS matters	1 (17%)	2 (13%)	1 (17%)	2 (40%)	1 (33%)	**7**	**0.97**
Efforts should be made to understand the short, medium and long term impacts of OHS improvement initiatives	0 (0%)	1 (6%)	0 (0%)	2 (40%)	1 (33%)	**4**	**0.78**
OHS representatives should be given authority to stop dangerous work, hazardous activities and unsafe behaviour	1 (17%)	1 (6%)	1 (17%)	0 (0%)	1 (33%)	**4**	**0.94**
Increasing number of women in leadership positions could strengthen OHS culture	1 (17%)	1 (6%)	1 (17%)	0 (0%)	0 (0%)	**3**	**0.83**

5.2.2.10 Theme 10: Perceptions about collaboration on OHS matters

The analysis of data for this theme showed that the participants perceived that a collaborative approach in which all the key stakeholders are consulted, engaged and actively participate in the development and implementation of OHS improvement programmes, was fundamental for attaining and sustaining positive OHS culture. At typical mining operation, the stakeholders could include top leadership (board of directors and senior management), management, frontline supervisors, workforce, inspectorate and contractors. Twenty-three participants felt that the involvement of all the stakeholders, particularly shop floor workers, will ensure that real OHS challenges encountered at workplaces are well understood, enabling the development and implementation of appropriate corrective actions. Six stakeholders suggested that effective participation of all stakeholders could ensure that all stakeholders jointly take responsibility on OHS matters, rather than blaming each other if something goes wrong. There was a shared understanding across all stakeholder groupings on all the aforementioned views. Five participants (representing state, employers, organised labour and OHS professionals) added that the process of stakeholder engagement should not just be a "tick the box" exercise but a

genuine desire to involve all the stakeholders in the identification of gaps in the OHSMS and co-creation of mitigation measures. The following quotations illustrate some of the participants' responses about collaboration on OHS matters:

One of the organised labour representatives noted: *"The "nothing about us without us" principle is very relevant for effective OHS management. Engagement, consultation and collaboration by all stakeholders is very important in order to secure their buy-in, commitment and ownership throughout the lifecycles of all OHS programmes. Mines should create various platforms for participation on OHS matters such as OHS committee meetings, OHS tripartite forums, OHS talks and use of OHS suggestions and complains logbooks. Stakeholder commitment could be secured by demonstrating the benefits of zero harm production that could be attained through cultivating and sustaining a positive OHS culture. A collaborative approach will allow a holistic understanding of the OHS challenges that are experienced by all the people in the organisation as well as to give people an opportunity to formulate interventions to improve OHS. Planning processes should include representatives of all stakeholders within the organisation."*

A participant representing employers commented: *"A collaborative approach in which all the stakeholders can participate in the initiatives will give all people a sense of ownership to the OHS improvement initiatives and creates commitment and buy-in. It is key to ensure employees form part and parcel of the OHS initiatives, rather than using a top-down approach in which employees are not involved during the development of the initiatives and are only instructed to implement the initiatives. Forcing people to simply implement initiatives in the absence of adequate consultation, engagement and involvement during conceptualisation, development and implementation of OHS improvement initiatives could result in lack of buy-in and resistance to change. It is important to create an environment where all people can freely engage about OHS matters. Effective participation of the workforce on OHS matters will enable the organisation to learn from people at the coal face. Moreover, involvement of all levels within the organisation will enable all people to understand their exposure to OHS risk and the importance of effective OHS management to ensure that every person returns home unharmed from work every day."*

Sixteen participants suggested that commitment and buy-in could be secured if all the people have a clear understanding of the OHS improvement initiatives, their respective OHS roles and how they are supposed to participate in the initiatives. Fourteen informants noted that commitment and buy-in could be enhanced by effective consultation and co-creation of OHS improvement initiatives and workplace OHS policies by all stakeholders, and seven participants mentioned strong VFL. There was some consensus across all stakeholder groups in both the aforesaid perceptions. Four study participants (representing employers, researchers and OHS professionals) felt that cultivation of a high-performance work ethic was also important for attainment of OHS goals. For example, one of the OHS professionals said the following: *"Successful implementation of any OHS improvement initiative is dependent on the level of understanding of the nature and importance of the initiative, and the level of commitment and buy-in by all the stakeholders, particularly shop floor workforce. For example, the CEO can set the tone for zero harm but if all the people do not toe the line, then OHS improvements will not occur. Teamwork and high-performance work ethic are also important."*

Six participants across all stakeholder groups suggested that organisational OHS culture was an outcome of the combined OHS culture of all the people within the organisation. Thus, it was critical to cultivate the desired OHS behaviour and OHS culture in all people within the organisation. This is illustrated in the following quotation from one of the participants from the state: *"It is important to note that organisational OHS culture is a product of the individual OHS cultures of all the people within the organisation. To improve organisational OHS culture, it is important to nurture the right OHS behaviour and positive OHS culture within all the individuals in the organisation."*

Four participants (representing employers, researchers and OHS professionals) recommended that the mining industry should consider including a higher level of education, say a minimum of matric education, as a recruitment criterion to facilitate the ability to comprehend concepts and fair engagements at all levels as captured in the following statement by one of the OHS professionals: *"The mining sector should consider adopting a relatively higher level of education, such as matric level, as a minimum entry requirement for employment in the sector.*

The inclusion of a higher level of education as a recruitment criterion is important to at least facilitate the ability to take-up concepts with understanding. Arguably, a higher level of education also enables "fair" engagements between all levels of workers."

Thirteen participants representing all stakeholder groups felt that in order to enable effective collaboration with all the stakeholders in the identification of constraints within the OHSMS and co-creation of corrective actions, it was important for organisations to create a conducive environment that will ensure free and voluntary participation by the stakeholders. All the stakeholder groups concurred that a conducive environment could be created by establishing a culture of respect and care in which all the people are treated with dignity and equality. For instance, the mines could demonstrate a culture of care and respect by allowing all people to freely air their OHS concerns and suggestions, providing feedback on the concerns and suggestions, and providing decent and conducive work environment. Nine informants from all the stakeholder groupings highlighted that it was important for mining companies to develop innovative ways of fostering and enhancing trust at all levels across the organisation. Three participants (representing state and organised labour) added that the industry as a whole could benefit if there is better alignment amongst all the stakeholders, particularly employers, labour and government on OHS matters. For example, two of the study participants made the following sentiments:

A key informant representing organised labour stated: *"Fostering trust at all levels within the organisation is crucial for effective management of OHS and success of OHS improvement programmes at any workplace. A culture of trust will facilitate a clear understanding of the importance of improving OHS and easily secure buy-in and commitment from all the stakeholder groupings. The organisations should focus on fostering effective working relationships at all levels, putting emphasis on factors such as trust, care and respect. People should be treated well, respected and be accorded decent working conditions."*

One of the employers' representatives noted: *"We have programmes aimed at improving relationships at all levels within the organisation such as diversity management programmes*

and programmes to curb unfavourable issues such as workplace bullying, victimisation, sexual harassment and harassment in general. We embrace a culture of respect and caring for the total well-being of all people and we treat all employees with dignity and with equal rights. Values such as care must be lived and demonstrated continuously, and not designated to a policy document."

Eight participants across all the stakeholder groupings concurred that it was important for all the stakeholders to realise that maintaining a healthy and safe working environment is not just a compliance issue, rather it is important for the wellbeing of all the stakeholders and the sustainability of the business. One of the participants from academia pointed out that: *"The various initiatives aimed at improving OHS in the mining sector could be effectively implemented when all the stakeholders consider OHS as matter of self-enlightened interest that is beneficial to all the stakeholders and the organisation. In other words, zero harm should not only be pursued to fulfil legislative requirements, rather it must be pursued because it is in the best interests of the total well-being of all the stakeholders and sustainability of the business. All the people should voluntarily embrace sound OHS management not because they are required to do so by management and the regulator, but because it is in their conviction that it is good for them, individually and collectively. Get to a situation where each person is the next person's monitor, as far as OHS is concerned."*

Moreover, the participants noted that the establishment of a positive OHS culture could be constrained by factors such as:

- Failure to engage, consult and involve all stakeholders, particularly the workforce, could result in lack of commitment, support, buy-in and alignment on OHS matters, as highlighted by twenty-one informants.
- Failure to listen to OHS concerns or OHS improvement suggestions from all the stakeholders as noted by fifteen participants.
- Failure to treat all the people with care and respect, trust deficit and poor stakeholder relationships at all levels across the organisation as suggested by eleven participants. For example, one of the OHS professionals remarked that *"One of the common*

comments from unions is that the employer cannot be trusted, in what they do or say. Trust is a fundamental requirement for any meaningful dialogue and engagement. Thus, the employer must endeavour to build trust. This can be done in the simple things, such as use of common facilities and amenities (change houses, tea rooms, canteens and parking). These simple (but fundamental) actions at a practical level, can begin to bridge the hierarchical gap that is common in SAMI. The industry should adopt the motto: what is good for the ordinary worker must be good for the manager. That is how it is elsewhere in the world, where equality is almost taken for granted."

The study participants' views pertaining to collaboration on OHS matters are summarised in Table 5.13. The symbols are defined as follows: A=government, B=employers, C=organised labour, D=Academics and researchers, and E= OHS professionals.

Table 5.13: Summary of views on collaboration on OHS matters

Participants views on collaboration on OHS matters	**Number (%) per stakeholder group**					**Total**	**IQV**
	A	**B**	**C**	**D**	**E**		
Involvement of all the stakeholders, particularly shop floor workers, will ensure comprehensive understanding of all OHS challenges	4 (67%)	10 (63%)	4 (67%)	3 (60%)	2 (67%)	**23**	**0.91**
Buy-in and commitment could be enhanced if all stakeholders clearly understand the OHS improvement initiatives and their respective OHS roles and responsibilities	3 (50%)	6 (38%)	3 (50%)	2 (40%)	2 (67%)	**16**	**0.95**
Stakeholder commitment could be improved by consultation and co-creation of OHS policies and improvement initiatives	3 (50%)	4 (25%)	4 (67%)	2 (40%)	1 (33%)	**14**	**0.96**
It was important to create a conducive environment were all	2 (33%)	3 (19%)	3 (50%)	3 (60%)	2 (67%)	**13**	**0.99**

stakeholders freely and voluntary participate on OHS matters							
It was critical to develop state-of-the-art techniques of fostering and enhancing trust at all levels	2 (33%)	2 (13%)	2 (33%)	2 (40%)	1 (33%)	**9**	**0.99**
It was important for all stakeholders to realise that good OHS management was a matter of enlightened self-interest	1 (17%)	2 (13%)	1 (17%)	2 (40%)	2 (67%)	**8**	**0.98**
Effective participation of all stakeholders could ensure collective responsibility on OHS matters	2 (33%)	1 (6%)	1 (17%)	1 (20%)	1 (33%)	**6**	**0.97**
It was critical to nurture the desired OHS behaviour and culture in all people, noting organisational culture was an outcome of the combined culture	1 (17%)	2 (13%)	1 (17%)	1 (20%)	1 (33%)	**6**	**0.97**
Stakeholder engagement process should be driven by a genuine desire to involve the stakeholders in OHS matters	1 (17%)	1 (6%)	2 (33%)	0 (0%)	1 (33%)	**5**	**0.90**
Nurturing a high-performance work ethic was important	0 (0%)	2 (13%)	0 (0%)	1 (20%)	1 (33%)	**4**	**0.78**
Introduction of higher level of education as a minimum recruitment criterion could enhance comprehension of concepts and fair engagements	0 (0%)	1 (6%)	0 (0%)	1 (20%)	2 (67%)	**4**	**0.78**
Alignment between the tripartite stakeholders on OHS matters could assist to drive OHS improvement	2 (33%)	0 (0%)	1 (17%)	0 (0%)	0 (0%)	**3**	**0.56**

5.2.2.11 Theme 11: Empowering all stakeholders to effectively manage OHS

The analysis under this theme showed that nineteen participants across all the stakeholder groups agreed that OHS culture could be improved by empowering all the people to take

responsibility of their own and fellow colleagues' OHS. This could be achieved through measures such as training, coaching, refresher courses, workshops, OHS talks, learning from OHS incidents and creating awareness of OHS matters. The training programme should be appropriately tailored for the respective target audience, taking cognisance of factors such as literacy levels and language barriers. For example, the following related comment was made by one of the study participants from the state: *"The culture of OHS could be improved by empowering all the people (including contractors) to effectively deal with OHS matters, including taking responsibility for OHS of themselves and other employees. This could be achieved through mechanisms such as training, refresher training, OHS leadership training, coaching, OHS talks, OHS meetings, task observations and VFL."*

Four study subjects (representing state, employers, researchers and OHS professionals) recommended that the industry should consider recruiting people with a minimum of at least matric qualification for all jobs. This is because a reasonably educated workforce could easily comprehend OHS information and instructions, thus was likely to embrace positive OHS culture which is critical for continuous OHS improvement. Three interviewees (representing state, researchers and OHS professionals) suggested that it could be useful to train all people in the mining industry about the concept of OHS culture, as illustrated in the following quotation from one of the OHS professionals: *"The OHS culture concept is not well understood in the mining sector, particularly by frontline supervisors and frontline employees. The industry could benefit by providing some tailored OHS culture training, to give all people within the company a clear understanding of the OHS culture concept and other associated soft skills that are required to cultivate a positive OHS culture."*

Stakeholders highlighted that the establishment of a strong OHS culture could be enhanced by factors such as:

- Empowering people at all levels in the organisation to effectively manage OHS through interventions such as high impact training, coaching and extensive OHS orientation programs, as noted by twenty-five informants from all stakeholder groups.

- Availability of a workforce with competence and skills to effectively manage OHS risks, as highlighted by twenty participants across the five stakeholder groups.
- Good personnel selection, job placement and promotional procedures, as suggested by five stakeholders from all stakeholder groups.

Thirteen participants across all stakeholders groups agreed that OHS culture improvement initiatives could be hampered by lack of workforce with competence to effectively manage OHS risks, and inadequate and ineffective training of the workforce on OHS matters.

Table 5.14 provides a summary of opinions of the key informants related to empowering stakeholders to effectively manage OHS. The symbols are defined as follows: A=government, B=employers, C=organised labour, D=Academics and researchers, and E= OHS professionals.

