THE UNIVERSITY OF THE WITWATERSRAND

SCHOOL OF MINING ENGINEERING

Research Report for the degree MSc Mining Engineering (specialising in Occupational Health & Safety)

MSc(50/50)	MSc by Research only
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Research title: Identifying factors contained in the Anglo American Safety Way that would have the greatest influence on the effectiveness of Occupational Health & Safety Management Systems.

Research Supervisor: Prof. Mavis (May) Hermanus

DECLARATION

I declare that this report is my own unaided work. I have read the University Policy on Plagiarism and hereby confirm that no Plagiarism exists in this report. I also confirm that there is no copying nor is there any copyright infringement. I willingly submit to any investigation in this regard by the School of Mining Engineering and I undertake to abide by the decision of any such investigation.

12th April 2019

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ABSTRACT

The South African mining landscape has changed significantly over the last decade with a rise in medium to large local mining companies. On face value many smaller companies do not have adequate knowledge, processes and systems on health & safety compared to the large diversified multinational operators. Occupational Health and Safety Management Systems (OHSMS) form the foundation of effective safety management. The aim of this study was to identify factors that would have the greatest influence on the effectiveness (sustainable and impactful implementation) of OHSMS. These factors were identified through an in-depth qualitative analysis in the form of a case study that focused on the implementation journey of the Anglo Safety Way (ASW). A comprehensive literature review and empirical study involving 15 employees from the corporate head office and 2 mines, delved deep into the success factors for eventual effective implementation. The key findings from the research that led to effective implementation of the system included:

1) The ASW was consistent with similar OHSMS in terms of the broad elements addressed in the system and systematic flow thereof.
2) In the experience of participants some elements had greater impact on effectiveness than others including leadership, a focused and consistent approach to risk management, people focus and involvement, and complimentary systems to enhance each element.

The findings from the research could easily be incorporated in the OHSMS design and implementation plans of other companies even where they have less resources, to facilitate effective implementation.

Keywords: Safety Management System; Implementation; Anglo Safety Way

AKNOWLEDGEMENTS

I would like to thank the following people that have made my journey that much easier in completing this research report:

- My supervisor, Adjunct Professor. May Hermanus, for her guidance, mentorship and encouragement over many years. She is really a phenomenal leader with unparalleled experience in the mining industry.
- The colleagues at Anglo American for always welcoming me back whenever I approach them for more research at one of their operations.
- Those individuals that volunteered to take part in this study without whom the qualitative research would not have been possible.
- The colleagues at Wits, Nancy and Ingrid, that assisted me with tips and advice in navigating through the academic process.
- My Dad and Mom for assisting me with other practical life commitments in times when I was committed behind a desk, and always encouraging and believing in me.
- My kids for being patient with me when I was sitting till late at night compiling the report.
- Many individuals like Dorian, Dave, Stanford, Sietse, Sizwe, Adri, Eugene, Paul and Deonie for their particular contributions in my journey to this point.
- The Lord for giving me the insight, strength, capacity and resolve to complete this portion of my M.Sc.

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LIST OF ACRONYMNS AND ABREVIATIONS

ASW	Anglo Safety Way.
CTF	Culture Transformation Framework.
HPH	High Potential Hazard.
HPI	High Potential Incident.
HSE	Health and Safety Executive – United Kingdom.
ICAM	Incident Cause Analysis Method.
ICMM	International Council on Mining and Metals.
ILO	International Labour Organisation.
LFI	Learning from Incidents.
MOSH	Mine Occupational Safety and Health.
NSW	New South Wales.
OHSAS	Occupational Health and Safety Assessment Series.
OHSMS	Occupational Health and Safety Management Systems.
PDCA	Plan-Do-Check-Act cycle.
SHE	Safety, Health and Environment.
SMS	Safety Management System.
TRCFR	Total Recordable Case Frequency Rate.
TRIFR	Total Recordable Injury Frequency Rate.
UK	United Kingdom.
US	United States.
VFL	Visible Felt Leadership.

1. INTRODUCTION

It is no secret that Mining and other extractive industries are amongst the most hazardous industries globally. A recent article (McPhillips, 2017) highlighted the fact that the global mining industry employees about 1% of the global workforce but is responsible for 8% of workplace fatalities. The South African mining industry has its own gloomy history wherein thousands of mineworkers have been killed, disabled and injured throughout more than a century of mining.

The mining industry globally and locally has however experienced a turnaround in its health and safety performance in the 21st century with advances in technology and through sustained social and regulatory pressures. A major event according to Hermanus (2007:531) that shifted the energy and subsequent improvement of health and safety in the SA mining industry was the 2003 tripartite agreement on Health and Safety milestones. Through this agreement major action plans towards 2013 were put in place addressing major fatality causing agencies like Falls of Ground and Transport & Machinery. Although the initial milestones were not achieved by the end of 2013, major improvements were already evident. As at the end of 2016 according to an article in the mining review (South African mining industry improves health and safety performance in 2016, 2017) the mining industry in South Africa had 73 fatalities for the calendar year.

When reflecting on the Health and Safety journey of the mining industry since 2003, it is notable as highlighted by Phakathi (2016) that there has been a 73% decrease in fatalities over the period 2003 to 2016. Despite this tremendous improvement over an extended period, the mining industry safety lagging indicators have reached a plateau as many of the technical solutions have largely been implemented. It has also been observed by many industry leaders and stakeholders that the effectiveness of some administrative controls and leading practices have waned due to the fact that the mining industry's culture is still not

conducive to sustained improvements. This fact was further emphasised by Shaw et al (2010:43) in a study that was done to establish the Culture Transformation Framework (CTF) for the SA Mining Industry. Shaw noted as part of the development of a framework for the industry that a positive organisational culture was essential in achieving exemplary occupational health and safety (OHS) results. Shaw further said that “A strategy that successfully integrates individual and organisational interventions is most likely to have the required results”. In the final recommendations stemming from the research done by Shaw it was clearly observed that the ideal framework for managing OHS in the mining sector includes elements from both the technical/ systemic risk management side as well as elements from a leadership, culture and behavioural nature. It is therefore clear that a number of interwoven factors would determine the OHS performance of an organisation. The critical link between Occupational Health and Safety Management Systems (OHSMS) and how these systems drive safety performance and improvements were further elaborated on in research conducted by Glendon and Stanton (2000:203) wherein they illustrated that safety performance management and measurement are key outcomes of the safety management system (SMS).

A coherent Occupational Health and Safety Management System (OHSMS) is therefore essential in embedding a framework like that identified through the CTF that is both reliant on both solid risk management principles and processes but retains elements that appeal and further develops the people responsible for executing the system on a daily basis and therefore ultimately achieving sustainable health and safety success. The focus of the study due to the interchangeable usage of OHSMS and SMS in many organisations and institutions (as elaborated on in section 4.1.1 of the literature review) is therefore specifically focused on occupational safety as a sub element within OHSMS and the safety improvements and performance realised from effectively implementing an OHSMS.

2. RATIONALE FOR THE STUDY

The purpose of this study was to focus on OHSMS as the foundation for driving, achieving and sustaining desirable OHS performance in an organisation. The rationale for selecting Anglo American as a case study in this regard was:

i. Anglo American has a well-established OHSMS system which it has enhanced and developed into the Anglo Safety Way (ASW), which has had a positive impact on Anglo American's safety performance over the period of implementation.
ii. The outcomes of the case study could benefit the SA mining industry as a whole as less resourced companies could apply the learnings / results, and the journey approach adopted by Anglo as this is also well established in mining wordwide etc.

Anglo American is a company with its roots firmly embedded in the history of South Africa but has also stood proudly amongst the top diversified multinational mining companies for the best part of the last century. Anglo American is also one of the few multinational mining companies that still has a significant presence in the South African industry amidst the rise of a plethora of local operators. Comparable safety statistics of mining companies is very hard to find as there are very few organisations and publications presenting individual company data as opposed to collated industry statistics. The International Council on Mining and Metals (ICMM) produced a safety benchmarking report for the first time in 2016 (Fig 1.1) which provided some insight on safety performance of mining companies.

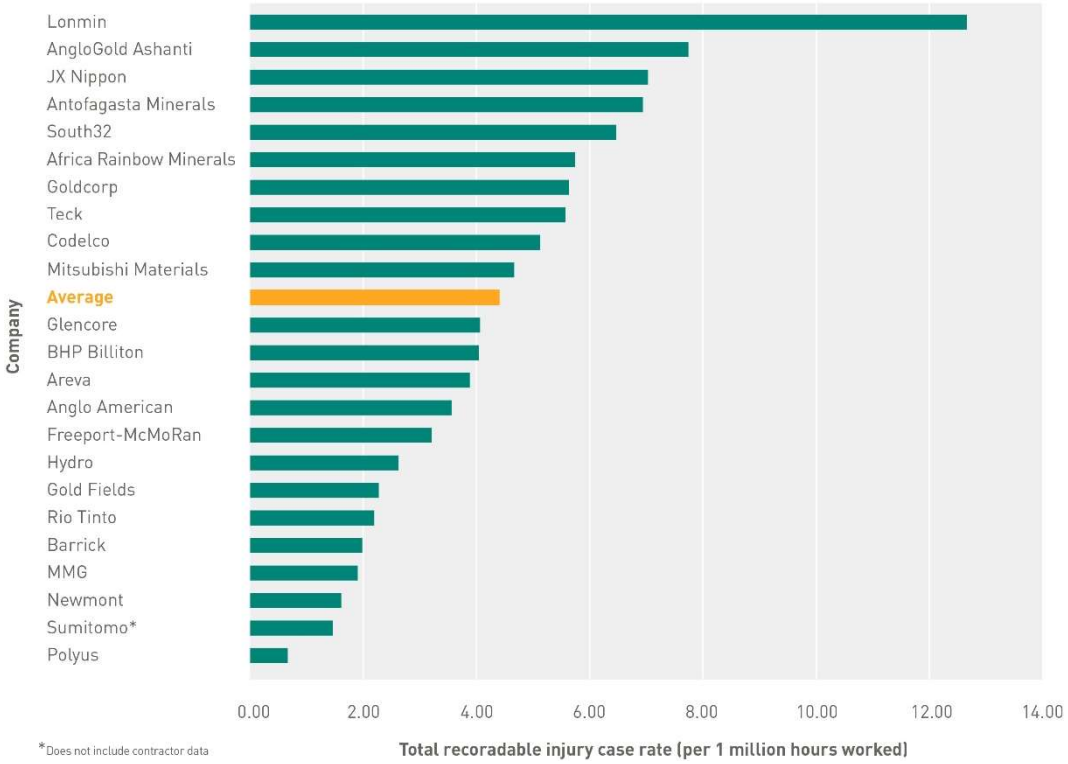


FIGURE 1.1 Total recordable injury frequency rate per 1 million hours worked for ICMM member companies across the 2016 calendar year (Source: ICMM, 2017:6)

It is quite clear from this graph that Anglo American's safety performance is quite impressive based on their Total Recordable Injury Frequency Rate (TRIFR), ranking as 10th best out of 24 companies, which is below most of their multinational competitors and even further superior to their peers in the South African mining industry. The performance of Anglo American relative to their peers in industry was also highlighted further in Table 1.1 where one could clearly see an impressive TRIFR (3,55 compared to an average of 4.26) considering comparative risk profiles, types of operations, mining methods and total number of hours worked. It should also be noted that Anglo American's fatality frequency rate at 0.038, is less than half of the industry rate as highlighted in figure 1.2.

TABLE 1.1 All data for for ICMM member companies in 2016 (Source: ICMM, 2017:7)

Company	Fatalities	Fatality frequency rate[3]	TRI (total recordable injuries)	TRI frequency rate[3]	Total hours worked
African Rainbow Minerals	0	0.000	276	5.72	48,255,477
Anglo American[4]	11	0.038	1,040	3.55	293,134,631
AngloGold Ashanti	7	0.056	972	7.71	126,000,762
Antofagasta Minerals	1	0.025	275	6.91	39,770,624
Areva[5]	1	0.057	68	3.87	17,591,617
Barrick	1	0.016	123	1.98	62,128,443
BHP Billiton[6]	1	0.007	594	4.03	147,458,556
Codelco[7]	4	0.030	676	5.10	132,500,985
Freeport-McMoran	6	0.041	472	3.20	147,291,443
Glencore[8]	16	0.049	1,329	4.05	328,262,516
Goldcorp	1	0.025	221	5.61	39,419,153
Gold Fields	1	0.018	124	2.27	54,669,196
Hydro	0	0.000	105	2.62	40,032,090
JX Nippon	1	0.155	45	7.00	6,432,504
Lonmin[9]	4	0.049	1,029	12.60	81,636,059
MMG	2	0.049	77	1.90	40,453,939
Mitsubishi Materials[10]	0	0.000	6	4.65	1,289,851
Newmont	0	0.000	116	1.16	71,910,761
Polyus[11]	2	0.048	28	0.67	41,923,314
Rio Tinto	1	0.006	345	2.19	157,495,226
South32[12]	3	0.065	299	6.44	46,412,204

Sumitomo	0	0.000	33	1.46	22,534,736
Teck[13]	0	0.000	191.6	5.55	34,544,502
Total	**63**	**0.032**	**8,445**	**4.26**	**1,981,148,588**

In considering the research topic of the research the researcher was confronted by two main questions. The first was to select a mining company with a safety management system that was well embedded and with a proven safety track record. Secondly there was the aspect of the value of the research in improving health and safety performance in the South African mining industry. The rationale therefore in selecting the Anglo American Safety Management System (The ASW as it is known) was therefore based on a multitude of factors. These included:

i. Anglo American is the only diversified multinational mining company with a historically significant presence in the South African mining industry across multiple high-risk commodities. In addition to this the company has also seen a steady improvement in its lagging safety indicators during the period in which it implemented its OHSMS with steady improvement trends thereafter as highlighted in Table 1.2.

