UNIVERSITY OF KWAZULU-NATAL

Application of systems thinking in organisational safety

By

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As the candidate's supervisor I agree to the submission of the dissertation for examination

The candidate has satisfied the requirements of English language competency.

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DECLARATION

I John Nkuna declare that this dissertation except where stated is my original work, has never been accepted for any degree and is currently not being submitted for any other degree.

The dissertation does not contain work copied and pated from the internet, unless specifically acknowledged and the source detailed in the Reference section.

I am currently employed by Anglo American Platinum as a Senior Project Manager from October 2007 to date. The organisation has embarked on a ZERO HARM journey which has motivated the research. Permission to use Anglo American information was granted by the Executive Head: Projects and Engineering.

Signed...

Date.....11 / 02 / 2013.....

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ABSTRACT

Organisations operate in environments that are characterised by constant change, they therefore should to be flexible enough to adapt to those changes for survival. It is argued that the greater the variability of the external environment the less structured the organisation should be, though these environmental changes in organisations can emerge in different modes, which can be; technological, economic and/or political (for example, the outcry of the country's youth for the nationalisation of mines and economic freedom) to mention but a few. The impetus for the research is to address organisational safety through identifying methodologies that are motivated by systems thinking.

Systems theory embraces both the ontological and epistemological views, in that the environment we live in is made up of systems (ontological view) and the very same systems interact at a given time and period with each other including the elements or subsystems that are in existence (epistemological view). The researcher adopted the soft systems methodology by acknowledging the complexity of the challenge but believes it affords an opportunity to learn and teach others about solving problems using systemic processes. Conventional management has often failed to address 'messy' challenges as it fails to take into consideration the existence of external and internal environments that influences the manner in which the elements interact in transforming input into desired output. When one takes into consideration mining and its related industries, the mining activities have become complex, costly, highly technical, and have been associated with high fatality rates due to the conditions and mining methods employed. Mining operations have for years been characterized by unsafe working environments leading to high levels of fatal injuries and management in general, whether at supervisor or other levels is faced with this enormous challenge influenced by a number of factors like; personal belief systems and behaviour, business value systems, business priorities, stakeholder and other expectations.

Subsequent to the enormous work that has been done to date, together with recommended strategies and also acknowledging that not all problems are systems problems, this

research endeavours to demonstrate that the application of system thinking to organisational safety can positively contribute towards addressing the challenge faced by the mining industry and other organisations. The use of soft system methodology brought about the ability to qualify the nature of interactions between the factors that exist in the environment within which these organisations operate for survival. There are three factors that influences safety in organisations, namely discipline, attitude and behaviour which makes the researcher to believe there is a long way towards reaching Zero Harm in work places and yet noticeable improvements has already been accomplished.

Key Words: organisational safety, fatal injuries, soft systems methodology, systems thinking

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List of Abbreviations

ARV – Anti-Retroviral

CEO – Chief Executive Officer

DMR – Department of Mineral and Resources

GDP – Gross Domestic Product

GST – General systems theory

LFI – Learning from incidents

LTI – Loss time injury

MHSA – Mine Health and Safety Act

SSM – Soft Systems Methodology

VCT – Voluntary Counselling and Testing

VFL – Visible Felt Leadership

Chapter 1: Outline of the study

1.1. **Introduction**

In an open system, the organization interacts with its environment (Thompson 1967, p.191). The same judgment is appropriate for mining and its related industries, mining activities have become complex, costly, highly technical, and have become associated with high fatality rates due to the conditions and mining methods employed. Thus, Peter Drucker's (2008) observation that 'change is unavoidable (...) organisations need to change their styles of management to match their businesses'. This has become a systems problem that can only be resolved through the application of systems thinking, referred to as the "general science of wholeness" by Von Bertalanffy (1968. P. 37).

Organisations operate in environments that are characterised by constant change. They should therefore be flexible enough to adapt to those changes for survival. They must be able to react to those changes employing strategic decisions that are most up-to-date. These environmental changes in the organisations can emerge in different modes, and can be; technological, economic and political (in recent times we have seen the outcry of the country's youth for the nationalisation of mines and for economic freedom) to mention but a few. We are faced with a really 'messy' situation (Ackoff, 1978).

Mining operations have for years been characterized by unsafe working environments leading to high levels of fatal injuries and management are faced with this enormous challenge influenced by a number of factors like; personal belief systems and behaviour, general ethical considerations, business value systems, business priorities, stakeholder expectations and others. The loss of lives also has an economic consequence such as medical, legal, administrative, property damage, lost earnings and lost benefits (Camm 2005, p. 91). Further to these costs there are expenses pertaining to insurances and worker's compensation together with indirect cost as a result of time delays due to

disruption of work processes due to the hiring and retraining required. As demonstrated on the statistics on Figure 1: **2011 Injury agency analysis**

Source: <http://www.angloplat.com>

 there are lead indicators in the form of agencies contributing to the fatal injuries and a number of initiatives such as drawing up a safety plan, using timber to hold up the hanging wall, have been instituted but most of them seem not to be making the positive contribution that they should be making to reducing the fatality rate.

Motivation for research

 According to Jay W. Forrester (1992) systems thinking means more than thinking, talking and acknowledging that systems are essential, but it implies a much broader and more outward awareness of systems. Subsequent to the recommended strategies, e.g. monthly safety performance and reporting, prioritizing safety in any work being carried out in the organisations and conducting risk assessments, management invited inputs from employees to address safety in the organisation. Bearing in mind that not all problems are systems problems, the situation captured my attention and prompted me to carry out research on the topic: *Application of systems thinking to organisational safety.*

1.2. **Background to the study**

Mining in South Africa started more than a century ago and since inception, the mining industry has been associated with a high number of fatalities, some totalling up to hundreds in one year or with catastrophic events like the unfortunate Coalbrook North Collieries disaster where more than 400 persons were killed in 1960 on what is assumed to be a combination of methane gas poisoning coupled with a fall of ground incident. The industry is challenged by high levels of unacceptable fatal injuries almost every year given that there are mining activities taking place.

Some of the mining giants including organisations like Anglo American Platinum have introduced a set of values with one of them being 'we put safety first'. Through this value the organisation has developed a vision called Zero Harm which entails, not accepting that people have to get injured at work and ensuring that everyone returns to their homes safely every day after each shift. In order for the organisation to achieve this, the following strategies have been developed:

- Management systems which include: the Anglo Safety Way standards, safe operating policies and procedures, planned task observations and safety campaigns;

- BAD, an acronym for **B**ehaviour, **A**ttitude and **D**iscipline. This is a safety campaign throughout the entire business targeting people's behaviour affecting safety. ;

- ELEI, which stands for **E**liminate **L**ow **E**nergy **I**njuries, like medical treatments kind of injuries. This consists of engineering out risks, which is about conducting risk assessments to identify all the risks and to eradicate them out of the system; and

- Wellness in the work place. This is to address illness and impediments that stop people from doing or being effective on their jobs.

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As an Anglo American Platinum employee, the researcher focused more on the company and the mining industry in general and on how the application of systems thinking can improve safety in these mining organisations.

Loni Prinsloo writing in the May 2011 edition of the *Mining Weekly Magazine* mentioned that the statistics released by the unions indicted that injuries decreased by 38% from 1126 in 2010 to 711 in 2011 but fatalities increased by 21% with 47 lives lost during that period. The challenge therefore remains. More lives than ever before are being lost in the mining industry with the Platinum Mines being the biggest contributor with 78% increase in fatalities.

Table 1 below shows the Anglo American safety statistics for all managed operations from 2010 up to and including year to date 2012 at the time of writing in the month of October.

Table 1: Anglo American safety statistics

Fatalities	YTD at 2012	Total 2011	Total 2010
Recordable	9	17	15
Frequency rates	**YTD at Jan 2012**	**YTD at Jan 2011**	**Total 2011**
FIFR	0.006	0.014	0.009
LTIFR	0.66	0.61	0.64

Source: http://www.angloplats.com

Anglo American recorded 15 fatalities in 2010, 17 in 2011 and has recorded 9 to date in the year in 2012 as detailed in Table 1. When taking into consideration the entire mining industry statistics, it is regrettable and unfortunate that within two months into the new year (February 2012) it had already recorded a disappointing 13 fatalities.

The numbers are a good tracking tool to determine the trends and to encourage the setting up of effective systems to curb the scourge and this echoes' well with a complex system that is sensitive to initial events.

It is also evident as indicated in the statistics, that there is still a great deal more work to be done before the mining industry gets it right. This is where the application of systems thinking could bring about the desired change to drive the Zero Harm vision. The statistics in Table 1 combined with the recognition of the vulnerability of employees towards dangerous mining environment, have prompted organisations like Anglo to institute a Safety/Zero Harm in action drive. It is believed that the 'Zero Harm vision is a

mechanism that might help to ensure that employees return home unharmed from their day's job.
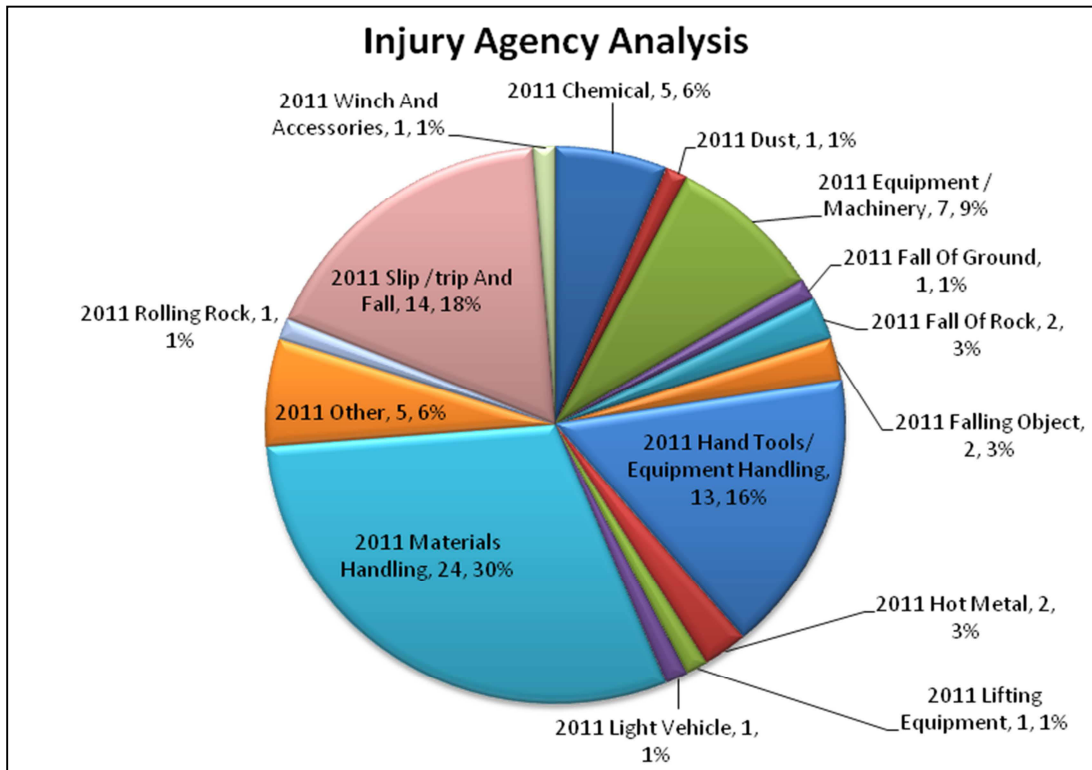
Figure 1: 2011 Injury agency analysis

Source: <http://www.angloplat.com>

The analysis depicted in Figure 1 above details the contributors to the total injuries experienced in 2011, the biggest being material handling followed by slip and fall then equipment handling. These injuries may not have resulted in fatalities but they are a good indicator of potentially serious injuries that may lead to fatalities.
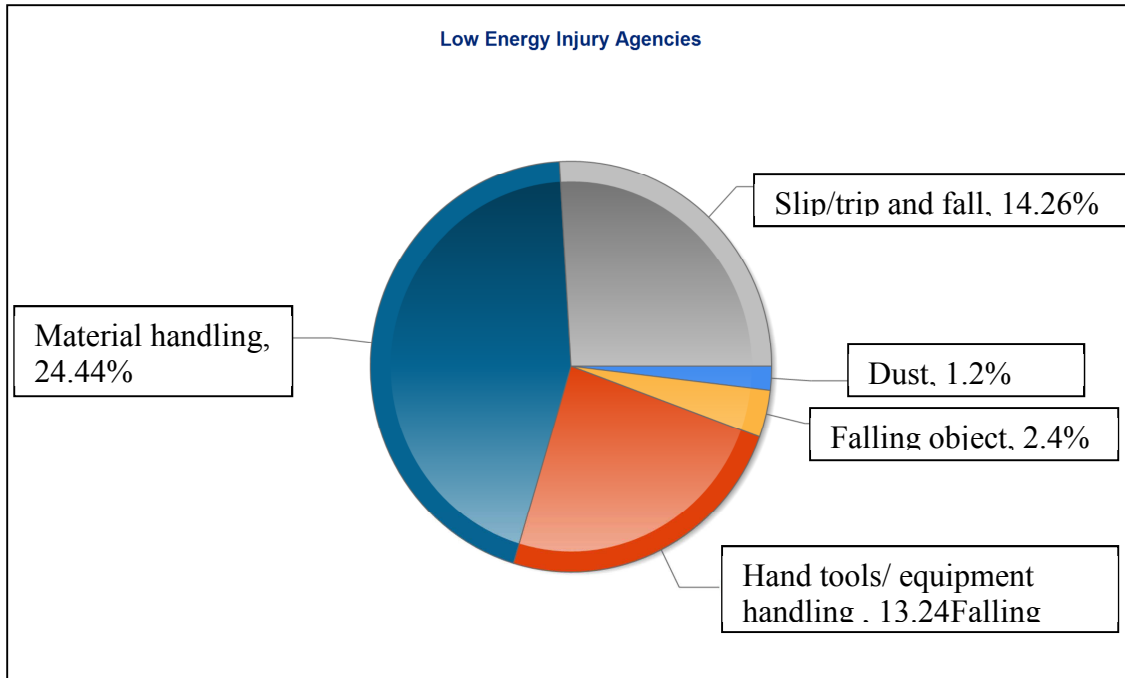
Figure 2: Low Energy Agencies

Source: <http://www.angloplat.com>

Figure 2, indicates the kind of factors at play at a given time and environment when work is carried out. These factors, if they are not understood and properly risk assessed, may result in injuries or fatalities. These are the factors that render the drive to Zero Harm complex as they are numerous and operate at the same time.

1.3. **Significance of the study**

 Having been exposed to systems thinking at the Leadership Centre, this suggested to the researcher different ways of solving problems or challenges including the complexity of the situation in the mining industry. The Anglo American Organisation is struggling to stop or to significantly reduce the high fatality rate. The researcher endeavoured to conduct a research project aimed at investigating whether or not the application of systems thinking can bring about the required improvements to organisational safety.

As South Africans it can be acknowledged that we have a painful past and currently still suffer from divisions and inequality. It may therefore make sense for organisations like Anglo, being the major role players in the mining industry, to consider investigating the application of systems thinking to address safety.

> *The more we study the major problems of our time, the more we come to realize that they cannot be understood in isolation. They are systemic problems, which means that they are interconnected and interdependent.*
>
> Capra (1996)

Systems thinking provides a different view in that it makes available methods that can be applied to resolve some of the complicated problems in a situation, whether personal or in a work environment. It is based on the type of relations between the parts in a given system compared to the parts individually.

Safety is a very broad matter and encompasses a number of elements including behaviour, discipline, background, leading by example etc. It is a life style and should be everybody's responsibility.

1.4. Problem Statement

The mining industry contributes a substantial amount to the country's GDP but safety has always been a challenge as most mining operations struggle with subjects like fall of ground and traming (interface between men and machinery) kind of accidents. All this has motivated the research.

These challenges have resulted in the government, through the minister of Mineral Resources, together with the labour movements or Unions and the Mine management speaking up and raising concerns about safety in the mining industry. Hence the 'Zero Harm' vision for companies like Anglo American Platinum.

During the recent Annual African Mining conference held in Cape Town South Africa in the month of February 2012, the minister in the Department of Minerals Resources was quoted as saying through an interview with Reuters,

> *"Fatalities which could have been avoided, we feel that CEO's must be held liable for those accidents, because they are responsible for the operations. As they show interest in how they grow the profits they must also show interest in safety."*

She went on to say she is concerned about the platinum industry's contribution to fatalities in the mining sector.

1.5. **Purpose**

It can be concluded that currently most of the methods and strategies employed to address safety require rethinking and possibly require the application of fresh ideas. The study has identified methodologies that are motivated by systems thinking in addressing organisational safety.

THE ROAD TO 'ZERO HARM' - CREATING A CARING CULTURE IN ANGLO

PEOPLE

P1. Personal Risk Attitude
P2. Caring & Recognition
P3. Management Leadership and Commitment
P4. Safety Accountability
P5. Employee Involvement and Consultation
P6. Coaching and Mentoring

RESILIENT
PROACTIVE
COMPLIANT
REACTIVE
BASIC
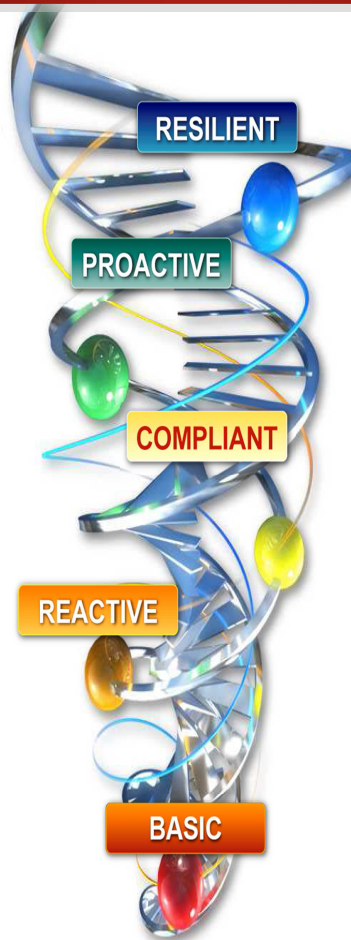
SYSTEMS

S1. Risk Management Adoption
S2. Strategic Planning
S3. Project & Process Design Management
S4. Major Hazard/Priority Risk Identification and Management
S5. Change Management
S6. Job and Task Planning
S7. Hazard Identification and Reporting
S8. Training and Competency
S9. Communications
S10. Knowledge Management
S11. Maintenance
S12. Procurement
S13. Contractor Management
S14. Incident Investigation and Analysis
S15. Emergency Response
S16. Safety Performance Measurement
S17. Auditing and Monitoring

Figure 3: The Journey model

Source: <http://www.angloplat.com>

There is a very close relationship between the Zero Harm vision and the systemic way in which to realize it. The organisation has therefore seen fit to develop a journey model or roadmap to Zero Harm through a people-driven approach and the application of systems that are established to achieve a resilient state where it is believed no person or employee will be harmed or killed whilst at work in the organisation (see

Figure 3). The journey model can also be referred to as an affinity diagram which will be best utilised by people with different experiences but working together towards a

common goal. This they will achieve by taking a large number of thoughts and grouping them together through natural relationships.

All efforts will be geared to getting the organisation to operate at the resilient level but the process involves addressing one level at a time as all these levels are interconnected. The accomplishment of the basic level will lead to the next level which is the reactive mode and addressing all matters at this level will therefore have the team geared up to tackle the compliant level leading to the ultimate goal of the resilient level.