Table 5.14: Summary of opinions related to empowering stakeholders

Opinions related to empowering stakeholders to effectively manage OHS	**Number (%) per stakeholder group**					**Total**	**IQV**
	A	**B**	**C**	**D**	**E**		
Significance of empowering all stakeholders to take responsibility of OHS of themselves and fellow colleagues	3 (50%)	9 (56%)	3 (50%)	2 (40%)	2 (67%)	**19**	**0.88**
OHS culture improvement initiatives could be obstructed by lack of competency to effectively manage OHS	2 (33%)	5 (31%)	2 (33%)	2 (40%)	2 (67%)	**13**	**0.95**
Sector should consider introducing mandatory minimum education requirements for employment	1 (17%)	1 (6%)	0 (0%)	1 (20%)	1 (33%)	**4**	**0.94**
Sector should consider introducing training on the concept of OHS culture	0 (0%)	1 (6%)	0 (0%)	1 (20%)	1 (33%)	**3**	**0.83**

5.2.2.12 Theme 12: Communication, feedback and awareness on OHS matters

This theme showed that providing timeous and effective communication, feedback and awareness campaigns on OHS matters, to all stakeholders within the organisation (including contractors), was critical to promote the cultivation of positive OHS culture. Twenty-six participants from all stakeholder groups noted that mining companies should develop and implement communication strategies in order to ensure that all levels within the organisation are timeously kept informed with accurate OHS information. The communication strategy should embrace two-way communication to allow all the people to freely raise OHS concerns from their respective workplaces, propose corrective actions and opportunities for continuous improvement, and provide inputs into the OHS management strategy. Seventeen participants representing all stakeholder groups felt that it was important to provide timeous feedback with regards to how the raised OHS concerns will be addressed, progress of implementation of the recommendations and why certain recommendations could not be implemented. Fourteen study subjects across all stakeholder groups concurred that pre-shift OHS briefings or toolbox talks could assist to reinforce OHS hazard awareness within the crews, making sure that the teams always have OHS at the top of their mind. This is highlighted in the following statement by one of the employers' representatives: *"Strong communication channels on OHS matters, including having feedback meetings with employees is important. The communication and feedback should be clear, timeous, accurate and appropriately tailored for the respective target audience. Tailgate talks, toolbox talks or OHS briefings should regularly be held with the crews in order to reinforce OHS awareness, making sure that the teams always have OHS at their fingertips. During OHS briefings, supervisors can draw attention to hazards, processes, equipment, tools, environment and materials to inform all workers of the risks in their surroundings."*

Eleven participants from all the five stakeholder groups concurred that effective communication would keep all the people across the organisation motivated and updated throughout the process. Six interviewees representing all stakeholder groupings proposed that at an industry level, continuous improvement in OHS could be promoted by creating more opportunities for organisations to benchmark against one another and share best practices through platforms similar to the MOSH process, workshops, seminars and field visits. Two

participants (representing state and organised labour) suggested that channels for anonymous reporting of OHS matters could assist to bring important insights and opportunities for OHS improvement to the attention of management, in environments where employees cannot freely talk about OHS matters. Ten informants from all stakeholder groups noted that the establishment of positive OHS culture could be stalled by poor communication and lack of feedback on OHS matters, while eight participants across all stakeholder groups mentioned fear of victimisation after raising concerns on OHS matters.

Table 5.15 summarises the perceptions of the interviewees regarding the importance of effective OHS communication. The symbols are defined as follows: A=government, B=employers, C=organised labour, D=Academics and researchers, and E= OHS professionals.

Table 5.15: Summary of perceptions regarding effective OHS communication

Perceptions regarding OHS communication	**Number (%) per stakeholder group**					**Total**	**IQV**
	A	**B**	**C**	**D**	**E**		
Importance of effective two-way communication on OHS matters covering all stakeholders	3 (50%)	13 (81%)	4 (67%)	3 (60%)	3 (100%)	**26**	**0.86**
Significance of providing timeous feedback on OHS matters	3 (50%)	7 (44%)	3 (50%)	2 (40%)	2 (67%)	**17**	**0.93**
Pre-shift OHS talks could reinforce the importance of good OHS management within the crews	2 (33%)	5 (31%)	2 (33%)	3 (60%)	2 (67%)	**14**	**0.96**
Effective communication could keep all people motivated	2 (33%)	4 (25%)	2 (33%)	2 (40%)	1 (33%)	**11**	**0.95**
Importance of sharing OHS information and best practices within the sector	2 (33%)	1 (6%)	1 (17%)	1 (20%)	1 (33%)	**6**	**0.97**
Anonymous reporting of OHS concerns could offer an	1 (17%)	0 (0%)	1 (17%)	0 (0%)	0 (0%)	**2**	**0.63**

alternative in repressive environments							

5.2.2.13 Theme 13: Perceptions about use of innovation to improve OHS

The analysis of data for this theme showed that twenty-three participants across all stakeholder groups perceived that technological innovation could result in significant improvement in OHS performance and OHS culture. Firstly, technological innovation could make mining less labour intensive, resulting in removal of the workforce from dangerous workplaces, allowing people to operate equipment remotely from safe positions. Secondly, technological innovation such as proximity detection (collision avoidance) systems, could be used to improve the effectiveness of the OHS risk management process. The following quotations illustrate some of the participants' thoughts about the impact of technological innovation on OHS performance:

A stakeholder representing employers remarked: *"We continuously embrace technological innovation as a means of removing our workforce from dangerous workplaces and improving the effectiveness of the OHS risk management process. Get people to work smarter (not harder), mechanise where possible, consider the application of technology to control risk and adopt best OHS practices. We actively encourage and reward personnel for OHS innovations."*

A participant from organised labour said: *"From organised labour perspective, we believe technology could immensely contribute to reduction of accidents as most machines will be operated from the control room with less or no risk to employees."*

Five stakeholders representing all stakeholder groupings highlighted that in certain deep level conventional underground mines, it was increasingly becoming challenging to mine safely and economically due to increased OHS risks from issues such seismicity, falls of ground, fatigue, production pressures and unconducive work environments. It was further noted that technological innovation could assist to ensure the realisation of the target of zero harm production, as captured in the following statement by one of the participants from academia:

"As mining gets deeper, the environment will increasingly become unconducive for conventional mining. Many conventional mines are old, the infrastructure is dilapidated and travelling times to working places are long. It may be impossible to simultaneously attain OHS goals and meet production targets (zero harm) at these mines. This will leave mechanisation as the only feasible solution for making the mining process more efficient and to remove workers from dangerous workplaces."

Three participants (representing employers, researchers and OHS professionals) cautioned that sustainable technological innovation in the mining sector could be hampered by lack of buy-in from stakeholders, particularly organised labour, due to fear of associated negative impacts such as job losses. This is highlighted in the following quotation from one of the OHS professionals: *"OHS goals could be achieved easier through the implementation of mechanisation strategies. But, in some instances, this is hampered, or slowed down by organised labour, for fear of their members losing jobs. In my opinion, this is irresponsible unionism, which may lead to the demise of the mining sector, particularly underground conventional gold and PGM mines, which cannot remain viable if they do not mechanise. It is postulated that with a more educated workforce, the tolerance for change can be enhanced. The more educated the worker, the more they can be retrained to "man" new machinery and also, the less such a worker would feel dependent on their current job, as they can migrate to other sectors (with a bit of re-oriental training). I noted that unions whose membership is in the skilled bands are less resistant to change."*

The study subjects' perceptions regarding the importance of use of technological innovation to improve OHS performance and effectiveness of the OHS risk management process are summarised in Table 5.16. The symbols are defined as follows: A=government, B=employers, C=organised labour, D=Academics and researchers, and E= OHS professionals.

Table 5.16: Summary of perceptions on use of technology to improve OHS

Perceptions on use of technology to improve OHS	Number (%) per stakeholder group					Total	IQV
	A	B	C	D	E		
Technological innovation could improve OHS conditions and enhance the effectiveness of the OHS risk management process	4 (67%)	11 (69%)	3 (50%)	3 (60%)	2 (67%)	**23**	**0.86**
Technological innovation could enable safe and economic extraction of deep and narrow orebodies	1 (17%)	1 (6%)	1 (17%)	1 (20%)	1 (33%)	**5**	**1.00**
Technological innovation could be obstructed by lack of stakeholder buy-in	0 (0%)	1 (6%)	0 (0%)	1 (20%)	1 (33%)	**3**	**0.83**

5.2.2.14 Theme 14: Effect of external factors

Analysis of data under this theme revealed that establishing and maintaining a sustainable OHSMS and a strong OHS culture require a holistic approach comprising a consideration of other external factors such as national health and safety culture and socio-economic conditions. Thirteen participants from the five stakeholder groups concurred that the establishment of positive OHS culture at workplaces could be enhanced if efforts are directed towards nurturing a positive health and safety culture at societal and national levels. This could assist in reinforcing health and safety as a way of life (lifestyle) rather than a workplace phenomenon. Moreover, six study subjects from all stakeholder groups highlighted that holistic approach should consider the impact of other socio-economic factors such as fatigue, stress, life pressures and diversity of people at the organisation. This is illustrated in the following comments from some of the study participants:

One of the OHS professionals said: *"The national safety and health culture also plays a part in the establishment of a positive OHS culture. People in the mining industry come from a diverse culture and background, thus, differences in thoughts, beliefs and values. Generally, in South Africa, people are usually self-centred and lacks a systems thinking approach. They*

disregard the impact of their actions on the entire system. For example, how many times do we see people driving into a chocked intersection blocking traffic, instead of stopping to allow traffic with the right of way and unblocked roadway to pass?"

An employer representative noted: *"South Africa is considered to be a third world country and due to this, in my opinion, most people come from a relatively high-risk taking background, in general. We often, expect people to suddenly switch into an OHS culture mode once entering a mine, whilst their behaviour at home or on the road is one of high risk taking. For example, drinking and driving, speeding and not adhering to the rules, being fully aware of the consequences. The mining industry must have a holistic approach that takes into consideration the whole value chain of an individual and not only the work component. If individuals consider health and safety in every aspect of their life, then OHS becomes a way of life and not something to only switch on when at work."*

Nine study participants across all stakeholder groupings highlighted that the establishment of positive OHS culture could be decelerated by disregarding the impact of the external environment, prevailing societal health and safety culture and other socio-economic factors on the OHSMS. Socio-economic factors include colonial legacy, corruption, nepotism, factionalism, favouritism, abuse of power, gender inequality, racism, tribalism and other forms of discrimination.

Table 5.17 provides a summary of the study subjects' views pertaining to the importance of a holistic consideration of factors from both the external and internal environment in OHS management. The symbols are defined as follows: A=government, B=employers, C=organised labour, D=Academics and researchers, and E= OHS professionals.

Table 5.17: Summary of views pertaining to consideration of external factors

Views pertaining to consideration of external factors	Number (%) per stakeholder group					Total	IQV
	A	B	C	D	E		
Importance of cultivating a positive health and safety culture at societal levels	2 (33%)	4 (25%)	2 (33%)	3 (60%)	2 (67%)	**13**	**0.98**
Cultivation of positive OHS culture could be negatively affected by lack of a holistic consideration of both internal and external factors	2 (33%)	3 (19%)	1 (17%)	2 (40%)	1 (33%)	**9**	**0.96**
It was key to take a holistic approach considering the impact of other socio-economic factors	1 (17%)	1 (6%)	1 (17%)	2 (40%)	1 (33%)	**6**	**0.97**

5.2.2.15 Theme 15: Perceptions about the CTF

The analysis of data under this theme showed that twenty-nine participants from all stakeholder groupings concurred that most people in the SAMI were familiar with the CTF, because it was part of the 2014 OHS summit milestones. Twenty-six key informants across all stakeholder groups felt that most of the CTF pillars were relevant in most companies' OHS management approach. Eighteen informants representing all stakeholder groups believed that the successful implementation of the CTF by the sector could break the plateauing OHS performance, resulting in significant improvement in OHS culture and OHS performance. Pillars that were mentioned as important include risk management, technology, leading practice, tripartism, bonuses and performance incentive, elimination of discrimination, leadership and regulatory framework.

However, eight study subjects representing all stakeholder groups noted that the knowledge of the CTF was only limited to management and most of the workforce was not aware of its existence. Seven participants across the five stakeholder groups highlighted that the industry has not yet realised maximum benefit from the CTF possibly due to factors such as minimum buy-in by all the stakeholders, slow implementation by the mining companies and poor

implementation approach. Six participants from all stakeholder groups highlighted the need to disseminate or popularise the CTF to all people within the organisation and the industry at large. Four participants (representing employers, researchers and OHS professionals) noted that all the CTF pillars were interrelated and optimum improvement in OHS could be attained if all the pillars are simultaneously implemented, rather than in a piecemeal manner. This is captured in the following comments from two study participants:

A key informant representing employers commented: "*All the pillars are relevant and inter-related. In my opinion, you cannot drive one pillar in isolation from other pillars. I feel that all the pillars, if driven and adopted effectively will result in an improvement in organisational culture and a subsequent improvement in OHS. The SAMI has experienced their best safety statistics to date with a resultant 51 fatalities for the 2019 calendar year as compared to the 81 in 2018. It seems like we have picked up the low-lying fruit and exhausted the implementation of physical controls. My opinion and projection is that we have plateaued at about 50 fatalities per annum and it is now time to focus on improving OHS culture (getting OHS into the minds and hearts of our people), thus allowing progressive improvements in OHS."*

A participant from the state noted: *"The CTF was introduced about eight years ago. Has anything changed significantly during those eight years to indicate success in the implementation of the CTF? The Pillars are known but not widely publicised or practised by the mining industry. The current economic climate is often used to defend lack of implementation, but evidence shows that there is positive correlation between OHS performance and productivity. Communication of the CTF is inadequate, and there is no incentive to comply or penalty for non-compliance. All CTF pillars should be understood on how they impact other pillars and OHSMS (i.e. systematic approach rather than the silo approach). Thus, significant OHS improvement could be achieved when a systematic approach, where the entire CTF is implemented in its totality rather than in phases."*

Three interviewees (representing employers, researchers and OHS professionals) hinted that the CTF was only a guiding document that could be used by the individual mines to develop a comprehensive and tailored OHS culture improvement strategy. For instance, one of the OHS professionals remarked: *"In summary, the CTF is a broad-brush and general guideline. Each operation should take the framework and adopt it to its own circumstances, obtain ownership from its workforce, set own goals, produce own relevant plans and implement. It is also imperative that the level of education be raised to enable flexibility of employment and meaningful engagements between the levels within the company."*

The participants recommended a number of opportunities for improvement of the CTF. Seven participants representing all stakeholder groups noted that there was a need to review and update the CTF in order to ensure the CTF remains aligned to global best practices, addresses the emerging issues such as technological innovation and women in mining and emphasise the importance of health not just safety. Four stakeholders suggested that the CTF could be enhanced by addition of more elements and / or streamlining existing elements, and providing some guidance to the sector on implementation and change management. Four participants (representing state, employers, organised labour and OHS professionals) suggested that the CTF should emphasise the importance of a holistic OHS management approach, taking consideration of all system elements such as the physical environment, people and practices. Three informants (representing state, organised labour and OHS professionals) proposed that the CTF should emphasise that leadership refers to all levels of OHS leadership including front-line supervisors, not just management. Three stakeholders (representing employers, researchers and OHS professionals) highlighted that the name CTF was misleading and revision of the name to OHS CTF could enhance recognition by the industry of the importance of the framework as a tool for improving OHS culture and OHS performance. Three stakeholders (representing researchers and OHS professionals) were concerned with the current reporting arrangements, where the progress of implementation of the CTF pillars was reported as part of mining charter requirements rather than in the same way OHS performance indicators like injuries, fatalities and occupational diseases are reported. The participants felt that this could unintentionally send a wrong message to the industry over the importance of the CTF.

