



Illegal mining's effect on the sustainability of a South-African Gold mine

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ABSTRACT

Gold mining is one of the cornerstones of the South-African economy, to an extent that the South-African gold mining industry was directly responsible for the establishment of the Johannesburg Stock Exchange (JSE) in 1887. Despite its importance to the economy, the gold mining industry is facing severe challenges of which the growth of illegal mining is one. Failure to understand the role that illegal mining plays on the sustainability of mining companies is detrimental to the sector, economy, and country as a whole.

The study investigates the effects of illegal mining on the sustainability of a gold mine. The problem of illegal gold mining continues to worsen with no viable solution in sight. The Government lacks the capacity to enforce laws and regulation that would have restricted the problem. The phenomena of illegal mining is further complicated by the existence of benefits to communities and prevailing socio-economic challenges despite efforts by the mining sector in advancing a narrative that the benefits are far outstripped by the costs, in particular, the sustainability of a gold mine. A qualitative study comprising of a convenient sample of 6 participants, allowed the study to reach a point of saturation. Semi-structured interview questions, with the aid of an interview protocol, were self-administered to the participants who are managers of a single gold mine.

The study concludes that the effects of illegal mining on sustainability are mostly negative and they include threats to the safety of miners and communities, destroying of the environment and along with it the socio-economic well-being of the surrounding communities which are important tenets of sustainability. The detrimental activities by illegal miners include unregulated conflicts that results in killings, hazardous handling of explosives, unsustainable handling of the geology and damage to the environment. Resolving the problem effectively requires that mining companies increase their engagement and investment as an alternative to costing in the problem and expecting the incapacitated Government to deliver on the solution.

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KEY TERMS

- Artisanal and small-scale miners
- Environment / Ecology
- Illegal Mining
- Illegal miners (Zama-Zamas)
- Mercury
- *Modus Operandi*
- Social Equity
- Social License
- Sustainability

LIST OF ABBREVIATIONS

- ASM - Artisanal and Small-scale Miners
- DMR - Department of Minerals and Resources
- JSE - Johannesburg Stock Exchange
- MPRDA - The Mineral and Petroleum Resources Development Act No.28 of 2002
- OHSA - Occupational Health and Safety Act
- PWC - Price Waterhouse Cooper
- SAPS - South African Police Service
- WHO - World Health Organization

CHAPTER 1

NATURE AND SCOPE OF THE STUDY

1.1 INTRODUCTION

Sustainability of gold mines in South Africa is under threat from a number of factors. According to Neingo and Tholana (2016:283) in addition to global challenges the South African gold mining industry has to face other operational challenges that are unique to the country and which threatens the survival and competitiveness of the industry. One of these factors is the growing number of illegal miners in South Africa. The South African Human Rights Council (2015:9) observed that up to 30 000 people were involved in illegal mining for 10 years, and it is increasingly becoming more complex. Illegal miners have moved on from operating only in abandoned mines, and appear to be especially prevalent where improperly sealed underground tunnels meet operational tunnels of current gold mining companies (Harvey, 2014).

Illegal mining is slowly becoming one of the growing socio-economic problems facing South Africa, and according to the Chamber of Mines (2016), illegal mining activities are increasing. Phala, Mistry and Matlala (2017:57) define illegal mining as conducting mining activities without a permit or license from the Department of Mineral Resources. Dozolme (2016) broadly proffered illegal mining as the absence of land rights, mining license, exploration or mineral transportation permit or of any necessary documentation that could legitimize the mining.

The term sustainability has been widely debated in recent years. Organizations, society and an increasing number of consumers are becoming aware of the sustainability concept. Sukitsch, Engert and Baumgartner (2015:1505) define the concept of sustainability as meeting the needs of an organization's direct and indirect stakeholders, without compromising its ability to meet the needs of future stakeholders. On the other hand, Flint (2013:26) defines sustainable development as improving people's life-enabling habits to meet our needs in the present without compromising the ability of future generations to meet their own needs. The livelihood and sustainability of gold mining companies are seriously compromised in cases

where illegal and legal miners find themselves operating in the same space and time. The effects of illegal mining could, therefore, be viewed from several contexts, of which the sustainability of gold mines is one of the more pressing contexts of interest.

Gold mines play an important role in the South-African economy, and as such their sustainability is a greater issue of importance for the South-African economy. The mining sector contributes a significant 7.3% to the South-African gross domestic product (GDP) (Chamber Of Mines Of South Africa, 2016). According to the Chamber of Mines (2016:9); PWC (2017:9) the gold mining sector directly employs 115 822 employees making it one of the leading employers and contributes about 16% of mining sector's revenue which was about R 69 billion in 2016. The sustainability of gold mines, therefore, is topical and will generate considerable interest to policy makers and decision makers especially if considered the negative role that illegal gold mining can play. It is within this background that this study investigates the effects of illegal mining on the sustainability of South-African gold mine.

1.2 BACKGROUND OF THE SOUTH AFRICAN GOLD MINING INDUSTRY

Gold mining is one of the cornerstones of the South-African economy, to an extent that the South African gold mining industry was directly responsible for the establishment of the Johannesburg Stock Exchange (JSE) in 1887 (Lukasiewicz, 2013:3). During the course of the last century, South-Africa produced almost 40% of all global gold ever mined, with 1970 being the best production year, producing a 1000 metric tons which equates to more than 75% of global production that year (Gold Fever Prospecting, 2018).

Due to the discovery of the world's largest gold deposit in the Witwatersrand, South Africa has experienced a major gold rush, with wealth-seekers flocking into the country from all over the world in search of gold. This Gold rush caused huge influxes of different nationalities, which directly contributed to South Africa's cultural, political and economic identity. Gold discovery in the country also triggered the South-African war, also known as the second Anglo-Boer war (1899-1902), which could only be described as terrible and destructive (SAHO, 2017). More than 100 years later and the Gold mining industry and the South-African economy is faced once again with a war, that

of illegal mining. This conflict between Government, Mining houses and illegal miners is a serious threat to the economy and business sustainability of gold mining companies. According to Harvey (2014), it has become apparent that illegal miners are not only operating on abandoned shafts but are more and more starting to infiltrate legal operating mines.

1.3 PROBLEM STATEMENT AND CORE RESEARCH QUESTION

Illegal mining occurs throughout South Africa and it has become a widespread problem in the backdrop of unfavourable commodity prices and worsening socio-economic conditions. The outcome has been the squeezing out of profitability in mining companies and the increasing number of illegal miners in the sector respectively. The mining industry is directly responsible for about 16% of all foreign direct investments into South-Africa, the second largest employer after agriculture and a significant contributor to the country's GDP at 8% (The Federation For a Sustainable Environment, 2018). Despite its importance, the industry is facing severe challenges of which the growth of illegal mining is but one. There is a growing discourse in South-Africa on the future role of illegal mining, particularly seeking to give answers to the question of sustainability of gold mines.

Illegal mining creates conflict between gold mining houses and illegal miners. Conflict is inevitable where two opposing groups are mining the same resource at the same location. The conflict is likely to negatively influence sustainability and viability in gold mines. Failure to understand the role that illegal mining plays on the sustainability of mining companies is detrimental to the sector, economy and country as a whole. Unsustainable gold mines threaten the investment stock, employment and slow down economic growth. Thus the question of the sustainability of mines, in particular, gold mines is one of interest to researches, decision makers, policy makers and the general public. This study investigates the effect illegal mining has on the sustainability of gold mine. Thus the aim is to inform policy makers, decision makers, academia and practitioners in an effort to help contain illegal mining in South-Africa.