TABLE 1.2. Anglo American Plc lagging safety indicators (Source: Anglo American, 2018)

Organization	Indicator	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
AA plc Managed	Year to date total LTIFR - all causes, per million hours	5.80	5.88	5.22	3.82	3.24	3.24	2.93	2.46	1.75	2.35	1.87	1.68	1.30
	Year to date total TRCFR, per million hours	14.35	12.35	11.36	9.06	7.24	10.11	6.42	5.42	4.02	4.66	3.55	3.17	2.44

ii. Anglo has outperformed its peers with comparable assets in the local industry and its safety performance is comparable to the best globally as highlighted in Figure 1.1 and Table 1.1.

iii. Anglo American has always been the forerunner in the South African mining industry in respect of many mining related disciplines and continues to have a major influence on health and safety policy and strategic direction at a local industry level. The adoption of leading practices for health and safety is testimony to this where Anglo American operations have been the source mine for 7 out of the 12 leading practices since 2008.

TABLE 1.3: Source Mines for MOSH leading practice (Source: Chamber of Mines of SA, 2018)

Source mines for industry H&S (MOSH) Leading Practices		
NR	**Leading Practice**	**Mine (Company)**
1	Continuous real time Monitoring of airborne pollutants	New Vaal (Anglo American)
2	Fogger system	Great Noligwa (AGA)
3	Footwall/ Sidewall treatment	Kloof operations (Goldfields)
4	Scraper Winch Covers	Moab Khutsong (AngloGoldAshanti) RPM (Anglo American)
5	HPD TAS tool	Two Rivers Plats (ARM)
6	Tyre Deflation Leading Practice	Sishen (Anglo American)
7	Ledging Planning LP	Mponeng (AngloGold Ashanti) Amandelbult (Anglo American)
8	Trigger Action Response Plans (TARP)	Kroondal Chrome (Xtrata)
9	Nets with Bolts	Union Mine (Anglo American)
10	Entry Examination and Making Safe	Driefontein (Goldfields)
11	Proximity Device Systems	Amandelbult (Anglo American)
12	Traffic Management Leading Practice	Sishen (Anglo American)

The second aspect as eluded to was therefore the impact that the research might have in the South African mining industry. In this regard there were also several indicators and evidence of the state of safety in the South African industry that the researcher took into consideration.

i. Even though the mining industry has shown significant improvement in safety it is evident that the industry is not improving at the rate envisaged by stakeholders in the industry as highlighted in a recent article (Odendaal, 2017).
ii. The local industry is dominated by local mining companies who often do not have the same resources, both in terms of financial means and human resources to invest in sophisticated safety systems. It is therefore essential that these operators explore mechanisms to “borrow” systems and approaches from those that have already implemented it. One proviso would however be that the system is proven to be effective and efficient in design and execution.
iii. The South African mining industry has a well-established culture of learning from one another as emphasised by (Hermanus et al, 2015:720) in relation to the MOSH leading practice adoption system that was established in the mining industry in 2008.
iv. The notion of a safety journey has been well established in the mining industry as emphasised by (Foster and Hoult, 2013:59) in their development of a journey model for the UK coal industry. It is therefore clear that different companies would be at different stages of their respective maturity ito systems and it would be in the interest to learn from the mistakes and successes of those who have progressed on the journey.

The OHSMS that was the focus for this research was therefore the ASW which outlines various elements that aligns well with other OHSMS like the Health and Safety Management Systems Framework which has been adopted in the United States mining industry as highlighted by Haas and Yorio (2016:50). There are numerous design and systemic management activities that support the implementation of an OHSMS as highlighted in the literature review. The study’s aim is to investigate some of the key factors or elements of a safety management system that will have the

greatest impact on the effective implementation of the system in the work environment.

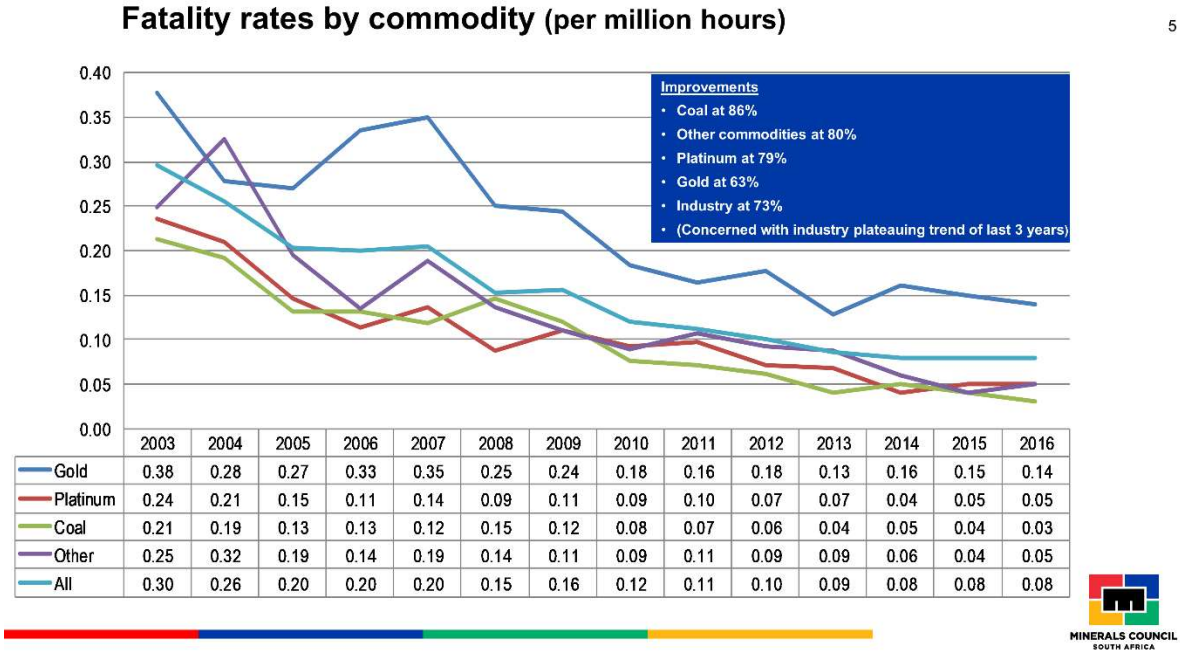
The Literature review focuses mainly on the theoretical overview and fundamental principles related to OHSMS in order to familiarise the reader with the purpose, design and general content of such systems. It is for this reason that a broad overview is given on the prominent systems that have been implemented including a detailed overview of the ASW. The empirical research by means of semi-structured interviews will be to understand the phenomenon/ individual case in question pertaining to the implementation and review process related to the ASW. The anticipation is that the research findings and conclusions will provide knowledge and guidance to other mining companies in terms of the optimal and effective implementation of a SMS. The guidelines provided from the study is based on the lessons learnt by Anglo American as one of the original implementers of a leading OHSMS system in a South African operational context.

3. RESEARCH AIMS

3.1 Research problem

The mining industry in South Africa has seen a steady decline in fatalities over the last two decades as highlighted in figure 1.2 below. Many of the successes in curbing fatalities and improving safety can be attributed to the implementation of engineering and other higher order controls as the understanding of safety and risk management has improved over the years. Strategies for improvement is however often directed by OHSMS. These systems should be embedded within organisations and must deal with a number of elements ranging from leadership and policy down to operational control and monitoring, audits and reviews as the final step in the risk management cycle. The specific information on the presence or absence of systems in organisations are however not publicly available, as

mining companies are very reluctant to report any deficiencies in their strategies and operational design. It is however questionable whether most of the emerging companies and local operators in the South African industry possess the knowledge, internal capacity, and financial resources to develop comprehensive systems which are often highlighted by the reported poor performance of companies and a failure to attain the milestones as set out in country health and safety objectives.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Gold	0.38	0.28	0.27	0.33	0.35	0.25	0.24	0.18	0.16	0.18	0.13	0.16	0.15	0.14
Platinum	0.24	0.21	0.15	0.11	0.14	0.09	0.11	0.09	0.10	0.07	0.07	0.04	0.05	0.05
Coal	0.21	0.19	0.13	0.13	0.12	0.15	0.12	0.08	0.07	0.06	0.04	0.05	0.04	0.03
Other	0.25	0.32	0.19	0.14	0.19	0.14	0.11	0.09	0.11	0.09	0.09	0.06	0.04	0.05
All	0.30	0.26	0.20	0.20	0.20	0.15	0.16	0.12	0.11	0.10	0.09	0.08	0.08	0.08

FIGURE 1.2 – South African Mining Industry Fatality Rates (Source: The Minerals Council South Africa, 2017)

3.2 Research questions

3.2.1 Research questions with regards to the literature review

Research Question 1: What are the typical elements that have been included in the leading OHSMS?

Research Question 2: Which of these elements could typically have the greatest influence in determining the effectiveness of OHSMS?

3.2.2 Research questions with regards to the case study

Research Question 3: What are the typical elements according to mine employees (management), that form part of their OHSMS and which of these elements were implemented by the mine?

Research Question 4: Which of the implemented elements of their OHSMS had the greatest impact in changing the safety performance of the mine?

Research Question 5: What particular actions were taken with regards to the implementation of the various elements that facilitated successful implementation?

4. LITERATURE REVIEW

4.1. Occupational Health & Safety Management Systems

The review of the literature is aimed at answering research questions 1 and 2.

4.1.1 Defining an Occupational Health and Safety Management System

It is first and foremost important to understand what is meant by referring to an OHSMS. The International Labour Organisation (as cited in Robson et al, 2007:331) defines an OHSMS as "*A set of interrelated or interacting elements to establish OSH policy and objectives, and to achieve those objectives*" It is furthermore important to note that the terms Safety Management Systems and Occupational Health and Safety Management systems are used interchangeably in many organisations, industries and existing literature. Robson et al (2007:332) notes that OHSMS in essence extends beyond traditional OHS interventions and programmes by incorporating the full spectrum as directed in Deming's cycle (Plan-Do-Check-Act, PDCA). Hughes and Ferret (2013:21) noted in their overview of SMS that the PDCA cycle has been prominently used in many SMS

including international standard systems such as HSG 65, OHSAS 18001 and ILO-OSH 2001. In looking at the definitions provided by these sources one could regard an OHSMS as a structured approach to manage and control risk in an organisation. An OHSMS consists of various elements which should be successfully implemented in order to have a holistic and functioning system.

4.1.2 Elements of a safety management system

Hughes and Ferrett (2013:20) suggest that health and safety management systems should be based on two fundamental principles which are:

i. The ability to develop a preventative safety and health culture.
ii. Applying a systems approach to managing occupational health and safety.

Even though these principles originally have reference to national health and safety systems they are equally applicable to organisational health and safety management systems. Redinger and Levine (1998:578) developed a comprehensive model for the development of an OHSMS after the review of extensive literature. In their model they included the following elements:

i. Management commitment and resources.
ii. Employee participation.
iii. Occupational health and safety policy.
iv. Goals and objectives.
v. Performance measures.
vi. System planning and development.
vii. OHSMS manual and procedures.
viii. Training system.
ix. Hazard control system.
x. Preventive and corrective action system.
xi. Procurement and contracting.

xii. Communication system.
xiii. Evaluation system.
xiv. Continual improvement.
xv. Integration.
xvi. Management review.

In considering the entire list Redinger and Levine (1998:578) then selected the variables that they considered to be the most important to the success of an OHSMS being:

i. Communication system/ Feedback channels.
ii. System evaluation.
iii. Continual improvement.
iv. Integration.
v. Management Review.

These prioritised variables support the elements included in the NOSA SHE management system. This management system formed the cornerstone of many OHSMS that are in used today and was widely applied by the South African mining industry during the latter decades of the 20th century as noted by Hedlund (2014:95). The SHE elements incorporated into the NOSA SHE management system (Samtrac for Mining, Participants manual,2013:236) includes:

i. Commitment and SHE management policy.
ii. Planning of the SHE management system.
iii. Implementation and operation of the SHE management system.
iv. Checking and corrective action.
v. SHE management system review.
vi. Continual improvement.

These elements are similar to systems and guidance provided by organisations such as the ILO and HSE. Essentially the elements culminate in a state of continual improvement as a result of the implementation of all elements that forms part of the OHSMS.

The Occupational Health and Safety Assessment Series also known as OHSAS 18001 is a management standard that has been adopted by various companies globally. Companies as a norm require OHSAS certification to display their due diligence on Occupational Health and Safety to their business partners and other stakeholders. The main elements and focal area as contained in the standard (BSI British Standards, 2007:5-14) can be summarised as follow:

i. General Requirements.
ii. OH&S Policy.
iii. Planning.
iv. Implementation and Operation.
v. Checking.
vi. Management Review.

Each one of the main elements contains a number of sub elements which results in around 28 elements that are reported on.

4.2 Design of a safety management system

In designing the SMS of the organisation, it is once again helpful to refer to the PDCA methodology (Deming's cycle) as mentioned earlier. By using this methodology all safety functions and actions can be detailed in order to have a systematic process which can be easily followed by all employees in the organisation, as it is critical that all employees should be able to participate and contribute to their own safety and those around them. The Mine Safety operations branch (MDG 1010 Minerals Industry Safety And Health Risk Management Guideline, 2011:38) of the NSW government in Australia provides a useful framework for the design of a safety management system. This framework is set out in figure 1.3 below.

FIGURE 1.3. Management and Risk Management (MDG 1010 Minerals Industry Safety and Health Risk Management Guideline, 2011:38).

Under each element of the PDCA model for Risk management (MDG 1010 Minerals Industry Safety and Health Risk Management Guideline, 2011:38), the MDG1010 model provides for the following elements:

1. Plan
    - Management Leadership.
    - Responsibilities/ Accountabilities.
    - Risk Assessment/ Management.
    - Compliance requirements.
    - H&S Planning and programmes.
2. Direct
    - Personnel training and contractor services.
    - Documentation and communications.
    - Facilities design and construction.
    - Operations, maintenance and management of change.
    - Community awareness and emergency response.
3. Check
    - H&S performance monitoring and measurement.
    - Incident investigation, reporting and analysis.
    - H&S management systems audit.

4. Adjust
    - Management review and adjustment.

In considering performance indicators for SMS Haas and Yorio (2016:50) noted that the U.S. National Mining Association developed a similar guiding document and framework, as shown in Figure 1.4, to that of the Australian mineral industry, in which they detailed how 20 specific management activities with regards to Health and Safety Management could be plotted across a tailored version of the PDCA cycle.