Table 5.18 provides a summary of the stakeholders' perceptions pertaining to the effectiveness of the CTF as a tool for cultivating positive OHS culture in the mining industry. The symbols are defined as follows: A=government, B=employers, C=organised labour, D=Academics and researchers, and E= OHS professionals.

Table 5.18: Summary of perceptions about the CTF

Perceptions about the CTF	**Number (%) per stakeholder group**					**Total**	**IQV**
	A	**B**	**C**	**D**	**E**		
Knowledgeable about the CTF	6 (100%)	14 (88%)	4 (67%)	3 (60%)	2 (67%)	**29**	**0.86**
CTF pillars were relevant in most companies' OHS management approach	4 (67%)	14 (88%)	3 (50%)	3 (60%)	2 (67%)	**26**	**0.82**
OHS performance plateau could be broken if the CTF was adopted and implemented correctly by the mines	3 (50%)	8 (50)	2 (33%)	3 (60%)	2 (67%)	**18**	**0.90**
Knowledge of the CTF was mainly limited to people in management positions	1 (17%)	3 (19%)	2 (33%)	1 (20%)	1 (33%)	**8**	**0.94**
Successful implementation of the CTF in the sector could have been obstructed by lack of stakeholder buy-in and change management strategies	2 (33%)	1 (6%)	1 (17%)	2 (40%)	1 (33%)	**7**	**0.97**
The CTF could be enhanced by aligning it to best practices in OHS culture management and emphasising importance of health	1 (17%)	2 (13%)	1 (17%)	2 (40%)	1 (33%)	**7**	**0.97**
Importance of popularising the CTF	2 (33%)	1 (6%)	1 (17%)	1 (20%)	1 (33%)	**6**	**0.97**
Optimum results could be realised through concurrent implementation of all CTF pillars	0 (0%)	2 (13%)	0 (0%)	1 (20%)	1 (33%)	**4**	**0.78**

CTF could be improved by inclusion of guidance on implementation strategies and change management, and putting emphasis on importance of systematic OHS management approach	1 (17%)	1 (6%)	1 (17%)	0 (0%)	1 (33%)	**4**	**0.94**
Importance of clarifying that leadership refers to all levels of OHS leadership including front-line supervisors, not just management	1 (17%)	0 (0%)	1 (17%)	0 (0%)	1 (33%)	**3**	**0.83**
Changing the name from CTF to OHS CTF could elevate its recognition as a tool for improving OHS culture and OHS performance	0 (0%)	1 (6%)	0 (0%)	1 (20%)	1 (33%)	**3**	**0.83**
Progress of CTF implementation should be reported on the same platform as fatalities and injuries	0 (0%)	0 (0%)	0 (0%)	2 (40%)	1 (33%)	**3**	**0.56**

5.3 Conclusions

The section presented the findings from the qualitative study, based on the fifteen deductive themes on perceptions and experiences of the study participants. Numbers were included in the analysis and reporting of qualitative data to improve the generalisability of the study findings and to assist the reader to have a holistic understanding of the diversity of the views of the key informants from the different stakeholder groupings. The IQV was specifically used as an indicative measure of the level of concurrence of the different stakeholder groups on a particular perception. Generally, a high level of concurrence amongst all the stakeholder groupings was noted on most of the perceptions under the different themes. In some few instances, moderate concurrence (when at least three stakeholder groups agreed on a certain view) and little concurrence (when less than three stakeholder groups agreed on a certain view) were observed.

The study found that the OHS culture concept was understood in several different but interrelated ways and there was some alignment in OHS goals across the mining sector. The findings showed that cultivation of positive OHS culture was critical for attainment of OHS goals and identified some best practices in the management of some of the key drivers of positive OHS culture. The identified OHS culture drivers include adoption of collaborative, reporting, learning, just, informed and compliance cultures, competent OHS leadership, right OHS behaviour, effective OHSMS, and holistic and systematic approach on OHS matters. Additional identified drivers include monitoring, evaluation and continuous improvement of OHS culture, proper planning and management of the OHS culture change process. The majority of the study participants were knowledgeable about the CTF and most of these felt that the CTF was relevant in most organisations' OHS management approach and successful implementation of the CTF could result in step change OHS improvements.

Little concurrence amongst the five stakeholder groups was noted on the following perceptions:

- Reference to the Khumbul'ekhaya zero harm initiative that was driven by MCSA.
- The use of the DuPont Bradley Curve's OHS culture transformation journey as an OHS culture assessment tool.
- The use of independent and competent OHS incident investigation teams to improve the effectiveness of the OHS incident investigation process.
- The importance of alignment between the tripartite stakeholders on OHS matters to enable progressive OHS improvements.
- The need to establish channels to facilitate anonymous reporting of OHS concerns by employees working in repressive environments.
- The importance of reporting the progress of CTF implementation in the same manner as other OHS performance indicators such as fatalities, injuries and diseases.

The next section discusses and compares the CTF against findings of the qualitative study.

CHAPTER 6 : INVESTIGATION OF THE CTF AGAINST FINDINGS OF THE QUALITATIVE STUDY

6.1 Introduction

An investigation was conducted to benchmark the CTF against the findings of the qualitative study, related to the key informants' experiences in managing OHS culture in the mining sector (step 4 in Figure 6.1).

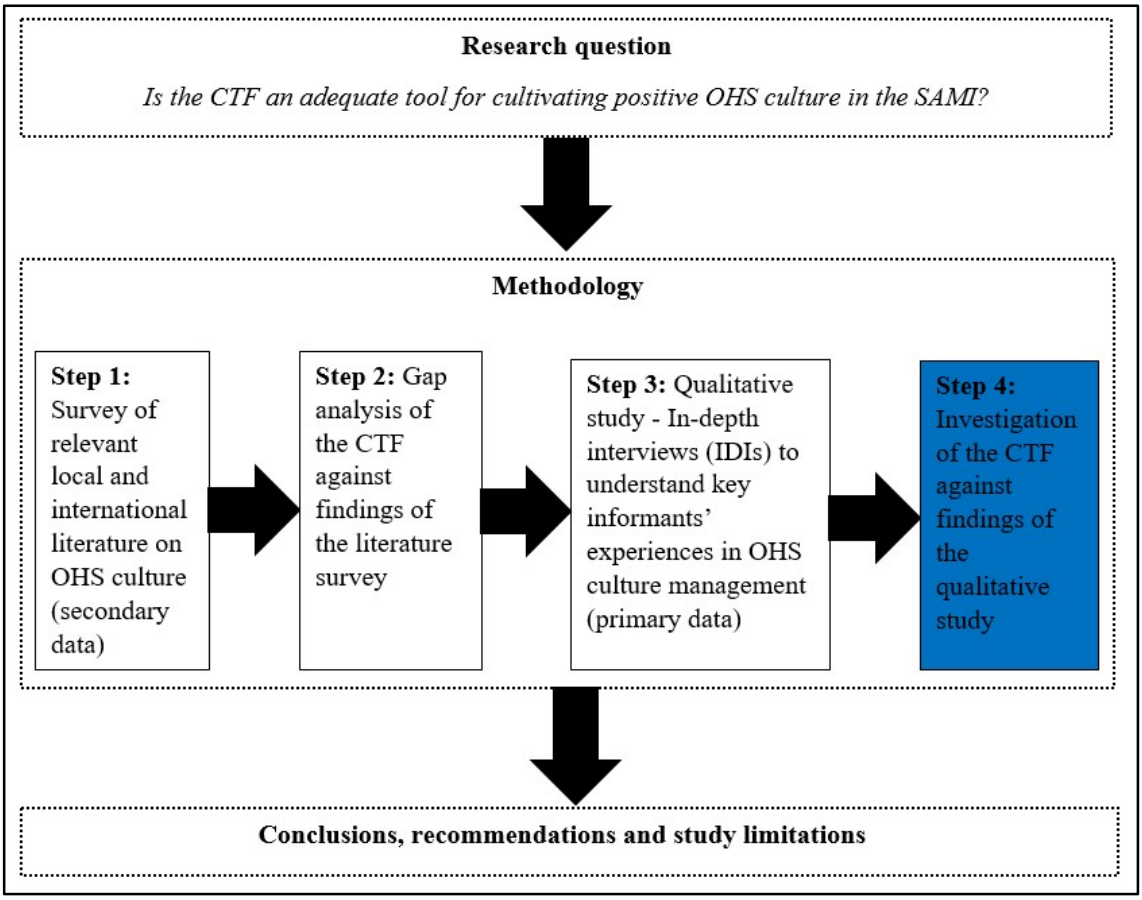


Figure 6.1: Diagrammatic illustration of the research methodology that was followed

The CTF was reviewed to establish if sufficient details were provided to allow a holistic understanding of the OHS culture concept, particularly OHS culture definition, OHS culture elements and significance of cultivating positive OHS culture. The investigation explored the gaps between the CTF and participants' perceptions on evolution models, assessment techniques, reporting and change management aspects related to OHS culture. The analysis also focused on the participants' perceptions about the adequacy and effectiveness of the CTF as a tool for cultivating positive OHS culture in the mining sector. Furthermore, the CTF was examined against the critical success factors for cultivation of strong OHS culture that were revealed by the qualitative study. Recommendations to improve the effectiveness of the CTF as a tool for nurturing positive OHS culture were formulated, based on the outcomes of the gap analysis.

OHSMS provides a tool for ensuring sound OHS management and deficiencies in OHSMS are indicators of flaws in OHS management within a particular organisation. OHS culture is the engine that facilitates the development, implementation and continuous improvement of the OHSMS. Thus, poor organisational OHS culture results in a deficient OHSMS, hence poor OHS performance. Figure 6.2 depicts the OHS culture improvement framework that was developed based on the best practices identified from the literature study. The departure point in developing an OHS culture improvement strategy is having a comprehensive understanding of the OHS culture concept. Understanding of the meaning of OHS culture can be enhanced by exploring the definitions, characteristics (elements) and benefits of establishing positive OHS culture. The second step involves having a holistic understanding of available OHS culture improvement tools. The tools include OHS culture evolution models, OHS culture assessment methods and change management approaches. The last step involves the identification of critical success factors for the cultivation of positive OHS culture, including development, implementation and continuous improvement of a SMART action plan for each critical success factor. The review of the CTF was also aligned to the OHS culture improvement framework (Figure 6.2).

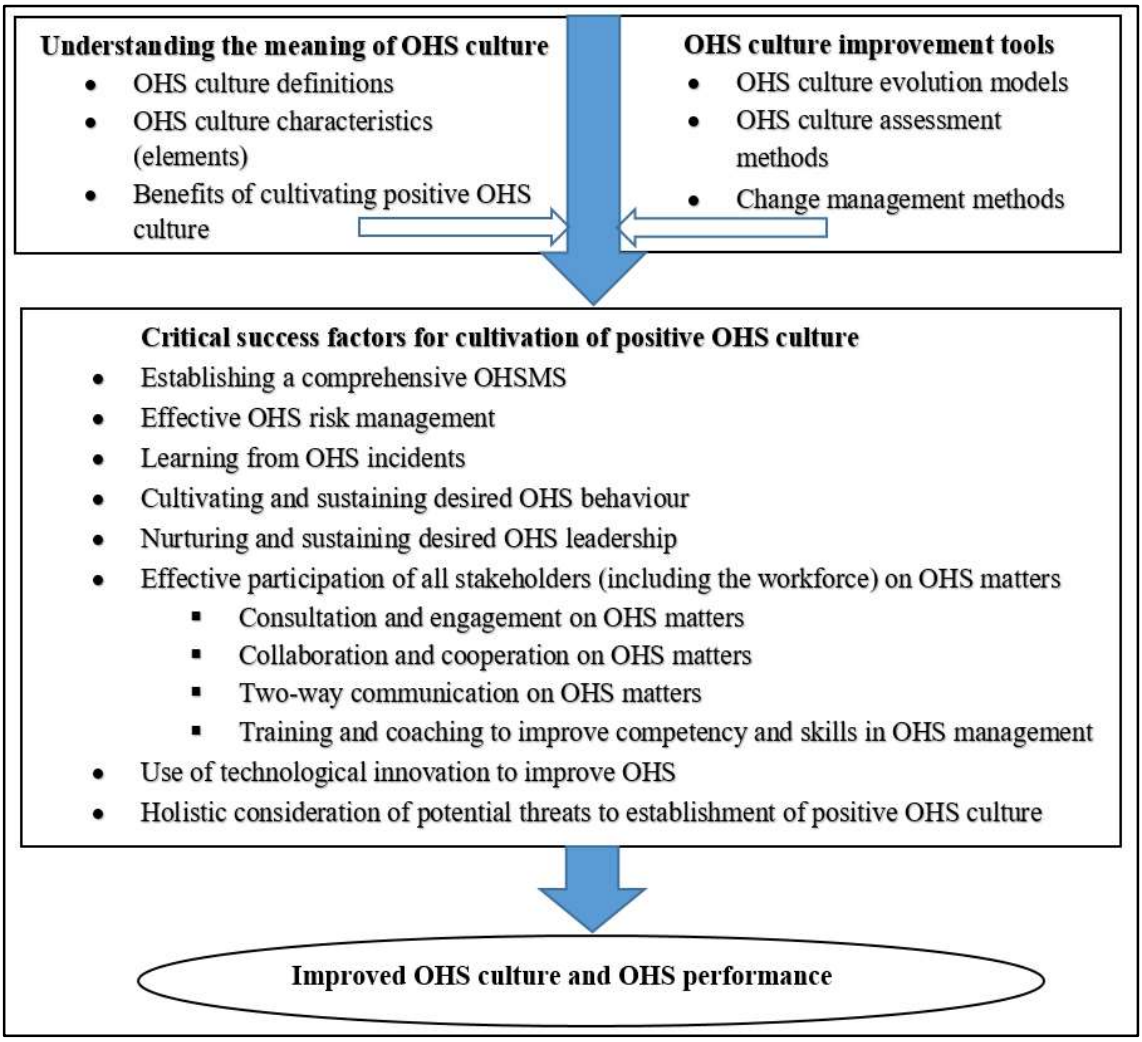


Figure 6.2: OHS culture improvement framework

6.2 Stakeholder understanding of the concept of OHS culture

6.2.1 Meaning of zero harm

The qualitative study found that sound understanding of the meaning of zero harm as a value, goal and belief is a critical prerequisite for winning the hearts and minds of all people within the organisation to effectively participate in OHS management. The finding confirms the finding that was made by King (2000). Most of the study subjects referred to the existence of

a common goal of attaining zero harm in most organisations. Some of the identified sub-goals supporting the attainment of the goal of zero harm include elimination of fatalities, injuries and occupational diseases, compliance to all OHS legal requirements and standards, and reporting and investigating all OHS incidents. This is consistent with findings made by King (2000), Mohapi and Zarske (2019), MHSC (2014) and MHSC (2016). Moreover, King (2000) argued that any other target apart from zero harm would suggest that it is acceptable to harm people as part of accomplishing production targets.