1.4 RESEARCH OBJECTIVES

The research objectives are split into primary and secondary objectives.

1.4.1 Primary Objective

The objective of the study is to investigate the effects of illegal mining on the sustainability of a South-African gold mine.

1.4.2 Secondary Objectives

To achieve the primary objective of the study the secondary objectives are.

- To describe the meaning of sustainability to a gold mine
- To explore the susceptibility of sustainability in a gold mine to illegal mining activities.
- To establish the illegal activities that are detrimental to the sustainability of a gold mine.
- To recommend a way forward for gold miners to deal with illegal mining activities.

The ultimate aim of this study, is to provide decision makers and management with a basis that maps the influence of illegal mining activities on gold mining sustainability. From this basis it will be determined if illegal gold mining has any effect on gold mining sustainability. Using the theoretical concepts and the results of the investigation, a possible approach towards illegal mining for gold mining companies may be suggested.

1.5 IMPORTANCE AND BENEFITS OF THE PROPOSED STUDY

The importance and benefits of the proposed study are rooted in the stakeholders of the study which includes academia, policy makers, decision makers and the general public. To academia and researchers, the problem of illegal mining and sustainability of gold mines requires a continuous update on what reality and knowledge is. This study provides the update by examining the body of knowledge and empirical data. Policy makers such as Government and the Chamber of mines must come up with

viable policies and regulation as there might be missed opportunities in the phenomena of illegal mining. The research contributes to the information required to make effective policies that regulates this phenomena. Decision makers are mandated to keep mining companies sustainable. The outcome on the study of the effect of illegal mining on the sustainability of a gold mine will serve decision makers in their mandate to ensure sustainability of mining companies.

Investment is important to the growth and development of the South-African economy as well as to combat unemployment. Mining companies' yields taxes for the Government and therefore can be considered as a valuable contributor to the national economy. Knowledge that enhances investment, economic growth and employment, benefits the general public directly.

1.6 DELIMITATIONS AND ASSUMPTIONS

1.6.1 Delimitations (Scope)

This study is limited to employees from a single gold mine who will be conveniently sampled. Generalisation off the study's outcome will be constraint with the qualitative research design method. The design method utilizes small samples which were conveniently selected. Generalisation will only be possible within the group represented by sample participants.

1.7 ASSUMPTIONS

In this research project, the assumption is that illegal mining do impact mining companies negatively, thus threatening sustainability. The aim of this research is to test this assumption, and if found to be true, the research will also seek to explore to what extent does illegal mining impact mining sustainability. The research will also explore what can be done to reduce the impact, by mining companies properly sealing off mine shafts to limit access to the illegal miners.

1.8 RESEARCH METHODOLOGY

1.8.1 Empirical Research

To accomplish the research objectives of this study, empirical research was done on a single South African gold mine. Gold mining operations, exploration and sustainability experts from the mine were approached to participate in this study. In order to obtain an in-depth understanding on the effects of illegal mining on the sustainability of a gold mine a combination of descriptive, exploratory and cross-sectional enquiries utilizing a qualitative research method were utilized. Thus this study is designed to collect and analysing opinions, attitudes and beliefs of gold mining experts with regards to the effects of illegal mining on the sustainability of the gold mine.

The primary data was then collected in the form of semi-structured interviews. These interviews provided room to the researcher to highlight critical and emerging areas of the research on illegal mining's effect on gold mining sustainability. The semi-structured interview was self-administered with the aid of an interview schedule. All interview data were transcribed and coded which led to the creation of themes. The coding was a manual process and no software were utilized. The transcripts were also sent to a qualitative expert to ensure credibility of the researcher's content analysis. The results from participant's responses were then used to establish whether illegal mining activities does effect gold mining sustainability. Once established that illegal mining does have an effect on sustainability, the study will attempt to provide mitigating alternatives to decision makers.

1.8.2 Limitations

1.8.2.1 Literature and Theoretical review

A literature review was done in the area of gold mining and factors threatening its sustainability. Special attention was given to the phenomena of illegal mining as one of the factors placing mining sustainability at risk. The following topics are covered in the literature study:

- History and background of the South African gold mining industry
- The Definition and relevant elements of illegal mining
- The Definition and relevant elements of sustainability
- Sustainability of a gold mine
- Illegal mining threatening mining sustainability
- The rise of the illegal miner
- Arguments against illegal mining
- Illegal mining's impact on surrounding communities
- Arguments in favour of illegal mining
- Modus operandi of illegal miners

The literature review was conducted utilizing a wide range of appropriate published journals, various websites, electronic and news articles.

1.8.2.2 Research

This study does exploratory research on illegal mining's effect on gold mining sustainability and was limited to the opinions and beliefs of experts from a single South African gold mine.

1.9 LAYOUT OF THE STUDY

The mini-dissertation is divided into five chapters, which will be presented as follows:

- **Chapter 1: Introduction and problem statement**

This chapter discusses the background, context of and causal factors to the study as well as the problem statement. The primary and secondary research objectives for the study is presented. It also presents an overview of the research design and layout of the next chapters.

- **Chapter 2: Literature review**

This chapter investigates, through a literature review, the phenomena of illegal mining and sustainability of a gold mine. Definitions of illegal mining and sustainability is provided and arguments for and against illegal mining are also reviewed.

- **Chapter 3: Empirical Research and Findings**

This chapter presents the research methodology by discussing the sampling methods used as well as the compilation of the survey instrument, the interview guide including the actual interview process, the study participants and the data collection. The results and findings of the investigation are also presented and discussed in this chapter. The chapter also presents the results from transcribed interview data. Themes were created for the investigation and are also presented and discussed.

- **Chapter 4: Conclusions and Recommendations**

The conclusions of the study based on the literature review and empirical investigation as well as recommendations for further study is presented in this final chapter.

1.10 MANAGERIAL IMPLICATIONS

Illegal mining may not support positive outcomes for a gold mine. It is incumbent upon managers to maintain positive outcomes for the mine and to do so managers need to understand the phenomenon of illegal mining. It is also incumbent upon managers to maintain the sustainability of the mine. The study informs decision makers on how to manage the factors associated with the phenomenon of illegal mining in order ensure sustainability of the gold mine.

1.11 CHAPTER CONCLUSION

There is a growing increase in illegal mining activity against the ever present challenges in the mining sector. The growth in illegal mining is likely to, have a negative impact on the sustainability of Gold mines. The study investigates the effects that illegal mining has on the sustainability of a gold mine. The outcome of this study helps to inform decision makers, policy makers and researchers on how to deal with the increasing phenomenon of illegal mining in central South-Africa.

1.12 CHAPTER SUMMARY

The chapter serves as a blueprint for the rest of the study, portraying the chapter layout, research methodology, scope and limitations, research objectives and managerial implications. With the resources sector being under severe pressure globally for the last couple of years it has become pivotal that the mining industry applies critical thinking in order to be sustainable. The mining industry will need to reinvent themselves and the mining models if operational effectiveness is to be achieved and this could only be accomplished through innovation, technology, forward thinking and lean management principles. All of the mentioned factors are well in the control of the mining houses and success will be determined by each organization's application of these factors. However, there are multiple factors outside of the control of mining companies that threatens their economical livelihoods, one of these factors is illegal mining. Using the theory principles and the empirical results, this study aims to determine what the effect of illegal mining is on the sustainability of a South African gold mine.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

In this literature review, the discussion is focused on the two primary areas of the study which are illegal mining and the sustainability of a gold mine. The primary study areas are broken down into secondary study areas that helps shape a rigorous, relevant and robust literature review of the investigation. The definition of the primary study areas are discussed in the next section.