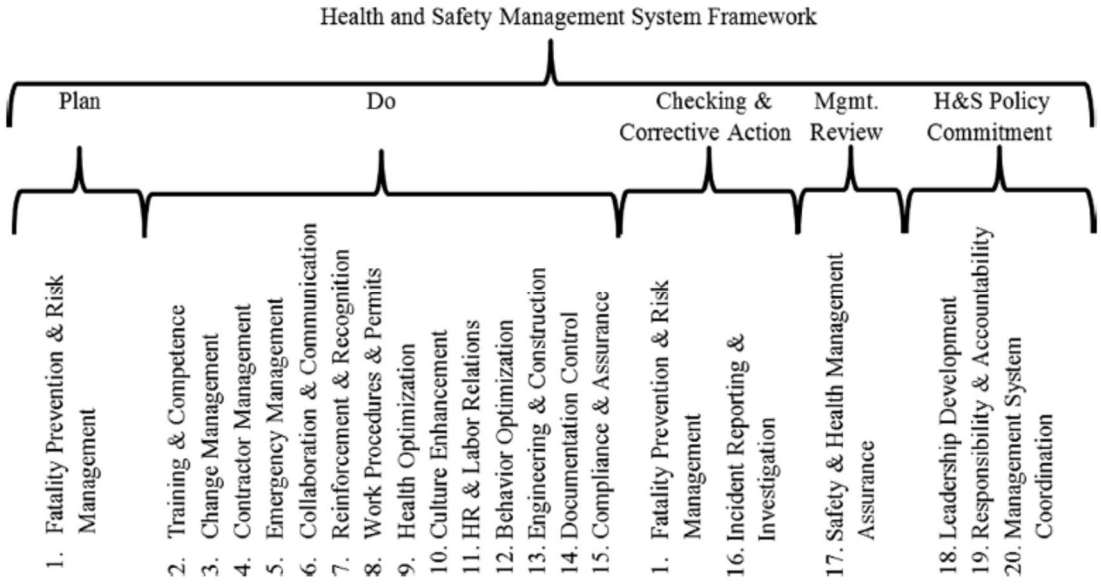


FIGURE 1.4. Organisation of the 20 elements of COREsafety under the tailored version of the PDCA cycle (Haas and Yorio, 2016:50)

The Qld-guidance-note-9 (2008:7) also included a number of the above-mentioned elements under the banner of “dynamic sub-systems” in their guidance note to the mineral industry. Some of the suggested subsystems are:

i. Change management.
ii. Workforce involvement.
iii. System performance: lead and lag indicators.
iv. Causal analysis: repairing defences.

v. Audit and inspection findings.
vi. Contractor safety and health.

As highlighted in the introduction the system should have a holistic systems approach by recognising the interrelationships and impacts of the various elements on each other and on the overall performance of the system. Organisations should use an appropriate combination of the abovementioned system design recommendations to design a system that is appropriate for the type of business and the operational risks they face. Ultimately most safety management systems should comply with these design frameworks in order to be effective and comprehensive in managing safety risk.

4.3 Implementation and review of a safety management system

It is always critical that organisations assess their progression towards a more mature health and safety culture. SMS provide the framework for improving the safety maturity in organisations as echoed by Liou, Yen and Tzeng (2008:20) "*To address the human factors issue, aviation safety management has changed from being reactive to being proactive using safety management systems*". Various safety maturity models have found their way into SMS and play a critical role in terms of both the implementation of the system and associated actions but also in terms of the review of the systems and the progression/ development of the system.

Figure 1.5 as contained in (MDG 1010 Minerals Industry Safety And Health Risk Management Guideline, 2011:43) depicts the Hudson Ladder model which was designed as a 5 prong model of safety maturity. The model has a "pathological state" at the most basic level of safety maturity and as the organisation develops its safety maturity it will eventually reach a high level of maturity at level 5 being in a more "generative state". Supporting each rung (next descriptive level of maturity) is a comprehensive set of behaviour and system standards which will both

give direction in terms of what actions are required to advance to the next rung but also some indication of what areas need to be assessed and reviewed. This approach together with traditional methods and tools included in the auditing and assurance functions of a business could provide greater insights on the progress that a company is making on improving safety and risk.

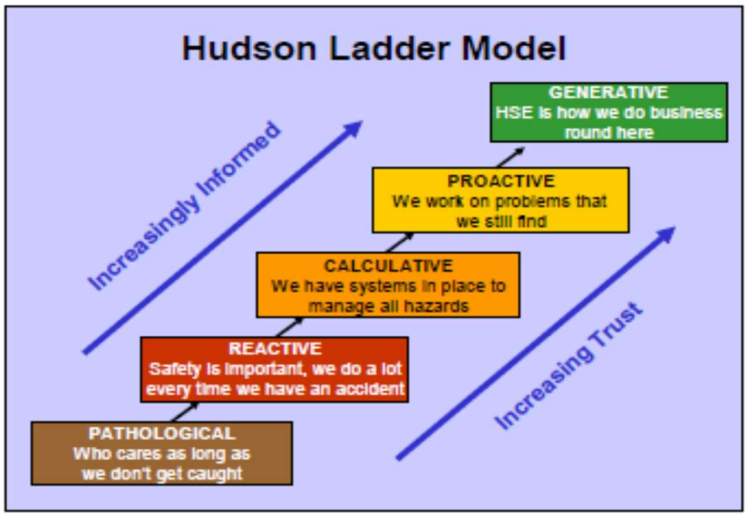


FIGURE 1.5. Hudson Ladder Model – Safety maturity (MDG 1010 Minerals Industry Safety And Health Risk Management Guideline, 2011:43)

The guidance note (Guidance Note QGN09 Reviewing The Effectiveness Of Safety And Health Management Systems, 2008:10) furthermore indicates that there are four aspects on which a health and safety management system should be audited on in order to review the effectiveness of the system. These aspects are:

i. Determine how the safety and health management system is intended to ensure the risks to persons from operations at the mine are at an acceptable level.
ii. Establish whether the safety and health management system is implemented and effective in ensuring the risks to persons from operations at the mine are at an acceptable level.

iii. Examine whether the safety and health management system is suitable for ensuring the risks to persons from operations at the mine are at an acceptable level.
iv. Use of an evidence-based approach where audit evidence is verifiable. The audit should be based on samples of the information available.

In auditing the system, the organisation will be in a position to improve aspects of the management system in line with the expected outcomes and goals of the system. A interesting survey was conducted by researchers (Chen et al, 2009) in terms of factors that particularly impacted the successful implementation of OHSAS 18001 as an OHSMS. The survey noted that "*the most critical factor for the success of OHSAS implementation was top management's commitment and support while the main reason of its failure was poor collaboration among company personnel*". This further underpins critical elements of implementation found in all of the systems and guidance mentioned above.

4.4 The Anglo Safety Way

The ASW is the SMS that Anglo American introduced in the period 2009/2010. The specific management system has been implemented by all Anglo American business units including local South African companies like Kumba Iron Ore, De Beers, Anglo Platinum and Anglo Coal (SA). Anglo describes (The Anglo American Safety Way: Safety Management System Standards, 2009:8) this as a SMS standard which consists of 12 main elements or standards as they are referred to throughout the system. These 12 elements according to (The Anglo American Safety Way: Safety Management System Standards, 2009:8) are:

i. Policy, leadership and commitment.
ii. Risk and change management.
iii. Legal and other requirements.

iv. Objectives, targets and performance management.
v. Training, awareness and competence.
vi. Communication, consultation and participation.
vii. Documentation and control of documents.
viii. Operational control.
ix. Emergency preparedness and response.
x. Contractor and business partner management.
xi. Incident reporting and investigation.
xii. Monitoring, audits and reviews.

At first glance it is clear that the ASW follows a structure similar to the proposed structures and layouts of the leading SMS in industry. The flow of the system is also very logical where it starts off with the policy, leadership and commitment of the organisation and end with the monitoring and review of the system.
Figure 1.6 as contained in (The Anglo American Safety Way: Safety Management System Standards (2009:8), is a graphical representation of the ASW depicting the content and element of the system: In supporting the SMS Anglo American has also drawn up safety golden rules and the Anglo Fatal Risk standards which are separately implemented within the organisation but they ultimately support most of the 12 standards. In 2008 Anglo American also started with a safety/ risk management program in which they trained numerous employees and stakeholders on their risk management processes which later included the detail on the ASW and other elements supporting this safety management system. Cynthia Carroll, as referred to in Carroll, C (2012:1304) the CEO at the time in 2012, stated the following with regards to the training programmes of the company. *“The company invited senior leaders from both the union and the Department of Mineral Resources to attend our executive risk management and safety program (to date 3,000 leaders have been through it), and since 2008 we have trained 12,000-line managers, supervisors, and frontline employees”.*

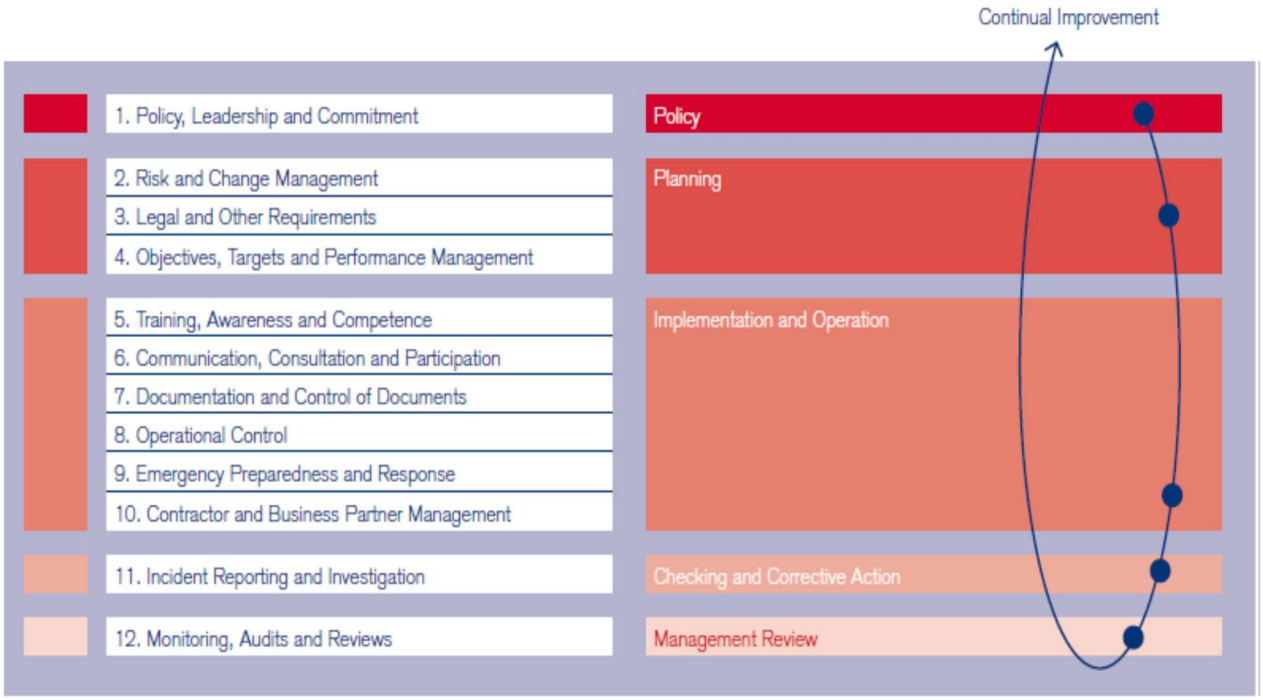


FIGURE 1.6 The Anglo Safety Way – content of the safety management system (The Anglo American Safety Way- Safety Management System Standards, 2009:8)

4.4.1 Critical examination of the content and elements of the ASW

This section of the review serves to highlight the important aspects which are present within the SMS of Anglo American. There are twelve "standards" or elements within the management system each highlighting various aspects, principles and actions which are important to successful implementation of the particular element/ standard.

4.4.1.1 Policy, leadership and commitment

Under the first standard of the SMS there are a number of important points and declarations that are made under 12 points within the standard/ element. The most important aspects are:

i. Executive committee endorsement.
ii. Transparency.
iii. Accountability of management.

iv. Compliance to international standards i.e. OHSAS 18001.
v. Operations and functions should have clear responsibilities, roles and accountability to implement the system.
vi. Focus on clear and effective communication.
vii. Safety as priority through dedicating the appropriate resources to implement and maintain the systems.
viii. Focus on adherence to systems and standards.
ix. Review of the system on periodic basis.
x. Visibility of leadership and involvement of all stakeholders and employees.

This element clearly serves as the basis for the implementation of the ASW. It sets the rules of engagement and the values and behaviour that are expected from people within the organisation in order to ensure that everyone is working towards a common goal.

4.4.1.2 Risk and change management

This element seeks to address the way in which the organisation identifies and responds/ control risk in a holistic and thorough manner. It provides explanation on risk methodology and terminology and how this should be implemented at the various levels of the organisation. Some important points in relation to this element is:

i. The application of the risk management process to the entire life-cycle of the operation.
ii. Risks assessment processes, methodology and tools.
iii. Responsible and qualified personnel who are accountable for certain aspects of the system.
iv. Focus on implementation of effective control measures.
v. Importance of documentation to be to standard.
vi. Training of employees on risk management.

vii. The importance of a formal change management program that is able to respond to changing risks within the operating environment.
viii. Updated risk registers to contain all the relevant risks within the business.

This element is quite comprehensive although it could be argued that Anglo American as well as industry in general are still finding it problematic to manage change within business. This has prompted a renewed focus on change management by organisations such as the Mine Occupational Safety and Health (MOSH) learning hub.

4.4.1.3 Legal and other requirements

This element is an overall commitment of the business to adhere to the legal frameworks and statutory requirements of the jurisdictions in which they operate. It also requires employees and management to familiarize themselves with these requirements in order to comply at all times.

4.4.1.4 Objectives, targets and performance management

The focus areas of this standard/ element are:

i. Measurable and quantifiable targets which are consistent with the objective and the vision of the organisation with regards to safety.
ii. Integration of risks and improvement thereof within the objectives of individuals and the organisation.
iii. Incorporation of standards and expectation into individual contracts and supplier/ contractor agreements.
iv. Development of annual and other periodic safety plans for improvement of specific risks within the business.
v. Making business safety objectives and expectations clear to all parties.