It is intended that the research will assist the organisations to understand the underlying factors that contribute to the scourge of the high loss of lives on a yearly basis. It is hoped that this study will be considered when future plans or strategies are developed.

1.6. **Research Methodology**

The nature of the research undertaken is a mixed method approach; it includes a quantitative methodology in considering historical mining data using statistics; and a qualitative approach as consideration was given to the applicable Anglo American Platinum safety related policies and standards. This was achieved by engaging literature that addresses organisational safety and organisational learning as it is evident that a mine employs social beings to conduct mining activities which brings into play the social aspect of the study.

The soft systems methodology is the method that informed the research in that the researcher acknowledges the complexity of the challenge but believes that this can be an opportunity to learn and be an opportunity to teach others about solving problems using the available systemic processes like rich picture and other models. The researcher will also draw upon personal work experience and perception of the status quo and will also analyse research reports to suggest improvements where necessary.

1.7. **General systems theory**

Sharing of information amongst peers in the organisation is the best learning tool that can be employed as a form of training. Sharing should not be limited to the great or good news but failures as well. By doing this the organisation can eliminate repeating mistakes, as learning from colleagues who have failed can be turned into a positive learning exercise in the organisation. When an organisation develops policies, standards and strategies, it is of the outmost importance that the content be understood by everyone affected by these documents. It should not be assumed that understanding has been achieved just because everybody who has been employed can read. Most organisations do not even consult the very same people who are expected to operate according to the organisations policies, and standards but they nonetheless expect them to adhere to the content without ensuring buy-in or complete understanding of their involvement.

Identification of risks and development of the strategies to mitigate the risks is all well and good but the stumbling block is when those risks have materialised and the mitigating strategies are put into play to avert the risks. Managers often make the mistake of not communicating the lessons learnt from experience and in the process deny other colleagues the benefit of such learning. The same applies to investigations after a fatal or serious injury. Almost all the employees will be alerted to the incident but that will be the end of the matter. All too often no follow-up communication on the findings of the investigation will be communicated to all employees in order to enable sharing of lessons learnt.

The systems approach empowers people by presenting a much more realistic view of the problem and is long-term orientated in that, by focusing on the interdependence of the components, a problem that could result in much more complexity in future can be understood earlier.

There are systems within a system and all the systems each have a purpose. In any system there are parts that need to interact to achieve the ultimate goal of their existence in that system. These parts are influenced by the environments in which they operate. They are

sensitive to feedback, and any changes in the environment will result in a different formation or interaction of the parts which may lead to an outcome that is different from that which might have been expected. An effective system provides continuous feedback to the parts to make certain that focus on the ultimate goal is not lost. If it happens that there is misalignment of the parts, the system will readjust itself. Though the system will adjust itself to retain stability, the fact of the matter is, it needs to be acknowledged that the environment did change hence the emergence of the new state after retaining stability.

The mining industry has seen a sharp increase in stoppages from the Department of Mineral Resources (DMR) and strike action in recent years which directly and negatively impacted on production. When a person dies or gets injured the mood and behaviour does change as people get shocked and naturally the body cannot perform at the same level it was before the incident. It takes few days for people to get back to their normal state and start being productive again and maintain the expected level of productivity as a result of intense fear or helplessness after witnessing a terrifying event.

Systems thinking can also be classified as a special language that is used in communicating a sense of wholeness rather than a sense of parts. This relates to the work situation in mines where everybody has a role to play in achieving the ultimate goal of safely mining minerals underground and for fulfilling the market demand for minerals so that the organisation can be profitable. It facilitates a common understanding of the challenges to be faced and stimulates timely responses.

The systems thinking field has produced tools that can graphically depict a complex problem and can map out possible solutions through tools like causal loop, systems archetypes and rich pictures to mention a few, all these tools are designed to resolve problems systematically.

Figure 3 can be used as a good example of a causal loop where steps are determined according to how to move from one level to another and history can be used to determine future outlook. Systems can vary from a simple to a complex system and as interaction

happens between a complex system and its environment, a resilient operation or organisation can be rendered an open system.

In the past management in organisations were never exposed or trained in this systems way of looking at things. Training institutions have now begun to introduce systems thinking in management training which has resulted in a paradigm shift from the manner in which organisations used to be managed. Systems theory ensures that managements view organisations with a more holistic vision. Lack of such a vision can be seen in organisations where there are no planned feedbacks sessions for implemented initiatives and no monitoring to see if expected results are obtained as planned or not. If not, have modifications to plans been effected and applied with enough time allowed to yield positive outcomes? For example, in mining organisations, comparisons can be made between fatal injuries experienced in the past years and those taking place recently in order to measure the effect of the interventions.

If the marketing department is doing well and business is booming whilst the safety department is poor, the whole organisation gets affected, which then negatively impacts upon the stakeholders and everyone who has a vested interest in the organisation. Management then have the task of observing the different patterns that are interacting e.g. behaviour that leads to specific unwanted events. The focus therefore will be upon devising strategies to address these patterns of behaviour rather than upon the events themselves.

1.8. Conclusion

Mine management together with relevant stakeholders have done a tremendous amount of work to reduce fatal injuries by instituting traditional systems like disciplinary action and related measures. These however do not take into consideration the systems thinking approach.

Systems thinking authors believe that the behaviour of a system is heavily dependent on its structure. Managers tend to pay too much attention to the events themselves and lose sight of the different behaviours which are determined by the embedded structure. Too often managers concentrate on safety without looking at the system as a whole or at other disciplines.

One thing that most companies miss is the dependency of the parts of the system upon the whole. For example if the one part of the body is missing the entire body gets affected which means the environment of the system has changed and the system will not be the same as it will adjust itself to the changes brought about for survival. More detail on this will be covered in chapter two where the systems thinking literature is reviewed.

Chapter 2: Literature review

2.1 Introduction

This chapter is intended to give a review of literature covering the application of systems thinking in organisational safety. The structure of the review covers selected aspects that impact on the topic from general systems theory to an in-depth look at soft systems methodology. Also covered are the different factors that have had a major influence on organisational safety like behaviour, culture and values. It is indicated in the review that there are a great number of books and articles that cover different areas that have successfully been influenced or transformed through the introduction of systems thinking. Through a careful selection process, the ones that relate closest to the subject matter were selected.

As was pointed out in chapter one, systems theory embraces both ontological and epistemological views, in that the environment we live in is made up of systems (ontological view) and the very same systems interact at a given time and period with each other including the elements or subsystems that are in existence (epistemological view). It was also pointed out in the previous chapter that conventional management has often failed to address 'messy' challenges (Luckett, 2003, Senge, 2006) as it fails to take into consideration the existence of external and internal environments that influences the manner in which the elements interact in transforming input into desired output.

Checkland and Scholes (1990) made the observation that 'Soft Systems Methodology presents a process in which organisations can, on a continuous basis, ...review themselves on their objectives and responsibilities'. This holds true for organisations like Anglo American Platinum that have to align continuously with changes in their environment and still remain competitive through adaptive systems in response to changes in the environment to preserve internal structure (Chapman, 2005). The methodology employed in this research uses systems thinking to identify gaps left by using traditional management approaches. The researcher will later demonstrate how the use of soft

systems methodology gets participants to appreciate and understand in-depth the differences in real world circumstances and generic problems in everyday life.

2.2 General Systems Theory

Systems thinking can have different meanings, depending on the discipline where it is applied (Werhane, 2002, pp. 33-42). Organisations operate in an environment where the different interrelationships systems affect each other in such a way that no one system can be isolated from another. Depending on the market demands, the Chief Executive Officer makes promises of a number of million ounces that the organisation will produce in a specific financial year. Daily the workers clock in for an 06h00 shift and change into protective clothing before heading underground on a rubber-tired car or cage or any other means of transport employed in that specific operation. The workers do their daily call and knock off for the next crew doing afternoon shift to continue and the last crew doing night shift will do all the cleaning and preparation for the morning crew and the cycle continues daily as long as it's a working day. The mineral-rich soil (ore) excavated underground gets transported out of the belly of the earth for treatment in the smelting and refining plants before being made available to the market. The smelting and refining plants each have their own systems and procedures before a platinum ounce is produced as a final product. This whole system can take up to 5 months from mining to final product and involves a lot of machinery and people interaction. All these can be understood if one thinks of the interconnectedness and relationship or dependence each part has on another(Scott Geller, 1996). It can only be understood by thinking 'whole' rather than by thinking in terms of individual parts of the platinum industry.

Ludwig von Bertalanffy, a biologist is credited by most authors as the man who first developed general systems theory (GST) in his quest to counter reductionism. His approach was that instead of reducing the human body to the different elements or parts, the focus should be on the way the parts relate to one another to make up the whole, hence systems theory (Jackson 2000, p.50).

Michael C. Jackson (2000, p.190) in his book *Systems approach to management* says:

> *"Complex problems involve richly interconnected sets of parts and the relationships between the parts can be more important than the nature of the parts themselves, they are sensitive to small differences in initial conditions – the butterfly effect".*

This systems theory concept can be applied to any discipline whether safety, technological or, biological, as was the case with von Bertalanffy. It can also be applied to science and even to theological terms.   Thinking in wholes refers to "unity and diversity in one body, for as the body is one and has many members, but all the members of that one body, being many, are one body" (Maxwell 1982, p.1402). For the body is not one member but comprises many parts. In an organisation everyone has a contribution to make which benefits the entire team as the members function like the organs and muscles in a body.

2.3 Organisations-as-systems

All organisations have been established to accomplish the desires of their clients but in the process there are emergent systems as a result of interactions between system elements like individuals, physical and social elements, as described by Professor Nancy Levenson (n.d.) of the Massachussetts Institute of Technology. An organisation that has individuals who collectively belong to a group that together represent a section of the organisation in the different departments (elements or parts) functioning for the maximization of the shareholder's wealth meets the requirements to be classified as a system. For example a project manager belonging to a project team that belongs to a Projects and Engineering department in the Anglo American Platinum organisation. Note the interconnectedness of different systems within a system.

Observing organisations as being the same as systems of independent parts can assist in understanding the organisation much better than through ordinary approaches (Jackson, 2000). More often than not, the traditional approach misses the human and technological

element and conveys the wrong idea about the relative importance of these aspects to the organisation. In an organisation like Anglo, the size of the human element or human subsystem has a major bearing on the outcome of studies such as this because if not well-considered it can render the whole exercise invalid. The view of the organisation-as-systems embraces all existing subsystems, the relationships and the interaction between the subsystems and their environment.

Churchman (1968, p.3) asked, 'how can we design improvement without understanding the whole system?' The organisations-as-systems phenomenon is more into promoting the survival of the organisation like organisms in a living organic structure than into objective achievement as is the case with most organisations. This neglects the social aspect of the organisation since it can only survive because there are living beings (parts) living and driving the organisation forward to transform all the inputs into outputs in the turbulent environment. Organisations should not be treated as machines to operate at the push of a button but should also keep in mind that it has a social component (subsystem) in the system that is driven by values and norms on how they interact with each other. In the organisations-as-systems approach, all participants benefit from the output as an integrated whole. When the whole system is disturbed, it will adjust itself to a state of normality for survival purposes in such a way that the parts of the whole become similar in shape to that whole (Jackson 2000, p.81-86). According to Professor Nancy Levenson (n.d.) in her presentation on *Applying systems thinking to safety in complex, Socio-Technical Systems*, accidents do not just happen but they arise from a slow movement of the whole system from a state of normality towards a state of high risk.

2.4 **Soft systems methodology literature review**

It is often said that experience is the greatest teacher but learning from experience can be confusing sometimes as it is more a matter of being conscious of the relationship between present phenomena and that which has been experienced in the past. Experience relies heavily on people admitting that there is a real problem which needs a real solution, this is 'the real world' where scores of people are losing lives in the mining industry every

year as expressed by Checkland (1988, 1985). Systems thinking acknowledge the idea of a situation (a system) that people (parts) may regard as a challenge (trajectory or subsystem), safety being one of the challenges faced by organisations.

Soft System Methodology (SSM) was developed in the 60's by Peter Checkland of the University of Lancaster for use as a modelling tool for the organized learning system. Bob Williams (2005, p. 2) stated that SSM controls the way you think in order to enable an open mind to operate in the thinking process. In SSM there are a couple of question that need to be asked in trying to understand the system which have to be dealt with before any major work is undertaken. These are questions like: what is the system dealing with and what are its objectives?

SSM begins with understanding a situation and articulates this through the use of a method called 'rich picture' which depicts all the different issues, opinions, ideas of what are considered by everyone involved to be relevant to the challenge (Checkland, 1981). It presents a pictorial view of the situation as per the interpretation of the participating member (Williams, 1999)

Soft systems methodology is one that allows exploration of how people in a situation can create their own world and act internally within that world (Checkland and Scholes, 1990). The system is recognized for its ability to include ordinary members of the organisation that learn through involvement and can be interpreted easily. As people get involved and learn it makes it easy to get buy-in to the perceived change. This environment gets participants to talk about the current situation in the organisation, exchange views about what kind of change they would like to see and to table the established solution.

Soft systems methodology is rich in techniques including rich picture, CATWOE one of Checkland's seven stages version and others which facilitate a richer understanding of the parts and in turn facilitates a richer understanding of the whole (Checkland, 1981). The rich picture makes it possible to use diagrams or images to point out the different

elements at play at any given time in a situation. Scott Geller (1996, p3) reported that accidents can be classified in a number of spheres of influence which include: the environment (i.e. the equipment and the climate of the working area), the people involved (i.e. attitudes, beliefs and personalities) and behaviours (i.e. safe and risky practices). The rationale here is that a situation will be complex because of the multiple interacting complex relationships between the elements in a system (Checkland, 2000). For example, values and belief systems, behaviour, culture, background, leading by example or walking the talk from senior management, politics, literacy levels, caring for each other to mention a few all have an influence on complexity of the relationships that exist in the Anglo system.

The acronym CATWOE originates from the root definition which expresses the most important function of a system; what the system will have to do to accomplish the main objective. The elements of the root definition are as described in Table 2
 below:

Table 2: CATWOE breakdown

(Adopted from the composite case study demonstrating the use of SSM for analysing IM by Mark Campbell Williams and Sunil Gunatunge 1999, p. 5)

Letters of the Acronym	Description	Anglo American
C	Clients – those that are affected by the changes in the system.	Customers Employees Labour Unions
A	Actors – those who execute the transformation process	Employees Management
T	Transformation – the main activity that transforms inputs to outputs.	The mining and processing processes Sales to customers

W	Worldview – embraced by the client.	The platinum market
O	Owners – those who own the entire system.	Shareholders Stakeholders
E	Environment – where the system operated and it has external and internal influences.	Competitors Mining industry Government

SSM stages

As defined by Checkland (1981), a typical SSM has seven stages which address both the 'real world' and some the 'conceptual world'. These stages include the problem situation considered to be problematic, expressing the problematic situation, determining the root definitions of the relevant purposeful activity systems, naming the conceptual models existing in the root definition, comparing the models and the real world, bringing about the required changes that are systemically desirable and culturally feasible and lastly developing the actions required to improve the problematic situation.

The determination of the root definition and the naming of the conceptual models belong in the systems thinking realm with the rest in the real world.

Soft Systems Methodology can best be applied in an environment where organisations are referred to as cultures, as the generally successful manner in which one can change the organisation is to focus on changing the way the employees of the organisation think (Jackson 2000, p. 261). If this challenge were to be won, then more than half the safety battle would have been won in Anglo and the rest of the mining organisations or the mining industry as a whole.

Checkland (1989) made an observation that soft systems methodology makes the management of the 'myths and meanings' its task. The mining industry has lots of fairy stories about it being known as a notorious industry where loss of life in no mystery. It is this kind of thinking that needs to be eradicated out of people's minds.

2.5 Organisational behaviour

Organisational behaviour centers on knowledge about the manner in which people or groups behave in the organisation. As suggested by Peter Drucker (1999, p.9) the first secret of effectiveness is to understand the people you work with. When taking a systems view, this concentrates on the whole person, the whole group and the whole organisation as the focus is the relationship between the organisation, people and their safety. No person is expected to behave the same as any other person which brings in the element of complexity as situational parts are interacting with one another even though the behaviour is, in most cases, governed by suitable principles which are defined by the organisation's values. Despite automation and the impact of robotics, organisations still rely heavily on humans for productivity. All the more reason for managers, or those in authority, to understand the human factor that contributes to levels of under- or over-performance, human behaviour cannot be ignored. A risky behaviour is understood to be the major contributor to most injuries (Scott Geller, 1996)

There are a number of causal elements or agents that contribute to particular behaviour; these include emotional intelligence, the value system current at a given time, the cultivated organisational culture and the whole environment. The cause and effect relationships are the main determining factors in people's behaviour in any organisation which has an impact on the person's productivity and ultimately influences the organisational safety. Behaviours and attitudes normally goes hand-in-hand, a change in one results in a change on the other and vice versa which is a proportionate interdependency (Scott Geller, 1996). There are instances where a person bypasses procedure and something goes wrong but nobody gets injured, their supervisors sweep the incident under the carpet and do not report it. The fact that nobody got injured should not be the reason why bad behaviour should be tolerated and such behaviour should be rooted out of the organisation if there is a drive to turn things around and to realize the principle of Zero Harm.

Organisations are complex and dynamic purpose-driven entities and scores of disasters occur because organisations ignore warning signs from signal incidents or do not learn

from past incidents (Cooke, 2006). Disasters are unwanted events and can be prevented but, due to socio-technical pressures they still occur.

On the 8th of April 2012, the *Sunday Times* newspaper reported as follows on one mining organisation that orchestrated a cover-up of a mining death:

> *The organisation will be criminally charged for the death of a miner, who was sent to do a dangerous job he wasn't trained for. This has resulted in mistrust between the management, the employees and trade unions as it is believed that the life of a human being is not respected in the specific organisation.*

An explosion in Westray Mine in Plymouth, Nova Scotia killed 26 miners on the 28th of January 1992 in what is believed to have happened after a number of leading incidents which ended up being labelled as near misses and production losses, a predictable path to disaster as described by (Richards, 1996). The question to be asked is: would these incidences have been avoided had systems been in place to predict or to facilitate learning from other incidences of lesser magnitude even in risky and complex systems? System thinkers do not always try to find the root cause for every accident that occurs but the elements at play at a particular time (Scott Geller, 1996). The other challenge with these organisations is that information is not shared with everybody to ensure that appropriate action is taken to avoid similar occurrence or to reduce the risk when many of them have had some form of warning sign.

Organisations are characterized by different kinds of people at a given time; those who require to be supervised every time (theory x) and those who show commitment to an objective (theory y) as proposed by Douglas McGregor in his 1960 book, *The Human side of enterprise*. The manner in which employees act and react in the organisation reflects the behaviour of that organisation, therefore safety must include an assessment of the environment, behaviour and personal factors (Scott Geller, 1996). People are the organisation's most important resource (Schein 1983, p. 2), and they are social creations that help relevant stakeholders to achieve things jointly which could have been difficult to achieve individually.

Some companies get themselves into situations where they are smeared with scandalous accusations which have a negative impact on public relations and affect the manner in which employees relate to their superiors. That kind of thinking gets embedded in employee's minds in such a way that they will never take anything said by senior management about safety seriously again as their judgment will always be clouded by the one incident where a colleague died and it was evident that management does not care about them. According to Scott Geller (1996, p. 2) it is important that a global view be taken when dealing with the issue of safety so to understand the number of win/win interdependencies required to optimise the other systems.