2.2 THE SOUTH AFRICAN GOLD MINING INDUSTRY

Over the last century, gold mining has become an important part of economic activity in South Africa. Over 50% of global gold reserves can be found in South Africa (Africa Mining IQ, 2018). Gold mining is an integral part of the South African economy, contributing 7.3% to the South-African GDP (Chamber of Mines of South Africa, 2016). The gold mining sector for many years commanded the position as the top employer. In recent times it has been overtaken by the agricultural sector but gold mining remains important to the country. According to the Chamber of Mines (2016:9) and PWC (2017:9), the gold mining sector directly employs 115 822 employees, making it one of the leading employers and contributes about 16% of the mining sector's revenue which was about R69 billion in 2016.

Over the past three decades, gold production in South Africa declined significantly. According to Stats SA (2016), gold production has declined 87.5% since 1980. Figure 2.1 below shows the decline in gold production.

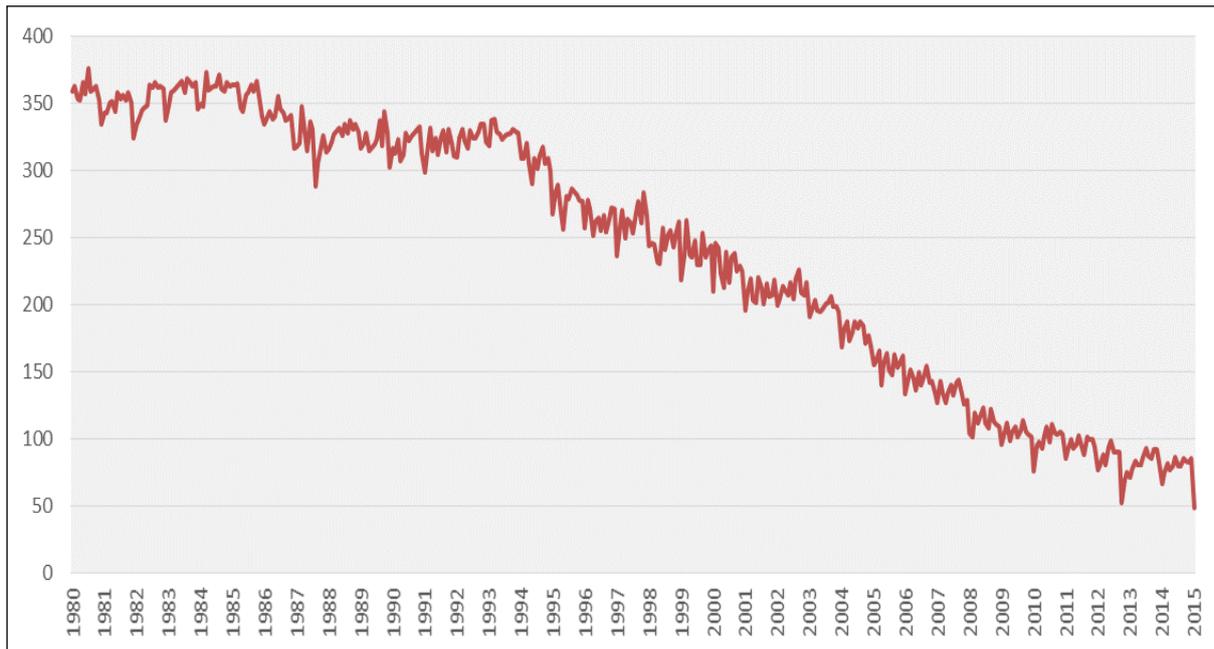


Figure 2.1: Monthly gold production index, 1980-2015 (Base: 2010=100). Source: Statistics South Africa (2015).

The decline in the gold mining sector highlights the importance of sustainability discussion amongst gold miners. Importantly so, because sustainability assurances by gold mining companies helps to secure social licenses to operate. A social license to operate is described in Moffat, Lacey, Zhang and Leipold (2015:1) as the demand of communities for more involvement in decision-making around operations and having expectations of receiving a greater share of the benefits from these operations. In many ways, the social licence reflects the evolving nature of the relationships between industries and the communities around the areas of resource extraction. Thus, a social license refers to the social acceptability of mining operations.

The question of sustainability becomes more important for mining companies, particularly against the chance that illegal miners may gain social licenses ahead of mining companies. This is possible as arguments in favour of illegal miners are increasing and the debate on which between illegal and legal miners contribute to visible socio economic benefits gains momentum. PWC (2017:32) argued that South Africa's own socio-economic challenges make illegal mining a lucrative alternative.

2.3 ILLEGAL MINING

There is a big body of knowledge on illegal mining, but there is very little literature on defining what illegal mining really is. There are several reasons that may explain the non-committal of academia, policy makers and practitioners. Generally, if mining activities takes place without the consent of the owners of the land or mining right, the activities can be considered to be illegal mining. The statement is in agreement with Phala, *et al.*, (2017:57) who defines illegal mining as conducting mining activities without a permit or license from the Department of Mineral Resources. In South Africa mining rights are issued by Government through the department of mineral resources. The issuing of mining permits and mining rights is administered by the Mineral and Petroleum Resources Development Act no.28 of 2002 (MPRDA). In the South African context, it is safe to assume that if anyone mines resources without the necessary permits or mining rights, that person would be considered an illegal miner. However, the mining industry and current literature does not provide a clear definition of illegal mining in South Africa. In practice, the definition of illegal mining is not straight forward. Mohanty (2018) observed that the Supreme Court in India ruled that any environmental and pollution law violations would constitute illegal mining. The ruling by the high court in this case distorts the definition of illegal mining to include permit and mining right holders who are in violation. In the South African context, illegal mining can thus be defined as the any mining activity that operates outside the legal framework of the country.

A distinction needs to be made between illegal mining, artisanal mining and informal mining. According to Strydom (2016:94) the distinction between illegal and small scale mining is that small scale mining is regulated and encouraged while illegal mining is not. Small scale mining, in South Africa is the same as artisanal mining elsewhere. It is, therefore, clear in the South African gold mining context that informal mining is synonymous with illegal mining as both exist outside the current regulation. The current discourse in Samuel, Oladejo and Adetunde (2012:38) and Eyewitness News (2018) is leaning towards the decriminalization of illegal or informal mining activities as they are having an increasingly profound role to play in the socio economic needs of communities. On the other hand, valid arguments exist against illegal mining particularly that it may taper down the benefits of legal mining. According to the

Chamber of Mines (2017), illegal mining is a serious threat to operating mines. The Mining Weekly (2017:1) reported that the South African Government is considering amending and relaxing laws for small scale miners in an attempt to combat illegal mining. The Mining Weekly (2017:1) further states that the deputy minister of mining Mr. Godfrey Oliphant is committed to finding a reasonable solution to regulate the artisanal mining sector in South Africa. This concession would only apply to surface mining and not to underground gold mining, due to the fact that underground gold mining is associated with multiple risks which may be problematic for small scale and artisanal mining.