The primary principle that the company conveys through this standard is that it will set high safety requirements within the business. It is

furthermore important that all performance systems are consistent with these expectations and serve to assist individuals and business units to achieve these goals.

4.4.1.5 Training, awareness and competence

This standard places focus on the requirement to have trained and competent employees in order to ensure that all work is performed in a controlled and safe manner. Some of the direct requirements of this standard are:

i. Continuous training of all personnel on Hazard Identification, risk assessment and control measures.
ii. Accountable persons to ensure that employees are trained.
iii. Communication and induction for visitors.
iv. Formal education and training systems and processes supported by comprehensive training development frameworks for groups and individual employees.

4.4.1.6 Communication, consultation and participation

This standard clarifies the purpose of the organisation to make safety accessible and transparent to all employees and stakeholders of the business. It also promotes efforts to include as many “coalface” employees as appropriate in designing some of the inputs into the safety management systems and also for these individuals to participate in reviews and changes to the system. Although the intent of this element is clear the organisation has failed up to date to really involve employees in a number of key decisions and standards pertaining to the OHSMS. Testimony to this this fact was an attempt by the Anglo American Tripartite structure to develop a document entitled “Standard for standards” or “Aligned approach to standards”, as often referred to in feedback presentations by the Tripartite steering committee to the Anglo American CEOs (Williams, 2015). This document was designed specifically to

provide management with a structured process in involving employees from all levels in the development of standards and procedures. The standard was never full incorporated in the suite of global organisational standards. There is often anecdotal evidence that employees are still of the opinion that their voices are not heard during the development and review of standards and procedures as borne out in many conversations and conferences.

4.4.1.7 Documentation and control of documents

The control of documents within the organisation is important both for statutory and proper governance purposes. The effective management of documents are essential with regards to statutory requirements of most mine health and safety legislation. During investigations and audits performed by parties' documentary evidence is often the backbone of all activities. Enforcement activities by the regulator scrutinize all documents in order to assess operational compliance to standards.

4.4.1.8 Operational control

This section deals with the control of risk. It focuses the attention of the organisation on the accepted risk methodology and hierarchy of control that is used in a standardized manner throughout the organisation. It also elaborates on the levels of risk control and the individuals responsible for ensuring that all measures are in place to adequately deal with the risk. The standard emphasizes the requirement to further ensure that controls are operational at all times to ensure the effectiveness of these controls. This section is fairly comprehensive and makes it easy for employees to understand the requirements with regards to safety controls within their area of responsibility.

4.4.1.9 Emergency preparedness and response

The emergency response standard communicates the importance of being prepared and be able to respond to emergency and disaster situations.

Some of the most important elements include the requirement that each operation should identify, assess and document all potential emergency and crisis situations and their impacts whilst developing plans to deal with such situations and the communication of these situations. The standard further emphasises the thorough implementation of these processes and regular drills to ensure employees are prepared and familiar with all aspects in the event of an emergency.

4.4.1.10 Contractor and business partner management

This element makes a very strong statement that contractors and business partners are integrated within the SMS considerations and that all parties are required to adhere to all requirements of the system. The standard further emphasizes that all partners and contractors will be subject to the same scrutiny ito compliance as well as the same consequences for non-compliance. It also touches on training requirements of contractor employees etc. It is important to note that Anglo American places a lot of emphasis on the fact that contractors are part of the business and critical stakeholders in assisting with the achievement of safety goals and objectives.

4.4.1.11 Incident reporting and investigation

Safety incident investigation is critical ito learning from the incident and system failures that led to the unwanted event. To this effect Anglo also initiated an incident investigation methodology called “Learning From Incidents” (LFI) which is based on earlier methodologies like the Incident Cause Analysis Method (ICAM) system but more focused on holistic incident causality looking at all the impacts of various systems and sub-systems. This methodology breaks away from the more traditional linear evaluation of causality and a sequence of events by assessing the systemic failures within the system including things like the failure of controls and drivers for human error (Aguilar, 2016).

4.4.1.12 Monitoring, audits and reviews

This standard sets out the importance of periodic audits within the business in order to evaluate the effectiveness of the safety management system as well as all other associated risk management activities within the business. One powerful inclusion in the Anglo system is a variation of the Hudson model which they dubbed the “Anglo Safety Maturity Process”. The process as depicted in Figure 1.7 assists the organisation to plan and review activities on both the systems and behavioural side of risk management in order to improve the system.

FIGURE 1.7 – The Anglo Safety Risk Management Process (Source: Anglo American, 2009.)

4.5 Supplementary actions to the Anglo Safety Way

Anglo American has been on a safety journey for close to a decade since the initial implementation of the ASW. It is notable as highlighted in the

Anglo American Report to Society of 2007 (Anglo American Report To Society 2007, 2008:25) that the company developed a number of complementary programmes and standards to enhance the implementation of the system *"We developed an Anglo American Safety Way, which sets out the management systems and safety standards that guide the way we work. These are now supplemented by a set of fatal risk standards and a safety risk management programme"*. The main programmes were centred around leadership in the form of the Visible Felt Leadership (VFL) guideline and associated training, the Risk Management Element through the Fatal Risk Standards, and the training element by delivering the SHE-RISK Management Training.

Conclusions from the literature review were that:

i. The ASW is well aligned to other prominent OHSMS in terms of the elements it addresses.
ii. It is more succinct in the design and approach and puts less of an administrative burden on the administrators of the system as a result of the fact that it is confined to 12 systematic elements.
iii. Anglo American has initiated other supplementary standards over a 10-year safety journey to enhance and facilitate the impact of the system.

5. CASE STUDY RESEARCH METHODOLOGY

A qualitative study on the ASW as a case study for OHSMS implementation was conducted by means of semi-structured interviews with 15 employees at a central corporate level and at 2 mines. The purpose was to understand the perspectives and experiences of employees in implementing the ASW.

5.1 The Aims of the study

The specific aims of the study were to answer the research questions pertaining to the Anglo Safety Way. These were:

Research Question 3: What are the typical elements according to mine employees that form part of their OHSMS and which of these elements were implemented by the mine?

Research Question 4: Which of the implemented elements of their OHSMS had the greatest impact in changing the safety performance of the mine?

Research Question 5: What particular actions were taken with regards to the implementation of the various elements that facilitated successful implementation?

5.2 Research method

The research methodology that was selected for purposes of this study was a qualitative research design. In considering the type of qualitative research the researcher selected a case study design as appropriate to generating the required information. Ritchie and Lewis (2004:52) said that the primary defining features of a case study is the investigation of a multiplicity of perspectives which are rooted in a specific context. This was further emphasised by Starman (2013:32) after a thorough analysis in which she concluded the following " *If we analyse these definitions in terms of differences and similarities, we would reach a conclusion in agreement with Simons (2009); that is, they all share commitment to the examination of complexity in a variety of real-life situations and they do not include various methods of data acquisition, for their focus is elsewhere*". In another article by Baxter and Jack (2008:545) the authors provided a checklist for case study design as provided by Yin. The four criteria that will inform whether a case study is a suitable research method is as follow:

i. The focus of the study is to answer "how" and "why" questions.

ii. You cannot manipulate the behaviour of those involved in the study.
iii. You want to cover contextual conditions because you believe they are relevant to the phenomenon under study.
iv. The boundaries are not clear between the phenomenon and context.

The researcher was satisfied that the case study design was appropriate since the empirical study centred around the specific journey of Anglo American in implementing its SMS. Apart from the appropriateness of the research method the researcher was further of the opinion that the selection of semi-structured interviews as data collection method (as further described in section 5.4) would be both an effective and efficient method as it would allow the researcher to have in-depth discussions with managers that were responsible for the implementation, review and refinement of the Anglo Safety Way.

5.3 Sample and Sample Size

The sample population for the study was selected on the following basis:

i. Participants exposure to the SMS both in terms of implementation and continuous review of the system.
ii. Employment within the company during the implementation journey.
iii. Reasonable knowledge on the content of the system and the integration and impact thereof within the broader safety and operational context.

The selection of the sample population to be included was further of importance in the design aspects of the empirical study. Richie and Lewis (2004:49) noted in this regard that the selection of populations or participants in a study was dependant on identifying individuals that would

provide the most relevant, comprehensive and rich information pertaining to the research questions. The decision on the number of participants were informed by both the requirements as set out by the university as well as relevant literature. For purposes of conducting masters level research the university suggested a maximum number of 15 study participants (MINN7094 – Research Methodology in Mining Engineering Guidance Note, 2016). Mason (2010:3) suggested as a guideline that the minimum sample size for qualitative research should be at least 15 participants. It should however be noted that Mason's focus in this instance was on Ph.D. level studies. Based on the abovementioned considerations the researcher opted to select a number of 15 participants for the study. The sample size was therefore keeping the study in range of both the requirement of the academic institution as well as conforming to academic rigor whilst avoiding a point of possible saturation by including too many participants.

5.3.1 Description of study participants

It was of utmost importance for the quality of the study that the study participants had to be selected very carefully. The researcher believed that it was necessary to select a mix of participants who had exposure at corporate level but also some who were very involved at operations level. Some other preferred criteria that involved the selection of participants with due consideration to the research design was the following:

i. Participants had to have reasonable exposure to the SMS both in terms of implementation and review of the system.
ii. Years of service with the company was important in order to give a retrospective reflection on the journey of implementation.
iii. Participants further would be required to engage on various aspects in terms of the respective elements of the ASW which meant that they would have to have reasonable knowledge on the content of the system and the integration and impact thereof within the broader safety and operational context.

All of the participants that volunteered for partaking in the study satisfied the abovementioned criteria. It should also be noted at this point that the researcher specifically approached individuals that were previously identified to fit the criteria but that the eventual decision in participating still rested with the respective individuals. There was a deliberate inclusion of safety, human resource practitioners and line management as different functions were held accountable for the implementation of different elements. Anglo has also articulated quite strongly over the last decade that safety is everyone's priority and responsibility. The multi-disciplinary input into the study therefore enriched the overall value of the empirical investigation. The eventual split of participants however leaned heavily towards safety managers as they volunteered on the basis believing they could contribute more substance to the research. There was a reasonable mix of gender and race and all of participants had more than 10 years' service with the company.

5.4 Instrument

Lamont and White (2008) presented a taxonomy of qualitative data collection techniques at a workshop of the National Science Foundation in the United States. This taxonomy as presented in Figure 1.8 provides quite a detailed overview of the techniques to be employed in the qualitative arena. From this taxonomy it is quite clear with consideration to the nature of the study already described in eliciting historical progress information and experience, that the preferred method of enquiry would be semi-structured interviews.

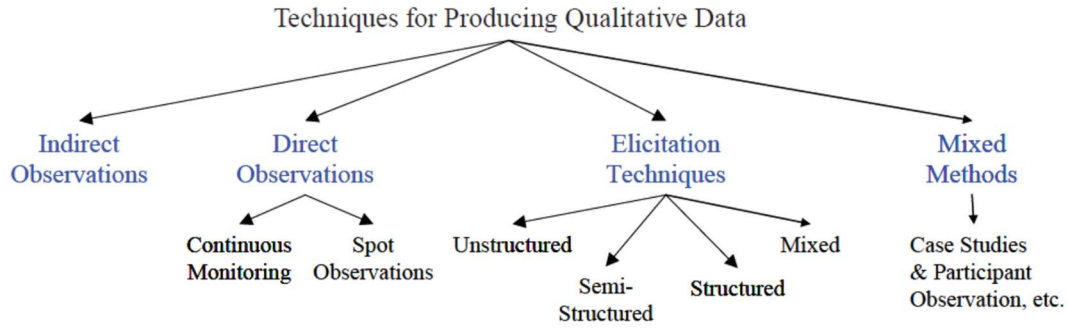


Figure 1.8 – Techniques for producing qualitative data (Source: Workshop on interdisciplinary standard for systematic qualitative research, 2005:34)

The list of interview questions for the semi-structured interview compiled in order to answer the research questions for the empirical study (see appendix D):

1) What is your role at the mine in respect to the implementation and review of the safety management system (OHSMS/ ASW)?
2) What was the safety performance like before implementing the ASW and after implementation?
3) Based on your operational experience, would you say that a formal SMS assists a mine to implement OHS actions and programmes in a more systemic/ holistic way?
4) What elements of the ASW have been implemented/ introduced in the mine?
5) Are there any elements of OHSMS that you think were omitted in the ASW?
6) In your opinion, were there elements that you have implemented which had a more positive influence on safety performance at the mine than others? Why?
7) In implementing the system, what actions if any, were particular helpful in ensuring that the system was properly/ successfully implemented? Please make reference to specific execution and provide further explanation?

8) Are there any shortcomings/ areas which you feel have not been implemented as successfully as envisaged? Please explain.
9) What advice, from a safety specialist's or line manager carrying the responsibility for implementing and maintaining the system, would you give other mining companies when it comes to implementing a safety management system?

The semi-structured interviews were recorded using a voice recorder. All participants signed consent forms for the interviews to be recorded in compliance to the ethical requirements pertaining to the study. To answer this first research question (Question 3) pertaining to the empirical research, the researcher included specific interview questions (Questions 4 and 5 below) in the interview protocol related to the elements that formed part but were also in the view of the participants possibly omitted from the ASW. A question linked to corroborating the implementation as cited in various company sustainability reports including the Report to Society 2007 (Report to Society 2007, 2008) were also put to the participants. The researcher included interview question 6 in the interview protocol to specifically address the second empirical research question. The question read as follow: "In your opinion, were there elements that you have implemented which had a more positive influence on safety performance at the mine than others and why?" In this specific instance the researcher was concerned with the specific elements amongst the 12 that was mentioned most frequently. Interview questions 7,8 and 9 was designed to elicit some views on supplementary actions that were taken to facilitate implementation. This also meant that further probing would be required at times as it seemed that some of the work that was done around possible things like communication, socialisation, engagement and enabling programmes did not always come to mind immediately. These actions as mentioned by the participants were captured and fed into the raw data and greatly influenced the emerging themes from the entire data set as this particular interview question was one of few that required more extensive responses.

5.5 Data Analysis

The data was analysed by means of the excel tool following the methodology and flow as eluded to in section 7.1 of this report.