The qualitative study found that there were contradicting opinions in the SAMI concerning the feasibility of attaining the target of zero harm. Similarly, the literature study revealed that globally, there is still some ongoing debate within the OHS fraternity, about the feasibility of attaining zero harm (King, 2000). Some key informants considered zero harm to be an aspirational target that is not always achievable. This is based on the premise that the mining industry, particularly deep underground mining, is a complex and uncertain environment. For example, in South African deep underground mines, there is a significant OHS risk arising from the rock mass behaviour that is not fully understood, controlled or predicted. The attainment of zero harm is further complicated by the fact that human beings, whom most of the mines are still depended upon to execute the work-related tasks, are always fallible and prone to make mistakes. Related findings were made by Geller (1996).

One the contrary, other participants believed that the target of zero harm was attainable as evidenced by mines that can go for several years without any fatalities. The stakeholders argued that zero harm can simply be attained if mines adopt the “if it is not safe to mine, we will not mine” principle. In other words, no task should take place if all the risks associated with the particular task could not be completely eliminated. The qualitative study revealed that the practice in most mines was to allow tasks to take place, if the associated OHS risks could be eliminated or reduced to acceptable levels. The proponents of zero harm further argued that it was unethical and morally wrong to make people work in environments where there was still some residual OHS risk. In this case technological innovation (remote controlled or autonomous mining) could be useful in ensuring that all people are removed from dangerous

workplaces, allowing them to operate mining equipment from safe places. The findings confirm findings made by King (2000) and Mohapi and Zarske (2019).

The findings from the current study are aligned to the findings of the literature review and reflects a gap in the CTF that could be closed by discussing the significance of adopting zero harm as a value, goal and belief.

6.2.2 Definitions of OHS culture

The qualitative study findings showed that the definitions of OHS culture that were provided by the participants are aligned to those that were identified by the literature survey. The study subjects defined OHS culture in terms of the following:

- ***The organisation's approach to OHS management*** - the way we deal with OHS matters around here. This is consistent with the definitions provided by authors such as Hopkins (2006), Hudson (1999), Reason (1998) and Mohammadfam et al. (2013).
- ***Outcome of cumulative individual OHS cultures***. Likewise, ICS (2013) and IOSH (2015) noted that organisational OHS culture is a collection of individual OHS cultures.
- ***Factors that drive the establishment of positive OHS culture*** – OHS within a particular organisation is predisposed by a set of underlying assumptions, values and beliefs that shape perceptions, attitudes, behaviour, personalities and approach to OHS management. OHS culture is also influenced by factors such as commitment to OHS, leadership styles, priorities, competencies, peer pressure, workplace conditions, socio-economic conditions and level of education. Similarly, the literature study revealed that OHS culture is influenced by a number of factors including shared values, beliefs, feelings, attitudes and perceptions (IOSH, 2015; ICS, 2013; MHSC, 2005; HSC, 1993; Stranks, 2007; Hopkins, 2006; Stephan and Soto, 2015).

As noted earlier, the CTF only defined OHS culture in terms of some of the characteristics of positive OHS culture, and this definition could constraint comprehensive understanding of the

OHS culture concept. Thus, the definition of OHS culture in the CTF can be improved by aligning it to the definitions that were revealed by the literature and qualitative studies.

6.2.3 Characteristics of positive OHS culture

The qualitative and literature studies identified characteristics of a strong OHS culture that are also included in the CTF. The common elements include existence of collaboration, just (non-blaming) and leaning cultures, shared OHS values and exemplary OHS leadership. Incorporation of OHS into all operational aspects of the business, recognition of OHS as a top priority, existence of clear OHS roles and responsibilities, elimination of discrimination and use of technological innovation to improve OHS were also noted as common elements.

Additional elements that were identified by the qualitative and literature studies, but not included in the CTF include genuine commitment by all stakeholders to continuously improve OHS, compliance with OHS requirements and taking personal responsibility for the safety and health of themselves and other people, both at work and in the society. However, the following OHS culture characteristics were revealed by the literature study only:

- Availability of comprehensive OHSMS, standards, policies and procedures to enable effective management of OHS.
- A reporting culture where all the people are prepared to report OHS incidents including problems, errors and near misses. Reporting OHS incidents give the organisation an opportunity to learn from past incidents and implement suitable measures to prevent repeats.
- An informed culture in which all the people within the organisation (including contractors and shop floor employees) are timeously kept informed with clear, accurate and customised information on OHS matters.
- Capacitation (through training, coaching and provision of adequate resources) of all people within the organisation to effectively manage OHS risks.

Moreover, both the qualitative study and the CTF did not cover the requirement for a flexible culture that was identified by the literature survey. In a flexible culture, the organisation could easily adapt to changes without compromising OHS. The mining industry is dynamic in nature and OHS could be impacted by changes such as change in employees (management and workforce) and introduction of new technology or mining methods. Thus, adoption of a flexible culture will enable the company and employees to effectively embrace change without sacrificing OHS. Moreover, in a flexible culture, decentralisation of OHS decision making and accountability on OHS is embraced at all levels within the organisation. This will support the establishment of a collaborative culture on OHS matters, since OHS will made a line management responsibility and all employees within the organisation will be held accountable for OHS performance (Reason, 1997; Hudson, n.d.; Hudson, 1999; Hopkins, 2006; Stephan and Soto, 2015).

The CTF can be strengthened by the inclusion of all characteristics (elements) of positive OHS culture that were revealed by the qualitative and literature studies.

6.2.4 Impacts of OHS culture

The qualitative study findings indicated that a strong OHS culture was vital for continuous improvement in OHS in the mining sector. OHS culture determines the mining company's OHS values, attitude towards OHS, OHS management strategy, OHS risk appetite and OHS risk tolerance. This is consistent with findings that were made by ICS (2013), Stranks (2007) and Mohammadfam et al. (2013). The qualitative study revealed that sound OHS management was a matter of enlightened self-interest for all stakeholders. For example, all people will benefit from improved OHS and wellbeing, whilst the organisation will benefit from improved sustainability and viability of the business. Similar findings were noted by ICS (2013), Stranks (2007), Hermanus (2007), Smith and Summer (2014), and Fleming (2001).

Findings from the qualitative study showed that organisations with a strong OHS culture and work ethic were likely to have a better OHS performance and productivity as compared to

companies with poor OHS culture and work ethic. The qualitative study revealed that sound OHS management was a key requirement for sustainable development and social license to operate. Moreover, it was found that OHS incidents were associated with a number of drawbacks such as bad corporate image, production stoppages, closure of mines and negative socio-economic impacts on employees, families and communities. These findings are aligned to findings by Stranks (2007), Hopkins (2006), Hudson (1999), Hudson (n.d.), Kotter and Heskett (1992), Randolph (1989), IOSH (2015) and Collins and Parras (1994).

The gap analysis suggests that the CTF does not provide the benefits of cultivating a strong OHS culture. The CTF could be strengthened by inclusion of a motivation on the significance of investing in OHS culture and OHS performance improvement initiatives.

6.3 Stakeholder experience of OHS culture evolution and CTF

6.3.1 Evolution, assessment, reporting and change management

The qualitative study found that comprehensive understanding of the prevailing OHS culture could provide insight on the efficacy of the OHS culture enhancement initiatives and gaps within the OHSMS, thus enabling the development of an informed OHS culture improvement strategy. Similarly, Ryan (2000) suggested that sound understanding of the prevailing OHS culture and gaps within the OHSMS was important to inform the development of OHS culture and OHS performance improvement strategies. The qualitative study showed that OHS culture surveys could be used in combination with OHS culture evolutionary models to determine the prevailing OHS culture. The importance of sustaining and continually improving OHS culture to prevent regression to old OHS culture was identified by the study. It was established that continuous improvement in OHS culture and performance could also be strengthened by publicising and celebrating good OHS achievements. Related findings were made by Kim et al. (2016).

The qualitative study revealed that changing OHS culture was a slow and complicated process that should be underpinned by proper planning, a holistic approach and structured change management process to mitigate factors that could hinder the establishment of a strong OHS culture. Typical identified factors that could hinder establishment of strong OHS culture include lack of buy-in and resistance to change by the stakeholders, poor OHS performance and poor productivity. They study also found that successful cultivation of positive OHS culture could be improved by appointing credible leaders and influencers drawn from the workforce to champion the process. Likewise, a number of authors concurred that OHS culture is a slow, challenging, time consuming and long-term process that should appropriately be planned, nurtured and managed (IOSH, 2015; Ryan, 2000; ICS, 2013; CBI, 1991; Kim et al., 2016).

The qualitative study findings are aligned to findings of the literature survey and were also noted as a gap in the CTF. The CTF could be enhanced by including guidance on methodologies for determining the prevailing OHS culture and managing the OHS culture change process.

6.3.2 Relevance of the CTF in the South African mining sector

This section discusses the study findings that are specifically related to the study subjects' perceptions about the sufficiency and efficacy of the CTF as a tool for nurturing positive OHS culture in the mining sector. The study revealed that the majority of the participants were knowledgeable about the CTF and most of the stakeholders who were conversant about the CTF also highlighted that the CTF was aligned to most organisations' strategies for cultivating positive OHS culture. Moreover, about half of the study subjects noted that the OHS performance plateau could be broken if the CTF is successfully implemented by mining companies. The relatively high CTF acquaintance could be due to the fact that the CTF forms part of the 2014 OHS summit milestones, which the mining sector is required to implement as part of the overall industry goal of attaining zero harm.

The informants made a number of specific recommendations for enhancing the CTF. A need was identified to align the CTF to best practices in OHS management, including putting emphasis on the significance of sound management of health not just safety and systematic OHS management approach. Highlighting the importance of integrated and holistic management of health and safety at workplaces is critical and could assist to break the legacy health and safety divide that have been dominant in most industrial sectors including mining.

The study subjects noted that the CTF did not unpack the meaning of OHS leadership which could be interpreted by most people as referring to management only. It is crucial for the CTF to highlight that OHS leadership refers to all people with positional, relational and expert authority, including management, technical experts, front-line supervisors and OHS representatives. This will allow the mining companies to tailor their interventions for the different levels of OHS leadership, thus enhancing the success of the OHS culture change initiatives.

The participants suggested that renaming the CTF to OHS CTF could elevate recognition and importance of the framework as a vehicle for facilitating progressive improvements in OHS performance and OHS culture. Moreover, the key informants noted that the current name (CTF), coupled with the requirement to report the progress of implementation of the CTF together with mining charter targets could have unintended consequences, as most people will fail to immediately recognise the CTF as a tool of improving OHS culture and performance. The importance of the CTF could be strengthened by changing the name to OHS CTF and reporting the prevailing organisational OHS culture in a similar manner with OHS performance indicators such as injuries and occupational diseases.

The qualitative study showed that the impact of the CTF on OHS culture and OHS performance in the sector could have been marginal due to several reasons. Firstly, it was noted that the knowledge of the CTF at organisational level was only restricted to management. This could be an indication of a general lack of a culture of collaboration, poor communication and poor implementation approach, resulting in lack of stakeholder buy-in and commitment and

subsequent failure of successful implementation of the CTF. Secondly, implementing the CTF in a phased approach could have constrained step-change OHS culture and performance improvement. Successful implementation of the CTF could be enhanced by effective communication at all levels, embracing a collaborative culture, taking a holistic approach and following structured change management process.

6.4 Stakeholder experience on critical success factors for establishment of a strong OHS culture

6.4.1 Establishing occupational health and safety management systems (OHSMS)

The qualitative study found that the establishment, implementation and continuous improvement of OHSMS was the backbone of effective management of OHS and cultivation of positive OHS culture. In other words, the departure point in cultivation of a positive OHS culture is operationalisation of a comprehensive OHSMS. The OHSMS comprise a set of procedures, actions and plans to enable systematic management of OHS. OHS culture is the medium for translating the OHSMS into practice i.e. ensuring that the OHSMS is embraced by all people within the organisation and implemented as planned. Similar findings were revealed by the literature that was reviewed (Zungu, 2016; ICS, 2013; Ryan, 2000; Kale et al., 2013).

Other objects of OHSMS identified by the qualitative study include ensuring effective OHS management, collaboration on OHS matters, proactive and effective OHS risk management, and empowering people at all levels to effectively manage OHS through interventions such as effective communication and targeted training. Similar objectives of OHSMS were identified by Zungu (2016) and de Jager (2018). Remarkably, all the aims of an effective OHSMS also form part of the critical success factors for cultivation of positive OHS culture. Thus, it can be argued that a comprehensive and adequate OHSMS should have inbuilt capability to promote cultivation and continuous improvement of OHS culture.