2.4 SUSTAINABILITY

The concept of corporate sustainability has been abundantly debated over the last few years, and is starting to emerge as a scientific concept (Sukitsch, *et al.*, 2015:1505; Kocmanova, 2011:203; Milne and Gray, 2013:13). According to Bergquist (2017:5) the issue of sustainability is deeply rooted within the industrial revolution. Businesses and industries have for centuries taken advantage of natural resources to fill their needs for energy and raw materials, most natural resources are limited in nature and have a depletion date. Businesses and industries must use these natural resources responsibly in order to sustain their economic activities in future.

University of Alberta (2014:1) defined sustainability as meeting our own needs without compromising the ability of future generations to meet their own needs. According to Feil and Schreiber (2017:667) sustainability is responsible for the solution to the deterioration of the human environmental system and sustainability measures the level of quality of this system in order to evaluate its distance from sustainability. In the same manner sustainability in a gold mine means the design, construction, operation and closure of mines in a manner that does not lead to the deterioration of the human environmental system (Bergquist, 2017:5). Sukitsch, *et al.*, (2015:1505) stated that the intense focus on and implementation of sustainability can support long-term business success as well as contribute to improving living standards. The sustainability of gold mines, particularly in South Africa, has become topical owing to a number of militating factors and amongst them the growing phenomenon of illegal mining.

2.5 SUSTAINABILITY IN A GOLD MINE

Many different people can interpret sustainability in many different ways. Sustainability can be described as the prevention of the depletion of natural resources in order to maintain an ecological balance. Sustainable development is defined by the Brundtland commission as; development that meets the needs of the present without compromising the ability of future generations to meet their own needs (UN Commission on Sustainable development, 2007). In view of the above definition, the sustainability of a gold mine can therefore be interpreted as its ability to meet current needs without compromising its own future needs as well as that of society. The need of a gold mine is to extract gold resources for the purpose of making profit. The question of sustainability for a gold mine is described by whether current extraction activities are generating a profit without compromising future profits and the welfare of society and condition of the environment. For that reason the mineral resources gets depleted and it is not practical that a gold mine will be able to defend its current profit in the future.

Alternatively, sustainability in a gold mine can be viewed as having three dimensions, economy, social and environment.

- The economic sector dimension is geared mainly toward improving human welfare, primarily through the production and consumption of goods and services (Flint, 2013:34). As a gold mine increases its activities it is hoped that the production and consumption of goods and services of surrounding communities increases as well. Such a relationship is important to achieving sustainability in the operations of a gold mine. The relationship between mining activities and economic welfare is typified in the case of the mining town, Blyvooruitzicht near Carletonville, where it was proven that closure of the mine can mean closure of the town itself (News24, 2017). A comparison can be set in motion to assess the response of the economic sector dimension to an increase in the activities of the gold mine against illegal mining activities.
- The social well-being sector emphasizes the enrichment of human relationships and achievement of individual and group ambitions. The current reaction of gold miners to the phenomenon of illegal miners can be interpreted to mean that the

activities of illegal miners degrades the ability of legal miners to enrich human relationships and ambitions of groups and individuals. It is an interpretation that may require further testing even though the negative impact of illegal mining is well documented and reported.

- The environmental sector focuses on protecting the integrity (reliability) and resilience (flexibility, toughness, ability to recover from change) of ecological systems.

A number of sustainability models have been postulated in literature over a period of time. Todorov and Marinova (2009:1219) stated that sustainability models can be classified into Pictorial Visualisation Models, Quantitative Models, Physical Models, Conceptual Models and Standardising Models. The sustainability models are explained in table 2.1 below.

Table 2.1: Models of Sustainability

Model	Description
Pictorial Visualisation Models	The three dimensions of sustainability (Economic, Social and Environment) in this model is represented either as pillars, embedded circles or in the popular Venn diagram of three overlapping circles. The three overlapping circles model place huge emphasis of the intersection between the three areas (see Figure 4). These models clearly emphasise the need for interdisciplinary and transdisciplinary. The implication of the model to the study is that illegal mining negatively influences the three pillars individually thereby reducing the capacity for attaining sustainability.
Quantitative Models	From a policy making perspective, with Economic models as a special sub-class, these models have attempted to find ways of embracing uncertainty and dealing to a various degree of success with long-range outlook. Despite this, the models have been poorly equipped to accommodate a holistic perspective, address the local-global perspective or acknowledge the need for stakeholders' participation. A common characteristic of the quantitative models is the fact that they remain dominated by the discipline from where they have originated, be it environmental science, engineering or economics. The Quantitative models suggest that those justifying illegal mining can come up with a model that serves their view. Just as well those who are against illegal mining can come up with an adverse model. The utility of the model in answering the research question becomes problematic.

Physical Models	The use of physical models for sustainability purposes has been restricted mainly to its environmental component. Physical models are very specific and mostly local. These models aim to reduce uncertainties, but are only a fragment of the global sustainability system. For the purpose of dealing with the question of how illegal mining influences sustainability in a gold mine, a one pillar approach compromises on the adopted definition of sustainability which includes interdisciplinary and transdisciplinary relationship between the three pillars.
Conceptual Models	This category of models is very extensive and is linked to a wake-up call to humanity and the limits to the natural environment. Most of these models contain a warning element and signals for alertness, in some cases threats and fears. Used in political agendas these models have generated wide debates and triggered policy responses. The inability of these models to manage uncertainty has been their weakest point and this has allowed for wide differences of opinion to emerge. The fight against the triple threat of poverty unemployment and inequalities have triggered several policy points and as such the relationship between illegal mining and sustainability of gold mines can add to the discussion.
Standardising Models	These models mostly includes indicators, benchmark values and targets. The development and application of sustainability indicators is an area of active research and practice that has drawn a lot of attention in recent years. Despite the intention for a long-term perspective, the practicality of all indicators is such that they represent a good snapshot for the particular moment and only if records are kept and data processed can they provide longer trends. Since illegal mining is illegal, the data available cannot be trusted to generate realistic indicators, benchmarks and targets. Most of the information available is a crude estimate of the actual.

Source: Adapted from Todorov & Marinova (1217:1220)

Figure 2.2 below depicts a conceptual diagram of three overlapping circles which is used to help visualize the interconnectedness of economics, social equity, and ecology (environment) and is adopted for this study.