2.6 **Organisational culture**

Culture refers to a complex system comprised of different values, norms and belief systems that guides people's behaviour, affects their decision making and impacts upon their unconscious minds. All of this affects their behaviour and sense of belonging to the organisation. Some of the benefits of culture are, it provides or creates common understanding of why things happen the way they do. Organisational culture is a collective behaviour of the employees of an organisation and cannot be compared with or judged to be better or worse than the other organisational cultures. According to Clugston et al. (2000, p. 22), organisational culture influences the organisation's effectiveness and efficiency. What matters is the value the culture adds to the organisation's drive to achieve desired goals. There are different kinds of organisational cultures and these can be described as follows:

➢ The dynamic, entrepreneurial and creative culture;
➢ The open, friendly and sharing culture;
➢ The structured and formal culture; and,
➢ The result-driven, competitive and goal-oriented culture which is prevalent in Anglo. The organisation strives to ensure that employees behave in accordance with the approved company values.

Gareth Morgan (1989) suggested that organisational culture is the glue that holds everything together in the organisation. With big organisations like Anglo employing different people from different backgrounds to work together for the benefit of the shareholders, the question to be asked is: Does complexity brought by the different groups influence organisational culture? Individual cultures can exist in the different mines around the country which at some point can contradict the overall organisational culture in that they impact upon interpretation and understanding of the different policies in different ways and can influence the daily activities of the workforce. Van Stuyvesant Meijen (2007, p. 1) suggested that a fit between the organisational culture and employees should increase the employee's commitment towards delivery as they adapt into the way things are done; this can be true for "safety" in the organisation because systems thinking regards organisations as complex but adaptive.

According to Schein (1983, p. 2), in most organisations the culture is developed by the originators or founders and is inculcated in current and future managers. An organisation exists because there are elements in a system (people) interacting for a common goal in a specific environment and through that interaction certain practices are developed which shape the culture of those individuals which, in turn, becomes the culture of the organisation they represent. This happens over a period of time and is usually backed up by some form of trajectory like history of challenges or changes that occurred and how the group overcome these and adapted to the environmental changes to ensure survival (Schein, 1983).

Schein (1983) says organisational culture is the pattern of basic assumptions invented by a specific group in their learning to survive changes in the environment which have been well received and are considered to be valid for teaching new recruits as a way to deal with changes. Culture is not something that can be observed in a single visit to an organisation as it is not a visible artefact but rather it comprises the assumptions behind the values which inform the behaviour of those working for the organisation.

People's backgrounds also play a role in defining the organisational culture; the founders will have their own views about how things should be done (Schein, 1983), for example, the saying: "we put safety first" might not be embraced by the every person in the organisation because his or her view might be to "get the job done irrespective..." These complex interactions of assumptions, theories, shared solutions and values result in the emergence of the definitive organisational culture. It takes some form of observation, some participation and sometimes training and or orientation to build certain behaviour patterns and values or beliefs in a group of people entering a new organisational environment. The enculturation process into an organisation's way of doing things should be flexible enough to adapt to changes in support of the bigger scheme of things.

The mining industry has over the years developed a non-caring culture where miners were not regarded as important human beings. They would be located in filthy hostels, grouped per their ethnicity and they would only be allowed to visit their loved ones once a month. Miners have a legacy of being badly treated and in their solidarity they developed a group culture which defines how they view an organisation which affects adherence to safety principles and practices.

Like culture which takes time to establish through a persistent manner of doing things the same way until people accept it as a norm, safety and safe practices will eventually get to a point where everybody will work and follow procedures without taking short-cuts to finish the job quickly. Simons (1960, p. 47) made an observation that prejudice, differences of culture and inequality of status discourage the growth of understanding, but through coaching and consistent teaching, the *safety begins with me* slogan and practice will get embedded in people's minds and if everybody buys into the vision or proposed solution, the expected changes could be realized. This can be achieved through formal ways like recognizing good performers by honouring individuals as *employee of the month* or through informal praise like "well done!"

The influence of change in organisational culture

Senge (2006, p. 69) made an observation that 'Systems thinking is a discipline for seeing the structures that underlie complex situation; people do not just resist change but being changed'.

The resistance can be overcome by communicating the intention, by involving everyone and by allowing some form of education and learning to take place. Change is part of our day-to-day reality and organisations need to learn to incorporate change into their daily activities. Organisations and people who are open to change do not only survive but thrive though those environmental changes and these changes can be managed in many different ways or methodologies such as Peter Senge's *Fifth Discipline's* "learning organisation". This is only achieved through a culture of personal empowerment and a mind-shift in moving from the thinking of how to fix what is broken to building on what is working. Employees in the organisation get used to doing things the way it has been done over the past number of years and are proud of this, but change in itself can be a learning process whereby new ideas are introduced and shared amongst all the members of the organisation. However, change autocratically imposed can be met with lack of cooperation, fierce resistance or outright rebellion. 'Leadership' is the one attribute that effect change in the organisation compared to "management" (Burman 2008, p. 22-27).

Different organisations exhibit different learning cultures, like being conservative and avoiding change but employing exploitative team learning styles to refine existing practices (one of Senge's learning organisation disciplines) and to develop a culture that prevents external information from influencing decision- making. Anglo American's attitude towards change has been by focusing on adapting with frames of reference in the organisation itself. This has been achieved by embracing government and labour unions and other structures' calls for a much closer look at the reasons why scores of people lose their lives underground. Adaptive learning is more advantageous, in this case, as it focuses on incremental change by reacting to disturbances by refining the safety system (Ehlers and Lazenby, 2005, p185)

The other learning prevalent in Anglo is the reformative learning culture in that the organisation is trying to develop current practices and ways of thinking through safety road shows and campaigns which involves moving outside its boundaries and scanning the mining environment in order to learn from others.

Recently the organisation embarked on a major generative learning drive by developing organisational values. Inspiration was sought from both practices that are more internal to the organisation and those that are external and generic in order to accommodate everyone including external stakeholders.

2.7 **Organisational values**

Rokeach (1973, p 5) define organisational values as:

> an enduring belief that a specific mode of conduct or end-state of existence is personally or socially preferable to an opposite or converse mode of conduct or end-state of existence.

Values in general are important as they influence how we function individually or as a group, they are a long-term group of beliefs about preferable ways of behaviour (Rokeach, 1973). They originate from past occurrences, personally and professionally and become a way of life, a "balancing feedback" as acknowledged by Senge (2006, p. 84). The manner in which we relate to our partners, our family members, or colleagues, law enforcement agencies, and other stakeholders in the life that we live is influenced by the values we exercise in each of the different engagements. The character of the employees in the organisation is mainly driven by the values present in that organisational system. Organisations such as Anglo American operate in a turbulent market and mining environments and the one thing that is constant in the business world, as pointed out above, is change. Organisations must therefore be flexible enough to constantly adapt to the ever-changing environment. Some if not most organisations tend to address change through reviewing their strategies for adaptation but are these strategies enough? Ehlers (2005, p. 2) defines strategic management as 'a process of

integrating all functions of the organisation for the formulation of strategies aligned with the environment for the achievement of the organisational objectives'.

Value is defined as the important belief that is shared by members of the organisation on the good or bad things. As already pointed out, values can make or break the organisation because they influence people's behaviour and everyone in the organisational has his or her own unique beliefs, ideas or perceptions of how things should be done and they display attitudes which make up the individual's value system, symptoms of a complex organisational problems. Hitt (1998) makes an observation, that each occupation is directed by certain beliefs or values. 'They communicate what we stand for and what is important to us' (Hitt, 1988). The South African government is calling for the mining industry to transform by giving equal senior management opportunities to people of colour and has given expected targets to be reached with specific timelines; at the same time the minister from the Department of Mineral Resources (DMR) wants CEO's to be charged with the death of people in their organisations. It is during these turbulent transformation periods that the existing organisational values present within Anglo operate as a foundation that can enable management not to lose focus. Even though all members are equally important, they are meant to be diverse in that they all embrace different personal values and they function better when they get to share these values with others in organisations or professions they belong to.

There is a positive correlation between values demonstrated in the work environment and the professional beliefs (Brenda, 2000). Brenda further claims that, if there is such a congruency, it leads to job satisfaction which then results in a productive workforce. The values don't just get formed by themselves but it is through leadership that envisaged that traditional ways of doing things are not always adequate and that individual efforts are not effective, which leads to astutely introduced changes in the organisational values and culture. It is only recently that senior management in the Anglo American Corporation decided to launch company values which will take some time to realize, as people have been over the years living according to their own belief systems. The challenge is now to establish how an organisation like Anglo can get everyone in the organisation to live by

the corporate values as some people's behaviour does not fully support the organisational values? Many will buy into the win/win concept but when it comes to practical demonstration of the win/win situation they fail to 'walk the talk'. Conflict will forever be part of life but if managed well it can be a means to pave the way for solutions to challenges. As employees of the organisation these values communicate their beliefs and indicate what is of importance to them.

2.8 Complexity in organisations

An organisation coevolves with environment in which it operates for survival (Jackson, 2003). Therefore it becomes imperative for the existing relationships to be very well managed to enable adapting to constant changes in the environment, therefore a global view should be considered when dealing with organisational safety in order to understand the number of interdependencies required to optimise the existing systems (Scott Geller 1996, p. 2).

Technology

Most of South African mining companies never took advantage of mechanized mining but recently there has been interest shown in mechanized mining. This is happening against the background of thousands of people who have lost their lives underground on the one hand and resistance from labour movements on the other hand, complaining about job losses that would follow-on upon mechanisation. The major challenge is efficiency as mining commodities are heavily dependent on predetermined prices driven by global exchanges; the more efficient the organisations are in extracting the minerals the more profit there is for shareholders, which is referred to as economies of scale (Ehlers, 2005).

In recent times the mining environment has seen drastic changes and there has been the emergence of automated mining, computerization of processes and safety monitoring systems. The main advantage of an automated system is mainly removing people from the dangerous working conditions. Some argue that it replaces people and therefore leads

to job losses, even though there could be some truth in that the fact that, these machines will need to be maintained, therefore allowing for the retraining and redeployment of some of the workforce.

In a recent publication by Sarlatech (2011), Rio Tinto, the second biggest mining company in the world has increased its driverless trucks from 10 to 150. These trucks are controlled remotely in Perth 1 500km away from the Pilbara mine site. Lately the organisation announced a $518million plan to exploit opportunities provided by driverless trains in Australia and the president, Greg Lilleyman said it is not about joblessness but about remaining competitive in the mining industry. These are some of the initiatives towards safety of the workforce. The labour unions in Australia continuously cry foul that the introduction of these driverless trucks and trains might not result in immediate job losses but will negatively affect job creation in the country.

The evolving mining technology environment has resulted in the emergence of mechanized mines which mostly uses rubber-tired vehicles for transportation of people and material underground. The introduction of these vehicles can be a major source of harm in that the driver can be blinded by lights of the oncoming vehicle or cap lamps if a crew is walking towards the vehicle and result in collusion. Systems like training of the driver and fellow employees will therefore have to develop to ensure that the environment adopts the changes as normal or traditional methods like shouting will never be effective when the machine is in motion and the high decibels of noise are at play (Adams, 2007).

One other technological progress realized in the mining environment is centralized blasting, where companies like AEL Mining Services are taking the lead in developing systems like Quickshot which it is believed will help improve safety and health in underground operations. Most mines use explosives for blasting the rock after drilling and the *Mine Health and Safety Act and the Explosive Act* details the calibre of person who should handle explosives and insists on training. The Act addresses a number of issues from storage to licensing, record keeping and control. In a typical working area, an

explosive charge is used which may include a fuse and a detonator, through a series of activities the drilled hole is then charged leading to a bulk explosion that results in the planned blasting. Even though there has been a move towards centralized blasting, the challenge remains when some of the drilled holes were not blasted during the blasting period and workers then clean the debris and start drilling again they may accidentally drill into or intersect with a previously used blast hole which may still contain residue of unused or un-detonated explosives and this may result in an accidental detonation and a loss of life. Jackson (1997) made an observation that the success of systems thinking is in linking theory and practice thinking.

In 2003, a software system called Pitram was introduced into the mining industry. This monitors the machinery, staff and site activities. The software was designed to enable one central control room managing multiple operations at the same time as there are a number of mechanized mines being established in the globe. Semi-skilled workers perform most functions including safety checking and the introduction of Pitram it is believed will reduce errors by pinpointing where activities are taking place without having to travel underground for inspections and expose workers to significant or hazardous tasks. These will be recognized upfront as the user is able to keep in touch through constant communication with the rest of the staff members.

While numerous technological initiatives and advances that should lead to possible solutions have emerged, it is discouraging that high fatalities are still being experienced every year in the mining industry. Why?

Illegal mining due to unemployment and its unintended deadly consequences
Illegal mining started many years ago in South Africa. In June 2009, the *Mining Weekly* magazine reported that 25 bodies of illegal miners were brought to the surface from Harmony Gold's Elands shaft in the Free State Province after an underground fire in the old workings. Chapman (2005, p. 31) acknowledges that if these illegal practices continues, 'unintended consequences' will occur the same as it was believed that the illegal miners might have died of smoke inhalation. More than 80 people lost their lives

during that year which was more than the 74 deaths reported by the mining industry. In 2007, 23 illegal miners were killed in an underground fire-related incident in an unused shaft at the St Helena Mine in the Free State Province with 20 killed in March of the same year in Pan African's Consort mine, in Barberton also due to underground fire. In March 2012, approximately 20 illegal miners were killed in a rock fall in a tunnel that runs between Grootvlei and Gravelotte Mines in Benoni.

Even if the Department of Mineral Resources does not take into consideration the death of illegal miners when reporting statistics, the death of a person is a loss of life and a loss of a provider to a family. South Africa is hit by a scourge of illegal mining that takes place in old workings found in closed non-operating shafts or mines. Due to high levels of unemployment people risk dying to make a living by joining what is believed to be a business syndicate that lures desperate unemployed men into joining these groups for a source of income, Chapman (2005) refers to this as ignoring the feedback that is in the system which is the possibility of getting injured or death.

Churchman (1968, p. 3) asks 'How can we improve without understanding the whole system'? If systems thinking is all about wholes and understanding the relationships at play at a particular time, it is imperative to understand that poverty, crime, corruption and desperation are some of the underlying factors that lead to people dying underground in non-managed operations. Holism gives attention to the relationship between the parts and it draws attention to unforeseen outcomes like illegal mining and illegal miners' deaths.

Even though systems thinking is strong in managing problems and in bringing about the required change, the researcher believes that it is fundamental that we break down the whole into fundamental elements to understand the real problem as it is believed that law enforcement agencies are battling to combat this illegal mining activity as there has emerged ways of communicating underground where these illegal miners will, upon a signal, retreat into dark enclaves (madala sites or mined out areas underground) where they hide until word is given that the agencies have left and the illegal operation

continues. Michael C. Jackson (2003, p.18) in his book *systems thinking: creative holism for managers* states that problems become more complex to manage as they show signs of greater complexity, change and diversity.

Nationalization of mines

There is a real opportunity to apply the diverse, effective and efficient systems thinking in relation to the nationalization of mines challenge. The youth of South Africa are pushing forward with the agenda of economic freedom and they believe that mines should be nationalized and put under the care of government in order to benefit every citizen in the country. Politicians are not shedding light on the economic realities of the matter as they are scared of losing votes. Ulrich (1994, p. 26-37) asked what kind of system could do justice to these kind of difficulties?

System thinkers often concentrate on one or two aspects necessary for high performance as they view the organisation as an open system constantly interacting with its environment. The mineral resources belong to the country it is argued, whereas the majority of the country's citizens remain poor and are not benefiting from the rich minerals that their country possess. People feel betrayed, feel used and some are blaming the apartheid system with some blaming Broad Based Empowerment deals which benefits the few who are already rich but which are not helping the poor.

The short-comings of complexity theory

The social aspect of life is very complex and functions in various ways Berger (2000, p. 7), in order to establish the hidden truth, it therefore requires the researcher to up his/her game. The theory of complexity cannot help us take specific positions or help us make accurate predictions like in the case of nationalization of mines because it is linked to chaos (Valle Jr, 2000). It is a sad reality that South Africa still has a high number of unemployed and poor citizens but will nationalization of mines help the situation? Will it reduce the high number of fatalities associated with the mining industry? The researcher does not think it is a solution.

In order to accurately predict the system's behaviour, it is required that the system be understood in detail. Technological improvements should be a major breakthrough in reducing safety-related deaths as it removes the workforce from dangers at the mining-face but regrettably high fatality numbers are still experienced yearly.

Complexity theory is not flexible enough to be able to practically model this situation. One cannot model every interaction in the history of the system without set boundaries and it will be difficult to make certain if enough has been taken into consideration. Some aspects may be left out thinking they are not important only to find out they were the missing link. This may result in decisions being made without a method that can predict the exact outcome. Then the question is, should decision-making be avoided hoping that solutions will emerge? It must also be noted that not making a decision is also a decision.

2.9 **The learning organisation**

There's a Zulu saying that goes 'Ufunda uze ufe' meaning we don't stop learning. An unknown author once said the day you stop learning is the day you stop living. According to Peter Senge (1990, p.3) learning organisations are:

> *...organisations where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning to see the whole together.*

Safety is for everyone and the slogan commonly used in Anglo circles is that *Safety begins with me*.

Systems thinking is all about understanding the complexity within which the team, personal or individual mental models and the development of a shared vision interact and influence each other (Senge, 2006).

Peter Senge in his book *The fifth discipline* argues that for organisations to learn they need a new view of leadership. These are people who are responsible for building organisations where people continually expand their capabilities to understand complexity. They are responsible for learning. He also talks about five disciplines of a learning organisation and demonstrates how organisations like Anglo can avoid learning disability which threatens their overall success including the Zero Harm in action drive.

When the current Anglo American Chief Executive Officer took over the position, she publicly stated that her passion and drive will be to reduce and change the current state of safety in the organisation. Senge's five disciplines are all about how people in the organisation think, interact and how they learn with one another. These disciplines are explored in more detail in the following section.

Systems thinking

This involves the way of thinking about life and the organisation in general seeing that people and organisations are bound together by an unseen framework. The organisation including other human endeavours forms a system Senge (2006, p. 6) Organisations need people to do the required work for survival and people need organisations for a source of living in the form of employment and supply of necessary goods. At the same time the very same people that work for these organisations are expected to work safely and to return to their homes safely which is the responsibility of both the employer and the employee. Learning should proceed by breaking wholes down to fundamental elements. It is important to understand and to learn why people take shortcuts when doing their work and why they do not follow procedures and in return get injured or lose their lives.