The qualitative study showed that in the absence of a South African guideline on establishment of OHSMS, mining companies were using different international standards such as ISO 45001, OHSAS 18001 and ILO-OSH 2001. The qualitative study further revealed that most of the OHSMS are primarily based on the PDCA management model, aiming to drive continuous improvement of OHS, through practices such as implementing best practices and corrective actions from incident investigations, inspections and audits. The findings are consistent with findings that were by made by Zungu (2016). The development of a SAMI OHSMS guideline based on global OHSMS best practices and tailored to suite South African mining conditions could significantly contribute to OHS improvement efforts in the sector.

The qualitative study revealed that the OHSMS could be reinforced by adopting a systematic OHS approach, taking into consideration all the different system elements such as physical work environment, systems, and people and organisational factors. Identified enablers of sound OHSMS include effective OHS risk management, adequate technical measures, state-of-the-art maintenance practices, good housekeeping, providing adequate resources and creating a conducive working environment. Availability of user friendly OHS legislation and standard operating procedures, culture of compliance, eagerness to continuously improve OHS by implementing identified opportunities for continuous improvement and proper planning were also found to be essential for effective OHS management. Moreover, the study established that effective OHS management and cultivation of positive OHS culture could be obstructed by factors such as poor OHSMS, ineffective management of OHS risks, poor planning, lack of resources, poor maintenance practices, inadequate legal framework, lack of a systematic approach and culture of non-compliance. Related findings were noted in the literature that was revealed (de Jager, 2018; Hermanus, 2007; Shorrock et al., 2014; Geller, 1996; IOSH, 2015; Ikin, 2015; Mohapi and Zarske, 2019).

The findings from the qualitative study are similar to findings from the literature study and also reflects a significant gap in the CTF. The CTF could be improved by incorporating the requirement of a robust OHSMS amongst the critical success factors for cultivation of a strong

OHS culture. It is also critical to emphasise the importance of adopting a systematic approach in OHS management.

6.4.2 OHS risk management

Proactive and effective OHS risk management was found by the qualitative study as one of the key drivers of continuous improvement in OHS performance and OHS culture. Comparably, Zungu (2016) and Hudson (1999) suggested that OHS risk management was the foundation of any efficacious OHSMS and progressive OHS improvement could be accomplished through proper OHS risk management. From the qualitative study, it was noted that the OHS risk management process could be improved by empowering all the people within the company to effectively manage OHS risks through interventions such as training and coaching. All the employees should be trained on OHS risk management aspects such as hazard identification, risk assessment and risk control at the coal face. Similar findings were revealed by the literature study (Hudson, 1999; Ikin, 2015; Hermanus, 2007).

The qualitative study revealed that in situations where the risk cannot be immediately managed, the right to refuse dangerous work and escalation of the risk for the attention of the immediate level of OHS leadership should be invoked. The right to refuse dangerous work and leave a dangerous workplace could be used in conjunction with TARP process to escalate complex OHS risks to the attention of frontline supervisors. The findings confirm findings by Stewart and Nite (2017) and Coulson et al. (2019).

The qualitative study found that risk management is a responsibility of every employee and the effectiveness of the process could be enhanced by effective communication and nurturing collaborative and caring culture within the teams. In this case, all employees will be encouraged to continuously scan, manage, raise awareness or escalate potential OHS risks. Other identified OHS risk management best practices include compulsory risk assessment for all tasks and involvement of all stakeholders in the risk management process. The involvement of all people in the risk management process will ensure that the organisation has a holistic understanding

of OHS risks faced at the coal face, enabling the development of relevant and practical mitigation measures.

Moreover, the qualitative study showed that the risk management process should holistically consider different system elements, potential OHS risks from both the internal and external environment, and issues such as fatigue, gender, diversity, living conditions, travelling and other socio-economic factors. A comprehensive understanding and holistic consideration of all potential risks will ensure that sufficient level of risk is incorporated into the organisation's OHS management strategy. There is consistent evidence in research which shows effective OHS risk management should encompass an all-inclusive consideration of different system elements such as OHSMS, physical work environment and people centred factors such as human behaviour, skills, knowledge, competence, gender and diversity (Ikin, 2015; Hermanus, 2007).

The qualitative study findings are related to outcomes of the literature survey. The risk management pillar of the CTF could be reinforced by providing some guidance on best practices that could be implemented to improve the effectiveness of the risk management process.

6.4.3 Learning from OHS incidents

The qualitative study established that learning from internal and industry-wide OHS incidents, could assist mining companies to develop and implement mitigation measures to prevent repeats of similar OHS incidents across the industry or even at the same operation. A number of authors concurred that learning from OHS incidents offers an opportunity for companies to continuously improve OHS (ICS, 2013; Ryan, 2000; IOSH, 2015). The qualitative study suggested that at an industry level, learning from OHS incidents could be enhanced by creating a platform for sharing details about OHS incidents such as description, causes and corrective actions. The platform could also be utilised for sharing some best practices on OHS

management and OHS risk management. Similar recommendations were proposed by CBI (1991) and ICS (2013).

The qualitative study found that it was essential to create an environment and strategies to encourage the reporting of all OHS incidents (including near misses) and sharing of OHS incident information at operational level. The qualitative study revealed that it was fundamental for mining companies to adequately investigate all OHS incidents, identify the root causes and develop and implement appropriate corrective actions to circumvent future recurrence of similar incidents. The qualitative study showed that OHS incident reporting could be impeded by unfair, unjust and blaming cultures, in which the workforce will be scared of being accused and penalised for causing incidents. The qualitative study established that reporting of OHS incidents could be improved by approaches such as educating all people about the importance of reporting all OHS incidents and adoption of just and non-blaming cultures. The aforementioned findings are aligned to findings by ICS (2013), Ryan (2000) and IOSH (2015).

The qualitative study also recommended that OHS incident investigation system could be enhanced by making use of independent and experienced OHS incident investigation teams. This finding was not revealed by the literature that was reviewed and is also not addressed by the CTF. However, the literature study revealed additional recommendations that were not revealed by the qualitative study or covered by the CTF. Ryan (2000) and Stranks (2007) concurred that the reporting of OHS incidents could be encouraged if OHS performance metrics are designed to put more emphasis on process accomplishments such as percentage of observed positive observations and number of risk assessments conducted, rather than outcomes such as number of fatalities and injuries. IOSH (2015) suggested that the substitution test could be used to enhance fair apportionment of blame.

The findings from the qualitative study are aligned with findings from the literature that was reviewed. The CTF could be enhanced by emphasising the importance of learning from OHS incidents and providing guidance on techniques that could be utilised to improve the

effectiveness of the OHS incident investigation system and for establishing just, reporting and learning cultures.

6.4.4 Cultivating the desired OHS behaviour

Findings from the qualitative study indicated that cultivating the desired OHS behaviour within all stakeholders was key for continuous improvement of OHS performance and establishment of a strong OHS culture. Likewise, ICS (2013) and Ryan (2000) confirmed that influencing the right OHS behaviour at all levels within the organisation could reduce the prevalence of unsafe acts and non-conformities, resulting in improved OHS culture and performance. The qualitative study revealed that organisational OHS culture was a product of the cumulative OHS culture of all the individuals within the organisation, thus it was crucial to nurture the desired OHS behaviour and culture within all individuals. Related findings were made by ICS (2013) and IOSH (2015).

The qualitative study suggested methodologies that can be used by organisations to nurture the right OHS behaviour such as demonstrating commitment to OHS as a priority at all levels, leaders walking the OHS talk and incorporation of OHS into all operational activities such as planning and meetings. Additional recommended strategies include fostering effective stakeholder collaboration on OHS matters, making use of the right incentives and performance metrics and implementation of programmes such as BBS, VFL and coaching. Examples of incentives that could drive the right OHS behaviour include OHS bonuses, prizes, awards and timeous celebration of OHS accomplishments. Furthermore, the qualitative study showed that the desired OHS behaviour could be instilled by designing all work functions in a manner that does not make OHS and production competing objectives and including a significant OHS component into performance contracts of all the people. Similar findings were made by Ryan (2000), Ikin (2017) and King (2000). Additionally, King (2000) recommended that behaviour observation team could be instrumental in championing the implementation of BBS programmes. The MOSH behaviour model could also be customised at mine level to mould the desired OHS behaviour (MOSH, 2018).

The qualitative study suggested that making compulsory OHS behaviour and risk tolerance screening, including intensive OHS induction for all new entrants into the mining sector could ensure the employment of people with the required OHS behaviour. The practice could also mitigate against the risk of potential dilution of OHS culture by the new employees. The findings of the qualitative study confirm findings by CBI (1991) and Ikin (2017). Moreover, the qualitative study revealed that the cultivation of the right OHS behaviour could be obstructed by failure to recognise OHS as a top priority and use of metrics and incentive systems that drive risk behaviour and non-compliance.

As noted, the findings from the qualitative study are aligned to findings from the literature survey. Analysis of the CTF showed that the need, significance and approaches of nurturing the desired OHS behaviour was not covered by the CTF. Thus, it is critical to update the CTF by highlighting the requirement, importance and providing guidance on strategies for promoting the establishment of good OHS behaviour.

6.4.5 OHS leadership

The qualitative study revealed that all levels of leadership (board of directors, management, front line supervisors, etc.) have a critical role in cultivating and sustaining positive OHS culture. The qualitative study showed that in order to nurture a strong OHS culture, it was vital for all levels of leadership to consistently demonstrate their commitment to OHS in the way they talk, lead and make decisions. Identified roles of top leadership, such as the board of directors and senior management, include defining the organisation's OHS values, vision, strategy, goals and desired OHS culture. The qualitative study suggested that senior leadership should create an environment where OHS is regarded as a matter of greatest importance, which should never be compromised in order to meet production targets. Senior leadership should also provide adequate resources and incentives to enable effective management and continuous improvement of OHS. These findings are consistent with the findings from the literature that was reviewed (Hermanus, 2007; Mohapi and Zarske, 2019; King, 2000; Stranks, 2007; CBI, 1991). Additionally, studies in the SAMI showed that factors such as production pressures, prioritisation of production over OHS, production-based bonuses and inadequate resources

have exacerbated ‘planisa’ (make a plan), an informal work practice that exposes mine employees to increased OHS risks (Stewart and Nite, 2017; Phakathi, 2002; Phakathi, 2009).

The qualitative study showed that senior leaders should define clear OHS roles and responsibilities, and provide adequate, competent and credible OHS leadership at all levels within the organisation. Similar findings were noted in the literature (Stranks, 2007; CBI, 1991; Cronje and Rajan, 2015). The qualitative study found that in order to enhance accountability on OHS matters, organisations could incorporate OHS performance into KRAs of all people within the organisation. Moreover, the qualitative study findings suggested that mining companies should have adequate and competent OHS practitioners who will be responsible for offering technical advice about sound OHS management practices and identifying opportunities for continuous OHS improvement. Likewise, the literature indicated that OHS culture could improve if senior leaders provide adequate, competent and credible OHS leadership at all levels, including first line supervision and OHS representatives (Pitzer, 2009; Weule, 2016).

The qualitative study showed that women naturally play a motherly role in most instances and the inclusion of more women at all levels of leadership could reinforce establishment of a culture of caring that is necessary for continuous improvement of OHS culture. This is consistent with findings from a South African study by Zungu (2014), which revealed that increasing the number of females employed in the SAMI and in leadership positions could result in improvements in OHS and productivity.

The findings from the qualitative study indicated that securing commitment, buy-in and support from all levels of leadership was important for successful execution of all OHS continuous improvement programmes. This confirms findings that were made by Hopkins (2006). The qualitative study showed that leadership buy-in and commitment could be secured by popularising and workshopping the leaders on OHS vision, goals, values and strategy, and outcomes of the cost-benefit analysis of implementation of the OHS improvement programmes. Similar findings were revealed from the literature that was reviewed (ICS, 2013;

Stranks, 2007; King 2000). The qualitative study also found that the establishment of a strong OHS culture could be hindered by factors such as lack of leadership commitment, poor leadership styles, lack of adequate and competent OHS leadership and lack of clear OHS roles and responsibilities at all levels across the company.

There is an alignment between the findings relating to OHS leadership from the qualitative and literature studies and the findings reflect gaps on the leadership pillar of the CTF. However, the qualitative study also identified the following additional findings that were not found in the literature that was reviewed. The qualitative study found that companies should appoint sufficient and competent OHS representatives, who should be given the power to stop all unsafe work and behaviour. The qualitative study recommended that mining companies should consider following an OHS risk-based approach and define acceptable risk levels, when planning all the different operational activities. Thus, it is critical for organisations to undertake detailed cost-benefit analysis, in order to understand the short, medium and long term implications of investing in different OHS improvement initiatives.

The additional findings from the qualitative study also offer supplementary recommendations that could strengthen the leadership pillar of the CTF. The recommendations relate to improving effectiveness of OHS representatives and utilising cost benefit analysis as a tool for prioritising investment in OHS improvement initiatives.

6.4.6 Fostering collaboration on OHS matters

In the qualitative study, it was found that a collaborative approach, embracing adequate consultation, engagement and active participation of all key stakeholders on OHS matters was fundamental for nurturing and sustaining positive OHS culture. The key stakeholders at a typical mining operation could include all levels of leadership (board of directors, management and frontline supervisors), shop floor workers, inspectorate and contractors. This finding is consistent with the findings form the literature study (Ikin, 2017; Wipaki and Dodd, 2014; King, 2000; Hermanus, 2007; Smith and Summer, 2014).

The qualitative study found that stakeholder commitment and buy-in could be improved by practices such as effective communication on OHS matters, empowering all people to effectively manage OHS and strengthening stakeholder alignment on OHS issues. It was noted that apart from enhancing buy-in and commitment on OHS improvement initiatives, the involvement of all the stakeholders will also ensure a holistic understanding of the real OHS challenges faced within the organisation, allowing appropriate corrective actions to be developed and implemented. Similar findings were made by Ikin (2017), Hermanus (2007); and Smith and Summer (2014). Additionally, research evidence suggest that zero harm was a matter of self-enlightened interest and there is a relatively better chance of securing buy in from all stakeholders (including the workforce) on OHS matters (Stranks, 2007; Hermanus, 2007; Smith and Summer, 2014).