Data analysis is quite possibly one of the most important aspects in relation to the qualitative study. There are a number of analytical traditions such as grounded theory, phenomenology and thematic analysis to name a few. Braun and Clarke (2006:4) notes that one of the main benefits of thematic analysis is the flexibility that it provides. They further pointed out that the ability to “thematise” meanings is one of the few generic aspects that are shared across different qualitative research analysis techniques. Despite the fact that thematic analysis provides the ability to quantify responses and themes it moves well beyond this according to Guest et al (2011:10) in identifying and relating implicit and explicit meanings within the data that is analysed.

The data analysis process is a thorough and systematic process that generally starts with the researcher familiarising him or herself with the data, going through a methodological assessment of the data and ends with the interpretation of the findings. In this regard Braun and Clarke (2006:16) suggested a six-step process to be followed. The researcher subsequently adopted this process for purposes of the research process. The six steps are as follow:

Phase 1 – Familiarising yourself with the data: In this step of the process the researcher mainly goes about the task of transcribing the data in the case where voice recording was used for the interviews. If the data was for instance manually recorded like often the case with moderator notes from focus groups, the researcher or person embarking on the analysis, will prepare the notes accordingly for analysis. The aim of this step in the process is to ultimately have the data ready to for initial code generation.

Phase 2 – Generating initial codes: The initial codes should be developed with having the research questions in mind. Researchers scan through the

data set to find quotes, phrases etc. with a particular meaning and match that with the code. A good rule of thumb is that all data sets should be coded and that there is no limit on the codes to be generated. The generation of codes/ coding can be done either manually or by using appropriate computer software.

Phase 3 – Searching for themes: At this stage the researcher starts looking for themes from the coded data. Braun and Clarke (2006:19) stated that “Essentially, you are starting to analyse your codes, and consider how different codes may combine to form an overarching theme”. There are many different techniques that could be utilised for identifying themes. Ryan and Bernard (2003:102) provides a comprehensive overview of the different techniques as detailed in Figure 1.9.

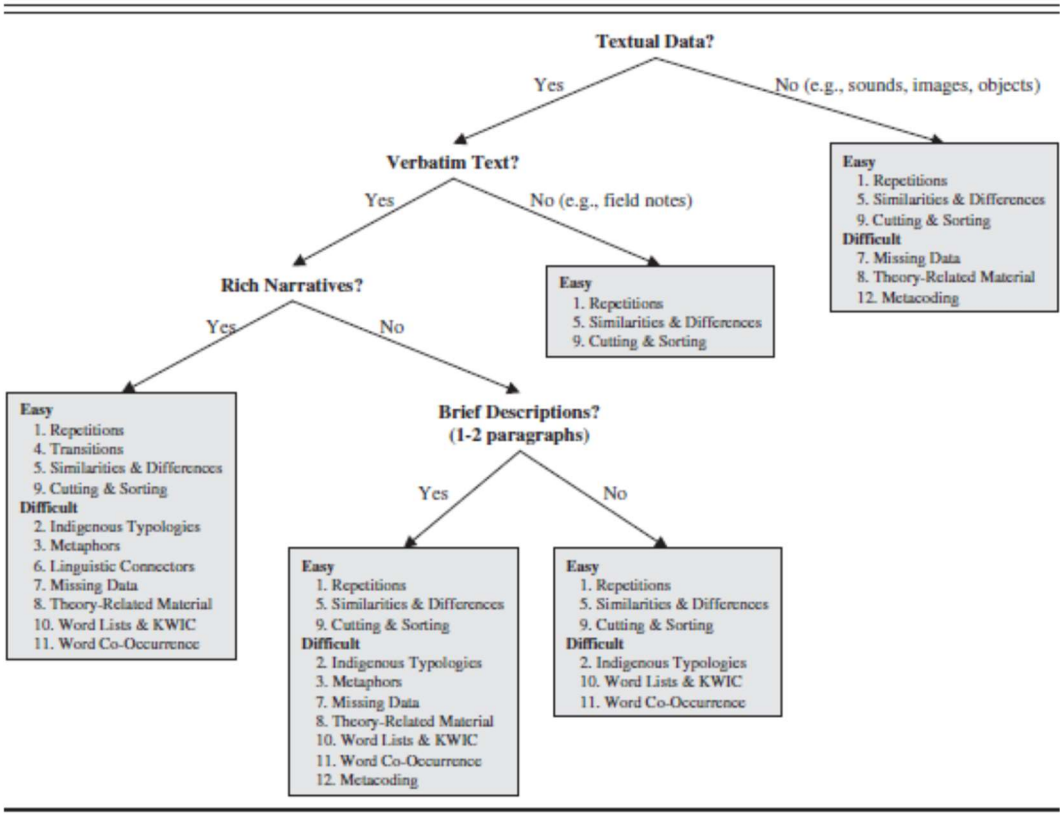


Figure 1.9 Selecting among theme identification techniques. (Source: Ryan and Bernard, 2003:102)

Phase 4 – Reviewing themes: Themes are then reviewed to ensure that all the codes have been captured and further a further consolidation of similar themes and a renaming of themes take place.

Phase 5 – Defining and naming themes: The essence of the themes are captured. Here Braun and Clarke (2006:22) suggests that the researcher might make use of a thematic map to highlight the themes relative to the content.

Phase 6 – Producing the report: The last phase of the analysis centres around the generation of the report detailing the findings of the thematic analysis.

The reliability of the instrument is very important in quantitative research. In qualitative research however, the reliability of the instrument is heavily influenced by the validity. (Seale, 1999:467) argued that reliability is really about the trustworthiness of the report. In this case the structured interview was reliant on the integrity and trustworthiness of the interviewer and how that impacted on the trustworthiness of the report. When coming to the issue of validity in qualitative research the focus shift heavily towards the quality of the research. (Davies & Dodd, 2002:281) argued that validity in qualitative research is concerned with the subjectivity, reflexivity, and the social interaction of interviewing. Overall it would seem that constructivism becomes an important concept when testing validity and reliability in qualitative research. Constructivism is the way in which individuals interpret, understand and are knowledgeable about certain aspects depending on their social exposure.

The researcher will demonstrate in the discussion of the empirical research how the abovementioned theory has been applied by means of a reflective overview of the research process.

6. ETHICAL CONSIDERATIONS

For purposes of the qualitative study, the researcher was bound by the ethical aspects and guidelines relevant to the study. A company representative needed to complete a form giving consent that the organisation in question could be used the research project. All participants were required to sign a consent form indicating that they were willing to participate in the research interview and that they did so freely and on their own accord. The participants gave their consent to the following issues as per the consent form that was signed:

i. Participation in the research is voluntary, the purpose of the study has been explained and questions in this regard has been answered.
ii. They would not receive payment for participating in the study.
iii. They had the right to withdraw from the study or withhold any information that they were not at liberty to disclose.
iv. They understood that their anonymity was secure.
v. They would be interviewed by the researcher and that the interview would be between 60-90 minutes in an area that would be suitable for the interview.
vi. Their identity would be kept confidential and not disclosed in research report.
vii. That the study, all ethical considerations and instrument to be used were authorised by the Human Research Ethics Committee (Non-Medical) of the University of the Witwatersrand.
viii. They understood the purpose of the research project which was explained and detailed in the participant information sheet that was handed to them.

7. RESULTS AND DISCUSSION

The results from the research will be presented in the form of a reflective overview by the researcher on the process that was followed in line with the six-phase process of Braun and Clarke as highlighted in section 5 of the report. This will be followed by a detailed discussion and overview of each of the themes that were identified through the qualitative interviews. In conclusion the researcher will articulate the findings and how it relates back to the research aim and questions.

7.1 Reflective overview of the research process

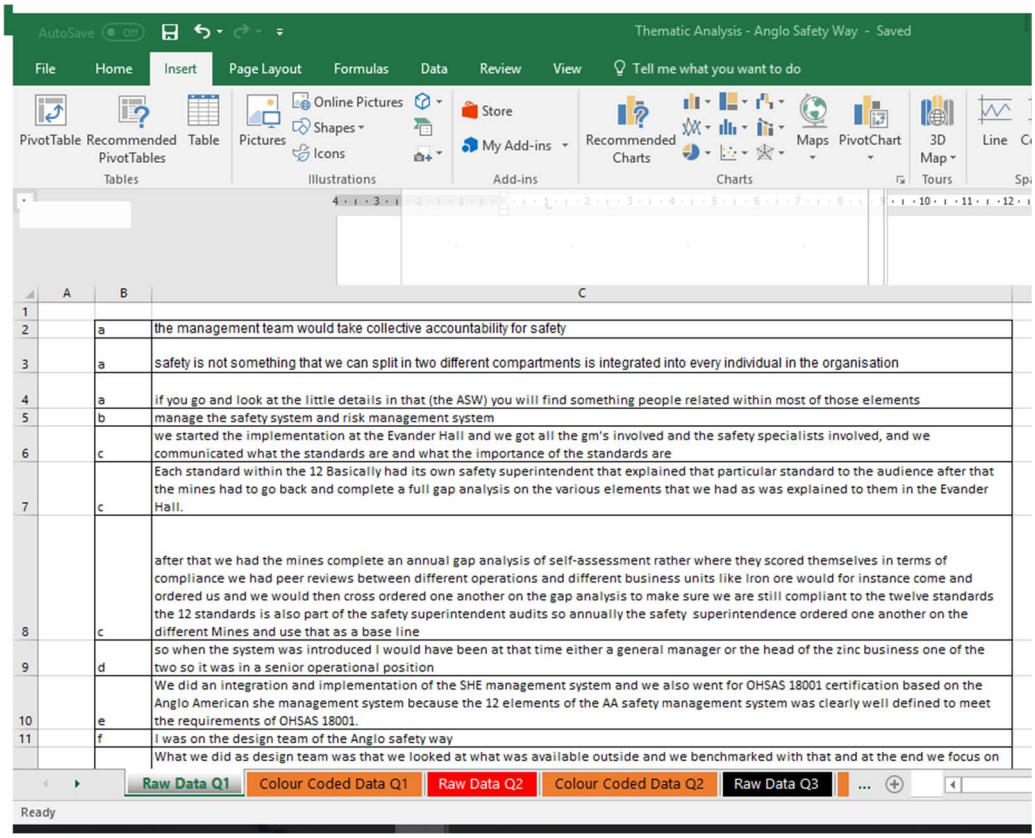
The researcher conducted the empirical research following the six-phase data analysis process by Braun and Clarke (2006) as referred to in the previous section. The researcher is of the opinion that the overview of the process will provide a thorough account of the systematic process that was employed throughout the empirical research process.

7.1.1 Familiarisation with the Data

The researcher conducted a total number of 15 interviews over a period of three months. All interviews were recorded and subsequently transcribed by the researcher. The process of personally conducting the interviews and subsequent transcription was the researchers first familiarisation with the data. The data was fairly organised and consistent across the entire data set as the semi-structured interviews were similar ito the flow of the questions with minimal additional questions required throughout interviews.

7.1.2 Generating initial codes

The Bree and Gallagher (2016:2814) process whereby they used the Microsoft Excel package as a simple and cost-effective tool for the coding and analysis of qualitative data was used. The process was originally used for the qualitative analysis of focus group data, but the researcher found that the methodological approach was suitable for the coding and analysis of the 15 transcripts in this study.



	A	B	C
1			
2		a	the management team would take collective accountability for safety
3		a	safety is not something that we can split in two different compartments is integrated into every individual in the organisation
4		a	if you go and look at the little details in that (the ASW) you will find something people related within most of those elements
5		b	manage the safety system and risk management system
6		c	we started the implementation at the Evander Hall and we got all the gm's involved and the safety specialists involved, and we communicated what the standards are and what the importance of the standards are
7		c	Each standard within the 12 Basically had its own safety superintendent that explained that particular standard to the audience after that the mines had to go back and complete a full gap analysis on the various elements that we had as was explained to them in the Evander Hall.
8		c	after that we had the mines complete an annual gap analysis of self-assessment rather where they scored themselves in terms of compliance we had peer reviews between different operations and different business units like Iron ore would for instance come and ordered us and we would then cross ordered one another on the gap analysis to make sure we are still compliant to the twelve standards the 12 standards is also part of the safety superintendent audits so annually the safety superintendence ordered one another on the different Mines and use that as a base line
9		d	so when the system was introduced I would have been at that time either a general manager or the head of the zinc business one of the two so it was in a senior operational position
10		e	We did an integration and implementation of the SHE management system and we also went for OHSAS 18001 certification based on the Anglo American she management system because the 12 elements of the AA safety management system was clearly well defined to meet the requirements of OHSAS 18001.
11		f	I was on the design team of the Anglo safety way
			What we did as design team was that we looked at what was available outside and we benchmarked with that and at the end we focus on

Figure 1.10 Screenshot 1 – Excel worksheet as used in the analysis of interview data

Figure 1.10 is a graphic depiction of the tool. Each one of the responses were inserted from the interview transcripts and grouped per question. The Raw data was sub-sequentially coded using different colour codes for each similar group of data.

7.1.3 Searching for themes

At this point the colour coded data were showing some patterns and the researcher started with a process of generating preliminary themes. Here the researcher was guided by the theme identification technique schematic by Ryan and Bernard (2003:102) as depicted in Figure 1.8. The verbatim text had a rich narrative, so the researcher ultimately made use of the technique in identifying repetitions and cutting and sorting as these were two of the appropriate techniques suggested for this type of data by Ryan and Bernard(2003:102).

7.1.4 Reviewing themes

The process of continuing to review the themes was quite an iterative process whereby the researcher continued to move back and forth throughout the data set. The researcher took care in reviewing each set of data for inclusion in the appropriate theme. In this stage of the process there was also a significant consolidation and editing of themes in order to refine themes for appropriate inclusion in the study.

7.1.5 Defining and naming of themes/ producing report

Theme consolidation was virtually completed at this stage. It should however be noted that the researcher combined the last two phases of the process largely due to the fact that the report as highlighted by Braun and Clarke (2006:23) would be of less significance in the context of this research study as the natural outflow of the entire study would be a discussion on the overall findings. The researcher arranged the themes by prevalence throughout the dataset and proceeded to capture the data overview or summary and key quotes from each of the themes identified. There were 17 themes that were identified in total. Table 1.4 provides an overview of the final themes that were identified and their prevalence within the study.