Mental models

Employees working for a mining giant like Anglo can easy get carried away with their own assumptions of everything around them, thinking that they are in control of their surroundings or environment. People create images or pictures in their minds through past experiences and those images influence the way they understand their world and the

decisions that are to be taken. Often people are not aware of these images and their influence in their behaviour (Senge, 2006). For example, workers amongst themselves can easily give names like 'professor'' to those who stick by the safety standards and policies and 'skhokho' to those that still get the job done but do not follow the set procedures and do not even report wrong doing.
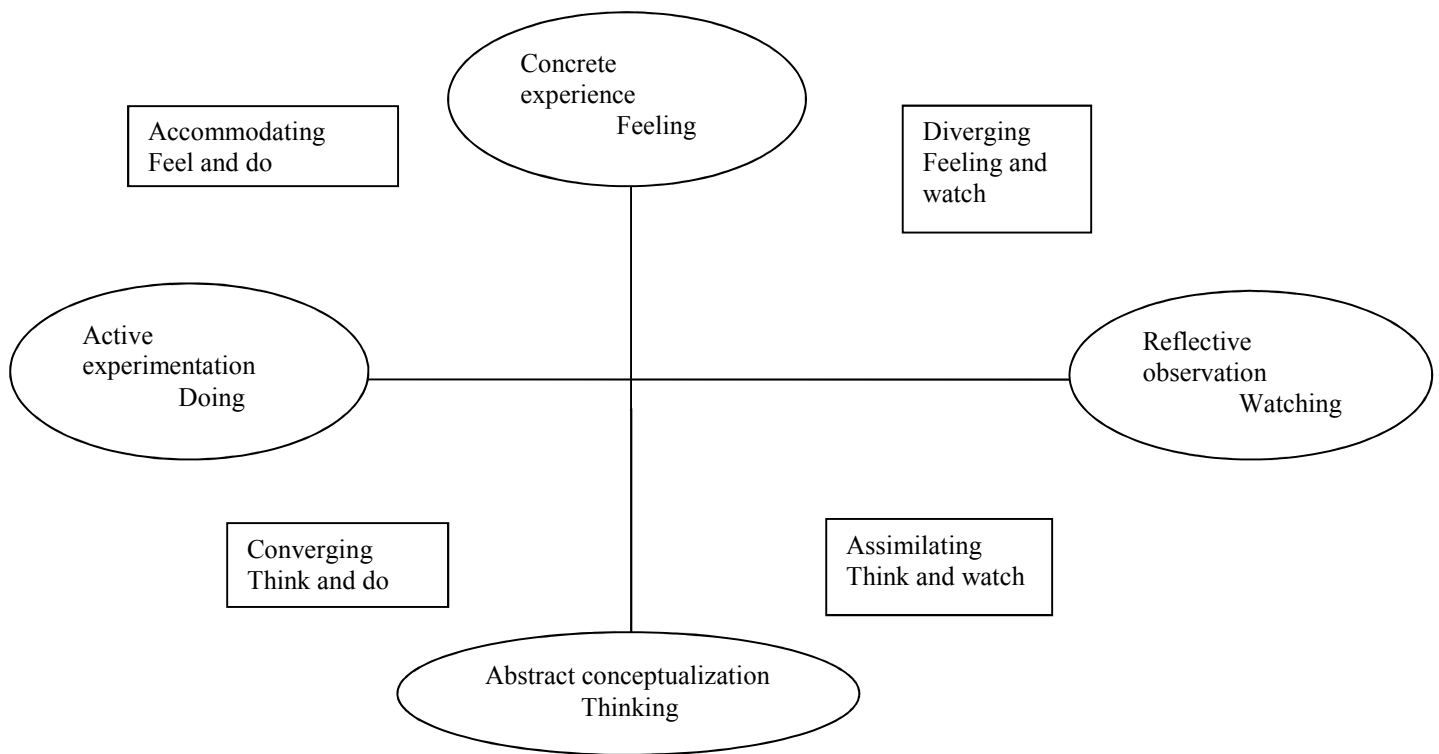
Figure 4:   Peter Senge's mental model (Courtesy: Senge, P.M 2006. The fifth discipline, Goubleday)

The organisation employs people from all walks of life and allows learning to take place because people learn differently. It also has those people who chose to watch others do and they reflect on what has happened. Others are doers. They get stuck whilst others chose to gain new information by thinking, analysing and planning whilst some choose to experience it. Peter Senge calls for turning the mirror inward to unearth our internal pictures of the world and to scrutinize them. These acts include exposing their own thinking effectively and to making that thinking open to being influenced by others.

Personal mastery

It will be difficult for people to buy into the Zero Harm vision if they lack self-understanding. Workers in the organisation could benefit from learning to be critical, creative and at the same time to be productive. If safety is everybody's responsibility, it should start with setting personal learning goals, with developing abilities to engage formal or informal opportunities that are presented by the organisation and with developing the ability to measure the progress made. Some people get to be defensive and argue that 'there's nothing new anybody can teach me because I have done this job for a long time'. Being defensive has its advantages because it prevents people from the embarrassment of being exposed but it also prevents correction of the shortcomings of an individual by those who have the knowhow. Those who possess high levels of personal mastery are able consistently to realize the results that matter most to them. They approach life like an artist's approaches his/her work of art and are committed to their own learning (Senge, 2006).

Most organisations are sitting on untapped talent in that young people join the organisation buzzing with energy and they may be well-educated and eager to make a difference. As time goes by, everything changes because only a few are considered for senior positions with the rest doing what they have to do to earn a living. They lose the excitement with which they started their careers (Senge, 2006), which contradicts the belief that personal mastery is all about creating what each person wants in life and in a work situation. Personal mastery is a matter of choice and a lifelong process, people possessing high levels of personal mastery are continually expanding their capacity to create their desired futures (Jacobs, 2007). No person in life can say 'I have arrived' because there is always something new to learn. People should start with small steps and increase these as they gain confidence as long as they are not forced to do so because they can easily adopt the boss's personal ideas rather than pursue their own, personal mastery. What matters most is to start and be able to see some progress being made rather than accepting the status quo like the belief that 'mining is tough, people will die anyway' which is also insensitive.

Team learning

A team refers to a group or a crew. Team learning therefore is focusing on the ability of a group to learn to work together in creating their own fate. People are employed in an organisation to work with one another and they become a group or a team of employees. Within the group there can be smaller teams responsible for different tasks operating in the bigger organisational system.

When teams learn together, they produce better results than individually and members develop more rapidly than they could have done individually, a team of individuals with IQs that are above 120 cannot have a collective IQ of 63, (Senge 2006, p.9)

A team does things together in a way that will make it impossible for individual performance, this they do by developing self-directing ability. The training on safety standards and policies can be viewed as a process of aligning and developing the capability of the team to develop the desired results i.e. Zero Harm and putting safety first.

People need a sense of belonging, being part of something big. For example in the last quarter of 2011, the executives of Anglo took a decision to stop all operations and took to the streets and visited all Anglo operations to talk to people and to demonstrate solidarity with all the workers in the safety campaign. People were touched by the gesture and felt part of the bigger Anglo family since it is believed that the discipline of a learning team starts off with a dialog. Unless teams learn, the organisation cannot learn (Senge, 2006)

Shared 'Zero Harm' vision

Ehlers (2005) defines a vision as a matter that provides a way for managers to integrate a wide variety of goals, dreams, challenges and ideas into one theme; in this case it is the Zero Harm vision. A vision is something graphic and life-like as a mental image of what doesn't exist (Senge, 2006). Even though there are glimpses of excellent performance

from other operations within the Anglo family, Zero Harm doesn't exist universally in the Anglo American environment as evidenced through the statistics in Table 1.

Table 3: Anglo American Platinum Safety Health and Environmental strategy

SHE Strategy			
Strategic Thrusts	**Safety Focus Areas**	**Health – Hygiene Focus Areas**	**Environment Focus Areas**
Management Systems	Irm.net ASW – SMS OHSAS 18001 RA – RM FOGM + Non Routine Contractor Mngmnt	Irm.net AHW SMS OHSAS 18001 RA – RM HIV / Noise / Thermal Healthy Workforce	IsoMetrix to Irm.net ISO 14001 RA – RM Water / Pollution / etc
Behaviour	Leadership Academy Values + Diagnostic Teamwork Incentives VFL	Leadership Academy Values + Diagnostic Teamwork Incentives VFL	Leadership Academy Values + Diagnostic Teamwork Incentives VFL
Engineering / Technology Solutions	ELEI – Eliminate Low Energy Injuries Loss Causation Model + Closeout	Noise Silencing Ventilation Utilisation Refrigeration	Environmental Friendly Technology Solutions Energy CO2 SO2
Wellness in the Workplace	RRC – Remove Risks and Coach ROSO – Role of the Safety Officer	RRC ROHO & ROVO Medical Surveillance	RRC ROEO

As indicated in Table 3, in 2008 Anglo introduced safety-specific strategies to manage safety and safety practices, this included the following:

- Management systems

Anglo safety way was distributed. This details how to investigate and report accidents, how to assess risk and what kind of procedure and policies, should be developed.

IRM.net which details where risk is growing and likely to result in an accident;

- Behaviour

This involved the introduction of organisational values to ensure everyone in the organisation has some form of common belief system;

- Engineering or technological solutions

The drive here is to engineer out the risk and to eliminate low-energy injuries, like medical treatment injuries and

- The Wellness in the workplace programme

This area details the psychological aspect and health of the employees in the workplace.

The manner in which the organisation puts together its vision has a great bearing on the success of that vision. If employees are only informed of the outcome of senior management planning processes and if management then expects employees to adopt the end result as their own without them having had input into the process they may be sorely disappointed. Putting together a shared vision is an inclusive process. Vision has to be shared and understood by everyone in the organisation otherwise it will not motivate or inspire people to deliver against it.

Interrelationships within the disciplines

Learning is not an event but a continuous process and people learn through associating with others, through observing what others do and through building relationships with fellow employees. Knowledge becomes valuable and important when it can be applied elsewhere, people can be given the best training on safety but if they cannot apply the knowledge in the workplace to reduce fatal injuries then it is pointless knowledge. Learning is a cycle that involves experiencing, reviewing what has been learnt, concluding and planning again and again.

2.10 **Summary of the literature review**

This chapter presented the literature review on the application of general systems thinking and related theories relating to organisations for improved performance. From the researched literature it can be observed that systems thinking has a role in organisations where it has been applied and for those organisations that do not apply systems thinking, they can learn new ways of thinking as an organisation.

Even though the numbers have been coming down over the past years to around 40% or so in terms of improvements in fatal injury rates, the challenge of Zero Harm has not yet

been achieved. The question remains: What will it take to achieve this goal? If some of the operations can achieve excellent results up to millions of shifts injury free, then Zero Harm is definitely possible only if the current stumbling block is removed - inconsistency.

The challenge I believe lies in lack of consistency in addressing the problem and all energies are spread out in pursuit of a number of possible solutions which need to be harnessed and directed. Despite all the various initiatives the organisation is not always getting the basics of safety management right as evident in the statistics and the reports circulated to all workers when an incident has occurred. This is largely due to inconsistent implementation of the standards and processes that have been put in place to keep people safe. The organisation has invested millions of Rands in developing and training people in safety systems but not all are consistently applying these practices and disciplines in their day-to-day work. Safety is still not intrinsic to what people do and the entire organisation is not living the safety value day in and day out and we are not holding people accountable for bad behaviour.

Chapter 3: Research design

3.1 Introduction

This chapter outlines the methodology applied in the research which is a combination of quantitative and qualitative research methods. There are a number of approaches to qualitative research as outlined by Atkinson et al (1998) and since the research is about safety in a workplace a qualitative methodology was chosen for its straightforwardness of application for in-depth understanding of human behaviour and addresses the 'why' and 'how' certain things happened. It also refers to anything that is not quantitative (Thorne, 2000). This method can be traced back to the early 20th century where it was applied in anthropology and sociology (Holloway 1997, p. 1-3) and the advantage being its ability to uncover knowledge about people's thoughts and feelings about safety in the organisation. It helps uncover the hidden and most valuable information from which to draw conclusions.

Qualitative methodology includes some open-ended interviews and questions, more about how the general public feel and think about environments they find themselves in which provides the supporting data required to respond to the hypothesis Thorne (2000, p. 68-70). It is a systemic method, a declaration maintain by Yeo (2002, p. 112) applied to get hold of information about problems encountered in the safety drive in organisations. The data is therefore used to observe the interdependencies of relationships that exist in a given system through the assumptions, principles and values about the subject matter that respondents provided together with conclusions by the researcher.

> Albert Einstein once said *"Not everything that can be counted counts and not everything that counts can be counted "*

People always have different opinions on why things do not happen the way they expect them and why certain things are happening but the truth of the matter is that these kinds of researches tend to unearth more understanding about myths and beliefs in certain areas of our lives in the organisations we work for. At times the research can be biased but it doesn't take away the intention to sway respondents and everybody who is involved,

Zikmund at al (2012) in the research to come up with some form of understanding which can be tested through existing theories or result in the emergence of new and untested theories.

The question remains, out of the sample of people who participated in the research, are they enough to represent the entire mining industry population? The answer is a resounding "No" because the researcher is limited in terms of time, location and the study is done under a controlled state of affairs.

Some leeway has been built into the research to allow for human behaviour with an understanding that human beings cannot be predicted, it is difficult to measure and foretell human responses Ajzen (1991, p. 179-211). People always have a choice and they react differently when exposed to the same thing depending on their level of broad-mindedness. This research does not dwell on why they behave in the way they do but value the applications of systems thinking in the working environment.

3.2 Research plan

A span of control was defined when conducting this research which are the things that one has authority on and they vary based on the course or environmental challenges (Dettmer, 1997). The overall focus is on the application of system thinking in organisational safety which I presume every individual or employee in any particular organisation can influence as long as they believe that they can do so. By creating a picture in your mind, one can achieve incredible things.

Sphere of influence
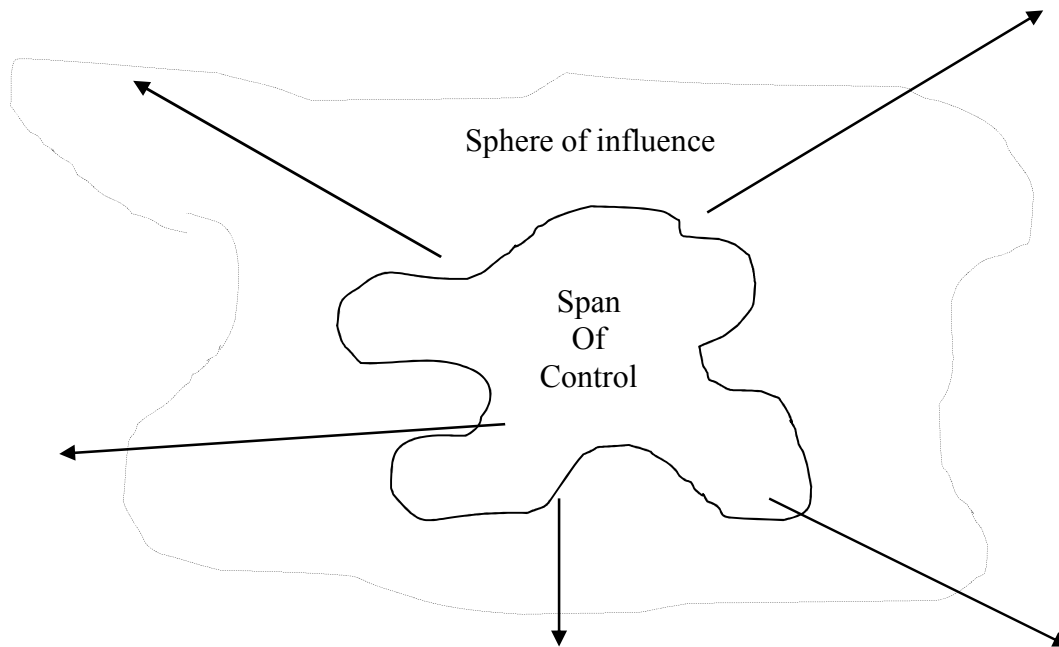
Span
Of
Control

Figure 5: William H. Dettmer's diagram on identifying your span of control and sphere of influence. (Courtesy: DETTMER, H. 1997. Goldratt's Theory of Constraints: A systems Approach to Continuous Improvement ASQC Quality Press)

The research design mainly detailed the composition of investigation and the data collection methodology to establish a possible solution to the problem statement. This was done through conducting investigations to gather information and also observations to possibly pave a way to understanding the deep-rooted elements of the underlying factors contributing to the disappointing yearly safety statistics from mining organisations. The main focus was on primary data and analysis of existing or secondary data (Mouton, 2011, Borgatti, 1990).

The research design involved identifying relevant information required to examine the hypothesis and answer the research problem and question. De Vause (2001) talks about causal relationships, that some answers to problems may be simple while others may be more complex. Safety in organisations can appear to be a simple application and believing that results will just happen without any effort, which is not the case. The truth

of the matter is that it takes more than just a word from senior management and relevant stakeholders to ensure safety.

Various methods of collecting information and data were used including numerical data like organisational statistics and, where possible, observations were also undertaken. Most of the information and statistics used in the research is from Anglo American Platinum through data analysis, surveys and interviews. It must also be acknowledged that most employees have got limited knowledge of systems thinking theory.

3.3 Grounded hypothesis

This refers to a systematic approach commonly used in social sciences involving the unearthing of new theory in the course of analysing collected data (Ken Ono, n.d.). This is done through set steps with the aim of generating a good theory. Data collection methods including, amongst others, interviews, observations and also a literature review was applied in this research.

All collected data was analysed before being utilized and any emergent ideas also considered. This was done using both inductive (allowing the data to generate certain conclusions or ideas) and deductive reasoning (where data is used to confirm the idea of current initiatives to address safety in organisations not being effective) and was not limited to written material but also took account of the general observation of people's behaviour in the work environment and the level of compliance to policies and standards will be analysed and conclusions drawn by questioning certain habitual behaviour . The questions asked were amongst others: "What is this all about? What is being referred to? Under what conditions do these things happen? What category do certain incidents fall under? (Dr Calman, 2006)

Grounded theory also make use of causal relationships and creates a framework for things to fit together to make common sense (Borgatti, 1990). The framework can be simplified into the following components:

Table 4: Borgatti's grounded theory framework (Courtesy: Source: http://trp.jlu.edu.cn)

Component	Description
Phenomenon	The subject matter of the grounded theory that binds everything together
Causal condition	The events and or variables that lead to the occurrence or development of the phenomenon
Context	This is the researcher's findings, things that contribute to the discovery of the new theory.
Intervening conditions	It refers to mediating variables (the go-betweens) applied in researcher's findings
Action strategies	These are the purposeful, goal-oriented activities that agents perform in response to the phenomenon
Consequences	Refers to the intended or unintended consequences of the action strategy.

3.4 Data collection methodology

The very first question that needs to be asked and responded to in an honest manner is that of how much data needs to be collected before deciding on the methodology to be applied. One of the ways that was used is individual engagement with people to pull together a deeper insight and to record the rich data at their disposal. It must be acknowledged that there are many excellent and detailed methods of collecting data however this research was limited to the following methods: (a) primary and secondary data, (b) surveys and or in-depth interviews, (c) structured and unstructured questionnaires, and (d) direct observation.

A number of considerations have been observed when choosing the data collection methods, these include the following:

a) Would the research questions be answered when the research is concluded?

b) How sensitive and critical is the information required?

c) How the data relates to my position in the organisation and that of the participants?

d) The sensitivity level of the arguments and findings as most of the data being used is internal to the organisation (i.e. Anglo American Platinum and the Anglo group companies).

e) Will the outcome of the research be made available to Anglo or remain private, or used for career enhancement only and the intended audience of the research being academic only?

Careful consideration was given to resources required and availability including the skills and ability of the researcher. The collected data was used as evidence for the arguments and for any emerging hypothesis. It was, therefore, of outmost importance to develop a system to organize collected data for analysis purposes.

A data collection protocol was setup and included the following:

i. How to record information when received;

ii. Labelling data immediately when received;

iii. Checking for correctness and eliminate erroneous information;

iv. Create backup for data received electronically;

v. Ensure that confidential data can only be accessed by the researcher; and

vi. Develop an excel spread sheet to log received data for tracking purposes.

3.5 **Primary and secondary data**

Primary data

This involved the process of collecting original data; in this research, data was either collected by getting some information from different sources such as company surveys or by getting specialists information from people who work with such information and this was used as lead indicators as to where and what kind of data should be prioritized. The data that was collected was highly relevant as it was not from a secondary source but

original in nature as it involved preselected participants (a purposive sample) who may have entrenched understanding and insight into the chosen topic.