The qualitative study established that buy-in and commitment on OHS matters could be attained if all stakeholders, have a comprehensive understanding of the OHS values, OHS improvement initiatives and their individual OHS roles and responsibilities. Thus, mining companies should develop and implement effective communication strategies targeting all levels within the organisation. The strategy should ensure that all stakeholders timeously receive accurate and tailored information and feedback on OHS matters. The qualitative study findings showed that two-way communication should be embraced in order to give all the people, particularly shop floor workers, an opportunity to provide their inputs into the OHS management strategy such as OHS challenges, potential corrective actions and recommendations for continuous improvement of OHS. It was noted that in order to maintain the goodwill, it was critical for the leaders to provide timeous feedback pertaining to the decisions made on the inputs, including reasons why certain suggestions could not be implemented. The qualitative study established that practices such as pre-shift OHS meetings could strengthen the workforce's vigilance and awareness on OHS hazards. Furthermore, it was noted that effective two-way communication could enhance the collaborative culture on OHS management and keep all stakeholders motivated and updated on OHS issues. It was suggested that sharing of OHS information and best practices could also be promoted at

industry level through platforms such as regional tripartite forums, MOSH process, workshops, seminars and field visits.

Likewise, IOSH (2015) and Hopkins (2006) confirmed that it was critical to create an environment where the workforce freely and openly communicate about OHS matters. Several authors also agreed that the shop floor workers were the executors and medium for change and it was critical to ensure that they have a thorough understanding of all OHS matters (IOSH, 2015; Stranks, 2007; CBI, 1991; Hopkins, 2006; Ryan, 2000). Thus, accurate, timeous and appropriately tailored communication with the workforce on all OHS matters was critical to secure buy-in and commitment (IOSH, 2015; Stranks, 2007; CBI, 1991; Hopkins, 2006; Ryan, 2000).

The qualitative study showed that it was essential for mines to create a favourable environment to encourage all the stakeholders to voluntarily participate in OHS matters. The working environment could be improved by embracing core values of respect, care, dignity, trust and equality at all levels, and providing decent and conducive work environment. It was revealed that meaningful participation of all stakeholders on OHS matters could be enhanced by empowering all the stakeholders to take charge of their personal and other people's health and safety, both at work and community levels. Stakeholder empowerment could be attained through interventions such as high impact training, refresher courses, workshops, VFL, coaching, OHS talks, learning from OHS incidents and effective communication. It was further noted that training and communication initiatives should be customised to suite the different stakeholders, taking into consideration factors such as literacy levels, language barriers, generational gaps and diversity. The findings confirm findings from the literature study (IOSH, 2015; CBI, 1991; Hopkins, 2006; Ryan, 2000; Hermanus, 2007; Smith and Summer, 2014; Ikin; 2017; Wipaki and Dodd, 2014); Ryan, 2000; King, 2000).

Additionally, the qualitative study found that the concept of OHS culture was not well understood at all levels, especially lower levels. Thus, training all people within the organisation about the concept of OHS culture and human factors could significantly improve

understanding and competency in management of these soft issues. The qualitative study also revealed that the sector should consider making a relatively higher level of education, say a minimum of matric education, as part of the qualifying criteria for employment in any position in the sector. This is because a reasonably educated workforce will easily comprehend information, embrace new ideas and meaningfully participates in engagements.

Analysis of the CTF against the findings from the qualitative study revealed that apart from mentioning the need to take a collaborative approach on OHS matters, the CTF falls short of emphasising the importance of fostering a collaborative culture on OHS matters. Furthermore, the CTF does not provide advice on practices that could be implemented by the sector in order to ensure active and meaningful participation of all stakeholders on OHS matters.

6.4.7 Improving OHS through innovation

The qualitative study revealed that technological innovation could contribute to significant improvement in OHS culture and OHS performance in a number of ways. Increased implementation of technology could make mining activities less labour intensive, resulting in a significant reduction in the number of people exposed to OHS risk. Remote controlled and autonomous mining could result in removal of employees from high-risk environments, whilst the use of technology such as collision avoidance, tracking and fatigue monitoring systems could enhance the efficacy of the OHS risk management process. Moreover, technological innovation could also enable safe and economic exploitation of deep orebodies that cannot sustainably be mined using existing methodologies. The qualitative study also found that innovation in the sector could be hindered by a number of factors including lack of buy-in from the stakeholders, thus it was key for the sector to find innovative ways of embracing sustainable technological innovation.

Similarly, the literature survey showed that the use of technology such as positioning and proximity detection systems (Hermanus, 2017), and remote and autonomous mining systems (Willis et al., 2004), could significantly improve OHS. In addition, the literature study revealed that innovation could result in the development and use of alternative efficient and cleaner

sources of energy such as fuel cells and hydro, electric and solar power, resulting in significant energy savings and improved OHS, due to reduction in air, noise and water pollution (Griffith, 2019; Abrahamsson and Johansson, 2008; Evans, 2019). Although the CTF's technology pillar recognise that technological innovation could improve OHS performance, the inclusion of additional benefits of innovation that were revealed by the qualitative and literature studies, could reinforce the pillar.

6.4.8 Internal and external factors that could obstruct establishment of positive OHS culture

The qualitative study showed that a holistic consideration of both internal and external factors that could obstruct the establishment and sustainability of positive OHS culture is also key in the practice of OHS management. Related findings were found in the literature that was reviewed (Hudson, n.d.; Stephan and Soto, 2015; Kim et al., 2016). Factors that were identified by the qualitative study include prevailing national health and safety culture and socio-economic aspects such as fatigue, stress, life pressures and diversity of people at the organisation. Additional identified socio-economic factors include colonial legacy, corruption, nepotism, factionalism, favouritism, abuse of powers, gender inequality, racism, tribalism and other forms of discrimination. Similar factors were noted by Stephan and Soto (2015), Kim et al. (2016), Hermanus (2007) and Stewart and Nite (2017).

Regarding prevailing societal health and safety culture, the qualitative study found that a significant number of people generally exhibit risky health and safety behaviour in society such as not abiding by road rules and it was not sustainable to expect these people to suddenly practice OHS culture once they are at work. Thus, the cultivation of a positive health and safety culture at societal and national levels could assist to embrace health and safety as a culture (lifestyle), rather than just a workplace matter, and this will have a positive effect on OHS culture and performance. Likewise, a number of authors concurred that instilling, embracing and promoting a health and safety culture at societal and national levels could significantly contribute to sustainable OHS management (Hopkins, 2006; Kim et al., 2016; ILO, 2009).

There is alignment in the findings of the qualitative and literature studies. The review of the CTF showed that OHS performance could be enhanced by eliminating discrimination at workplaces. However, the CTF did not address all threats that were identified by the qualitative and literature studies. The CTF could be reinforced by incorporating additional threats, including the importance of cultivating a health and safety culture at societal and national levels. A holistic consideration of internal and external factors that could obstruct the establishment of a strong OHS culture could assist mining companies to anticipate sufficient risk and incorporate appropriate mitigation measures into their OHS culture improvement strategies.

6.5 Conclusions

An investigation was undertaken to identify gaps between the CTF and participants' experiences in managing OHS culture in the SAMI. The findings of the qualitative study were also compared against the findings from the literature survey. Similarities were observed between most of the gaps that were identified by examining the CTF against findings of the qualitative study and gaps that were revealed by comparing the CTF against findings from the literature survey. This could be due to the fact that the CTF was only a guiding document providing some minimum standards that could be used by the sector to improve OHS culture. Most mining companies are utilising international OHSMS guidelines and most of these comprise the majority of the critical success factors for cultivation of a strong OHS culture. Moreover, the study findings appear to indicate that the practices on OHS culture management in some mining companies in the SAMI are more advanced than the guidelines provided in the CTF. This could be because some of the companies are multinational companies and most of these have cooperate OHS management standards that are aligned to global best practices. Additionally, local mining companies could also be implementing global best practices in OHS management.

Evidently, the findings from the qualitative study are aligned to the results from the literature review, from which the hypothesis was developed. Thus, the findings from this study supported the research hypothesis postulating that the current CTF for the SAMI is an inadequate tool for

developing positive OHS culture. There is a need to align the CTF with best practices and ensure that it remains an adequate and effective tool for cultivating positive OHS culture in the mining industry. Appendix 6 provides consolidated findings of the gap analysis between the CTF and best practices in OHS culture management that were revealed by the literature and qualitative studies. The consolidated findings shown in Appendix 6 summarise gaps and recommendations to close gaps in the CTF.

CHAPTER 7 : CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

The mining sector remains one of the major vehicles of socio-economic development and providers of employment in South Africa. However, injuries, fatalities and occupational diseases that occur in the mining industry result in substantial and undesirable socio-economic consequences to mining companies, employees and society. Thus, the continued sustainability of the sector requires effective management of OHS to protect the health and safety of employees and prevent damage to equipment and infrastructure.

Although the SAMI has made significant strides in improving OHS conditions over the past two decades, the OHS performance improvements have plateaued at unacceptably high levels. Improving OHS culture in the sector could assist to break the plateau and promote progressive improvements in OHS, contributing to the attainment of the industry goal of zero harm. The CTF was developed about a decade ago to assist the SAMI to continuously improve OHS culture and there have been some progressive developments in the subject of OHS culture over the years. The need to ensure that the CTF remains an updated and effective tool for promoting the establishment of strong OHS culture in the sector has necessitated the review of the CTF.

The CTF was examined against findings of the qualitative and literature studies, to identify some opportunities to improve the CTF. The following similarities were noted between gaps that were revealed by examining the CTF against the findings of the qualitative study and gaps that were identified by benchmarking the CTF against global best practices in OHS culture management that were found in the literature that was reviewed:

- Definition of OHS culture provided in CTF could limit holistic understanding of the meaning of OHS culture. The meaning of OHS culture could be better understood if OHS

culture is defined as the organisation's approach to OHS management that is an outcome of cumulative individual OHS cultures. OHS culture is predisposed by a set of underlying assumptions, values and beliefs that shape factors such as perceptions, attitudes, behaviour, personalities and approach to OHS management.

- The CTF does not include all OHS culture elements that were revealed by the qualitative and literature studies. Gaps were noted in respect of importance of OHSMS, decentralisation of OHS decision making and accountability, empowering all employees to effectively manage OHS risks and importance of informed culture. It is critical for the CTF to cover all characteristics of a strong OHS culture as the characteristics enhance understanding of OHS culture and provide insight on the prevailing organisational OHS culture.
- Meaning and rationality of the zero harm concept as a belief, value and goal is not discussed in the CTF. A clear understanding of the meaning of zero harm is important to secure stakeholder buy-in on zero harm initiatives.
- Lack of guidance on approaches for determining the prevailing OHS culture and managing the OHS culture change process. Moreover, reporting the progress of implementation of the CTF together with mining charter targets could dilute the importance of the CTF. The CTF should provide advice on techniques for assessing prevailing OHS culture and change management. The CTF should also be reported on the same platform with OHS performance indicators.
- Definition of OHS leadership and roles and responsibilities of different levels of OHS leadership are not provided. The CTF should unpack the meaning of OHS leadership and provide guidance on responsibilities of different levels of OHS leadership.
- CTF does not highlight the significance of collaboration on OHS matters and offer guidance on practices that could be used to improve effective participation of all stakeholders on OHS issues. It is important that the CTF is updated to include importance of effective participation of all stakeholders and practices that could enhance establishment of a collaborative culture on OHS.

- CTF falls short of articulating the importance of nurturing positive OHS culture, implementing robust OHSMS, systematic approach in OHS management and use of technology to improve OHS. The CTF could be improved by emphasising the significance of driving positive OHS behaviour, having a structured OHSMS, following a systematic OHS management approach and use of innovation to improve OHS.
- CTF does not provide guidance on strategies for establishing just, reporting and learning cultures, enhancing the effectiveness of the risk management process and nurturing good OHS behaviour. There is a need for the CTF to provide advice on practices for improving effectiveness of OHS risk management, cultivating desired OHS behaviour and creating just, reporting and learning cultures.
- The CTF does not holistically consider all factors that could hinder the successful establishment of positive OHS culture. A holistic understanding of potential threats that could obstruct development of a strong OHS culture will facilitate the development of informed mitigation measures.

The commonalities in the identified gaps could be because some mining companies in the SAMI have already adopted global best practices in OHSMS. Establishment of a sound OHSMS is a foundational requirement for cultivating positive OHS culture, and poor OHS cultures are usually associated with poor or absent systematic responses to OHS problems. Evolutionary models which lead to the consideration of positive OHS culture reflect this. When sound systems and reliable technology are in place, progress includes continual refinement of the underpinning OHSMS, progressive technological innovation and the adoption of new systematic elements and practices which address human factors, frame failures as organisational learning opportunities, and raise questions about the appropriateness of organisational culture. There is a need to align the CTF with global best practices and to provide guidance on approaches to aid successful cultivation of positive OHS culture and subsequent improvement in OHS performance.

The following qualitative study findings that were not found in the literature that was reviewed and the CTF are noteworthy, although they represent the views of the minority of the study participants:

- The need to appoint adequate and competent OHS representatives and giving them authority to stop unsafe work, acts and behaviour.
- The importance of conducting detailed cost benefit analysis to prioritise investments in OHS improvement initiatives based on holistic understanding of short, medium and long term implications.
- Providing training on OHS culture and human factors could improve understanding and competency in management of these soft issues at all levels within the organisation.
- Employees' ability to understand information, grasp new ideas and participate in engagements could be improved by introducing a mandatory minimum level of education for all new employees in the mining sector.
- Putting more emphasis on the importance of integrated health and safety management could assist to ensure that mines pay balanced attention to the management of both health and safety.
- The use of independent and competent OHS incident investigation teams could enhance the effectiveness of the OHS incident investigation process.
- A clear understanding of various OHS leadership hierarchies could help companies to tailor different OHS improvement interventions for different target audience.

Appendix 6 provides a summary of the consolidated gaps between the CTF and findings from the literature and qualitative studies. The identified gaps could be used by SAMI industry stakeholders implementing the CTF to supplementing the content of the CTF.

7.2 Recommendations

To promote progressive OHS improvements and move beyond the current plateau in OHS performance, the following recommendations are proposed with regards to practice and further research.