Table 1.4 Overview of themes identified in the empirical study

No,	Theme Name	Prevalence
1	People involvement in safety	58
2	Formalised systems & structured approach to safety	43
3	Implementation Success	36
4	Leadership requirement	35
5	System complexity	30
6	Appropriate Risk Focus/ Levels of Risk Implementation	28

No.	Theme Name	Prevalence
7	Complimentary systems	27
8	Rigorous assessment	22
9	Constant Improvement	21
10	Learning culture and organisation	16
11	Trained and competent people	16
12	Management Accountability & oversight	16
13	Communication is key	16
14	Safety as an integrated discipline	16
15	Safety as a journey	8
16	Change ever present	8
17	Compliance mindset	5

7.2 Overview of identified themes from the empirical study

This section is intended to provide the reader with a comprehensive overview of each of the identified themes. The reporting of these themes is done through highlighting the key points as articulated by the respondents, with a set of direct quotations from the respondents in terms of what they have observed and experienced. The themes will also follow in the order of prevalence as arising from the entire data set. Each one of the themes highlighted below will include a section on positive and negative aspects summarised from the narrative in relation to an aspect that was eventually included in that theme. The quotes from some of the participants also provides a more tangible sense to the reader in terms of pertinent thoughts raised by the respondents. The researcher will provide the relationship of the themes to the research questions in the following section.

Theme 1 – People involvement in safety.

Positives: The General Managers and safety specialist were involved in the implementation from the outset and there was tremendous effort in exposing all employees to the system early in the implementation. A number of respondents articulated the priority of making contractors part of the organisational “family”. It was emphasized that the system should make sense to the people on the ground. Some comments were made that the system closes gaps that are people dependant which might give an indication that the system was somehow succeeding in “out engineering the human factor” or alternatively addressing behavioural aspects adequately.

The engagement of people in obtaining buy-in and understanding the system, rather than prescriptive implementation was preferred. This is where VFL was seen as a key tool for enabling the engagement of all across the organisation. It was also pleasing to note that people were having extended conversations on getting people's input into different design elements of the system like procedures and the reviewing of standards.

Negatives: It was noted that the cascading of the system took quite a while to penetrate all operational areas and relevant disciplines of the organisation. Some were of the view that the system is still lacking in terms of the people element, in that aspects such as requisite behaviours could have been emphasised more. There was a strong comment made that miners and engineers did not understand the soft issues. Complacency in terms of the application of the required rigor towards the system seemed to be an issue when things went well within the business and safety front.

Some of the key quotes made by respondents related to this theme included:

"*If you go and look at the little details in the ASW you will find something people related within most of those elements*".

"*The ASW had a positive impact, not only to look at the stats, but also the acceptance from the people. I believe anything can be introduced just depending on the way you introduce it*".

"*By law it clearly states that the contractors are also employees. Generally, the mind set has changed for us because we make contractors more part of the business the engagement and the Communications. If I look at years ago, I don't think contractors were so much involved in safety participation. If you look at communication sessions and safety performance, the indicators that were there previously weren't so detailed as now. I think that they are participating a lot more in the organisation now and feel more accountable and part of the business*".

"*I think Stakeholder Engagement is something that in later years people realised was quite important*".

"*Key to that for us is engaging with the people on the floor. People on the floor want to see their GM and managers*".

Theme 2 - Formalised systems & structured approach to safety

Positives: Safety, health, environmental and social functions and tasks were executed on and ad-hoc basis during earlier years in the organisation but were largely better integrated through a more formalised system at the advent of the ASW. Respondents felt that a simple and easily understandable systematic approach worked well. It was articulated numerous times that the Safety Way served as a foundation and a structured approach to the organisation’s safety management which prompted management involvement and activity on a daily basis. Any further initiatives and actions were aligned to the ASW. The implementation of the ASW provided an opportunity for making systemic improvements.

Negatives: The early implementation issues were really a symptom of the general lack of structure across other operational areas within the business. The system took time to implement and create real sustainability within the system.

Some of the key quotes made by respondents related to this theme included:

"If one looks at why the mine health and safety act was amended one could say that the key was that mining had a significant amount of fatalities and incidents and I think a general shortage of structure and even safety performance".

"The one part is that we had numerous and various degrees of compliance and safety performance amongst the coal operations, those operations that had a structured and formal system in place seemed to be doing much better with regards to their safety lagging indicators as well as the leading indicators that they were putting in place but clearly there was a defined value added for having a structured SHE system in place at the operations".

"There was a strong awareness and huge frustration that we didn't have quick answers. In retrospect there were no quick answers and so this system was an important element in the more formal processes which were aimed at a more common structured approach to how we managed safety".

"The SHE management system's elements needed clarity as well. When we first look at the SHE management system it was not prescriptive to the detail you need in place but gave you the outcome that needed to be delivered".

"You cannot manage safety effectively without that systematic approach to it, and then keep it simple".

Theme 3 - Implementation Success

Positives: Continuous review was seen as an imperative. A recognition that there is always on-going development in the safety discipline, so you can never be fully implemented. The importance of the system as a “whole system”. Resources, both financial and in terms of personnel was dedicated to run with the implementation.

Negatives: Mixed success in implementing some of the elements. Document control and the update of supporting documents remains problematic. Questionable whether the entire system was fully implemented as originally envisaged. Consistency in implementation was an issue.

Some of the key quotes made by respondents related to this theme included:

"Anglo coal spent 900 million rand to get onto the Fatal risk standards which is part of operational control".

"We found that operational control was the single common weakness that we had throughout the business and I would suspect it is still the case today".

"So, on all the 12 elements there are defined auditing protocols that are in place to see how you were doing on the implementation of the actual 12 standards. We had to implement all 12 elements and then we received an audit in the implementation of those 12 standards".

"One area that got a lot of focus and that provided very little genuine improvement was around objectives and targets".

"Your leadership buy-in right up front is important. If they don’t make use of the information, they don’t support the management oversight and management review committees, then your system is going to fall flat on its face".

Theme 4 – Leadership Requirement

Positives: The number of energetic youth and the age of the operations had a bearing on the success of the system. The implementation succeeded in galvanising leadership around a central issue. One pivotal issue in terms of driving success was the appointment of element leaders responsible for driving each element on the ASW. Complimentary programmes like the VFL process enhanced the impact of the leadership element and provided practical tools for engagement; the CEO and other executives were setting expectations on implementation but also played a key role as sponsors for the implementation.

Negatives: In the beginning there was strong leadership commitment but an absence of robust programmes and systems. Initially the leadership element did not have enough substance. Role modelling down the organisation is not happening as it should.

Some of the key quotes made by respondents related to this theme included:

"I must say that the improvement cannot be 100 percent ascribed to the Anglo safety way. The Safety Way did assist tremendously because it guides you in the right direction since element 1 starts with leadership, and leadership is tremendously important when we discuss safety improvement".

"This (VFL) creates a sense of how important he (the operator) is, that even the manager is willing to come down to his section".

But I would say that the VFL effort has probably been the best because it awakened management responsibility to be engaged".

"We would have 2 sites in the coal business. One would be performing really well and the other one wouldn't. They both had the same set of systems. The fundamental difference was always leadership and so for me it's the most indefensible and probably the most important of all".

"So, the Chief Executive has to endorse it".

Theme 5 – System Complexity

Positives: The elements of the ASW is simple and the approach provides a clear framework and direction. An acknowledgement that line management carried the primary responsibility for implementing the system. The articulation that engagement and training of people was key in making people conversant with the system.

Negatives: Buy-in from workforce is dependent on the user-friendliness of the system which means that significant effort is required in making the system tangible to the users. Operational control is maybe not clear enough to those who need to exercise it. There were contrasting views on the simplicity of the system where some were of the view that it was not simple enough to the person at the coalface. Language dynamics are real issues that needs to be dealt with. Documentation around the system is too complicated.

Some of the key quotes made by respondents related to this theme included:

"Any elements added will maybe just create a longer list. I think the 12 elements are uniquely structured and easy to use".

"I think we need to simplify what we do. If the operator at the face, in the stope or in the plant gets it, and can give a sensible version and a practical version of what we want to achieve, then you have reached your objective".

"If you look at our operational risk management you need to do A1,A2,A3 to just understand it. Where I think the Safety Way was a very logical straightforward thing to implement. So, I think keep it simple".

"We need to find ways in making it more practical for the guys on the ground".

"Some of the procedures are not very well understood by the operators because we are talking high-level in our procedures, and if you give it to an operator and he reads it he gets confused after the second page because we are not making things simple. We are out there to complicate things and I think that is a big gap currently".

Theme 6 - Appropriate Risk Focus and Levels of Implementation

Positives: Important aspect in that the structure and content have different applicability at various levels of the organisation. The need to make it practical at all levels. Controls and actions need to be appropriate and in relation to the unwanted event that you want to address. Accountability and responsibility differ based on your level in the organisation. People on the ground should be concerned with basic objectives like safe production and not burdened with onerous targets and demands. A move from lagging to leading indicators and more appropriate indicators

Negatives: Should not be left to the site because it creates inconsistencies in implementation.

Some of the key quotes made by respondents related to this theme included:

"What I'm trying to say here is that the objective of trying to get injuries down and also concentrate on fatalities is different. The differences in those two approaches is the acceptance that things that cause fatalities are not the same things that cause injuries".

"We need to simplify and break it down into tangible bite size chunks for guys to understand for us to meet the outcome of this particular element in the standard and as a manager this is what I need to direct focus on, and as a supervisor my actions need to be slightly different in the implementation to meet the outcomes of that element".

The continuous risk assessment and issue-based risk assessment will be relevant for the person on the floor. For medium levels will be the WRAC system and for management it will be baseline".

You had a bit of lagging indicators where the drive should have been to get leading indicators. You want to say what is my leading indicators telling me to stop the lagging indicators from happening and I think that has evolved over the years".

Eliminate the things and focus on the things that kill you or injure you severely. This is not saying that you should not focus on other things or what are the pro-active things that we could be doing or should be doing to prevent those things from happening. We need to move everyone's mindsets".

Theme 7 – Complimentary systems

Positives: The ASW is well aligned with other health & safety management systems like the OHSAS. In developing the ASW, the system was benchmarked with the best systems and standards globally. A number of complimentary standards and systems were developed in enhancing the elements of the ASW like the FRS, the training modules and global guidelines like the critical control guidelines released by the ICMM. Efforts around change management was enhanced to deal with operational emergent changes as opposed to the focus planned change which was the primary focus of the ASW element 2. Provision of additional tools followed the initial implementation of the ASW to complement some of the elements in example VFL to enhance element 1.

Negatives: Dual standards were implemented at various stages in compliance to both external certification and organisational standards.

Some of the key quotes made by respondents related to this theme included:

"We did an integration and implementation of the SHE management system and we also went for OHSAS 18001 certification based on the Anglo American SHE management system because the 12 elements of the AA safety management system were clearly well defined to meet the requirements of OHSAS 18001".

“Although our system did not prevent the incidents, the severity of the injuries sustained were very much less because of the Fatal Risk Standards, so they were the other things that in terms of the performance was major".

"He (the architect of the ASW) looked at the best systems he could find globally".

"At the time we certified the OHSAS 18001 it had a requirement for about 18 elements. What it tried to do was to abbreviate some of those that had very close touch points and put them together and ended up with the 12 standards. In my mind that worked a lot easier than OHSAS 18001 did and we also did exercises with external service providers as we mapped the 18001 standard to the ASW. We didn't find any shortcoming and we could very easily plug everything in the ASW into 18001 and vice versa".

"So many of the supporting work that I have mentioned, the A courses, LFI, VFL and those things were not there before the ASW it actually came about after the ASW, which by and large those things were enablers".

Theme 8 – Rigorous Assessment

Positives: There was an entire regime of audits and peer reviews central to the assurance of the system. These internal audits were particularly helpful to ensuring the effectiveness and sustainability of the system. Auditing against a maturity index was quite helpful. Peer auditing facilitated the sharing of best practice and created a sense of ownership and unity on the system. Auditing played a role in performance

management as people at various levels could see the hard numbers related to their performance on the elements of the ASW.

Negatives: One of the pitfalls of the auditing process at the beginning was that it created a compliance mindset. Auditing should be done for the right reasons.

Some of the key quotes made by respondents related to this theme included:

"We had the mines complete an annual gap analysis of self-assessment where they scored themselves in terms of compliance. We had peer reviews between different operations and different business units. Iron ore would for instance come and audit us and we would then cross audit one another on the gap analysis to make sure we are still compliant to the twelve standards".

"We also have our own internal audits on the standards. I think what is making a difference in terms of sustaining the system is that we make use of a lot of the info on standard itself into the current Enablon system (data capturing system) for inspections".

"There was a maturity index that was associated with the system but there was also a system of peer review that focused on certain or all of the elements of the ASW".

"A site would be peer reviewed by a group of people (senior managers) who were peers of the people they were assessing. It had a twofold effect. One it taught people an awful lot of best practice elsewhere and two of course, people who were originally quite suspicious of the motives of this thing actually began to welcome it".

"Initially the ASW was given out with standards and a set of requirements. This was what was expected but it did not really give guidance as to how you would do it and this is why following a number of peer reviews that was based on the ASW, there was a lot of done worldwide across all AA sites".

Theme 9 – Constant Improvement

Positives: Anglo American has seen a steady improvement on health and safety over the last decade including a decrease in the severity and number of incidents as reflected through the improved Total Recordable Case Frequency Rate (TRCFR) as illustrated in Table 1.2. The system creates a rhythm around safety and drives continuous improvement. Improvements were made not only in the system but also in terms of key areas such as job tasks and training.

Negatives: There is always room for improvement in any one of the elements as the system will never be 100% effective and people will not necessarily always be 100% compliant.

Some of the key quotes made by respondents related to this theme included:

" One is the lagging indicators where we have seen a decrease in the lagging indicators, so we have seen an improvement overall, and I would contribute that to risk management which is one of the standards".

"We probably had a 30% reduction after 3 years on our safety lagging indicators".

"We have seen a downward trend in the last 10 years and was purely just and effort and this contributed no doubt. I think it made safety a bit more structured".