Advantages of primary data

- ➢ Easy to interpret – collected data can be interpreted from first-hand experience rather than having to rely on conclusions made by others from secondary data;
- ➢ The main issue is addressed – the researcher has complete control of information flow and can plan and sort it out in a manner which is suitable for the researcher.
- ➢ Up to date data – under normal circumstances, secondary data is not recent and may not be specific to the subject matter being researched.
- ➢ Proprietary material – the data collected has never been collected before therefore the collector can own the data and under no circumstances can the researcher be forced to share this with others.

There are a number of disadvantages with regards to collecting primary data but for the purposes of this research it was intended that the centre of attention would be more on the advantages which add value to the enquiry.

Secondary data

This refers to data or studies that have already been collected or conducted in a similar area of concern and which may not have received due attention because of political or environmental challenges. This was considered together with already existing data from archives within Anglo. Any other form of secondary data including and not limited to audio recordings, transcript interviews, focus group log books, and literature covering safety in organisations and related topics was not overlooked as it was easily accessible.

It is also of great importance to study the reasons why and how the data was collected at the time it was collected (Boslaugh, 2007). The research plan involved checking for availability of the secondary data that was in line with the questions to be answered by this research and also to check on the likely margin of error in the data and on the general dependability of sources. This collected data was analysed to create a detailed and

testable hypothesis. There are benefits in using secondary data in that it is cost effective (data already exists, qualitative or quantitative) and allows for flexibility compared to starting from scratch but follow through on some thinking from other researchers.

Advantages

➢ Economy – the data already exists therefore no expenses were incurred or resources used for data collection (which the researcher could not afford).
➢ It required less effort – the expertise and professionalism required has already been applied during the collection and analysis stages.
➢ It saves time – data is already sorted and stored in a specific format and ready for use.
➢ It helps identify the gaps that will be filled with primary data
➢ It broadens the understanding of the challenge at hand as arguments and conclusions have already been made.
➢ It provides the basis for comparison with primary data.

The disadvantage with secondary data is that this does not cover the whole range of concerns raised by this research as it was collected for other reason which might not be the same. It could also cover a different environment and not mining organisations compared to the research topic.

The plan was to use what was available and relevant to my research and whatever was not used directly was utilised as additional information to support certain arguments.

3.6 Long-service employees survey and in-depth interviews

Those people who have been with the company or have been in the mining industry for years and have developed an understanding of the things that have been done to and not to yield positive results were targeted, that included the safety managers. Such wealth of experience and knowledge was used to draw conclusions. Some of these employees are professionals in the safety field of work through training and some have moved up the

ranks due to good safety performance and long service; they can therefore provide valuable information on the systems that have been implemented before.

Technology has improved to such an extent that most of the planned questionnaires and interviews could have been conducted remotely but nothing comes close to using the traditional face-to-face interview system where a great deal can be gathered during the sessions compared to doing it remotely as the interviewer is able to pick up visual signs and can guide the conversation and ask follow-up questions. Where a face-to-face was not possible then the use of technology was applied including telephone interviews though it has to be noted that the use of the telephone limits the openness of the dialog on a certain opinion that could be shared by the respondent.

Kahn & Cannell (1957) explain interviewing as 'a conversation with a purpose'. The five (5) in-depth interviews which are semiformal without predetermined outcomes and which document what the interviewee says formed part of the plans for this research. Questions were systematic and conveyed the attitude that the participant's views are valuable. This was to encourage the sharing of information as interviews in a qualitative methodology can be semi-structured or nondirective as reiterated by Jarratt (1996, p. 9). It is easy to get vast amounts of utilizable data in an interview when questions are structured to steer the responses towards the required information. It is also of outmost importance to ensure that the language use is common to the interviewer and the interviewee to avoid misinterpretation when data is analysed.

3.7 **Questionnaires amongst peers**

In comparison to interviews, where the researcher asks questions openly, questionnaires refer to forms that are made available for the respondents to fill in during their spare time without any interference (Mouton, 2011). The added advantage with questionnaires is that they enable clever contacting a large number of peers in a short space of time using a list of preselected questions that will steer the thinking and response in a manner that gives an insight into the chosen problem statement or insight into the underlying factors

that have a bearing on the progress to achieving what has been set by the organisation like Zero Harm. Another advantage of the use of questionnaires is that it is reasonably 'easy on the pocket'.

These questionnaires were divided as follows:

- Postal questionnaires which were responded to with the researcher not present; and
- Structured interviews where the respondent (safety managers) was asked to complete the questionnaire by verbally responding to questions. The interviewer took the leading role and directed questions depending on the kind of interest and response from the interviewee.

As per the chosen subject matter of safety in organisations, the questionnaires were limited to a close-ended type of questions where the respondent is guided to a Yes/No kind of answer to enable data analysis to be done with ease through quantitative analysis rather than opinionated responses which sometimes are difficult to interpret. A check list was developed to ensure that the questions asked in the questionnaire were relevant to the research topic. The checklist included the following:

- Is the question necessary and useful?
- Do respondents have enough understanding and adequate knowledge to answer the question?
- Has appropriate language been used which will be understood by all respondents?
- Have abbreviations been used and are they well understood?
- Is the question direct or vague?
- Is the question misleading and could it lead to more than one kind of response?
- Are all assumptions made generic enough to be understood by the respondents?

It must be noted that respondents were allowed to give brief comments on their understanding of the safety challenges faced by the organisation and this also gave them a platform to share their contribution to the journey to Zero Harm. Qualitative analysis was employed for these kinds of responses.

Questionnaires also have limitations in that when applied in complex situations like the application of systems thinking in organisational safety, they might render difficulties in analysing the data and people might not have the required level of interest in the questionnaire which will result in very low responses.

3.8 Direct Observation

This method involves watching a situation where the matter being researched is applied and related information, actions and behaviour is recorded. This methodology involves a face-to-face contact with the person being observed.

Observing a group of employees perform their duties and making a note of the manner in which safety procedures and standards are applied in a live working environment was undertaken. This provided substantial information into conditions within which safety procedures are applied and how feasible it is to be conscious of safety when conducting daily duties.

AngloAmerican   **PLATINUM**

Project Safety

Statistics

• Current LTIFR	-	0.11
• Current LTIFD	-	986
• MTC days	-	241
• Total shifts PTD	-	368,846
• Total hours PTD	-	3, 451,959
• Total FIFR	-	0

Zero Harm in action

Monthly VFL tours ➡ BAD (Behaviour – Attitude – Discipline)

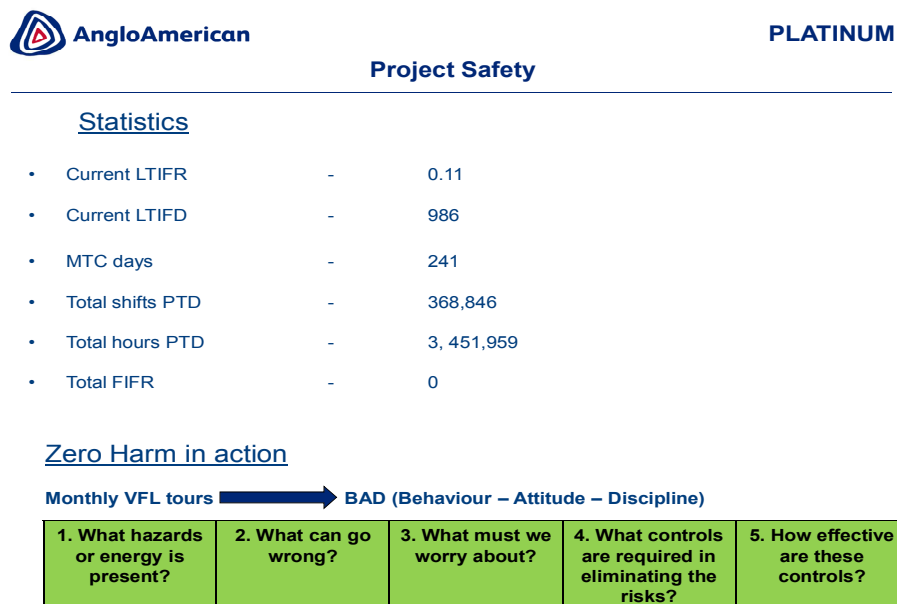| 1. What hazards or energy is present?	2. What can go wrong?	3. What must we worry about?	4. What controls are required in eliminating the risks?	5. How effective are these controls?

Figure 6: Bathopele capital project statistics

Figure 6 details the safety statistics achieved by the researcher's project team at Bathopele Mine by mid-year in 2012. As part of my contribution to Zero Harm in action within Anglo I have instituted monthly VFL (visible felt leadership) tours by the entire project team to the underground workings at Bathopele Mine. The aim is to observe, ask questions and coach where necessary. This initiative encourages employees to open up to management and to discuss issues of concern and they are able to share suggestions. A total of 5 questions were developed which are being used as a guide to the type of matter to observe over and above compliance to safe working procedures, the results are evident as detailed on Figure 6 above.

These questions are as follows:
    a) What kind of hazard or energy is present in the working area?
    b) Is everybody aware of what could go wrong when conducting their jobs?
    c) Is there anything that one should continuously worry about when working?
    d) What control does one need to eliminate the risk identified?
    e) How effective are the controls?

After each underground tour, the team had a debriefing session where observations and or any particular learning got shared and the outcomes were recorded.

As part of observation and gathering enough information obtained through VFL, written Anglo material like standards, policies, annual reports and other documentation was collected to support the conclusions or findings from observations.

Other information was collected through attending meetings where executive management addresses employees about safety performances and safety drives. At times this included the impact that organisational safety performance has in the market and the organisation's image. There's also interest from labour movements like the National Union of Mine workers and others who represents the worker's needs in the mining industry. All this information was collected and analysed for research conclusions.

3.9 **Data management**

This involved making sure that collected research data was handled in the correct manner which included the process of storing and archiving the material and disposing of unwanted records in a safe and acceptable manner. This took place during the research process.

Most of the collected data for this research was electronic data, therefore it was important to store this on a separate hard drive to avoid incidents where the data is erased or lost and sometimes it is accessed by unauthorised people. The researcher was solely responsible for keeping all data. Backups and regular virus protection updates were run to ensure the integrity and preservation of the data. Data can be lost or stolen and data theft is when it is deliberately taken without permission. Lynn Greiner (2002, p.) says 'it is important to have an adequate level of security if the machine is stolen'. Everyone who is in a position where they could be separated from the device needs security. I think the best way to look at it, is to look at the criticality of what you're doing and if it's of outmost importance to the business environment, you have to determine the value of the information and match up security needs"(Greiner, 2002)

Anglo is a private company; information distribution is sensitive. Therefore all information sourced within the company through the library, the intranet and any other internal material was treated with confidentiality and for academic purposes only. Interviews were transcribed as soon as completed and questionnaires were documented to form a basis for arguments and conclusions. Where recording and writing seem to unsettle the interviewee, the recording and taking notes was stopped and the interviewer through careful listening gathered as much information as possible and immediately wrote the information down as soon as the interview is over so that the details were not lost. The interesting facts gathered during the interview could then be used for the next interview to elaborate on the issue and to get other people's views.

3.10 Data analysis

Data analysis is the most complex, mysterious but important part of the research and the selection of the appropriate methodology is critical as each method interpreted data differently.

For a researcher the issue of correct language use is of outmost importance in order to avoid misinterpretation of data seeing that it comes from various sources. For example political pressure can render the data to be skewed and unreliable. People may document certain aspects to be politically correct. The data recording process started with 'cleaning' where data was inspected and erroneous data was corrected. Information gathered was not thrown away but saved during the cleaning process with all changes to the data well documented.
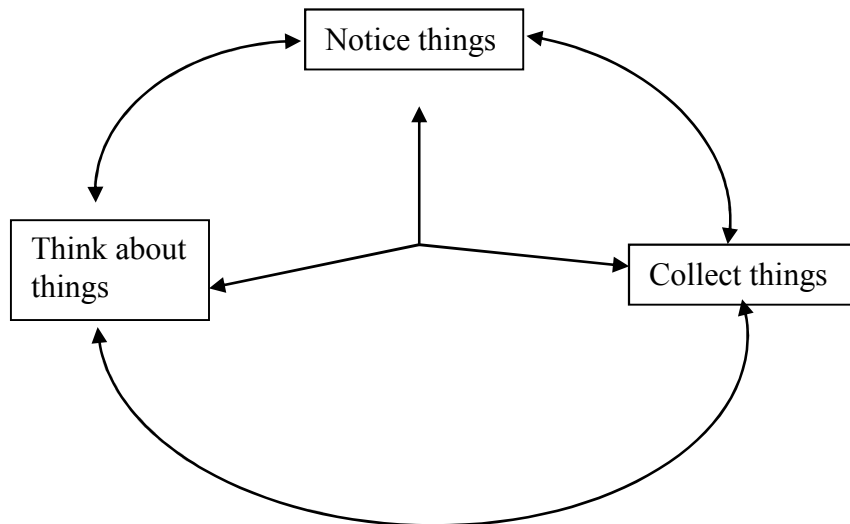
Data analysis

Figure 7: Saidel's data analysis model (Courtesy: SAIDEL, J. 1998. Qualitative data analysis, Qualis Research)

Saidel (1998) describes data analysis as 'a process of noticing, collecting and thinking about interesting things' as depicted in Figure 7 above. It can also be noted that there is interdependence within the three elements in the model. Data analysis has many features and includes a process of inspecting collected data in order to draw attention to useful information to draw conclusions. It is divided into initial data analysis and main data analysis.

Initial data analysis

During the initial analysis, data was analysed without answering the main research question.

Quality of data

Data quality was checked during early stages of collection and cleaning. This involves checking if there was any influence during the distribution, checking if there is a trend of missing information and investigating common approaches or lines of attack. The ultimate quality of supplied or gathered data assessment is heavily dependent upon the follow-up analysis to be conducted during the main data analysis exercise.

Quality measurement

This involves checking for consistency in the way data is structured as an indication of level of reliability of the data. Also to be noted is the level of variance of the gathered data.

Did the execution of the study accomplish the objective of the research?

Check if the background and substantive variables are equally spread throughout all aspects of the data. Investigate if the targeted sources of data all covered relevant information which met the minimum requirements for data collection and also if all interests are represented in the sample chosen.

Characteristics of data sample

The structure of the sample was clearly defined which included the size of the group used for direct observation where a group of employees was observed in how they execute their day-to-day jobs.

Final stage of initial data analysis

The findings of this final stage were documented with possible conclusions being drawn and plans also being described for the main analysis that followed. The question that needed to be asked at that stage was: What should be done with data that doesn't fit the scale; does it get omitted or does one try to compare this with other data rather than throwing it away? It was therefore decided that only useful data will be considered.

Analysis

There are several ways of analysing data using statistical techniques to make a distinction on the level of data variance.

Main data analysis

Here the most important endeavour is to answer the main research question as well as to take note of other important and relevant information that will inform the research findings and emergent hypotheses.

Confirmatory data analysis

Under normal circumstances the type of approach is decided before data is collected and in this research it was decided that the use of Soft systems methodology would be applied. The following 3 questions are to be asked and responded to:

Are there a significant number of employees who clearly understand the meaning of a safe working environment?

What are the shortcomings in the current approaches and initiatives for them not to deliver the desired results?

Can the introduction or application of systems thinking bring about the desired change?

The concept of systems thinking refers to the existing interrelationships within a system rather than to linear cause and effect. This calls for a change in the thinking patterns in order to embrace the concept. This will be reflected on during data analysis.

Generalization of information was checked, as it easy for respondents to want to be on the safe side and not get to the core of the challenge or to give out too much information and end up generalizing. For example when employees talk about safety they can just look at it as following procedure by making safety checks before entering a work place and forgetting that it goes beyond practical but includes the state of mind, living the organisational values, ensuring that one must become one's brother's keeper and making sure that the organisation produces safe profitable platinum.

Computerised data analysis

There are a number of computer software programs that can be applied to data analysis and in this research, excel was the main software applied. The problem in the analysis of data is complex.

Preparation of research findings

The research findings are presented using a combination of the soft systems methodology as a systematic approach which is ideal for dealing with real-world problems and other general systems thinking approaches that are relevant to this research, not limited to for example to the conceptual models of human activity with the main focus on the stakeholder's viewpoint.

At some point people have a specific view of how things should be and not how they are, which makes a huge difference during data analysis. The advantage of using the concept model of human activity is that it allows for the use of bubble diagrams to describe the flow of activities and to demonstrate logical dependencies (Checkland, 2001).

It must be noted that there could be possible obstacles to the analysis process and this can include affected parties to the collected data like the department within the organisation or institutions who might have reached a compromise when the secondary data was collected such that it might not be used in future. The other element will be interest shown by the department head who might want to include or involve certain members of his/her department with a different agenda compared to the objective of the research like forcing the research to fit within the greater organisational drive which could delay conclusions.

The collected data was analysed through assessing its relevance to the research topic and possible drafts and discussions took place before final conclusions were reached.

3.11 Summary of research design

The research design chapter outlines the methodologies to be used which are both qualitative and quantitative. It is believed that the collected data, was original and reliable as conclusions were drawn using this data.

As mentioned before, a proper description of the research to be conducted is vital for the end product as it provokes questions why things are happening the way they are so that when conclusions are made they are from the correct premise (De Vaus, 2001). Most researchers battle to draw final conclusions because of asking wrong questions.

Research requires a good understanding of the target audience's motivation and aspirations because the process of collecting data can be frustrating if not enough time is spent choosing the audience (Hawley, 2009). The advantage in this research is that the organisation (Anglo American Platinum) is in a Zero Harm drive which is in line with the research objective and almost all employees are expected to contribute towards the vision, therefore the level of interest is assumed to be high.

The following chapter (research findings and analysis) presents the collected data through the use of graphs and tables with pictures where applicable. The list of relevant and supporting tools used for data collection including amongst others the video clips and recordings will form part of the portfolio of evidence to be submitted with the final copy of the research report.

Chapter 4: Research analysis and findings

4.1 **Introduction**

This chapter articulates the analysis of data collected followed by an in-depth discussion of the research findings which speaks to the problem statement that motivated the research. The data is analysed to determine, explain and investigate if the application of system thinking in organisational safety can have a positive impact or can improve the current state of affairs.

The following four exercises were conducted and included a combination of surveys within the Department and my own for the study, namely;

- The first was a quick Anglo American Platinum values survey within the Projects and Engineering Department concentrating more on the Mining Projects Division(see attached appendix A);
- The second was a survey on one of the Anglo American Platinum values "we deliver on our promises" (see attached appendix B);
- The third was a safety questionnaire in the generic mining industry and within Anglo American Platinum mining operations (see attached appendix C); and
- A semi-structured interview was conducted with a safety practitioner and unstructured interviews with staff members in the related field of work(see attached appendix D).

The safety questionnaire which is the main focus area of the research was issued to 116 possible participants. The assumption made is that almost all the selected participants have some form of understanding of organisational safety and will give valuable input into the research. Some of the selected participants are safety practitioners who study and analyse safety-related information for reporting and advice where required.

This was carried out with a primary focus on the Anglo American Platinum limited organisation which is the leading producer of PGM's (platinum group metals) and which contributes about 40% of new platinum to the world. In the spiral dynamics theory, which is a theory of human development, the organisation could be equated to the strategic 'orange meme' which encourages people to act in their own self-interest. Anglo's main source of existence is through the manipulation of earth's resources for the benefit of shareholders (Beck, 1996).

The organisation's vision is to achieve Zero Harm in all operations through the effective management of safety. In simple terms this means that the organisation, as has been pointed out earlier in this dissertation, deems it to be unacceptable and unnecessary for employees to be injured whilst working in their operations. They believe that all employees should be able to go back to their dwelling places unharmed at the end of each working shift. The organisation believes that their operations should have primarily safe, well-designed plants, equipment and infrastructure with a strong risk-based safety management plan and systems driving required results and behaviour. Key to this vision are the three basic safety principles:

- Culture
- Learning
- Standards

These safety doctrines set out the basis of the required culture, likely behaviour and performance standards in the organisation.