Practice

The MHSC and mining companies implementing the CTF are recommended to note the gaps identified by the current study and summarised in Appendix 6. The identified gaps could be used to complement the content of the CTF and assist mining companies in their endeavours to cultivate, sustain and continuously improve OHS culture. A strong OHS culture will result in step-change improvements in OHS and break the current plateau in OHS performance. The complexity and dynamic nature of the mining industry warrants that the CTF be reviewed regularly (say after every five years), to ensure that it remains aligned to global best practices in OHS culture management and SAMI context. Furthermore, the MHSC is advised to develop and implement programmes to promote the cultivation of a positive health and safety culture at societal levels. This could strengthen and embrace health and safety as a universal way of life for all stakeholders (rather than a workplace phenomenon), hence contributing to sustainable OHS management.

Potential for further research

There is no inherent generalisability of the current study findings as the research methodology was restricted to a limited qualitative study. Insights were obtained from a sample of key informants representative of the SAMI stakeholders but not from the workforce. However, the results of this limited study suggest that further research is warranted. Although the analysis of the CTF against the findings of the qualitative and literature studies is comprehensive, the small size and narrow composition of the sample of key informants is a significant limitation. The current study findings could be advanced using mixed research methods (qualitative and quantitative approaches), with a representative and larger study population, including soliciting the views of the workforce and

verification of the strategies and practices adopted by individual mining companies. Further studies could thus build on the findings of the current study and provide further recommendations on improving the CTF.

7.3 Study limitations

The following limitations are associated with this study:

- The key informants in this relatively small qualitative study generally occupy leadership roles in the SAMI, and shape policy. Their views may not reflect the perspectives of the workforce. Consequently, the study findings cannot be generalised to the SAMI as a whole.
- As indicated in the previous section, these limitations could be addressed as follows:
    - Using mixed research methods (qualitative and quantitative approaches) together with solicitation of the views of the workforce. These changes would result in a broader study, with a larger and more representative study population, thus enhancing the generalisation of the results.
    - Including a process for verifying the participants knowledge of mining company strategies could also improve reliability of a broader study that includes participants drawn from the workforce.

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Appendix 1: The Culture Transformation Framework (CTF) for the South African Mining Sector

The Culture Transformation Framework



Changing Minds Changing Mines

Overview

In September 2008, principals of the South African Mining Sector at the Tripartite Stakeholder Leadership Summit agreed that an action-driven plan was necessary to ensure significant improvements in mine health and safety performance. The key themes of the actions that were identified are:

- Strengthening culture of health and safety.
- Promoting a learning industry and building capacity.
- Making workplaces safer and healthier.

As part of implementing the Leadership Summit Action Plan, there was a need to implement a culture transformation framework with a view to significantly improve the culture of health and safety across mining sector. Over the years, most of the Mine Health and Safety Council (MHSC) focus has been on attempting to improve workplace health and safety or to control workplace risks primarily through technical aspects or the design of systems and controls. It has become increasingly important to focus on organisational factors that have an impact on the outcome of health and safety performance, with health and safety culture recognised as having a definitive impact on the outcome of the incident. To this end, the MHSC undertook the project *Changing Minds, Changing Mines* with the aim of developing a framework that would guide the South Africa Mining Sector into making a revolutionary change towards attaining zero harm in the sector.

For the purpose of this framework, the term health and safety culture encompasses:

"***the extent to which individuals and groups will commit to personal responsibility for health and safety; act to preserve, enhance and communicate health and safety concerns; strive to actively learn, adapt and modify (both individual and organisational) behaviour based on lessons learned from mistakes; and be rewarded in a manner consistent with these values***."

Vision, Mission Statement

Vision

We, the Tripartite Stakeholders of the South African Mining Sector, see a future in which ***EVERY MINE EMPLOYEE SHALL RETURN HOME UNHARMED EVERY DAY***.

Mission

Through the individual and collective efforts, each member of the South African Mining Sector, shall (led by the leaders and principals), adhere to the values of care, dignity, respect, accountability, honesty, integrity, transparency, equity and equality to attain **ZERO HARM.**

Strategic Approach to Health and Safety

We acknowledge that:

a) Our approach was wrong in the past; we need to move away from blame and paternalism.

b) An effective health and safety strategy involves multiple dimensions including leadership behaviour, management systems, societal culture, technology and worker behaviour.

c) The above dimensions vary in nature and magnitude between different companies and sites and therefore priorities differ.

In building our health and safety strategy we shall:

a) Involve employees and be proactive and systematic.

b) Express clear roles and responsibilities at all levels.

c) Aim for systems that are simple, understood by all employees and which empower employees.

d) Aim to build a trusting culture.

e) Adopt leading practice.

Pillars of the Culture Transformation Framework

The Culture Transformation Framework (CTF) is based on the following premise:

The South African Mining Industry will be safe, healthy and productive with risks controlled at their source through collaborative action from all the tripartite stakeholders. The collaborative efforts will strive to ensure that through a learning and participative culture where everybody is treated with care, dignity and respect. At all times, clear standards will be enforced by effective regulator mechanisms through fair sanctions that drive performance improvements focussed on determining the root cause rather than assigning blame.

Utilising the above, the pillars against which the CTF is based are:

PILLAR		INTENTION	RESPONSIBILITY
1	**INTEGRATED MINING ACTIVITIES**	We will base mining activities on the recognition that health, safety and production are not competing objectives. Safety and health are the outcomes of work well done.	Individual Mines Holding Companies Chamber of Mines
2	**RISK MANAGEMENT***	We will seek to eliminate risks at their source and investigate the root causes of incidents.	Individual Mines Holding Companies Chamber of Mines Government
3	**TECHNOLOGY**	We will adopt mechanisation and technology as a key method of eliminating health and safety risks to mine employees.	Individual Mines Holding Companies Chamber of Mines Mine Health and Safety Council Government
4	**LEADING PRACTICE***	We will take a common approach to identifying and facilitating the	Chamber of Mines

		adoption of leading OHS practices and research outcomes.	Government MHSC
5	**ELIMINATION OF DISCRIMINATION***	There will be no racism, genderism and any forms of unfair discrimination.	Individual Mines Holding Companies Chamber of Mines Government
6	**BONUSES AND PERFORMANCE INCENTIVES***	We will ensure that ZERO HARM is prioritised ahead of production.	Holding Companies Organised Labour Chamber of Mines
7	**TRIPARTISM**	Government, labour and employers will regularly engage to pursue common objectives and goals for the mining industry.	ALL Stakeholders
8	**REGULATORY FRAMEWORK**	We will develop clear, concise and understandable legislation that includes enforceable minimum standards.	Mine Health and Safety Council
9	**INSPECTORATE**	We will create an effective, well-resourced inspectorate that can protect people at and around mines with integrity and job pride.	Government
10	**DATA**	We will establish a data system that allows effective and timely collection, capture, analysis, communication, dissemination and use by the industry of mine Health and Safety information	Government
11	**LEADERSHIP***	That our leaders will lead by example in walking the ZERO HARM talk.	All Stakeholders

Note: * = Pillar is prioritised

Culture Transformation Implementation Model

In order for any framework to be successfully implemented there has to be clear, practical objectives, measures and of paramount importance finite timelines and reporting processes.

- The Head of South African Operations of each company will lead, with the participation of worker representatives, a gap analysis between company values, systems and programmes and the minimum standards and activities as contained in the Implementation Model below.
- Where gaps are identified, the collective recommendations of all involved parties will be used by the companies to adjust their own culture transformation values, systems and programmes to address the gaps in the gap analysis.

Pillar	Description (What are the minimum standards?)
1. Leadership	All mine sector leaders (which includes as a minimum the Board of Directors to all levels on an operating mine) play a critical role in changing culture. A leadership programme for all operational levels of leadership with which includes, as a minimum: a) An annual performance assessment of our zero harm leadership that evaluates whether we do what we committed to do in the 2008 Tripartite Action Plan on Health and Safety (i.e. have a clear vision for safety and health improvement and articulate it every day with passion, respect and transparency; comply with OHS rules at and outside of work, walk the talk; require participation of all employees; values the advice of OHS professionals; integrate OHS in all business decisions; provide positive feedback when you see progress; hold our organisation accountable for improving OHS; show eagerness to learn; fully commits to improving health and safety culture.) b) A development programme to strengthen our ability to do what we committed to do in the 2008 Tripartite Action Plan on Health and Safety including visible leadership. c) A visible leadership programme with measureable targets and enabled by freeing time of leaders to do this effectively and with appropriate involvement of worker representatives. d) A programme to effectively engage and empower workers.

Action Plan:

Activity	Responsibility	Date
Do a gap analysis between the company's leadership programme	Companies	6 months after the tripartite approval of this framework

and the above-mentioned minimum standards		
Adjust the company's leadership programme to address the gaps identified in the gap analysis	Companies	6 months after the tripartite approval of this framework
Pilot a health and safety leadership assessment and discuss experiences and next steps (Note: All such assessments shall be confidential between the person being assessed and their immediate supervisor)	Stakeholder principals	End 2012

Pillar	**Description (What are the minimum standards?)**
2. Risk Management	Risk management should always focus on measures to prevent accidents and such measures should be based on objective risk assessments. Since blame is the key cultural challenge in our sector, changes to our accident investigation systems is a priority. The accident investigation system and the quality with which it is implemented play a critical role in transforming our culture from blame to a just and learning culture. The accident investigation system must, as a minimum, include: a) A distinction between different types of human error, i.e. slips or lapses (unintentional lapses in attention, inadvertent omissions, natural human limitations), mistakes (unintentional lack of knowledge to select the appropriate plan of action, incorrect judgement), routine violations (violations are deviations from understood and accepted normal practice for whatever reason), exceptional violations. b) An explicit consideration of organisational system issues. c) A regular evaluation, carried out by a multi-functional internal stakeholder team, to establish whether the corrective measures deal with the underlying systemic issues rather than with the behaviour of individuals.

Action Plan:

Activity	Responsibility	Date
Do a gap analysis between the company's accident investigation system and the above-mentioned minimum standards	Companies	6 months after the tripartite approval of this framework
Adjust the company's accident investigation system to address the gaps identified in the gap analysis	Companies	6 months after the tripartite approval of this framework
Enhance the provisions of the Mine Health and Safety Act related to accident investigations and inquiries to support the transformation of culture from blame to a just and learning culture	DMR	End 2012
To improve the quality of accident investigations, facilitate the identification of leading practices in accident investigations and development of universal training on the use of these tools	Employers	End 2012
To improve the quality of accident investigations, participate in independent, no name, no blame teams to investigate successes in key risk areas	All stakeholders	End 2012

Pillar	**Description (What are the minimum standards?)**
3. Bonuses and Performance Incentives	Bonuses and performance incentives can send mixed message that production is more important than ZERO HARM. We should strive to have a ZERO HARM operations bonus systems, across ALL levels of the organisation, that: a) Enhances safe and healthy production. b) Includes a combination of leading and lagging, safety and health indicators in the determination of the zero harm. c) Includes a regular evaluation of whether those affected by the bonus system understand it and consider it fair.

Action Plan:

Activity	Responsibility	Date
Do a gap analysis between the company's production bonus system and the above-mentioned minimum standards	Companies that have production bonuses	6 months after the tripartite approval of this framework
Review production bonus systems and ensure unions are part of the consultation process about the principles of the new zero harm operations bonus	Companies that have production bonuses	End 2012

Pillar	**Description (What are the minimum standards?)**
4. Leading Practices	There will be a common approach to identifying and facilitating the adoption of leading OHS practices and research outcomes, which includes: a) Support sector level initiatives on the implementation of research outcomes and leading practices. b) Investigate leading practices/new research objectively with appropriate consideration of benefits and risks to be as low as reasonably practicable. c) Leadership support at ALL levels have a clear understanding of what they have to do to enable and lead sustainable adoption and this is appropriately included in their performance contracts. d) There is early and effective involvement of those affected by the adoption including their knowledge, beliefs and values. e) Adequate training, technical support and explicit financial resources for adoption. f) Monitoring of progress with the adoption and sustained monitoring of its impact through self-assessment and independent verification.

Action Plan:

Activity	Responsibility	Date
Do a gap analysis between the company's leading practice adoption system and the above-mentioned minimum standards	Companies	6 months after the tripartite approval of this framework

Adjust the company's leading practice adoption system to address the gaps identified in the gap analysis	Companies	6 months after the tripartite approval of this framework
Continue the adoption (including full implementation) of leading practices identified by the MOSH Learning Hub where practically possible using a risk-based approach. Where not practical companies, companies should investigate alternatives to address the risks. (Note: Companies should recognise that in their adoption they must consider the implications of adopting all the leading practices.)	Companies	Demonstrate evidence of wide-spread adoption of these leading practices by the end of 2012.

5. Elimination of Discrimination	Racism, genderism and any other forms of unfair discrimination are obstacles to the kind of workplace relationships that are conducive to achieve ZERO HARM. We should eliminate these with programmes, which as a minimum, include: a) Diversity management competence as a requirement for all levels of management (to be part of the leadership programme). b) A focal point to champion diversity management in the organization. c) Regular diversity audits (to be part of the monitoring of the culture transformation in the organisation.) d) A more culturally-sensitive way to deal with serious injuries and fatalities including an opportunity for mourning through e.g. a memorial service at the affected operation. e) A culturally-sensitive health awareness process to raise awareness about health issues.

Action Plan:

Activity	**Responsibility**	**Date**
Do a gap analysis between the company's programmes to eliminate discrimination and the above-mentioned minimum standards	Companies	6 months after the tripartite approval of this framework

Adjust the company's programmes to eliminate discrimination to address the gaps identified in the gap analysis	Companies	6 months after the tripartite approval of this framework
Ensure members participate in the opportunities for mourning and health awareness processes	Organised labour	Ongoing

Responsibilities

In order to ensure that the CTF can be implemented the following roles and responsibilities are defined:

Employers			**Organised Labour**	**Government**	**Mine Health and Safety Council**	**Professional Associations in the Mining Industry**
Individual Mines	**Holding Companies**	**Chamber of Mines**				
• Develop and apply site-specific strategies to implement the framework in collaboration with the workforce through their elected representatives.	• Develop and apply enterprise-specific strategies to implement the framework in collaboration with the workforce through their elected representatives. • Ensure that all sites across the	• Coordinate employer input to developing and applying industry strategies to implement the framework through tripartite forums	• Represent the industry's workforce in developing and applying industry strategies to implement the framework through tripartite forums.	• Represent the Government of South Africa and the public interest in developing and applying industry strategies to implement the framework through	• Popularize the framework widely through Regional Tripartite Forums and other mechanisms. • Facilitate support to smaller organizations (including contractors) in implementing the culture	• Lead and facilitate input to regional tripartite forums where culture transformation is discussed. • Arrange regular discussions amongst their members on issues identified in the culture

	enterprise make sincere and constructive efforts to implement this transformation framework	• Facilitate the industry's sincere and constructive efforts to implement this transformation framework	• Contribute to and support workplace representatives in developing and implementing site and enterprise specific strategies.	tripartite forums. • Develop and apply strategies to implement the framework within the Department of Mineral Resources.	transformation framework. • Develop a process to monitor implementation of the Culture Transformation Framework. • Develop a process to report on sector level information regarding culture transformation. • Facilitate a regular review of the Culture Transformation Framework and prioritise new issues	transformation framework

Reporting and Monitoring

The following gives effect to the Monitoring and Reporting included in the 2008 Tripartite Action Plan and the Mining Charter:

- Companies will as part of their Mining Charter commitments report to the DMR, in accordance with the table below, on the percentage progress that they have made with their culture transformation programmes.
- The Mine Health and Safety Council will make arrangements for the verification of the reports in cooperation with the DMR.
- The Mine Health and Safety Council will monitor the Culture Transformation and compile a sector level report for the principals of ALL the stakeholders.