"Greenside was running average of between 27 and 29 in a year and I had to redo the entire system and implement the system in 2011 and 2012. We have seen a major reduction in injuries and lot of commitment from the guys with regards the system and now we are averaging between 4 and 5 accidents a year".

"Safety improvement plans were based on the elements of the ASW, so your improvement initiatives that you would strive for the next year would typically box those within the elements that is contained within the ASW".

Theme 10 – Learning Culture and Organisation

Positives: The system is important to facilitate cross learnings. Learning from incidents Is an actual element in the framework which emphasises a requirement to learn from unwanted events. Anglo developed the ASW by taking the best aspects from other systems in global organisations and multi-national companies. The categories of incidents that are focused on to generate the learnings are very pro-active i.e. reporting and investigation of High Potential Incidents (HPIs) and High Potential Hazards (HPHs).

Negatives: There were no negative or contradicting issues raised in relation to this theme.

Some of the key quotes made by respondents related to this theme included:

"And when it all lands on the same framework then the cross learnings are that much better. I'm not sure that we did it that well in beginning but it allowed it at a later stage".

"Stakeholder engagement would also include doing the best you can to pull out of systems like the ICMM, oil and gas industry, other mining companies and elsewhere".

"At New Vaal we are very fortunate with a positive culture that was created in incident reporting. Here even the smallest incident gets reported. It is not in fear that reporting gets done it's just the Culture that we report so that we can investigate".

"We had a campaign called “Do it right” basically trying to get the message across that what we do, we do it right the first time. We had an outside guy who did a show. We took our previous accident at the mine – we wanted to show our people what went wrong and what could have been done to prevent those accidents. It had a good impact on our people; significant improvement was visible in terms of behaviour. At one stage we had a lot of reports that people weren’t doing the right things in the working place".

"Learn as quickly as you can from those who are clearly ahead of you on the maturity curve".

Theme 11 – Trained and Competent People

Positives: The development of the Risk Management training was key in ensuring that personnel utilise the system correctly in the field and through this training the organisation was able to develop competence at various levels of the organisation. A recognition that training should be on-going as new systems and complimentary programmes are brought online.

Negatives: Lack of holistic training has been a contributor to the ineffective execution of some elements of the ASW. People should be trained on a risk-based approach in order to identify safety hazards and conditions which from some of the evidence seemed to be lacking in certain cases. A dependency at times for support from the corporate centre as some skill deficiencies exist in the operations.

Some of the key quotes made by respondents related to this theme included:

"Training I think is key to especially on risk management like you're different A- levels, A1 and A2 and A3 and then just to make sure that you are trained for it to be used accurately in the field".

"We had a very formal process again of training people and then we had a whole lot of guidelines around assessing the maturity of the implementation of each of these elements".

"The one Anglo safety way area that is most critical is the training on the Anglo safety way".

"Where I did not see too much difference in approach when I physically visited them initially, I certainly saw subsequently improved competency of people in their commitment to safety. What I realised was that their hazard

awareness and the management of risk associated with those hazards was very different".

“In Anglo American we have always struggled to get consistent training and capacity building rolled out”.

Theme 12 – Management Accountability and Oversight

Positives: Management carries a collective role and responsibility for safety which is consistent with the values and the cross-functional involvement in safety that had continuously been echoed by the organisation. Operational control is one key element within the safety way that highlights management's role and accountability for the system and safety in general at the operations. There is a clear understanding that safety should primary be driven and the responsibility of line management.

Negatives: Consequence Management coupled to management accountability is still an area that requires massive improvement. People must be appointed and held responsible for certain elements to avoid confusion on who is responsible for what. Accountability drives the actual engagement of people on safety in many cases.

Some of the key quotes made by respondents related to this theme included:

" The management team would take collective accountability for safety".

"I think that was one of the key things in the SHE management system that you got to have is structured and periodical review and the management oversight that needs to be done to ensure the proper implementation and sustainability of your SHE management systems".

"I always tried to drive the system really hard because I believed if people can identify hazards and do a risk assessment and understand what the operational controls are and the supervisory levels are actually exercising

operational control in terms of their inspections and task observations you will drive incidents down".

"But that was driven by the safety way's requirement in the combination of legal and operational control that people should know what their responsibilities were and that had a big change in getting people engaged in safety".

"If we look at the structure of the 12 elements it becomes part our monthly performance criteria where we will set the objectives for the year. Each official will be accountable to give feedback on the 12 elements and their performance".

Theme 13 – Communication is key

Positives: People want to feel part of the organisation and any developments. It's not only about passing-on information but also about getting input into the design and review of standards, systems and processes. You can only get everyone onboard through effective communication.

Negatives: Sometimes the intent and strategic fit would not be articulated correctly, and people would treat the Anglo Safety Way as an initiative as opposed to an integrated system.

Some of the key quotes made by respondents related to this theme included:

"The person on the floor, the operator and artisan want to feel that they have been consulted with. I think key is that they want communication especially when there is any changes in the organisation or if there are any things coming up. Communication is key especially with the safety performance".

"Communication plays a vital role for the person on the floor".

"When we rolled out the safety way we could relate back to some of the things we were in the process of doing or some of the things we have just done or planning to do so as we rolled out the ASW anything that we were going to do in the future was closely aligned to the ASW and its standards. (communication)".

"For instance, in the communication system where I created a weekly report and explained what was happening out there with our mines, what was happening at Greenside, what the stats was like. We send out a weekly report where everyone was informed what was happening inside the rest of Anglo so that "upped" the communication, and for each and every element there was something small that we learnt out there that we communicated".

"With safety you need to be committed it's no use everybody is sitting on the surface on the computers you need to be there you need to be underground and to be involved. Go to the plant and go and talk to other people. Go and talk and do VFL you will be surprised how many people doesn't have a clue what a safety system is they know all the principles behind how to be safe. Just talk to people they will give you more advice than what any system can give you. You can't sit in the office and think your system will sort everything out".

Theme 14 – Safety as an integrated discipline.

Positives: Safety is discussed at all meetings. Anglo American has been more systemic in terms of how it runs all the respective business processes and a formal integrated approach is therefore indispensable. Safety is just something that is part of all the work you do. At a strategic, monitoring and operational level you would find that various disciplines have responsibility for elements of the safety way.

Negatives: No negative comments were raised in relation to this theme. It would therefore appear that integration is fairly well executed within the organisation.

Some of the key quotes made by respondents related to this theme included:

"Safety is not something that we can split in two different compartments. It is integrated into every individual in the organisation".

"We for instance include safety as a standard item on our agenda even in our Union meetings. No matter what we talk about the agenda item starts with the safety way".

"Safety cannot be a value, but it should be integrated in everything you do"

"Whatever is in the safety way is actually part of all the work you do and if I look at the points what I see is Policy, leadership and commitment. Risk and change management is highly integrated, and you need to do it. So, it's not just safety only".

“In my opinion I think the mistake initially and later improvement was we had a safety management system, a health management system and an environment management system so the safety professionals took the safety management system and implemented it and only in some of the operational context as a consequence we would address the health and environmental issues. That might have been at the time the right thing but if it was a SHE management system integrating all the components of SHE we might have had a better system implemented in place, we would not have had a silo effect, we would have created a better link on the operations as our activities that you are performing does not only have a safety impact but also a health and environmental impact which is now more formally identified and focused upon".

Theme 15 – Safety as a journey

Positives: The articulation that one system is not the panacea of safety management but that it creates the basis and the framework to work from. Safety is often articulated as a journey since there is a continuous drive for further improvement of the system as new knowledge and technology surface.

Negatives: Some benefits are only realised long after the system has been implemented.

Some of the key quotes made by respondents related to this theme included:

"When the safety system was introduced it was really the first part of the journey".

"I suppose you travel a safety journey we all eventually travel the same journey. We only use different vehicle, but the benefit of having a logical ordered approach is without any doubt".

"They weren't genuine leadership components and they weren't genuine risk and they weren't taken into genuine action. All the really good risk-management stuff was only developed after this but in the journey, it's not about things that we have done but this probably prompted it to be done".

"You have to have a system of maturity assessment and set some targets for measuring that maturity".

"There is a lot of people that have been on this journey and it is a journey, and understand where you are on the journey and pick up as much as you can from those ahead of you".

Theme 16 - Change ever present

Positives: Change management is embedded into a number of procedures and processes. A number of initiatives have been taken to deal with

emergent change and making people conversant with appropriate actions around managing the change effectively.

Negatives: The operational changes in the environment is still quite difficult to manage as the change management element within the ASW like in many other companies is skewed towards the planned change realm.

Some of the key quotes made by respondents related to this theme included:

“You need to take out the insecurities people might feel that this is a threat because it is something new. Manage the change that it brings and then the gap analysis if you know what you need then it is easy to implement every one of the standards".

"The first one is change management a lot of work. It is excellent, and you need it".

"The problem with change management is you tend to look at, driving a different machine now. It's not about the different machine it's about first of all how are you going to implement it, what is your method statement? How are you going to tell people to use your system how are you going to tell people if you're putting a new system into place? That is also change management”.

"We have a checklist that tells you and indicates what exactly it is that you need to do. This is a change management procedure that tells you exactly what to do and what to look at and how to do it. This is the most common one, people use it and that also goes into your audits and checks as well. You take the piece of paper that you get, and you look at all the headings and see if you comply. That is the biggest help on the change management".

"There are always changes in operations and we need to be able to identify those changes to ensure no one gets injured".

Theme 17 – Compliance Mindset

Positives: Deeper understanding of the reason and rationale behind systems and the objective of the system might address the compliance mindset in many cases.

Negatives: The mining industry is often a heavily legislated environment which by the sheer nature of it drives a compliance mindset.

Some of the key quotes made by respondents related to this theme included:

"In terms of audits we comply if you go to any others you will see that we comply because we do what we have to do, but do you really learn from those findings? Do you really learn? I think it's a no".

"A lot of documentation generated compliance and tick box without real action and change and improvement behind it".

“The fourth one which we cannot shy away from was legal and other because in our industry we must make sure that as a minimum we meet the requirements of what regulation is throwing at us in the operations".

"New people get into the system and they need to understand the staff and the system but if we miss that section of sustaining the system, we've got a culture where people sort of feel obliged to comply".

"Avoid the compliance mindset".

8. Conclusions

8.1 Literature review (Research Questions 1 and 2)

Research Question 1: What are the typical elements that have been included in the leading OHSMS?

In terms of research question 1 the researcher conducted a thorough analysis in firstly understanding and unpacking the definition of a SMS.

Here the researcher observed the fact that the terms OHSMS and SMS were used interchangeably in industry and in most cases, these were merely referring to the occupational safety discipline. The literature further highlighted the content of various SMS including the NOSA SHE management system, the health and safety management systems framework as used in the U.S, the requirements of OHSAS 18001 and finally the 12 elements of the ASW. There were no significant differences observed ito the elements or content that was covered in these systems. In most cases the elements only appeared in a different order but largely covered the same areas of safety management either as main elements or sub-elements within the system. All the elements found in the respective systems were well aligned with the model as developed by Redinger and Levine (1998:578) in which they highlighted the typical elements to be included in a SMS.

Typical Elements found in the systems reviewed were:

i. Management commitment and resources.
ii. Employee participation.
iii. Occupational health and safety policy.
iv. Goals and objectives.
v. Performance measures.
vi. System planning and development.
vii. OHSMS manual and procedures.
viii. Training system.
ix. Hazard control system.
x. Preventive and corrective action system.
xi. Procurement and contracting.
xii. Communication system.
xiii. Evaluation system.
xiv. Continual improvement.
xv. Integration.
xvi. Management review.

OHSMS provide direction and certainty in respect of the OHS and risk elements that the company focuses on and the approach taken to materialise certain objectives. This was further emphasised by Wold and Laumann (2015:23) after extensive literature review on SMS and OHSMS stating that "*A Safety Management System is hence a formalized way of dealing with these practices, roles, policies and procedures, and is defined in various ways in the safety literature*".

Research Question 2: Which of these elements could typically have the greatest influence in determining the effectiveness of OHSMS?

In answering Question 2 for purposes of the literature review the researcher found that in the context of OHSMS it was also essential to recognise that the successful implementation and execution will be dependent on the balance and interaction of the system with the human factors within the workplace. Here Wold and Laumann (2015:29) highlighted their research finding that workers in the oil and gas industry resorted to their own interpretation and execution of safety practices and requirements of the SMS largely due to a distortion in the communications between levels of the organisation. Makin and Winder (2008:939) developed a conceptual framework for improving the application of SMS. In their model they highlight the interactions between the workplace, systems and people as depicted in figure 1.11.

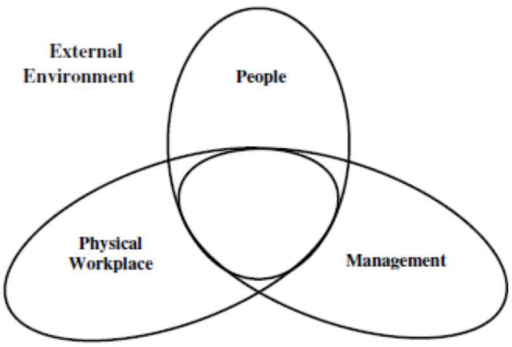


FIGURE 1.11. – Areas from where hazard might arise. (Source: Makin and Winder 2008:936)

The important aspect from this context is to identify the critical elements of the OHSMS that will be the most effective in managing and controlling these interactions. Some of the most important elements arising from the literature which is common is most safety management systems include:

i. Policy, leadership and commitment.
ii. Risk and change management.
iii. Objectives, targets and performance management.
iv. Training, awareness and competence.
v. Communication, consultation and participation.
vi. Operational control.

The abovementioned focus areas prove to be critical when effectiveness (sustainable and impactful implementation) of an OHSMS is determined by level of engagement people have with the technical workplace and management domains.

Conclusions were that the ASW is well aligned to other prominent OHSMS in terms of the elements it addresses. It is however more succinct in the design and approach and puts less of an administrative burden on the administrators of the system as a result of the fact that it is confined to 12 elements. Anglo American has however initiated other supplementary standards over a 10-year safety journey to enhance and facilitate the impact of the system. These actions were also the focus of the empirical study in understanding the additional impact that such programmes might have had.