With approximately 40% of the world's platinum produced by Anglo, it could not have been a better choice to base the research on the safety systems, policies and strategies in this large organisation. At the time of the research, the price per ounce was floating around US$1,400.00 as a result of lesser or weaker auto catalyst demand than expected. Labour and safety-related operation stoppages also contributed to the reduced supply of platinum to the market; this has in return put the platinum industry under immense pressure to cut costs.

In line with the systems thinking way of resolving complex problems, the organisation also looks at the wellness/health of the employees as it has approximately 4000 employees on Anti Retroviral (ARV) treatment and it conducts annual Voluntary Counselling and Testing campaigns (VCT).

4.2 **Methods of data analysis**

I have chosen to employ the descriptive statistical data analysis method as it allows for the display of details of the percentage of the respondents to a specific question. Of the 116 potential respondents, only 35 completed the questionnaire, equating to a **30%** response rate with **97%** of the responses being usable. A considerable number of those who responded are safety practitioners, which increased credibility of the supplied information.

Successful people reach their personal and professional goals not simply because of who they are, but more often because of what they do (Halvorson, 2011). This holds true and is in line with what the research is all about, ensuring that systems thinking methodologies are applied to enhance safety in organisations.

4.3 **Discussion of findings**

No demographic data, age range was requested from participants in this research as it is believed that safety has no age restriction and this was confirmed by the number of respondents who gave a resounding 'No' on the question asked if illiteracy contributes to substandard working conditions and non-adherence to standards and policies. The level of literacy has no bearing on safety, age or number of years of experience but has got everything to do with training, understanding of the minimum requirements as stipulated in the standards and policies, coupled with the associated attitude towards the application thereof. A person doesn't have to obtain a certificate or diploma to be able to apply their mind effectively to working safely. Capra in his book, *The Web of life* argues that in the

theory of living systems, mind is not a thing but a process, if people's minds are trained and developed well, they should be able to execute their work safely and efficiently.

The safety managers interview results

Mr Johan Bester, the Group Safety Manager in the Engineering and Projects division with 40 years experience in the mining industry has explicitly mentioned that visible felt leadership is the safety way in the organisation and it addresses the employee's behaviour, for example people not wearing their seatbelts and also talking on their cell phones whilst driving because impulsively if a phone rings, naturally any person's reaction would be to grab and answer the phone, knowing very well that it is wrong.

Col. George E Reed (2006, p. 10-13) said 'for every problem there is a solution that is simple'. Mindset change or shift is what is required for employees to comply to the rules and regulations that have been developed to ensure a safe working environment.

The questionnaire results

The questionnaire stimulated more opinions and insights such as the emergent hypothesis like:

Mind-set change

Half the challenges encountered by organisation with regards to safety is the mindset, where some of the employees have the idea that accidents will happen to somebody else and not themselves.

Blame shifting

It is the understanding and feeling of most of the employees that if an accident happened and is investigated, those conducting the investigations will always look for somebody to blame which leads to reduced cooperation from the workforce and extraction of information that could assist in drawing up conclusions.

Focusing on root cause

Safety related investigations should be based on a holistic nature where deficiencies are analysed and understood through reductionist thinking (Steward 1995, p. 279). There are

too many subsystems interacting in a particular incident and one cannot pick one matter and blame everything that would have happened on the one issue, system thinkers do not think in small scale or individualistically, so said Professor E. Scott Geller (1996).

What is constant in organisations is the ever-changing environment within which they operate, therefore organisations are required to go through a change-management course of action which involves a systematic approach to adapt to changes in the environment and to bring about change for both persons and the organisation at large. The change process has different aspects like adaptation, controlling and affecting (Kotter, 1995). Change for Anglo or the mining industry in general should wholly adapt to the systems thinking way of doing things. This can be achieved by studying the problems that the organisation faces in terms of safety and to do so within the context of the day-to-day reality of its operations and not in theoretical isolation.

Unintended consequences

Often time's good initiatives are tabled by the organisations like the values and culture drive in Anglo American Platinum but the execution thereof and follow-up is where most organisations get it wrong coupled with employees always striving for the incentive-based goals. This can be summed up in a few words - 'lack of shared vision' as described in Senge's disciplines of a learning organisation. If incentives are paid for production and not for safety, this creates unintended consequences (Chapman, 2005). The mental model that will be prevalent to employees will always be production as a goal to strive for compared to safe production. Organisations should consider making safety rewards/incentives to be daily and not be awarded only at the end of a bonus period 'provided the employee has survived'. Sometimes 'safety' or 'working safe' is taken out of context and employees may misunderstand the meaning; thinking that safety will come automatically, as said by the Bathopele Mine section engineer. It is important that employees are made aware that they need to put some effort into working safely; it doesn't just come by talking about it.

4.3.1 Organisational Values

The organisational values can be defined as preferences concerning appropriate courses of action. These can also be referred to as the 'personality' of the organisation (Strydom, 2007). Anglo American Platinum has six core values underpinning the organisation's vision and these apply to how it conducts its operations and their dealings with external stakeholders. The structure of a system can be defined as 'the physical embodiment of its pattern of organisation' (Capra, 1996). Living systems are always in contact with their environment therefore if these values need to be understood and embraced by every employee in the organisation then they will most likely be compromised when it comes to implementation. Within the 6 values, the safety value 'we put safety first' is the number one value and takes priority over everything that is done in the organisation.

As can be seen in Figure 8, a total number of 24 out of 33 people participated in the quick values survey with some choosing to remain anonymous which equates to **73%** participation. Another survey was conducted where one Anglo value ('we deliver on our promises') was chosen and only **33%** (12 of a possible 33) responded in the questionnaire. It can be concluded that a total of 66 employees were invited to participate on both the surveys with an average response rate of **53%**. It is evident that employees do not have the same understanding of the meaning of each of the values which makes it difficult to live the values fully. There has been no team learning or process to align and develop the capacity for the team to create the results that everybody in the team should aspire to achieve (Senge, 2006).
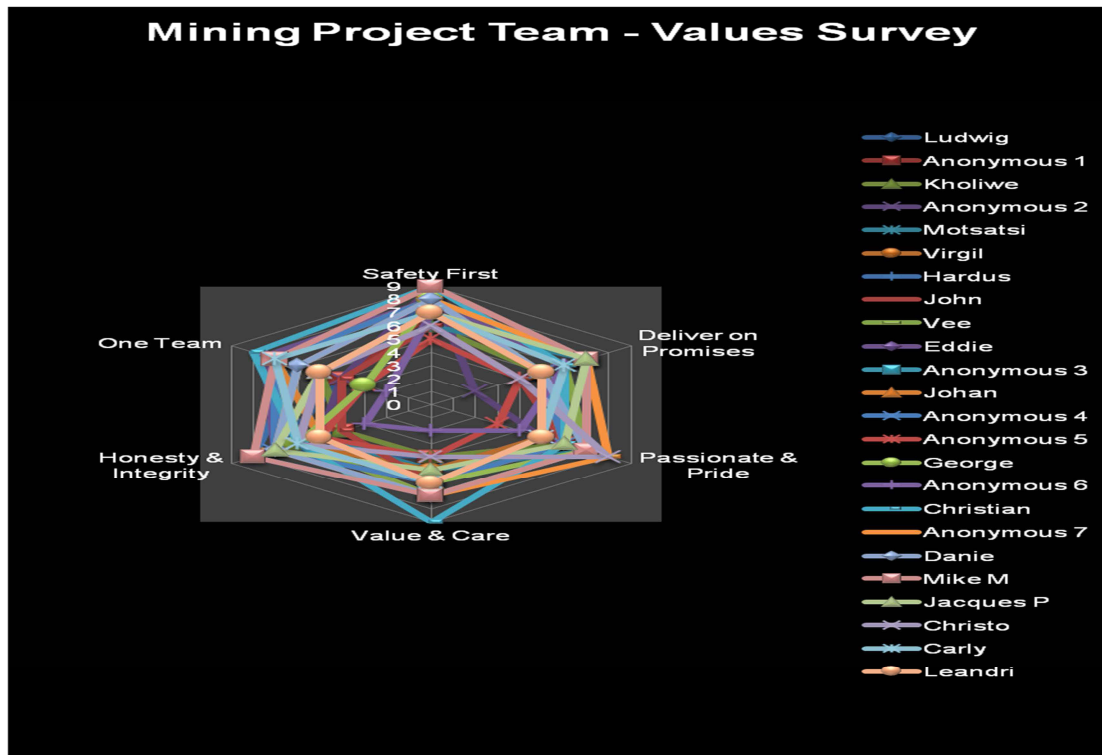
Figure 8: Results of the Anglo American Platinum values survey conducted within the mining projects portfolio.

Team learning is referred to by Senge as the 'fifth discipline'. It is all about learning through association with others, the same way as organisational values are created, they are to guide the organisation's way of doing things and they are also referred to as the corporate culture. These values signify the fundamental principles and/or moral standards that the organisation deems to be vital for their existence and success. They are also reflected in business architecture, the decor, organisational regulations and the general way in which things are done (Strydom, 2007). Unfortunately values are lived, therefore they require everybody in the organisation to act or behave in a specific manner that doesn't contravene these values. It is through these that the leadership of the organisation is able to shape employee's minds and build an organisational culture.

4.3.2 **Safety in action**

Safety is the first value on the list of values within the organisation and highest priority in all the things that are done. Anglo American owns and operates a large variety of businesses which by virtue of their magnitude, diversity and geographical locations creates crucial safety, health and environmental challenges. The overall conduct of Anglo American businesses embraces the systems approach, the values and standards which guide the employees are set out in good faith which takes into consideration the business principles and the environment under which the organisation functions. Gareth Morgan in his metaphors refers to organisations like Anglo as organismic organisations which are perceived to work like living organisms concerned about survival. It competes with other organisations for the natural resources for survival and also ensures good relations with other players in the environment (i.e. people). This it does by ensuring safety of the key players in its survival, the employees, hence the development of the safety focus area in the strategic thrust (Morgan, 1986).

Strategic Thrusts	Safety Focus Areas
Management Systems	IRM.Net Safety Management System – Platinum Way Risk Assessment – Risk Management FOGM + SPOTM
Behaviour / People	Leadership Academy Values + Diagnostic Teamwork Incentives VFL + PTOs
Engineering / Technology Solutions	ELEI – Eliminate Low Energy Injuries Loss Causation Model + Closeout
Wellness in the Workplace	RRC ROSO Emergency Preparedness Healthy Worker = Safe

Key strategic focus areas in Projects:-
- Risk management – completing Baseline risk assessments
- IRM.net (Information Management) (Leading Indicators)
- Respond to risk , Snr. Management visit high risk W/places
- FOGM – Reporting, ABS-P in investigation
- SPOTM – Apply Group actions

- ZHIA – Role out and implementation
- Values , measured and actioned on all levels
- VFL – systemize and track

- Incident and Injury Management (No repeat)
- LFI – Adopt group learning
- New solutions
- Auditing – Proactive and closeout action

- Emergency preparedness and response
- Hygienic facilities
- Remove from risk and coach – the way

Figure 9: Anglo American Platinum strategic thrust.

Source: <http://www.angloplats.com>

Systems thinkers often concentrate on the one or two areas within a system/organisation that are necessary for high performance, hence Anglo American developed the Anglo Safety Framework which shows the inter-relatedness of all the methods that are used to manage safety as depicted in Figure 9. The strategic thrust diagram can be equated to the affinity diagram in the systems thinking environment where each matter is grouped together with associate matters to form a scenario, e.g. leadership academy, values and diagnostic, teamwork, incentives and visible felt leadership, all these form an element referred to as people behaviour within the strategic thrust. These methods include the Anglo Safety Principle, the Anglo Safety Way Safety Management System Standards.

They were developed through a process of internal and external consultation and collaboration with subject experts.

The general feeling is that only those involved in safety are the ones that are really concerned about safety. When one consults other people outside of the safety division, it becomes very evident that the majority feel that safety is only there because it has to be there. Even though times as well as circumstances may change, systems tend to endure (Col. Reed, 2006) therefore it is therefore fitting that interaction with others and opportunities for coaching on poor safety performance should be sought after by safety champions or officers in organisations.

The butterfly effect

In a quick walk-around in any working place, it is easy to discover at least one person performing an unsafe act. The question remains, what do we do about it? The natural reaction is that most people turn a blind eye for various reasons.

There are those rare individuals, who because of some form of exposure or deeper understanding believe in creating a safer working environment for all, one flap of the butterfly's wings can cause a change in weather in a far country (Lorenz, 1963). These individuals will always make a point of having an interaction with others with the aim of getting the next person to appreciate that they are working unsafely and they will encourage them to adopt a safer working procedure. These people can be classified as 'blue meme employees' in the spiral dynamics environment (Beck, 1996) because all they do is encourage others to look at life as having a meaning and a purpose with predetermined outcomes.

This is done through the 6 steps interactive behaviour coaching technique adopted by the Bathopele Mine Project Team:
- ➢ Observe, make contact and stop unsafe act/condition,
- ➢ Complement (look for something positive and mention it);
- ➢ Discuss consequences of the unsafe act;

- ➤ Get an agreement to work safely going forward;
- ➤ Discuss other safety issues; and
- ➤ Thank the person or team before embarking on a personal journey or continuing with one's own work.

By taking time to do just the few things listed above to improve an unsafe environment, this can save the organisation from production losses that could easily lead to huge financial losses, sensitive dependence to initial conditions. Safety should not only be demonstrated and lived out underground but can be a lifestyle characteristic, like observing window washers in an 8-story building on holiday oversees who are not using safety harnesses and stopping them to bring to their attention the dangers and consequences of working without harnesses at an elevated level.

4.3.3 Background and literacy levels

Within the organisation's premises or operations, the company culture or way of doing things is the order of the day. If this company culture is compromised, people's background/upbringing will predominate which might impact negatively on organisational safety.

During any child's upbringing, the kinds of behaviour displayed by parents (even foster parents) have a major impact on how a child will present himself/herself when they grow up. The archetypes from the collective and individual wellsprings are activated within the individual and start stimulating the child at birth to engage early with their environment (Smith 2011, p. 30). If the child is brought up in an environment where normal behaviour at home is displayed as violent or always at risk, which is how the new adult will pursue life. If they have not been disciplined when growing up, how will they show respect in the workplace environment and also respect their superiors when given instructions. A great deal has been written on the subject of background or upbringing. It has been pointed out, for example, that if an individual is brought up in an uncaring environment that could affect their stance on safety. If you grow up taking risks or in a

more hazardous environment one will be prone to be more risk-tolerant than others. What is also evident in organisations is that employees and employers are also not doing enough to try and understand each other's cultural background.

Helen Smit in her book *Beneath* says an individual needs to communicate effectively with the real world in order to survive. There exists a belief that safety requires common sense, therefore being illiterate will not prevent a person from working unsafely, but it will pose limitations on such a person should they wish to better themselves and that is where language can become a problem and considerations like teaching a person in their preferred language could have added benefits. Employees should be taught in their preferred language on matters like standards and policies for better understanding. When a person is not adequately trained to perform a certain task, it could lead to non-compliance to standards and procedures and could result in serious injury. Tradesman and or miners are trained to work safely but certain habits and complacency play a big part in causing accidents.

From the research conducted it is evident that literacy levels are not a contributing factor when it comes to injuries. According to Frank Bonafede a Risk and Safety Manager for the Bathopele Phase 4 and 5 projects, a good leader should be able to take along even the illiterate employees. Based on investigations conducted after incidents it became apparent from the injured as well as colleagues that it is not a lack of knowledge that caused the incident but rather unforeseen circumstances. Observing training sessions where the so called illiterate people are trained, it is beyond belief that they could answer any question posed to them. It can also be argued that those people who are literate have added advantage, they can easily understand standards and procedures and are expected to apply them with ease but it is not the sole contributor to compliance, the other element is staying focused on the job at hand and not become complacent.

4.3.4 **Systems, procedures and policies**

Forester and team developed what is now known as system dynamics which models change in a network of variables. This system is closely linked with organisational cybernetics which is based on a different epistemological orientation and is best in illustrating the thinking behind organisations being treated like machines and/or organisms (Jackson, 2000). The safety drives, initiatives and attention given to safety in organisations are just actions which can be defined as simple general systems thinking applied in the context of an organisation. Although this is the case, they can only add value if the persons responsible for conveying the message themselves believe that they can be effective.

People out there believe that systems, standards and policies do add value and sometimes it makes the situation worse, too much safety awareness can lead to the failure of basic safety processes but Strydom *et al*., 2007; in the *book Introduction to Business Management* says, the first step in control of an organisation is to establish standards. There are instances I believe where individuals need to apply their own thinking rather than the programmed way of doing things as there is interconnectedness between the human intellectual, the environment where work is done and the approved standards and systems to be adhered to. Organisations like Anglo have a lot of safety systems and initiatives, safety bonuses, etc, but all these are dependent on the employee's mindsets and whether the institution's values and policies are aligned with his/her goals or not. It remains a tall order to achieve the end objectives if there are major misalignments of expectations. Success stories must be told and rewarded through well though systems to avoid unintended consequences.

The manner in which the organisation coordinates all systems from approved standards and policies to taking care of employees through wellness programmes and celebrating achievements, goes a long way in ensuring motivated employees. If an organisation has motivated employees who are willing to put in a particular level of effort for a particular amount of time towards the achievement of a particular objective then that organisation is set for success (Strydom, 2007). The organisation has initiatives like Applaud where

employees who have excelled in safety within their different divisions are awarded. These may seem like a small initiative but they contribute immensely towards people's attitudes.

One of the initiatives that seem to be effective when it is well-administered is visible felt leadership (VFL) which forms part of the behaviour or people element of the strategic thrust. This is where underground or surface visits are planned and put to action. During these visits management or supervisors engage formally with workers/operators to understand what they do and how they do it then they demonstrate better ways if there are any or congratulate good work and adherence to procedure where it is due. This goes a long way in ensuring a working relationship that is based on honesty and trust between the employees and management, and senior management demonstrating concern about employee's safety and wellbeing.
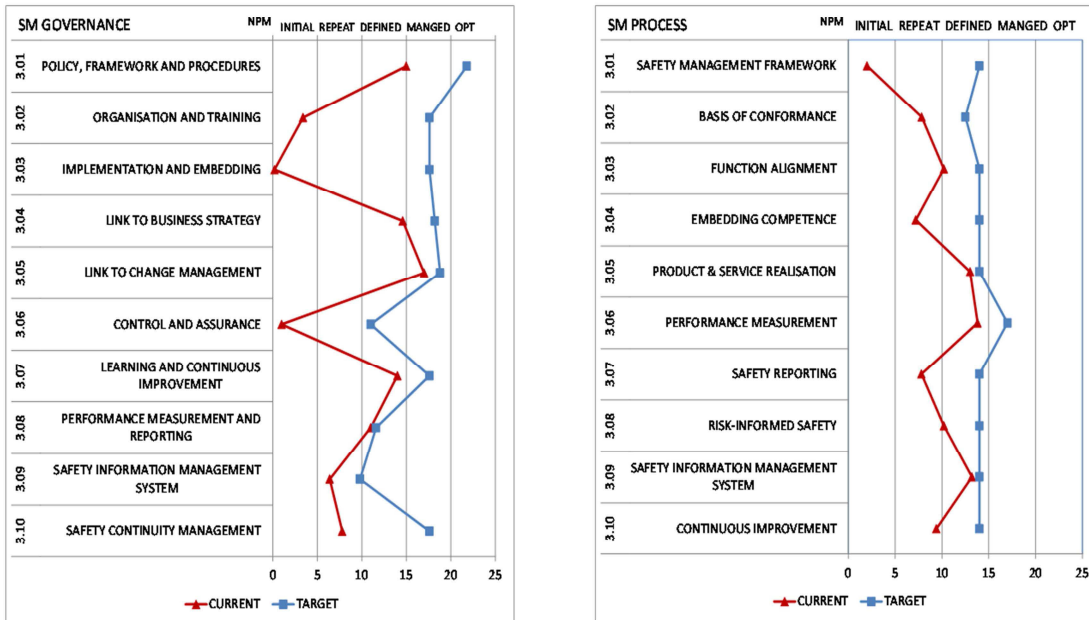

Figure 10: Anglo American Platinum Safety Management Systems

As depicted on Figure 10, safety processes and governance forms an integral part of safety management where benchmarks are performed with targets set and measured progressively. On the flip side, it must be acknowledged that too many initiatives at any

given time might clutter people's concentration and mindsets which may end up negatively impacting on improvements. Generally most organisations have adequate standards and policies but some organisations are too tolerant on offenders breaking the codes of practice, procedures and not living the company values and this negatively impact the implementation of the systems and progress towards Zero Harm.