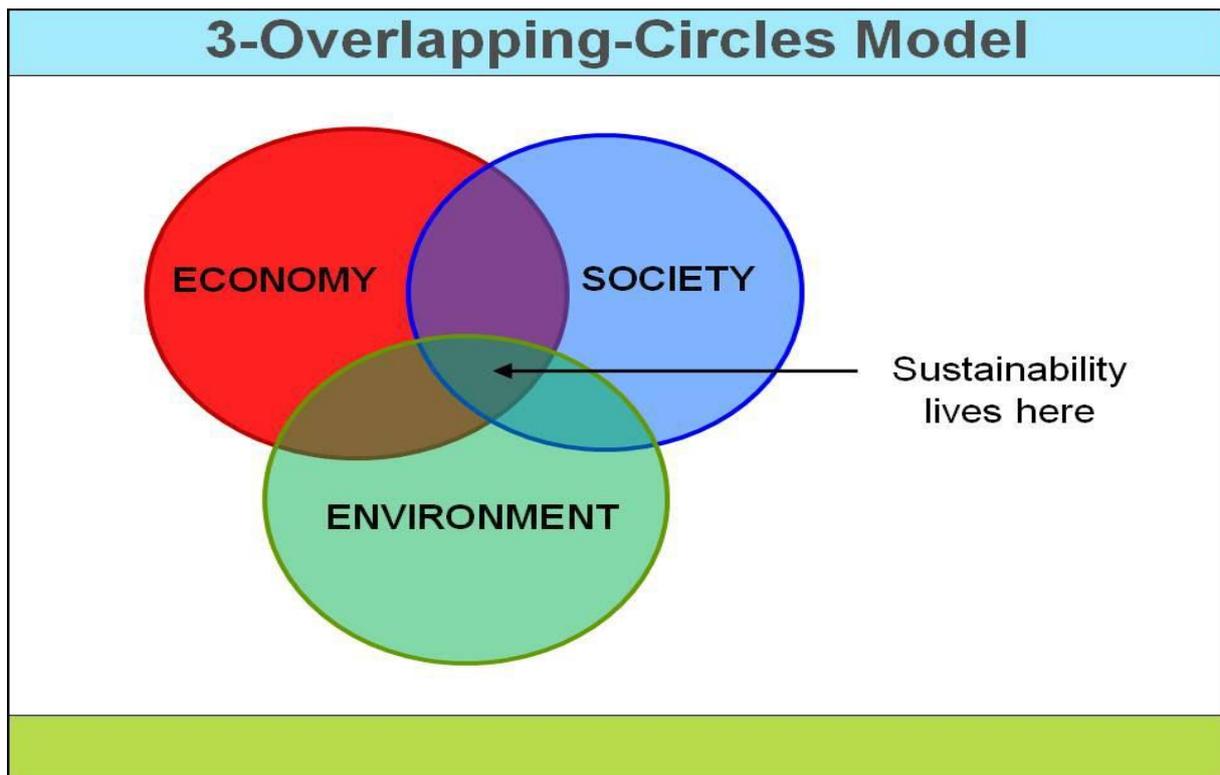


Figure 2.2: 3-Overlapping Circles Model. Source: Sustainability Advantage (2010:33-35).

The three-overlapping circle symbolism reveals how the core of sustainability demands equal consideration of all 3 sectors in a relationship, rather than simply striking the best balance one can achieve (Flint, 2013:33-35). An example would be when an organization chooses profit over environment or people. In his study the 3 overlapping circles model is adopted to illustrate what the sustainability of a gold mine means. The theory seems to suggest that illegal mining is adverse to the transdisciplinary and interdisciplinary relationship between the 3 pillars. If we are to accept that illegal mining negatively influences sustainability of a gold mine. It is also important to note that illegal mining can negatively impact all the pillars and at the same time impacting the pillars positively. The overlapping circles model, therefore, sets an interesting balanced scale tipping of which provides an answer to the research question. Sustainability in mining, therefore, does not aim to suggest that mines should operate forever, but how the operations can contribute to sustainable development. Efforts should be to maximize returns on projects and at the same time strive to improve the environmental and social sustainability.

2.6 ILLEGAL MINING THREATENING MINING SUSTAINABILITY

According to Debrah, Watson and Quansah (2014:913) artisanal and small-scale mining (ASM) plays a fundamental role in the national and local economies of resource-rich countries in Africa. The Minerals Council South Africa (2018) argued that illegal miners, equivalent to artisanal and small scale miners (ASM) elsewhere, present major risks to themselves and to the health and safety of employees of legal mining operations. The two opposing views suggests a lack of consensus in the South African context, which could amount to loss of opportunities. While there is a clear agreement between policy makers and gold mining decision makers in the South African context about the legality of these miners, the growing activities and the suggested ripple economic effects suggest otherwise. The question of the sustainability of gold mines, therefore, needs further highlighting and discussion to mediate between the opposing parties and views. This is in view of arguments by Debrah, *et al.*, (2014:913) that more effort must be geared towards fostering this type of economic activity to sustain livelihoods in rural communities.

Across Africa, efforts to operationalize ASM based on a sustainable development framework have been quite tedious and often ineffective. This is because most of these frameworks lacked context and an understanding of the continuum from the artisanal through small-scale and up to the junior miner, grouped under the general term 'ASM' (Debrah, *et al.*, 2014:913).

According to Odhiambo (2015:1) sustainability of gold mining projects is hard to achieve among the countries where the resource is mined, as more often extractors compete to gain from this activity with less concern on its availability in future. Most regulations in the gold mining sector are not designed to effectively ensure the availability of the gold resources in the future. In the South African context, the argument would be that the country is endowed with huge gold deposits with most resources in the reserve category. The only binding constraint is safety issues as the deposits gets deeper and harder to mine. The sustainability issue in gold mining is still pertinent due to the depletion of the easy gold. This phenomenon of competing to gain from gold resources with less concern of its availability in future is responsible for mine closures and declining production. Mine closures and declining production can explain

the unsustainable deterioration in the economic, environmental and social conditions of mining communities. The problem of illegal mining could have been born from mining operations chasing production at the expense of sustainability. It is difficult to quantify economic impact of illegal mining on the economy. PWC (2017:93), nevertheless, went on to state that approximately R7 billion is lost annually due to this illicit trade.

Illegal miners have moved on from operating only in abandoned mines, and appear to be especially prevalent where improperly sealed, abandoned tunnels meets operational tunnels of current gold mining companies (Harvey, 2014). The livelihood of mining companies is seriously compromised in cases where illegal miners and legal miner's finds themselves operating in the same space and time. This poses a serious threat to the health and safety of the mining company's employees, and since local law enforcement do not have the capacity to go underground the sustainability of the companies comes under immense pressure. South African Government has asked mining companies to increase and intensify their security services (Crowley, 2014). The fact that the South-African Police service cannot send police officers underground to assist, places gold mining companies in a difficult situation, with falling commodity prices, rising costs and they still have to deal with illegal miners.

To worsen the situation Sibanye Gold's CEO Neil Froneman (2014) has reported that some of their own employees seems to be involved with illegal miners during their leave periods, assisting the illegal miners with blueprint information, clock cards and food. Policeman, Security guards and mining employees take bribes from illegal miners to give them access to the mining facilities and equipment (Crowley, 2014). The South African Government has been blamed for not doing enough to assist legal mining houses to combat this illegal activity. At Sibanye Gold's annual general meeting in February 2016, Froneman (2016) added that Sibanye Gold spends around R75 million a year in an attempt to contain the problem. With these factors, mining companies will not be sustainable, which will inevitably lead to more job cuts which in turn will lead to a growing number of illegal miners, because retrenched employees will ultimate join this dangerous and illegal trade.

The decade long decline in gold production and industry employment is indicative of the fact that the sustainability of gold mining is under threat. The decline in gold production is illustrated in the figure 2.3 below.