8.2 Empirical Case Study (Research Questions 3, 4 and 5)

The questions that the researcher sought to address during the empirical investigation were as follow and will be discussed sequentially.

Research Question 3: What are the typical elements according to mine employees that form part of their OHSMS and which of these elements were implemented by the mine?

The following interview questions were asked in this regard:

Interview question 4: What elements of the ASW have been implemented/ introduced in the mine?

All 15 participants could provide an adequate description of the elements of the ASW that were implemented and confirmed that all 12 elements of the ASW were indeed implemented in the respective mines and in the company overall. The responses also suggested that participants were familiar with the progress of the implementation and were truly part of the implementation of various elements.

Interview question 5: Are there any elements of OHSMS that you think were omitted in the ASW?

All the participants in the study were conversant with both their own system and with other systems, in particular the OHSAS 18001 standards system which was previously implemented by most mines prior to the advent of the ASW. None of the participants were of the view that any elements were required to be added to the system. A number however articulated the fact that the people and behavioural element was majorly underplayed and diluted in the system despite the fact that elements like leadership, engagement and training were prominent and standalone elements within the system. It should also be noted here that theme 5 entitled system complexity was central to the responses on this question as well, as most participants felt very strongly that the system should be kept simple hence also the resistance to suggest any additions to the system elements. It should be noted that none of the participants made reference to the incumbent ISO 45001 standard for health and safety. The reason for this might have been due to the infancy of the formalisation and implementation of the system globally at the time when the research was conducted.

Research Question 4: Which of the implemented elements of their OHSMS had the greatest impact in changing the safety performance of the mine?

The outcome of the results was as follows:

Table 1.2 – Frequency and Rank of the importance of the elements and their impact on improving safety performance

No	Element	Frequency
1	Risk and Change Management	15
2	Operational Control	9
3	Policy, leadership and commitment	8
4	Incident reporting and investigation	6
5	Legal and other	3
6	Training, awareness and competence	3
7	Communication, consultation and participation	3
8	Monitoring, audits and reviews	2
9	Documentation and control of documents	2
10	Emergency preparedness	1
11	Contractor and business partner management	1
12	Objective, targets and performance management	0

The thematic analysis and more specifically the views articulated throughout the responses ranked the top three elements as risk management, leadership and operational control which employees felt had a real impact in improving safety performance. This was also consistent with themes like leadership requirement, appropriate risk focus, and management accountability as derived from the thematic analysis. Risk and change management was notably mentioned by all of the participants as key elements that continually acted as drivers for safety improvement as people were focusing on the risks in an operational context with more rigour, whilst at the same time anticipating and acting on a dynamic and changing environment through a more robust management of change process.

Research Question 5: What particular actions were taken with regards to the implementation of the various elements that facilitated successful implementation?

Interviewees responses indicated that requisite leadership, a formalised, focused and consistent approach to risk management, people focus throughout implementation and complimentary systems were elements that greatly contributed to a more holistic and successful implementation of the SMS. These views on the success in the ASW implementation were also aligned to the findings of Chen et al (2009) in that leadership (top management commitment) was key in successful implementation of a system whilst the people focus, and collaboration as cited by interviewees overcame on of the most significant failures as cited by Chen. Some of the more prominent quotes highlighting these enabling and facilitating actions to effectively implementing a SMS were:

"Key to that for us is engaging with the people on the floor. People on the floor want to see their GM and managers" – in reference to VFL as a coupled enabler to element 1.

"So, the Chief Executive has got to endorse it" – In reference to the key enabling factor that the Chief Executive Officers of Anglo American took a very hard stance and keen interest in the system during the design and implementation of the system.

"I think we need to simplify what we do. If the operator at the face, in the stope or in the plant gets it, and can give a sensible version and a practical version of what we want to achieve, then you have reached your objective" Articulates quite strongly to constant drive to make the system and contents tangible for the employees on the ground which links strongly with theme 5 and elements 5 and 6 which is training and communication respectively.

"Stakeholder engagement would also include doing the best you can to pull out of systems like the ICMM, oil and gas industry, other mining companies and elsewhere" – The participant articulated probably the principle central to the research in that companies do not have to start from scratch but leverage the learnings from others in designing an optimal system and implementing it effectively.

In conclusion the researcher is confident that the specific research aims were achieved in identifying factors in the ASW that would have the greatest influence on the effectiveness of OHSMS. Two additional learnings were generated from the overview of the identified themes. The first important point was that the sample population was overall very aligned with all of the objectives, implementation learning and outcomes of the ASW irrespective from which level or discipline they originated. This speaks volumes in terms of the penetration and alignment of the ASW and the overall values of the organisation on safety. The second point was that it was evident from the responses that the company and managers within the company have not reached a point of complacency and comfort that the system has been implemented 100%. People did acknowledge shortcomings where observed by them, but these were ultimately overshadowed by the massive improvements in safety and the overall value generated by implementing a holistic SMS. Companies that are in the development stages of such systems will find massive benefit and value in incorporating the findings from the report into their design and implementation plan of their system. Anglo American has generated a massive amount of learnings in terms of the things that companies should be doing to facilitate implementation of safety systems but also a recipe in avoiding some of the major pitfalls in implementation. Incorporating this body of knowledge could have a major bearing in terms of cost saving through implementation and simultaneously create confidence across the workforce that the company is able to learn from those that have come before them on the road to Zero Harm.

9. Limitations and recommendations

The researcher considered possible limitations to the qualitative study. The main limitation was that the study participants targeted to partake in the study, were mainly managers and other senior officials that were responsible for the implementation and review of the system. It could be argued that the voice of the lower levels of the workforce was missing in the study despite the fact that the study was specifically designed in that way. The danger always exists that an element of “groupthink” might cloud the responses in the case where the sample is drawn from a homogenous group of employees. A larger follow-on study which includes lower level employees (operators, miners, labourers and the like) would certainly enhance the knowledge on whether these employees find value from the OHSMS at their level of implementation in an operational context.

Some recommendations that the researcher would promote for future studies in this field would be to:

i. Include more companies in possibly a multiple case study design which would also allow for comparative analysis on other factors like organisational culture that might play a role in the success of the implementation of OHSMS.
ii. The findings from this research could easily be incorporated in OHSMS design and implementation plans of other companies to facilitate effective implementation.

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APPENDIX A

Research Office

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

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: H17/07/17**
PROJECT TITLE	Identifying factors contained in the Anglo American Safety way that would have the greatest influence on the effectiveness of Occupational Health and Safety Management Systems
INVESTIGATOR(S)	Mr L McMaster
SCHOOL/DEPARTMENT	School of Mining and Engineering/
DATE CONSIDERED	21 July 2017
DECISION OF THE COMMITTEE	Approved
EXPIRY DATE	22 August 2020

DATE 23 August 2017 **CHAIRPERSON** J. Knight

(Professor J Knight)

cc: Supervisor : Professor M Hermanus

APPENDIX B

INFORMATION SHEET

INTERVIEWS WITH OCCUPATIONAL SAFETY PRACTITIONERS AND MANAGERS

A STUDY ON IDENTIFYING FACTORS CONTAINED IN THE ANGLO AMERICAN SAFETY WAY THAT WOULD HAVE THE GREATEST INFLUENCE ON THE EFFECTIVENESS OF OCCUPATIONAL HEALTH & SAFETY MANAGEMENT SYSTEMS.

Good Day.

I am Leigh McMaster, working at the Chamber of Mines of South Africa. I am a student conducting an M.Sc research study which involves looking into the implementation of Occupational Health and Safety Management systems (OHSMS) to determine what the success factors are with regards to this implementation. You are invited to participate in this research study .You have been identified as a possible participant for this study because you are part of the Safety/ management structure at a management level that is/ and has been responsible for the implementation of the organisational safety management system or responsible for maintaining the system.

1. **Purpose of the study**

The purpose of this study is to answer some pertinent questions around the effectiveness of the OHSMS and how it was implemented in the workplace. It is therefore important for the purpose of this study that employees (managers & specialists) who have been part of the implementation and management of the company's OHSMS provide some of their perspectives and experiences associated with successful elements of the system.

2. **How the study will be conducted**

If you volunteer to participate in this study I will interview you face-to-face at a time and place most convenient for you. The interview will take about 60-90 minutes. During this interviews I will ask you questions about your work as a safety practitioner with some level of responsibility for implementing and managing the OHSMS of the mine. The interviews will preferable be audio-taped in order to transcribe the information accurately.

3. **Payment for participation**

You will not receive any payment for participating in this study.

4. **Confidentiality and Anonymity**

The records of the interviews will be kept **confidential** by the researcher. All audio recordings of interviews will be destroyed at the end of the research period. You will remain **anonymous** in any report or publication generated by the study.

5. **Participation and withdrawal**

You can choose whether to be in this study or not. If you volunteer to be in this study you may withdraw at any time without consequences of any kind. You may refuse to answer any questions you don't want to answer and still remain in the study.

6. Principal investigator

The principal investigator/ interviewer for the study is Leigh McMaster. If you have any questions or concerns about the research, please feel free to contact him

Leigh McMaster: Office number is 011 498 7702 Cell number: 083 899 8992 email address is lmcmaster@chamberofmines.org.za

7. Study/ Research Supervisor

The supervisor for this research study is:
Prof. May Hermanus
Executive Director: NRE (CSIR)
Phone: 012-841-2938
Email: may.hermanus@csir.co.za

8. Rights of research participants

You may withdraw your consent to participate in the study at any time. There are no penalties for doing this. If you have any questions about your rights as a research participant then you may contact the coordinator below for further details on addressing the issue with the relevant ethics committee. **Participants are entitled to obtain a copy of the research findings by sending a request to the researcher or the research supervisor as well as public access via Wits online library system/platform.**

APPENDIX C

INFORMED CONSENT SAFETY PRACTITIONER/ MANAGER

IDENTIFYING FACTORS CONTAINED IN THE ANGLO AMERICAN SAFETY WAY THAT WOULD HAVE THE GREATEST INFLUENCE ON THE EFFECTIVENESS OF OCCUPATIONAL HEALTH & SAFETY MANAGEMENT SYSTEMS

I, _____, consent to participate in a research project conducted by Leigh McMaster, for the purpose of **Identifying factors contained in the Anglo American Safety Way that would have the greatest influence on the effectiveness of Occupational Health & Safety Management Systems**. I understand that:

- ☐ My participation in this research is voluntary, the purpose of the study has been explained and my questions in this regard has been answered
- ☐ I understand that I will not be paid for my participation.
- ☐ I understand if I feel uncomfortable in any way during the interview discussion session, I have the right to decline to answer any question or to end the interview discussion or to withdraw my consent to participate. Anonymity have been assured.
- ☐ Participation involves being interviewed by a researcher.
- ☐ The interview will last approximately 60-90 minutes and may be extended with my permission. Notes will be written during the interview.
- ☐ My identity will be kept confidential. My name will not appear in a research report.
- ☐ I understand that this research study has been reviewed and approved by the Human Research Ethics Committee (Non-Medical) of the University of the Witwatersrand.
- ☐ I understand the purpose of this research project which have been explained and provided to me.
- ☐ I understand I will participate in **one interview**
- ☐ I have been given a copy of this consent form.

Study Participant Name and Signature: _____

Researcher Name and Signature: _____

Date:

CONSENT TO AUDIO RECORDING & TRANSCRIPTION

Only the researcher will be able to listen to the recordings. The tapes will be translated and transcribed by the researcher. The recordings will be stored for two years after publication of the study or six years in the absence of publication. Your identity will be kept confidential. Your name will not appear in the research report.

By signing this form, I give my permission for the researcher to audio record the interview as part of this research. I also understand that this consent for recording is effective until the 31st January 2018.

Participant's Name:_____

Participant's Signature: _____**Date:**_____

Researcher's Name:_____

Researcher's Signature: _____**Date:**_____

APPENDIX D

03/06/2017

Questions for the semi-structured interview on the Anglo Safety Way.

Acronyms:
ASW- Anglo Safety Way
OHSMS – Occupational Health and Safety Management Systems
SMS – Safety Management Systems

Extracts from research proposal wrt research questions and hypothesis

1.1 Research problem

The mining industry in South Africa has seen a steady decline in fatalities over the last two decades. Many of the success in curbing fatalities and improving safety can be attributed to the implementation of engineering and other higher order controls as the understanding of safety and risk management has improved over the years. Strategies for improvement is often directed by OHSMS embedded within organisations which deals with a number of elements ranging from leadership and policy down to operational control.

1.2 Research question

1.2.1 Research questions with regards to the literature review

Research Question 1: What are the typical elements that have been included in the leading Occupational Health & Safety Management Systems?

Research Question 2: Which of these elements could typically have the greatest influence in determining the effectiveness of OHSMS?

1.2.2 Research questions with regards to the empirical study

Research Question 1: What are the typical elements according to mine employees that form part of their OHSMS and which of these systems were implemented by the mine?

CHAMBER OF MINES of South Africa

Research Question 2: Which of the implemented elements of their OHSMS had the greatest impact in changing the safety performance of the mine?

Research Question 3: What particular actions were taken with regards to the implementation of the various elements that facilitated successful implementation?

The interview questions for the semi-structured were compiled in order to answer the research questions developed for the empirical study. The following nine questions were subsequently decided on:

1) What is your role at the mine in respect to the implementation and review of the safety management system (OHSMS/ ASW)?
2) What was the safety performance like before implementing the ASW and after implementation? .
3) Based on your operational experience, would you say that a formal SMS assists a mine to implement OHS actions and programmes in a more systemic/ holistic way?
4) What elements of the ASW have been implemented/ introduced in the mine?
5) Are there any elements of OHSMS that you think were omitted in the ASW?
6) In your opinion, were there elements that you have implemented which had a more positive influence on safety performance at the mine than others? Why?
7) In implementing the system, what actions if any, were particular helpful in ensuring that the system was properly/ successfully implemented? Please make reference to specific execution and provide further explanation?
8) Are there any shortcomings/ areas which you feel have not been implemented as successfully as envisaged? Please explain.
9) What advice, from a safety specialist's or line manager carrying the responsibility for implementing and maintaining the system, would you give other mining companies when it comes to implementing a safety management system?