4.3.5 Leadership and safety in organisations

Management and leadership are two different elements that should be balanced for the success of organisations. The key behaviour of great leaders is that they 'take risks and experiment, they challenge and change the status quo by enabling others to act independently' (Corrie, 2010). This was evident when the Anglo American plc CEO, Cynthia Carol and her executive team availed themselves to talk to employees and 'exchange thoughts', which on its own remained on people's minds for months if not years as it is said that communication and control makes the organisation viable. During that presentation she reiterated her personal commitment to safety and that of her executives.

The systems approach sees the organisation as an 'open system' constantly interacting with its environment, therefore the elements who are the managers or leaders should demonstrate the ability to "'walk the talk' which is an ultimate test for leaders as there is a perception that some leaders will ride on the achievements of others instead of walking the talk. Employees believe that management pull straight faces and talk nicely when employees are still undergoing training at the training centres and tell all the 'nice to hear stuff', but once they get to the working places, production takes priority over everything. Through the visible felt leadership tours undertaken, the vast majority of employees, i.e. those responsible for doing the hard work underground (or surface) believe this perception to be true.

Attie Meyer, a Safety Manager who was interviewed for this research had this to say, "Although management genuinely cares about safety it is not evident enough in day-to -

day interactions with people". There is also a good number of managers that truly value and care for their employees' safety. The drive should be to change the way people think by changing their minds. The challenge then is with the ones whose drive is self-enrichment before worrying about addressing safety in the work place. The question remains; why do some leaders act differently when it comes to what is expected by their teams? Are there different rules for leaders from those that apply to the employees when it comes to safety in organisations? The drive to Zero Harm is for every employee in the organisation not only workers as can be seen in the picture (Figure 11) below. Signatures of senior management committing themselves to putting safety first in everything they do should be displayed. To see people's development as a means toward the organisation's ends subtly devalues the relationship that can exist between individuals and the organisation (Senge, 2006).

Figure 11:   Commitment by Anglo American Platinum senior managers to put safety first

Source: <http://www.angloplats.com>

An unknown writer wrote:

> "*We all are shaped differently by our own exposures in the way we interpret pictures*"

Generally leaders/mangers in the organisation do care and are not just focusing on business as usual; however organisational design, policies and procedures are so structured that it is a constant challenge to make somebody believe that safety is a fundamental business culture/mindset when all that management is focusing on is to meet targets set by superiors in the organisation.

4.3.6 Employees in the organisation

Gareth Morgan likens the existence of people in the organisation to the 'culture metaphor' and he says that their survival depends on the achievement of a shared vision. The essential character of the organisation is conditioned by the fact that their component parts are human beings who can attribute meaning to their situation (Jackson, 2000). The saying that goes 'actions speak louder than words' and this cannot be far from the truth considering the manner in which employees conduct themselves when safety discussions are taking place. I sat in safety meetings/presentations and observed people finding it more beneficial or much more important to respond to e-mails than to concentrate on what was being discussed. At the end of the day it is everybody's responsibility to work safely.

Safety should not be forced upon people as it will remain an additional burden to people. Management should, however, work hard to get buy-in from workers, that way a lot can be achieved. Employers must employ meta-cognition in organisations, i.e. learning to learn to work with employees (Senge, 2006). Employees now have the right to withdraw from a dangerous working place for their own safety and the safety of those that work with them compared to decades ago. This is dependent on how safe they perceive their working places to be and also the nature of the job or task being performed. To a large extent, the attitude and knowledge displayed by the leader of the team will contribute to whether or not the team feels safe. It is said that most leaders are not looking for shining eyes or looking to make others powerful but for the empowerment of others for the achievement of the ultimate goal.

Working underground is a high-risk kind of occupation and employees need to be in the correct mindset before commencing with their duties. The majority of the employees have in their working careers seen incidents like 'fall of ground' or 'a drill rig getting stuck' therefore they are well aware of the risks associated with working underground but the challenge remains, some become complacent in their daily tasks to the extent that they don't feel threatened anymore when in a dangerous position underground, which is a massive risk. The other factor which is related to complacency is getting used to the substandard environment which breeds ignorance and risk-taking due to production pressures.

4.3.7 Behavioural patterns in the organisation

Bob Williams says system thinking's soft systems methodology compares the world as it is now to what it might be in future. The results of this comparison are a better understanding of the world and new improvement ideas arise (Williams, 2005). Injuries or fatalities happen because there was either an unsafe act or condition (the world as is now) which would have been created by people and led to the disturbance of the environment resulting in the disturbance of the state of equilibrium. Behaviour patterns and injuries go hand-in-hand. If a person performs work in an unsafe environment daily without thinking about what could happen, the very same act could lead to serious injury. The person's attitude towards his/her job on the day will most definitely play a big part in how a person will perform on that particular day. Figure 12 below demonstrates all the top ten activities performed in the different categories of people-related injuries.

Slip /trip And Fall - Top 10 Activities Performed
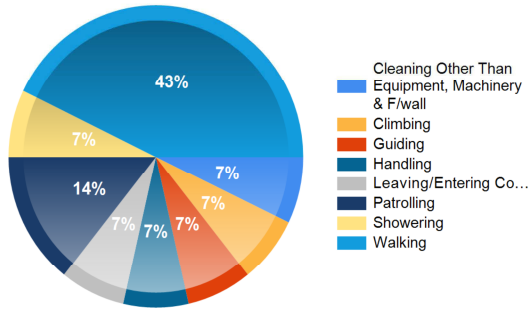
Materials Handling - Top 10 Activities Performed
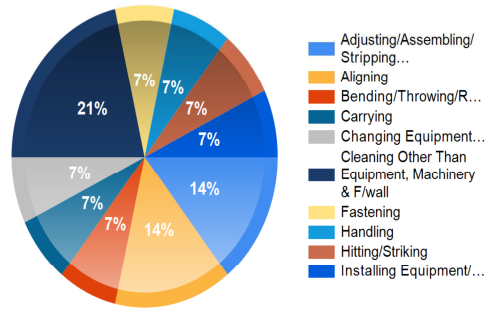
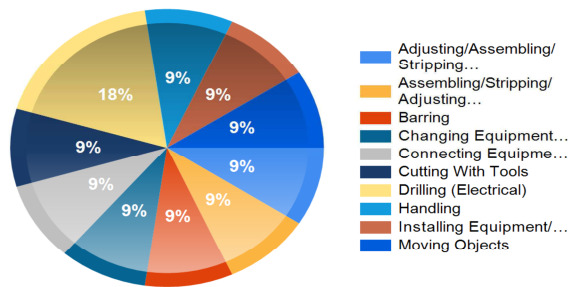**Hand Tools/ Equipment Handling - Top 10 Activities Performed**

Figure 12: **Top 10 activities performed by people in Anglo American Platinum mines**

Source: http://www.angloplats.com

As indicated above, 14% of the slip and fall incidences happen during patrolling with 21% of incidents in material handling happening whilst people are working with machinery on the footwall and 9% of the hand tools injuries happen when people are using the tools to cut. These numbers demonstrate a lack of planning, risk assessment and focus when doing the job. Most people, including those that participated in the questionnaire, believe that the majority of accidents could be prevented through people following correct procedure and adhering to standards, but there are cases like the so called 'acts of God' where people have no control in the working place like an earth movement and massive rock falls. Despite this, some operations or organisations have

proven that organisations can operate accident free. Root cause analyses show that organisations can be accident free.

The other contributing factor to behaviour is the manner in which management carry themselves or behave when around subordinates. If managers could learn to start showing or demonstrating care towards others, until they begin to get to know and acknowledge the different cultures and backgrounds that exist in an operation they will fail to notice how the behavioural patterns that exist or that could be developing within the organisation spread to almost the entire organisation which is often referred to as the butterfly effect. This is where the application of system thinking becomes more real than anything as it is all about the reaction to the failure of natural science when confronted with complex real world problems (Jackson, 2000).

In cases where management puts pressure upon employees to complete certain tasks because they are chasing production targets, this added pressure may result in injuries due to fatigue and lack of concentration. By ensuring that all parties are aware of the dangers associated with the task and by understanding the best practice to undertake the task then a safe working situation should be achieved. This happens when people are more aware of their surroundings and have a clear mindset.

Yes, most of the injuries are preventable and there are always some that will need to be engineered out. It is best to create a hazardous free working area or if it can't be hazardous free then have pro-active controls in place to prevent injury, preferably physical and audible controls. Most accidents happen due to a chain of events that went wrong and if one link could be taken out of the chain the incident could be avoided.

4.3.8 **Is Zero Harm evident**

The Zero harm vision will only succeed when it is shared by all in the organisation not just amongst senior management only. Most organisations have brilliant systems and procedures in place but what is missing is the implementation strategy. Considering safety statistics and performance amongst some operations, it proves without a shadow of doubt that Zero Harm is possible - but there still is room for improvement.
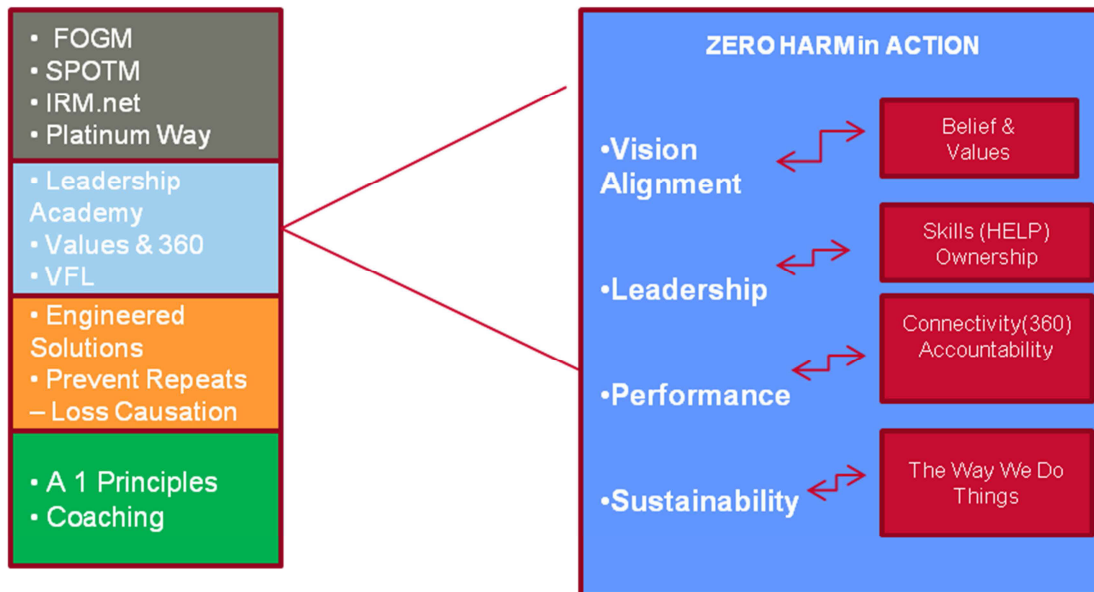

Figure 13: Zero Harm in action

Source: <http://www.angloplats.com>

If system thinking is about the interaction and interconnectedness of the parts and the way we do things then the Zero Harm in action as laid out on Figure 13 is the correct way of applying systems thinking in organisational safety (Jackson, 2000). Figure 13 demonstrates the interrelationships in various scenarios. There is a general perception that mining is a dangerous working environment and that accidents are part and of the mining activities. However, it has been proven worldwide and in different industries that Zero Harm can be achieved, irrespective of the risk profile.

4.3.9 **Should something more be done?**

Current initiatives are as good as the level of buy-in from employees. Organisations still need to master the art of involving employees when new initiatives are being developed and decided upon as these are the very same people who can make it work. 'Seeing is believing' is an old expression that stands true for the phenomenon where senior management visit employees underground as often as possible and engage with them as they conduct their VFL (visible felt leadership) tours. Talking to senior management and seeing them in worker's environments, having donned the underground gear and not in their corporate suites, goes a long way in affecting employee's attitudes as there is a sense of belonging and a buy-in to what management preaches. It must be noted that an employee with the right attitude and correct frame of mind toward safety does so much good in preventing accidents; maybe this is rather where the focus should be.

When planning has been done and checking if the plans can be effective is also complete then what is lacking is putting all these into action. Organisations have high tolerance levels, improvement is required in addressing skills shortages and insufficient training for quality. Effective disciplinary processes must be pursued in order to avoid repeats and to ensure long term success. Michael C. Jackson (2000, p.1) says *"Complex problems involve richly interconnected sets of parts and the relationships between the parts can be more important than the nature of the parts themselves"*.

Employees are the greatest asset for any organisation, therefore is it of the outmost importance that management find a way to get the operators at the face to believe in Zero Harm and also to get them to understand the reasons behind what management is trying to achieve and why?

4.4 **General comments and conclusion**

System thinking is strong in managing problems and bringing about desired change (Jackson, 2000). The mining industry in South Africa is doing much better in controlling safety in mines compared to countries like China where it is believed that it contributes 80% of mine deaths around the world each year.

Employees always strive for the incentive-based goals. If incentives are paid for production and not for safety, production will always be a goal to strive for. Safety rewards/incentives should be an everyday thing and these should not be awarded only at the end of a bonus period 'providing the employee has survived'. Sometimes 'safety' or 'working safe' is preached out of context such that employees think it comes automatically. Employees must be made aware that they must put an effort into achieving work safely. It can be concluded that the introduction of production bonuses contributes a lot to the continuous unsafe behaviour of mining workers. It is very difficult to strike a balance between incentivizing people to do their best compared to paying them a fair wage considering all risks involved. Management seem to be able to get the message to supervisor level, but for people that are driven by production bonuses, meeting production targets becomes the prime objective, often to the detriment of safety. Richards (1996, p. 135) made an observation that sometimes management's drive for production together with tough stance on safety, contributes immensely to unwanted consequences, therefore it is accurate to say that senior management is faced with a messy situation rather than a structured problem (Ackoff, 1978).

It is believed that the use of systems methodologies can help management to deal with complex situations by enabling them to recognize their own assumptions and values that they bring to the enquiry (Midgley, 2000). Safety is everyone's responsibility and everyone must demonstrate the acceptable attitude towards safety at work, on the roads and at home. There is still a long way to go with regards to reaching Zero Harm in our work places but over the years a noticeable improvement has been accomplished. The one thing that is common in life is change and resistance to change is still a massive factor in our journey to Zero Harm. Until this resistance to change factor (RC factor) is

dealt with in the working place, or the new ways of thinking (system thinking theories) have been embedded in people's minds, those who firmly believe in Zero Harm have a great challenge ahead, but this challenge is one that is exciting and holds major benefits for all persons wanting a safer working environment and a better future for all.

Like any other organisation, Anglo Platinum has good safety topics and it strives to enhance safe working conditions but the challenge is implementation. It could serve the organisation well if they were to involve the underground workers in workshop / brainstorming sessions to understand their concerns and issues regarding safety implementation systems and initiatives at ground level.

There are three other factors that influence safety, namely discipline, attitude and behaviour. Organisations can have the most modern and updated equipment and machinery and good housekeeping, but if the three factors mentioned are lacking accidents will continue to happen. Safety is in the mind and as soon as people realize that they are responsible for their own safety, safety in general will improve. But people tend to think it is someone else's responsibility. Safety is in general a 'common sense' issue; everyone should primarily look after his / her own safety first before expecting the organisation to look after their safety.

Chapter 5: Recommendations and conclusion

5.1 **Introduction**

This chapter is the last for the research and it is aimed at giving the conclusions on the full research findings and emergent hypothesis together with recommendations for consideration should any researcher wants to pursue the matter in future. It is common knowledge that the mining industry is associated with serious and fatal injuries. A number of initiatives including but not limited to hazard and operational studies (HAZOPS), risk management, stakeholder involvement and disciplinary sittings for none adherence are not yielding the desired results to convince the public at large that something is being done.

The research focused on safety in mining organisations with much focus on the Anglo American Platinum (Pty) Ltd. It is still concerning for every stakeholder and the South African society at large that the mining industry is forever reporting a high number of serious and fatal injuries every year.

5.2 **Summary of theory**

The aim of this research was to determine whether or not the application of systems thinking in organisational safety can be beneficial and can help reduce the high and unacceptable safety- related serious and fatal injuries. In an attempt to satisfy the aim of the research through the use of soft systems methodology to try an enquire and also action improvements for the formless dilemma of safety in the mining industry in general together with Anglo American Platinum in particular were analysed to understand the background to the current situation and also to determine what kind of undertakings the organisation is conducting to address the issue at hand (Checkland, 1981, 1999).

Through the application of soft systems methodology, using techniques like rich picture, CATWOE and others, it was possible to identify means and ways of tackling real and messy problematic situations that hinder progress in the Zero Harm initiative. Bob

Williams (2005, p.2) says '*the application of soft systems methodology assists in comparing the world as it is now and what it might be in future*'. The organisations strategies, systems and initiatives are proving to be valuable even though it must be said that there is still a long way to go in addressing all issues.