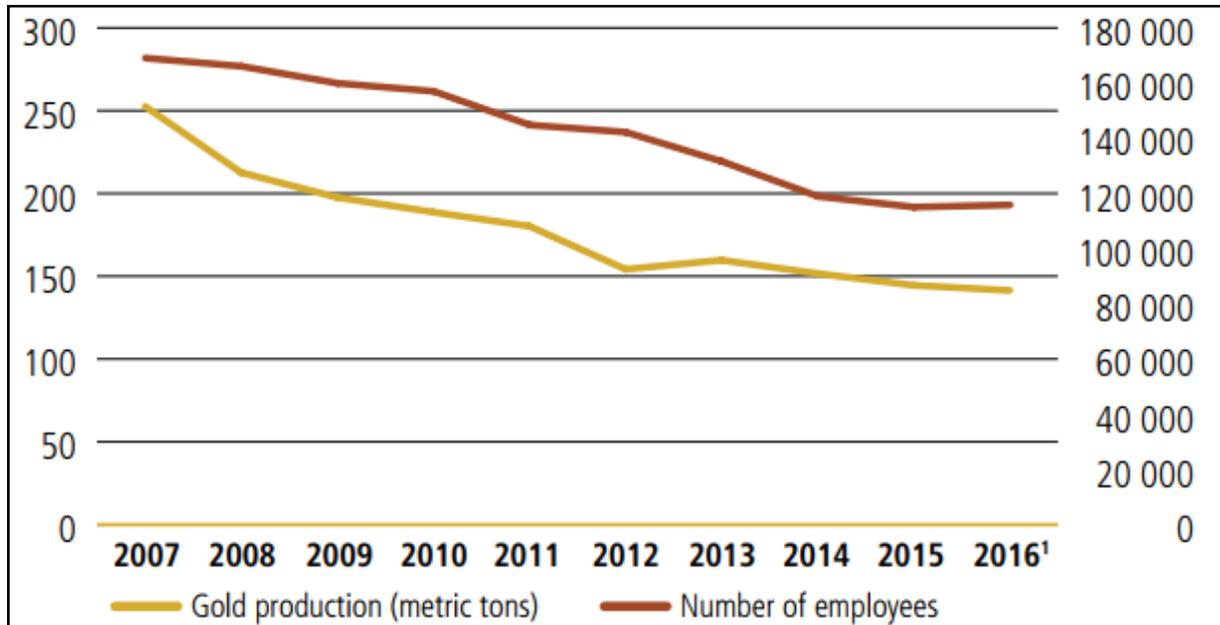


Figure 2.3: Gold Production and Industry employment (2007-2016). Source: Chamber of mines (2016).

Figure 2.3 clearly illustrates how the decline in production has a direct effect on employment. The chart shows fall in production 2007 (251 metric tons) to 2016 (140 metric tons) resulted in loss of ± 50 000 jobs (170 000 (2007) – 120 000 (2016)). As the industry continues to shed jobs in order to keep the business sustainable, it inevitably leads to retrenched workforce joining the illegal trade.

South Africa is regarded as fertile grounds for illegal mining. Over the last 100 years the country has witnessed the rise and fall of many new mining shafts of companies trying to cash in on the South African gold reserves, leaving behind at the present moment many abandoned shafts. South-Africa is littered with almost 6 000 abandoned mines and mining companies are blamed for not properly sealing mines to prevent access for these illegal miners (Boning, 2015). Figure 2.4 below shows the locations concentration of 5 906 abandoned mine shafts. These mines were officially listed as abandoned mines as of May 2008 by the Auditor General, many of which are gold mines, specifically in the Gauteng province of South Africa.

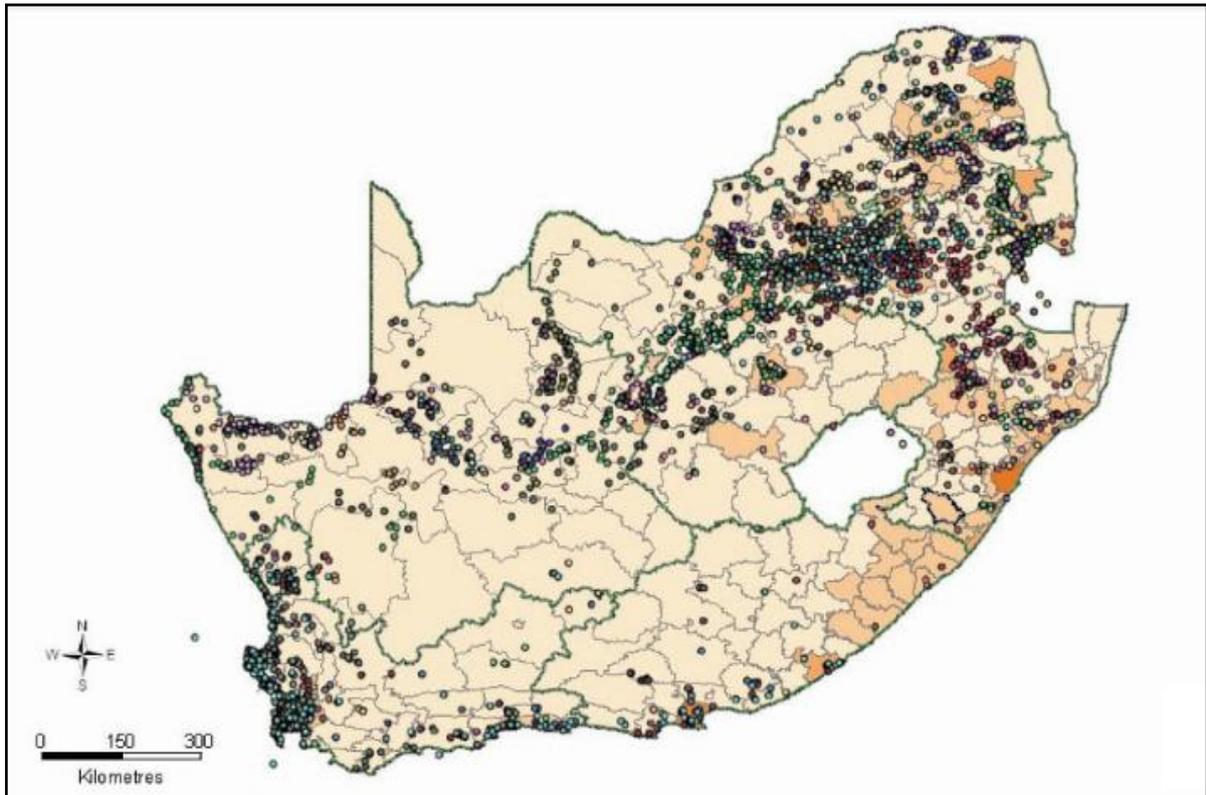


Figure 2.4: Abandoned Mines in South Africa. Source: Statistics South Africa (2015).

To properly close off these mines would cost an estimate of around \$2.7billion (Harvey, 2014). Most of these mining companies responsible no longer exists, making it difficult to place liability on old mining companies. Mining companies and the Department of Mineral Resources (DMR) have recently collaborated to properly seal of these old mine shafts (Thelwell, 2014). These efforts resulted in 180 shafts being sealed, but 180 out of a total of 6000 shafts does not seem to be significant enough, more needs to be done.

Gold mining is largely dependent on large capital investments, and according to Steenkamp and Clark-Mostert (2012:1-5), the extent of damage done by illegal miners on abandoned shafts is such, that any attempt to revitalise these old mines will be uneconomical. Based on this fact the country has witnessed a sharp decline in capital investment into mining, which in turn closes the door on jobs that could have been created with capital investments into revitalising old mining shafts.