Reporting and Monitoring Scoring System

Performance against each of the pillars identified above will have to be reported using the table below. The scoring system is described as follows:

The system or programme to deliver against each of the pillars needs to be reported against:

- *If, a mine has no system/programme in place then the score will be "0".*
- *If a new system/programme or a revision to the existing system/programme is planned, developed or implemented then the score will be either "1", "2" or "3" respectively.*
- *A score of "4" is obtained if the system has been implemented and reviewed for suitability or requires no revision.*

It is imperative to note that since the Mining Charter only provides for an overall score of 2 that the total of all the scores has to be reduced by a factor of 10%.

Measure and Scores	Systems or Programme in support of the Pillars					Final Score = (Actual score * 0.1)
	None	Planned	Developed	Implemented	Reviewed for suitability or no revision necessary	
SCORE	0	1	2	3	4	
Priority Pillar						
Leadership						
Risk Management						
Bonuses and Performance Incentives						
Leading Practices						
Elimination of Discrimination						
TOTAL SCORE ***(=sum of final score of each pillar)***						

Commitment by Stakeholder Principals

The tripartite stakeholders comprising of State, Organised Labour and Employers agree to the above framework for implementation within the South African Mining Sector.

Principals of Stakeholders within the South African Mining Sector		
The Minister of Mineral Resources	President of National Union of Mineworkers	President of the Chamber of Mines .....
President of the Association of Mine Managers of South Africa	President of UASA-the union	President of SAMDA .....
President of South African Collieries Managers Association	President of Solidarity	

Signed on this day: _____

At: _____

Appendix 2: Ethics clearance certificate to conduct the study

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)
R14/49 Magweregwede

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: H19/05/13**
PROJECT TITLE	Refinement of the occupational health and safety (OHS) culture transformation framework (CTF) for the South African mining industry (SAMI)
INVESTIGATOR(S)	Mr F Magweregwede
SCHOOL/DEPARTMENT	Mining Engineering/
DATE CONSIDERED	24 May 2019
DECISION OF THE COMMITTEE	Approved
EXPIRY DATE	20 February 2023

DATE 21 February 2020 **CHAIRPERSON** _____
(Professor J Knight)

cc: Supervisor : Professor M Hermanus

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University. Unreported changes to the application may invalidate the clearance given by the HREC (Non-Medical)

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to completion of a yearly progress report.**

_____ 21/02/2020
Signature **Date**

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

Appendix 3: Participant Information Sheet for IDIs



Participant Information Sheet for IDIs

Dear Sir / Madam,

My name is Fleckson Magweregwede and I am a Masters student in Mining Engineering at the University of the Witwatersrand in Johannesburg. As part of my studies, I have to undertake a research project, and I am investigating gaps in the occupational health and safety (OHS) culture transformation framework (CTF) for the South African mining industry (SAMI). The aim of this research project is to identify gaps in the OHS CTF and refine the OHS CTF for the SAMI.

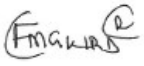
As part of this project, I would like to invite you to take part in an interview. This once-off activity will involve answering questions and will take around 30 minutes. With your permission, I would also like to record the interview using a digital voice recorder.

You will not receive any direct benefits from participating in this research, and there are no disadvantages or penalties for not participating. You may withdraw at any time or not answer any question if you do not want to. The interview will be completely confidential and anonymous as I will not be asking for your name or any identifying information, and the information you give to me will be held securely and not disclosed to anyone else. I will be using a pseudonym (false

name) to represent your participation in my final research report. If you experience any distress or discomfort at any point in this process, we will stop the interview or resume another time.

If you have any questions during or afterwards about this research, feel free to contact me or my supervisor on the details listed below. This study will be written up as a research report which will be available online through the university library website. If you wish to receive a summary of this report, I will be happy to send it to you. If you have any concerns or complaints regarding the ethical procedures of this study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical), telephone +27(0) 11 717 1408, email Shaun.Schoeman@wits.ac.za

Yours sincerely,

Researcher	**Supervisor**
Name: Fleckson Magweregwede Signature:  Phone: +2761 202 8644 Email: 713060@students.wits.ac.za	Name: Professor May Hermanus Phone number: +27 171 77043 Email: May.Hermanus@wits.ac.za

Appendix 4: Informed consent form



CONSENT FORM TO PARTICIPATE IN A UNIVERSITY OF THE WITWATERSRAND, SCHOOL OF MINING, MSc RESEARCH STUDY

Title of project	**Refinement of the occupational health and safety (OHS) culture transformation framework (CTF) for the South African mining industry (SAMI)**
Name of researcher	**Fleckson Magweregwede**

I agree to participate in this research project. The research has been explained to me and I understand what my participation will involve.

I agree that my participation will remain anonymous: **YES NO** (please circle)

I agree that the researcher may use anonymous quotes in his research report: **YES NO**

I agree that the interview may be audio recorded: **YES NO**

I agree that the information I provide may be used anonymously by other researchers following this study: **YES NO**

Name of participant	
Signature of participant	
Date	

Appendix 5: Research tools



Qualitative study questions guide

You are kindly requested to answer the following questions based on your knowledge and experience in the mining industry. For the purpose of this study, occupational health and safety (OHS) culture can be defined as the values and practices that all levels within the organisation share to ensure that OHS risks are appropriately managed.

1. What is your role or position within your organisation? *(select the suitable option)*

☐Senior Manager ☐Middle Manager /Professional staff ☐ Team leader / supervisor ☐ other

2. What is the nature of the business for your organisation? *(select the suitable option)*

☐Mining ☐ University or research institution ☐ Government ☐Consulting ☐ Mining suppliers ☐ Other

A. <u>Questions guide for mining industry stakeholders who were not employed by the mining companies</u>

3. What is your understanding of the meaning of OHS culture?
4. Does the mining industry have OHS goals? Please explain and provide details about the OHS goals.
5. In your experience, does organisational culture play a role in achieving OHS goals? Please explain.
6. What can the mining industry do to cultivate a positive OHS culture? Please explain.

7. How can the various initiatives aimed at improving OHS culture in the mining sector be effectively implemented?
8. In your experience, what factors can promote and obstruct the establishment of positive OHS culture in the mining sector?
9. Are you familiar with the culture transformation framework (CTF)? Are any of the elements (pillars) mentioned in the CTF document relevant to your approach in managing OHS? Please specify. *(The CTF document is attached for information purposes).*
10. Do you have any other comments or views you would like to add?

B. <u>Questions guide for mining industry stakeholders who were employed by mining companies</u>

3. What is your understanding of the meaning of OHS culture?
4. Does your organisation have OHS goals? Please explain and provide details about the OHS goals.
5. In your experience, does organisational culture play a role in achieving OHS goals? Please explain.
6. What does your organisation do to cultivate a positive OHS culture? The response may consider different levels in the organisation, the workplace and significant risks. Please explain. You can provide any relevant supporting evidence such as guidelines, standards, programmes, videos, talk topics and training material.
7. How can the various initiatives aimed at improving OHS culture in the mining sector be effectively implemented?
8. In your experience, what factors can promote and obstruct the establishment of positive OHS culture in the mining sector?
9. Are you familiar with the culture transformation framework (CTF)? Are any of the elements (pillars) mentioned in the CTF document relevant to your approach in managing OHS? Please specify. *(The CTF document is attached for information purposes).*
10. Do you have any other comments or views you would like to add?

Appendix 6: Consolidated gap analysis findings and recommendations to improve the CTF

Item	Focus area	Findings / identified gaps	Recommendations
1	Definition of OHS culture	Definition of OHS culture provided in CTF could constrain comprehensive understanding of the OHS culture concept	The definition of OHS culture should be reviewed to include shared assumptions and values on OHS matters and factors that influence OHS culture such as behaviour, beliefs, perceptions, attitudes and feelings
2	Meaning of zero harm	The CTF does not deliberate on the meaning and rationality of the zero harm concept that is critical to demystify any vagueness and secure stakeholder buy-in on zero harm initiatives	In order to win the hearts and minds of all stakeholders, the zero harm concept should be understood as a value, belief and goal that is important to ensure every mine employee returns home unharmed every day. It is also key for the organisation and all levels of leadership to continuously demonstrate commitment to zero harm
3	Evolution and assessment of OHS culture	Description of the different OHS culture evolution stages, how OHS culture progresses from poor to the strong OHS cultures and methodologies for OHS culture assessment are not addressed by the CTF	The characteristics of the OHS culture evolution stages, OHS culture evolution sequence and tools for assessing the prevailing OHS culture should be incorporated into the CTF. Understanding of prevailing OHS culture will enable formulation of an informed OHS culture improvement strategy
4	Positive OHS culture characteristics	The CTF does not cover all best practice OHS culture elements. Gaps were noted in respect of importance of OHSMS, decentralisation of OHS decision making and accountability, empowering all employees to effectively manage OHS risks and importance of flexible and informed culture	The following OHS culture elements should be included in the CTF: • Embracing OHS accountability at all levels and decentralisation of OHS decision making • Capacitating all stakeholders to effectively manage OHS • Availability of effective OHSMS • Existence of reporting, flexible and informed culture

Item	Focus area	Findings / identified gaps	Recommendations
5	Significance of positive OHS culture	The CTF does not justify the importance of establishing positive OHS culture	Motivation on the importance of cultivating positive OHS culture to enable continuous improvement in OHS could enhance buy-in and commitment to OHS culture improvement initiatives from all the stakeholders
6	OHS culture performance indicators	OHS culture performance indicators provided in the CTF could limit holistic understanding of prevailing organisational OHS culture	There is a need to review the OHS culture performance indicators to ensure alignment with the best practices that were revealed by the literature study
7	Name and reporting requirements	The current name (CTF) and the requirement to report implementation progress together with mining charter targets, could dilute the importance of the CTF	Importance of CTF could be elevated by changing the name to OHS CTF and reporting OHS culture on the same platform with OHS performance indicators like fatalities and injuries
8	Change management	CTF does not recommend a change management methodology to effectively manage the OHS culture change process. Moreover, implementation of the CTF in a phased approach, could result in marginal OHS culture and performance improvement	• Provide guidance on change management considerations that should be implemented to mitigate against all issues that could inhibit cultivation of positive OHS culture • The different OHS culture critical success factors are interrelated and simultaneously interact with different components of the OHSMS. A systems-based consideration of all the OHS culture elements, rather than an individualistic approach could likely deliver optimum OHS culture and performance improvement
9	OHSMS	The CTF does not reinforce the importance of a robust OHSMS as the foundation for sound OHS management and importance of systematic approach in OHS management. It was further noted that the SAMI does not have a standard OHSMS	• Incorporate OHSMS and articulate the importance of a holistic approach, taking cognisance of all system elements (technological, human, and organisational). Emphasising the significance of integrated and holistic management of health and safety could assist to ensure that companies pay equal attention to the management of both health and safety

Item	Focus area	Findings / identified gaps	Recommendations
			• There is a need to develop OHSMS guidelines for the sector
10	Learning from OHS incidents	Guidance not provided on strategies for establishing just, reporting and learning cultures	• The CTF should include guidance on best practices for cultivating reporting, learning and just culture within an organisation. The focus should be on identification of root causes of OHS incidents and development of corrective actions to prevent repeats • Use of independent and experienced OHS incident investigation teams could assist to improve the effectiveness of the OHS incident investigation system
11	OHS risk management	CTF does not detail practices for enhancing the effectiveness of the risk management process. Furthermore, the SAMI does have standard OHS risk management guidelines	Provide guidance on strategies to improve the effectiveness of OHS risk management and develop risk management guidelines for the SAMI
12	OHS behaviour	CTF does not elaborate on the significance and methodologies of promoting good OHS behaviour	The significance of positive OHS behaviour in cultivation of a strong OHS culture and advice on methodologies for establishing good OHS behaviour should be included in the CTF
13	OHS leadership	CTF does not define OHS leadership and roles and responsibilities of different OHS leadership levels	• Provide the definition of OHS leadership, including clear roles and responsibilities for all levels of leadership. Understanding the different levels of OHS leadership could assist the mines to customise the different interventions for different target audience (levels of OHS leadership) • Appointing adequate and competent number of OHS representatives and empowering them to stop unsafe work and acts

Item	Focus area	Findings / identified gaps	Recommendations
			• Appointing more women in OHS leadership positions could strengthen the culture of caring that is necessary for continuous improvement in OHS • Utilising cost benefit analysis to understand short, medium and long term implications of different OHS improvement initiatives
14	Collaborative culture	CTF does not emphasise the importance of effective participation of the workforce on OHS matters and provide guidance on techniques that could be used to enhance collaboration on OHS issues	• Include emphasis on significance of collaboration on OHS and guidance on methodologies that could be used by the mines to optimise the participation of all stakeholders, particularly the workforce, on OHS matters • OHS culture and human factors training could improve understanding and competency in management of these soft issues • Introduction of a mandatory minimum level of education could enhance employees' ability to comprehend information, embrace new ideas and participate in engagements
15	Technological innovation	Advantages of technological innovation are not provided in the CTF	Elaborate on the benefits that could be attained by embracing technological innovation
16	Constraints	Apart from the requirement to eliminate discrimination at workplaces, the CTF does not holistically consider other factors that could hinder the successful establishment of positive OHS culture	Additional potential constraints such as prevailing social, political and economic environment, national OHS culture and leadership deficiencies should be included in the CTF