Checkland (1981, p. 214) made an observation that the world consist of complex interacting systems. The business world can be referred to as a complex system that involves transformation of raw resources into end products and services in order to meet customer needs for profit (Strydom, 2007). The same holds true for mining organisations, they transform all the ore that is dug underground, process it to a finished ounce of platinum or bullion of gold to satisfy the market needs for the product. All these processes, the digging underground, the processing and smelting and the packaging is done by resources that include human beings, therefore it is imperative that the environment be made safe for the production of these products. The organisations themselves are managed by people who when they wake up in the morning to go to work, they have hope to return back home to their families in safety. Success or failure of the organisations is heavily dependent on the organisation's ability to attract, develop, retain and motivate the properly skilled employees – the human factor drives everything these days (Kreitner, 2007).
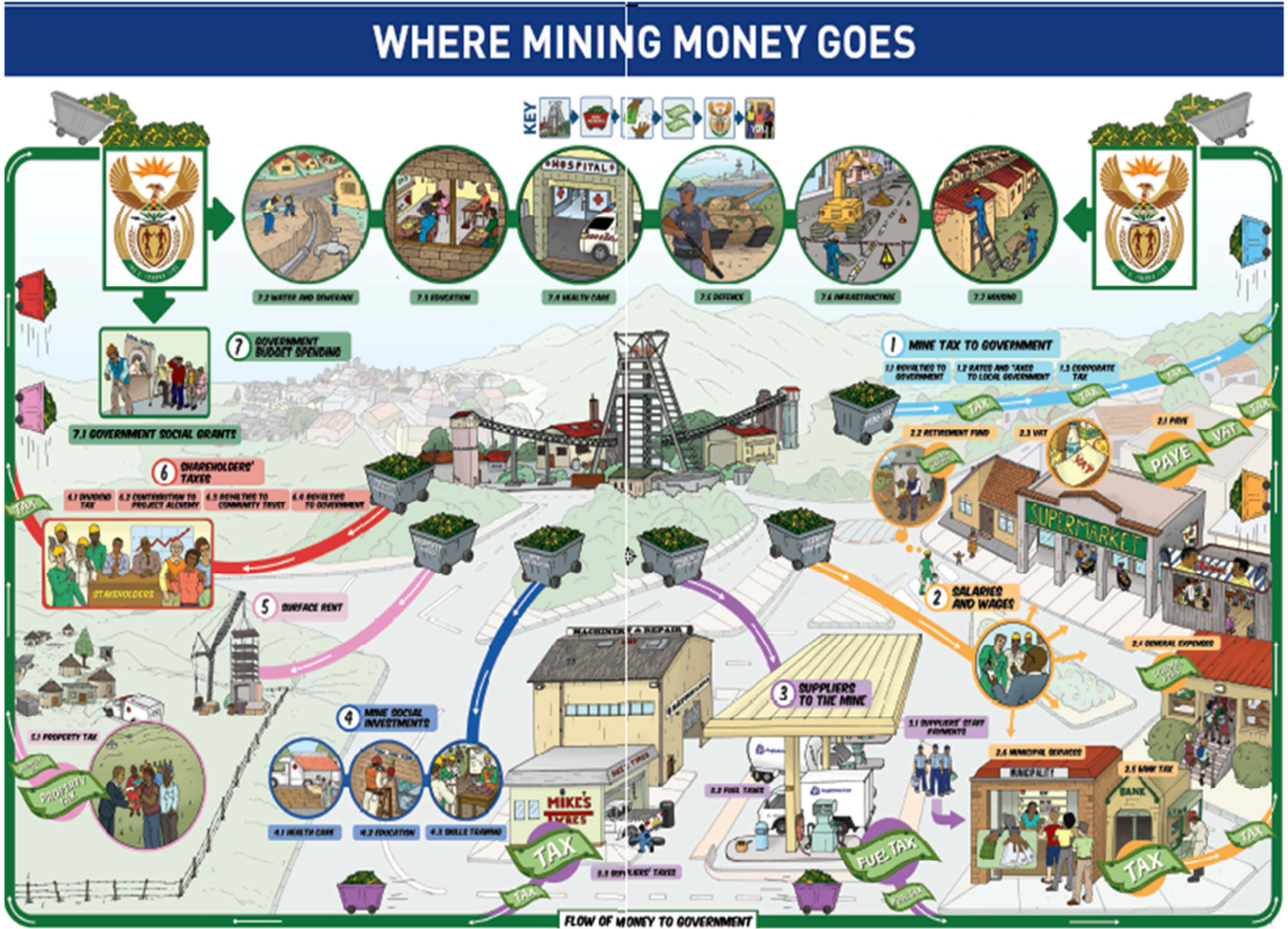
Figure 14: Rich picture detail where Mining money goes.

Courtesy of Tswelopele newspaper (Angloamerican Platinum)

5.3 The general organisation's environment

A rich picture represents an holistic view of a situation as perceived by the person analysing it, showing how constituent elements all fit together (Steward, 1995). As much as the organisations exist to make profit, they regularly touch human lives, they provide employment, they have a social responsibility to educate, remunerate in order to feed and inform stakeholders. These can be achieved through effective communication processes like the soft systems methodology's rich picture which presents a mechanism to learn about complex problems as depicted on Figure 14. Some organisations do more than most people can comprehend, as demonstrated in the picture above which was adopted from the educational Anglo Platinum's Tswelopele newspaper for this study. Profits or money made by the mining organisations flows out to different sectors of the society, e.g. building clinics, supermarkets, roads and infrastructure, safety and wellness including training and development amongst other activities. Some good public relations exercises and community involvement by these organisation to educate the public in what they do and how much they contribute to the wellbeing of the community could have a huge impact on the manner in which the society views mining organisations which will also positively change the attitudes towards the employees.
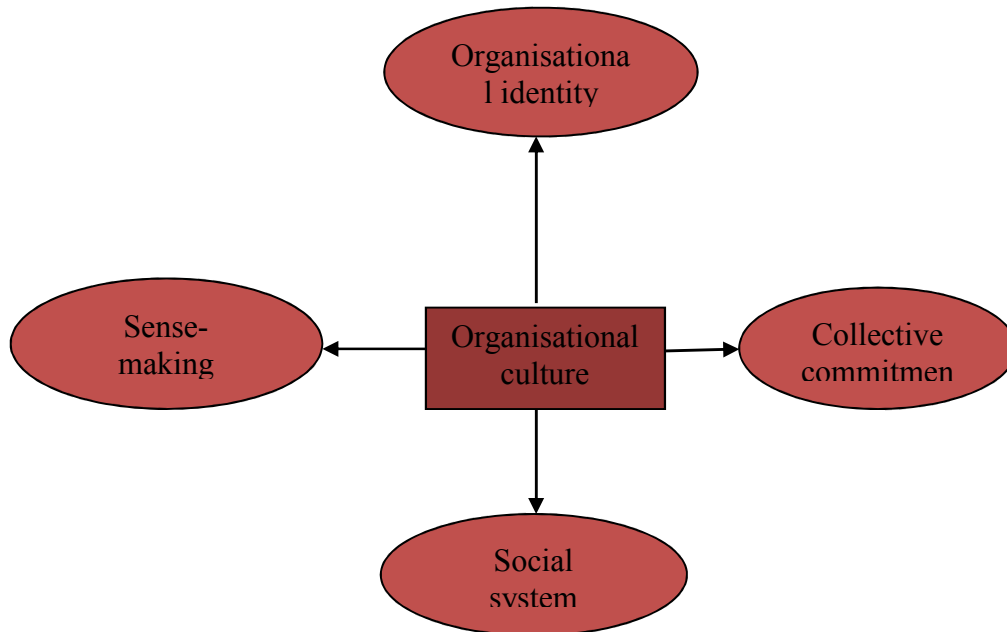
Figure 15: **Collective commitment** (Courtesy: KREITNER, R. 2007. p. 81. *Organizational behaviour,* New York, McGraw-Hill)

The manner in which mining organisations distribute their wealth into the society in which they operate is a function of the organisational culture which fulfils the four functions as depicted on Figure 15. It gives members some form of identity where employees identify with the organisation's ways of doing things, This smoothens the progress for collective commitment, it promotes social system stability which is the extent to which the work environment is viewed in an optimistic light and lastly it shapes behaviour by helping society members make sense of their surroundings. This is achieved through employees and the society at large understanding why the organisation is doing what it does (e.g. mining activities in the area) and they support it fully without compromising what the organisations value (Kreitner, 2007).

In analysing the data, it was found that there are countless issues pertaining to amongst others, behaviour, and management's attitude towards safety, and communication that doesn't get to the actual workers who are carrying out the very act of mining. The most critical element of any organisation is the fact that it has human beings which brings into

play the political element which focuses on how the organisation is governed. The political metaphor by Morgan (1986) emphasizes the importance of relationships between the organisation and individuals which is characterised in many different ways:

Unitary

This makes reference to a well-integrated team pursuing a common goal; that of Zero Harm in the workplace. The safety strategic thrust, the Mine Health and safety Act (MHSA) and the Mining Charter, all of these elements are geared up together toward one objective, safety and wellness of the workforce in the mining industry. Organisations are like organisms that survive all the way through self-regulating mechanisms which enable them constantly to adapt to changes in the environment within which they operate, the same way as the soul gives the body some purpose to be alive (Jackson, 2000). When the organisation is functioning at equilibrium (working effectively), and it happens that the state of equilibrium is disturbed then the complex relationship between the elements will eventually ensure that either the old state is restored or a new form of equilibrium emerges. Negative feedback or self-regulation does help managers to react as they cannot accurately determine what type of environmental disturbances the organisation will face as time progresses and as they carry on with their daily activities.

Pluralist

Anglo American as an organisation has operations all over the world and employees from different nations within those operations who have different interests and backgrounds. They sometimes see the organisation as some form of association where they all come together for a common purpose – mining and earning a living. These employees get controlled through rules and policies that govern the operations together with strict hierarchical authority as if they are machines (Chapman 2005, p 30). The fact that they get treated like machines means they get to be communicated to as such and seeing that if a machines has ten different ways of breaking up, it gets to be communicated to in the ten different ways in which only the machine understands. Whether as a child or an adult, communication is a vital element of survival, therefore is important that when exercising

some form of control on a machine or an individual through communication, it must be done in a language that the machine or the individual understands. From birth the archetypes from the surroundings and individual wellsprings get activated and they start stimulating the individual from birth to start engaging actively with their environment (Smit, 2011).

Radical

Some employees think that management do not even live up to the values that are being preached as the company's values; it is believed that they are just doing what they get paid for at the expense of others, they are failing to walk the talk. It is therefore unfortunate that the very survival of the organisation is heavily dependent on the achievement of shared values and beliefs between the employees and management.

It is also visible from people's behaviour that their upbringing has formed the foundation of how they live their lives. Outside the work place one does not have the authority to dictate to people the way to live but as a company and as leaders and even co-workers it is possible for us to give advice to each other, coach and lead by example. Not everybody has had the privilege of having a safe and happy upbringing, but together people can definitely influence the outlook for the future - this requires hard work and perseverance to realize the long-term rather than the short-term benefits.

Working safe is a mind-set matter and needs to be embedded into employees' brains. Communication plays a vital role and the ability to communicate is crucial for successful safety achievement. It must also be acknowledged that human beings are prone to mistakes, all because they are human and at times they will experience what is referred to as 'human errors' when under pressure to produce. It can be argued that some people do not have mechanical empathy or intrinsic knowledge or awareness of the dangers of machinery or situations just because they have repeatedly done the same job it is now routine work and they are so used to the environment where they operate. Only others are viewed as careless or clumsy or accident prone. Legislature or rules cannot eliminate these conditions; careful exposure, mentoring and appropriate training would contribute

tremendously if executed as it should be. The main challenge is to trigger a person's knowledge with regard to a dangerous situation and to ensure that the situation is addressed appropriately. A person's background has a huge effect on gaining these skills in a time frame that will allow them to become a safe worker.

5.4 **Inventiveness and learning organisations**

Some organisations like Anglo American Platinum, have introduced an initiative called learning from incidents (LFI) which is a process that helps minimize the potential for reoccurrence of safety incidents including health and environmental matters which plays a vital role in the journey to Zero Harm. By preventing safety incidents from occurring, the organisation can create a more stable operational environment, reduce the number of production stoppages and improve productivity, which will enhance both the safety and operational performance.

The organisation has a safety incident alert tool called Incident IQ, available to all Anglo American employees who have access to the intranet. Incident IQ is a knowledge sharing searchable database that monitors both Anglo American and external safety news and alerts (from the media, safety and mining bodies and government sources). It extracts valuable safety information and distributes it directly to people's inboxes for the very reason that knowledge or information becomes important and useful only when it is used. In sports, arts and science, it has been demonstrated that team learning adds value but businesses are not there yet as there are occasional instances where team intelligence exceeds individual intelligence for the reason that when teams learn, they don't only produce incredible end results but the individuals also develop faster than they could on their own (Senge, 2006). Even though human purposes and goals continuously change, organisations operating like learning teams with a leader who formulates a bold goal have a better chance of achieving that goal throughout the challenges and adversity. Trust must also be earned all the way through visible leadership and even better when they employ systems methodologies.

5.5 Unintended implications of organisation's initiatives

i. Incentive bonus system

The incentive bonus can easily result to unintended consequences as employee's main focus turn to the bonus than safe production to ensure they get their bonuses safely; these are new discovery or learning for companies like Anglo and any other organization.

ii. Introduction of values system

Anglo's intentions were excellent when the values were introduced but like any other organisation the implementation therefore becomes the difficult part where emergent subsystems manifest themselves like the clash of upbringing values and organisational values, for example you get managers who will tell all the "right stuff" during training, but once at their working places, they change their tone and it is a case of production, production and more production, safety doesn't take precedence in work done.

5.6 Recommendation

Safety in the early 20th century and before was never a priority as it is in the 21st century. Vulnerable, desperate and uneducated people in those days were exposed to underground working conditions that were hazardous every single day; it was required of them to think about the tasks at hand and also to apply their skills from the training received from the mine. The working pressures for those people on the face are very high and they had to keep personal focus and apply what was learnt during training that was received to avoid injuries. Learning is grounded in and it transforms experience gained over the years, therefore training, skill, ability, willingness and application of standards and common sense is very important for a safe operation as evidenced by those organisations who have achieved more than two decades in the mining environment without any incidents.

Statistics shows that accident rates have increased or have reached a plateau and serious injuries and fatalities are slowly dropping. Even though there are still dramatic cases like

the BP Texas disaster, that had excellent safety statistics and suddenly experience a multi-fatality event (Corrie, 2010), the numbers are showing a steady decline compared to decades ago.

Table 5: Weekly fatality statistics for the mining industry

Commodity	Fatalities*		
	Actual		
	01/01/2011 - 15/10/2011	01/01/2012 - 15/10/2012	% change
Total	94	80	-15
Gold	41	37	-10
Coal	9	9	0
Platinum	26	22	-15
Other	18	12	-33

* Provisional figures

As can be seen in Table 5 above, the actual fatality comparison between 2011 and 2012 shows an average of 15% drop which means a lot of work still needs to be done on the Zero Harm journey. The mining industry does need transformation as called for by the South African government. At the same time it is currently facing challenges that require interventions from all stakeholders including the society at large. This can be ensured through the application of systems thinking theories and methodologies which ensures that it comes together without force (Jackson, 2000). The country's economy is heavily dependent on mining as it contributes a high percentage to the country's GDP.
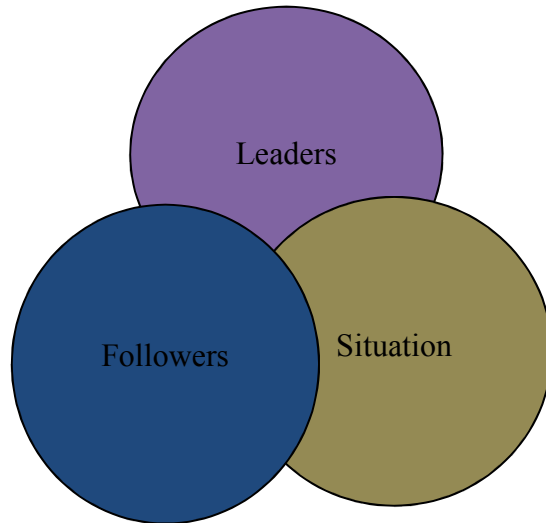
Figure 16: Hersey and Blanchard's model (Courtesy: HERSEY, P. 1993. *Management of Organizational Behavior: Utilizing Human Resources,* Englewood Cliffs)

The leaders in the mining industry together with the country's leadership need to work together in trying to resolve safety issues in the mining industry as depicted on Figure 16: Hersey and Blanchard's model above. Situations and events will always emerge, however it is up to the leaders to come up with relevant strategies that will align the follower's energy to adjust themselves to dealing with the changes in the environment. This can be achieved through leading by participating, where the leaders don't only tell what, how, where and when to do something but share with their followers in decision making with their main role being that of facilitating and communicating (Hersey, 1993).

5.7 Conclusion

Research conducted through participation is often socially relevant as it involves stakeholders who are part of the problem situation and also they form part of the hypothesis that emerges from the interaction that drives required changes in that situation (Reason and Bradbury 2001). This research investigated the application of systems thinking methodologies and theories in organisational safety. It has been demonstrated

that Anglo American as an organisation has to some degree applied the systems methodologies though there are a number of areas where more can be done.

A substantial effort to reduce the accident and fatality rates has been made by Mine management. This they have done by adopting measures within the traditional framework of the mining organisations (Simons, 1960). Over and above such achievements, the introduction of initiatives like the learning from incidents database can help bridge the gap between normal accidents theory and high reliability theory (Cooke, 2006). Most of the incidents are as a result of a chain of events which could have been detected and prevented if such learning systems had been in place on time. According to Russell Ackoff (2006), we can learn from mistakes if identified and corrected. The airline industry together with the energy industry specially those organisations that operate the nuclear systems have for a long time had some form of learning system (e.g. black box and others) but the mining industry has not been proactive in that area and it is therefore difficult to draw conclusions on the effect of the learning system as the researcher could not access any literature or evidence to assess impact to date.

In systems thinking, the underpinning obligation is to be holistic in approach and to ensure that the theory covered is realistic and can be applied in the organisations without any difficulties. Steward and Fortune (1995, p.279 - 286) claim that the two most important steps of good management are the ability to identify potential risks and to take action to avoid them. Managers can now focus on those issues that incite behaviour that leads to specific events compared to reacting after events have happened as was previously the case. This research has demonstrated that organisations can successfully apply systems thinking theories and methodologies to address complex challenges like safety which embraces a number of aspects of life from human behaviour, values and cultures, legacies of the past, belief systems and the environment where these organisations operate. It has also demonstrated that learning together can improve the organisation's knowledge base and as learning organisations they can share lessons learned.

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APPENDIX A: Research questionnaire and percentage responses

Question	YES	NO	SOMETIMES
Are you concerned about organizational safety?	**90%**	0%	10%
Are you doing something about safety every day?	**67%**	9.09%	21%
Have you ever noticed an unsafe act/condition?	97%	0%	3%
If yes, have you corrected or act on it?	69%	15%	15%
Do you think people's background/upbringing has an effect on organizational safety?	81%	6%	4%
In your opinion, is illiteracy a contributor to none compliance and injuries?	**48%**	18%	33%
Does any of the company initiatives/systems/procedures/policies add value?	**88%**	0	15
Do you believe that management, care about safety or they are just doing their job as long as no one gets injured, its business as usual? ?	**45%**	15%	36%
Do you believe your colleagues are conscious about safety in the organization?	**76%**	3%	21%
Does any employee in general have control of his/her safety?	**79%**	0%	21%
Do you think underground employees perceive themselves to be at risk every time they undertake to go down the shaft to start their shift?	**45%**	15%	33%
experienced in the operations?	**91**	0%	9%
Do you believe that the majority of accidents could be avoided/prevented?	**94%**	3%	3%
Do you believe that 'Zero Harm' is possible in any operation?	**76%**	21%	3%
If "Zero Harm is possible" is it evident enough?	**21%**	46%	21%
Are the current Anglo American Platinum's safety initiatives enough?	**48%**	42%	12%
Should something be done to enhance current initiatives?	**85%**	9%	3%

APPENDIX   B: Ethical   clearance

UNIVERSITY OF
KWAZULU-NATAL
INYUVESI
YAKWAZULU-NATALI

27 June 2011

Mr JE Nkuna (208523587)
Leadership Centre
Faculty of Management Studies
Westville Campus

Dear Mr Nkuna

PROTOCOL REFERENCE NUMBER: HSS/0390/011M
PROJECT TITLE: Application of Systems Tools in Organisational Safety

In response to your application dated 22 June 2011, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol has been granted **FULL APPROVAL.**

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment /modification prior to its implementation. In case you have further queries, please quote the above reference number.
PLEASE NOTE: Research data should be securely stored in the school/department for a period of 5 years.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

Professor Steven Collings (Chair)
HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE

cc. Supervisor : Prof K Pillay
cc. Mrs C Haddon

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