2.7 THE RISE OF THE ILLEGAL MINERS

The sharp decline in South Africa's mining industry creates opportunities for illegal mining. In 1980, South Africa's share of global mining was around 40%, which fell to just under 5% in 2016 (Mills, 2016). The gold mining industry served as a huge employer for South Africa and its neighbouring country's blue-collar labour force. Rising input costs, lower receiving gold price and ageing of shafts has led to a decline in the industry inevitably leading to job losses and many unskilled workers were left with no means of getting an income. Illegal mining in South-Africa is on the rise due to poverty, unemployment and illegal immigrants, which brings about multi-dimensional challenges (Crowley, 2014).

South Africa for many years used to be the number one gold producing country in the world, but have now slipped to the sixth spot with China taking the top spot (World atlas, 2017). As can be noted on Figure 2.5 below, South Africa reigned supreme in gold production measured in metric tons per year since 1960.

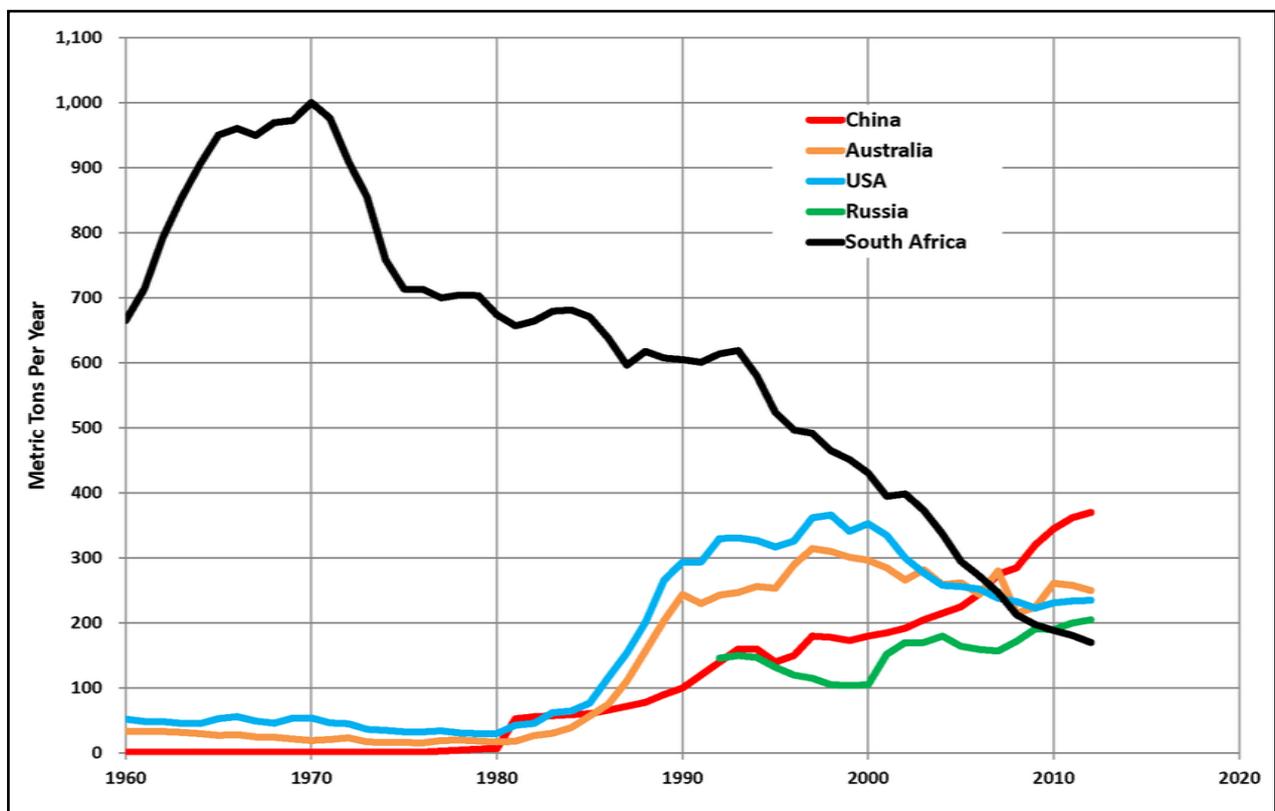


Figure 2.5: Top Five Gold Producing Countries since 1960. Source: USAGOLD (2015).

The above chart portrays a compelling story about South African Gold production since 1970, while the rest of the world seemed to be increasing output, South African production went into a downward spiral. The chart also depicts how China, Australia, USA and Russia overtook South Africa as a gold producer between the years 2005 – 2012. The chart paints an alarming picture for the mining industry and the South African economy. Despite the South African gold mining's contribution to the global and local economy, the sector is facing a wide variety of social, technical, economic and operational challenges, which leads to South Africa losing its competitiveness in the global gold industry (Neingo & Tholana, 2016:283-290).

According to the Chamber of Mines (2016) the South African mining industry has lost roughly 50 000 jobs over the last ten years, mostly from the gold industry and with the prospect of more to come. Although a Citibank survey done in 2010 labelled South Africa as the world's richest mining country in terms of non-oil reserves, a lack of investor confidence coupled with high costs and a hostile labour force has marred the industry. This decline is an attribute to the rise of the illegal miners, affectionately known as Zama-Zama's (loosely translated meaning chance takers).

According to a South-African Human Rights Study (2015:9-12) as much as 30 000 people are involved in illegal mining. In central South Africa the illegal miners has a propensity for stealing mine infrastructure such as copper wire and cables (Love & Kariuki, 2015:9-11). This action is particularly detrimental for current operating mines, as their capital spent increases and possible standing time leads to huge daily production losses. Most of illegal miners hail from neighbouring countries such as Zimbabwe, Mozambique and Lesotho. These workers are sometimes found to be old veteran miners and do not qualify for the compensation fund and once they get retrenched, they do not return home, but stay in that area looking for employment.

Regional poverty contributes a lot to the supply of illegal miners. Their home countries (Lesotho, Mozambique, Swaziland, Zimbabwe and Malawi) have some of the world's highest child mortality rates and score very low scores on the UN's Human Development Index (Harvey, 2014). According to PWC (2017:18) these migrant workers have to support as many as 10 dependants and with South Africa's high

unemployment rate, their chances of finding employment is very low and ultimately they join the illegal mining business as a means to survival.

2.8 ARGUMENTS AGAINST ILLEGAL MINING

The Minerals Council of South Africa identified negative social and financial impacts associated with illegal miners. According to The Minerals Council of South Africa, (2018) the comprehensive list of negative impacts includes:

- The fact that illegal miners present major risks to themselves.
- Risks to the health and safety of employees of legal mining operations.
- Illegal miners acquire illegal materials for their operations such as explosives, copper cables, and diesel equipment from mines.
- Illegal miners make illegal electricity connections.
- The miners use extremely un-environmentally unfriendly refining methods and materials, destroy the social fabric of mining communities
- Illegal miners bribe workers to gain access and secure food and other supplies.
- Threats of violence to employees and management and the creation of a lucrative syndicate market supplying commodities.

According to Steenkamp and Mostert (2012:2) mining infrastructure has also fallen prey to illegal miners and their activities are making revitalisation of old mines uneconomical. In addition, the activities of illegal mining can contribute significantly to an increase in the social ills such as prostitution, child labour, substance abuse and creation of illicit economies. It is also plausible that the negative factors, as identified in The Minerals Council of South Africa, (2018), in their entirety can precipitate the decline in gold production hence negatively impact sustainability in the operations of gold mining companies. The argument is particularly relevant if considered that there is an increasing role, to the performance management of a mining company, being played by maintaining the health and safety of miners which has come under threat from illegal mining. OHSWA (2016:3) argued that employers are only truly sustainable when they ensure the safety and health of their workers.

2.9 ILLEGAL MINING'S IMPACT ON SURROUNDING COMMUNITIES

There is growing debate about the impact of illegal mining on surrounding mining communities. Violent turf wars between different illegal mining groups are believed to be behind the deaths of more than 200 illegal miners (Mzamo, 2017). These turf wars are for control over highly lucrative underground territory, and heavily armed thugs' waits on the surface to rob the illegal miners of their gold bearing ore (Mzamo, 2017). These violent shootouts directly affects the communities, because these wars starts at the old mine shafts but spills over into the community. According to SAPS annual crime report (2017:14) illegal mining has been identified as an additional cause of murders, and that 0.7% of all murders in Gauteng alone can be linked to illegal mining.

The smelting of gold usually happens within the community, and the use of mercury poses a serious threat to the health of the community and the environment. Illegal miners boil the mercury, which goes from liquid to gas which is very toxic (Molosankwe, 2012). The illegal miners uses mercury to extract gold from the gold-bearing material, which holds serious health risks for the illegal miners themselves and surrounding community (Steenkamp & Clark-Mostert, 2012:1-5). Mercury is extremely toxic to the flesh and too much exposure can easily cause nerve damage. Exposure to mercury can damage the central and peripheral nervous systems. The inhalation of mercury vapour can produce harmful effects on the nervous, digestive and immune systems, lungs and kidneys, and normally are fatal (WHO, 2017).

While the use of these toxic substances is perpetrated by illegal miners, accountability and cost of such actions are carried by the community and the gold mine. This is mainly because illegal miners are normally invisible, unlike the mine which is physically identifiable during the course of their operation in the community. The community is more likely to blame the visible mine for the deterioration in the environment and the social fibre. Thus raising the cost for the gold mines in preserving the environment and society for sustainable operations. Rehabilitation costs for the mine are also affected by the activities of the illegal miners, considering that it is directed in the mining charter that mines must leave the environment as they found it. Jaiye (2013:13) stated that Illegal mining is one of the biggest problems with regard to environmental destruction and ecological disruptions. These illegal miners begin their environmentally hostile

mining activities in an uncontrollable manner, and create destruction to mother earth, which is often accompanied by pollution of the soil and rivers with mercury and cyanide (Jaiye, 2013:13). Current legislation imposed by the DMR, requires mining companies to set aside enough money to properly rehabilitate mines (Mabuza, 2018). If a mining company fails to rehabilitate, the state is supposed to be able to access these funds and carry out the rehabilitation itself.

2.10 ARGUMENTS IN FAVOUR OF ILLEGAL MINING

Steenkamp and Mostert (2012:8) observed that the upside to illegal mining is in the removal of old and derelict infrastructure which lowers the cost of re-investment for new potential investment. They also argued that the recovery of trace amounts of gold from the fine residue dumps and surrounding infrastructure indicate the presence of easily recoverable gold during start-up of new operations by re-processing the dumps and slime dams. According to Debrah, *et al.*, (2014:913) if made legal, artisanal and small scale miners (ASM) can contribute to the national income, to sustainable development and aid development of rural areas. From the perspectives of these arguments it would appear as if the continued illegalization of ASM is a missed economic opportunity for South Africa. According to the National Development plan 2030 (NDP30) the development and growth of the economy will be driven more by small businesses going forward. The National Development plan 2030 (NDP30) further states that and it would facilitate the removal of administrative and regulatory burdens on small businesses. Legalizing ASM aligns well with the economic blueprint whereby the size, survival and viability of small businesses are of greater importance to the SMME sector. The other important factors are the direct socio economic benefits, associated with illegal mining, that address the increasing challenges of unemployment, poverty and inequalities which basically act as push factors (Masweneng, 2017). The arguments in favour of illegal mining give a sense that there may be mutual benefits to be gained if legal gold mines were to lobby for illegal mining's legalization. It may not be a complete view to consider the activities of illegal miners as completely averse to the sustainability of gold mines.

Arguments also exist that illegal mining is important to the economy of local poor mining communities. The syndicates behind these illegal miners offers large sums of

cash to local traders to provide illegal miners with basic necessities. It is not just illegal miners going underground mining, an entire ripple effect of businesses develops around the sites where illegal mining occurs. Communities start seeing local businesses selling clothing, kneepads, protective gear, bulk food and alcohol (Hosken, 2017). There is a view from community members that illegal mining reduces crime and should illegal mining stop overnight, it would have a major impact on the community, economically due to the fact that local businesses has become reliant on the business from illegal miners (Masweneng, 2017).

2.11 MODUS OPERANDI OF ILLEGAL MINERS

Illegal miners target underground shafts mostly abandoned shafts, mine dumps and soil trenches. Underground illegal mining is by far the most prominent, because it gives direct access to Reefs that yields a higher grade of gold than soil or mine dumps (Nhlengetwa & Hein, 2015). Based on the fact that underground ore produces a higher return, illegal miners set their sights on old and abandoned mining shafts. According to Neingo (2016:285) South African mines currently receives a grade of 5 grams per ton from underground ore and surface mining's grades are much lower. The first target on these abandoned mine shafts is the steel infrastructure, that is stripped off and sold for cash, thereafter illegal mining activity commence on these sites (Steenkamp & Clark-Mostert, 2012:1-5). To gain entry into the shafts, the illegal miners will either bribe or sneak their way into an existing mine or blast open shaft entries which have been sealed with concrete. It seems the approved hinderers to the old shafts are giving in way too easy to the activities of illegal miners. There is debate on who should shoulder the responsibility of properly sealing old mining shafts (Boning, 2015). The current method of sealing disused mine shafts has the advantage of lowering costs of potential re-mining activity but gives an advantage to illegal miners. On the other hand it has been suggested that blasting the entrance of old shaft entrances with dynamite will be effective in stopping illegal miners from entering the shafts but such a decision would raise the cost for any re-investment into the mine. The question of the method to be carried out to close off disused mining shaft is therefore answered by the value placed on re-investment in mines versus the impact of illegal miners. If illegal miner's impact is conclusively found to be negative and costly, then sealing the mine shaft by blasting the entrance is the best option. Whereas if the impact of illegal mining can

positively be managed then the current sealing off method is relevant. Nzimande and Chauke (2012:135) argued that it is imperative that mining companies identify rehabilitation as a critical strategic pillar that directly influences license to operate. The rehabilitation of land disturbed by mining is a statutory requirement and effective rehabilitation is essential for maintaining a social licence to operate (Glenn, 2014:48).

It is believed that some of the illegal miners are part of a gold cartel formed by organized crime syndicates. According to Mzamo (2017) law enforcement in South Africa are of the view that illegal mining is largely orchestrated by highly organised, well-financed and complex local and international crime syndicates that have up-to-date maps of mining operations. International characters involved in the syndicate includes Israelis, Indians, Chinese and Pakistanis. According to Phala, *et al.*, (2017:57) there appears to be various levels of illegal mining that exist with each level connected and supported by the higher levels as demonstrated in figure 2.6 below.

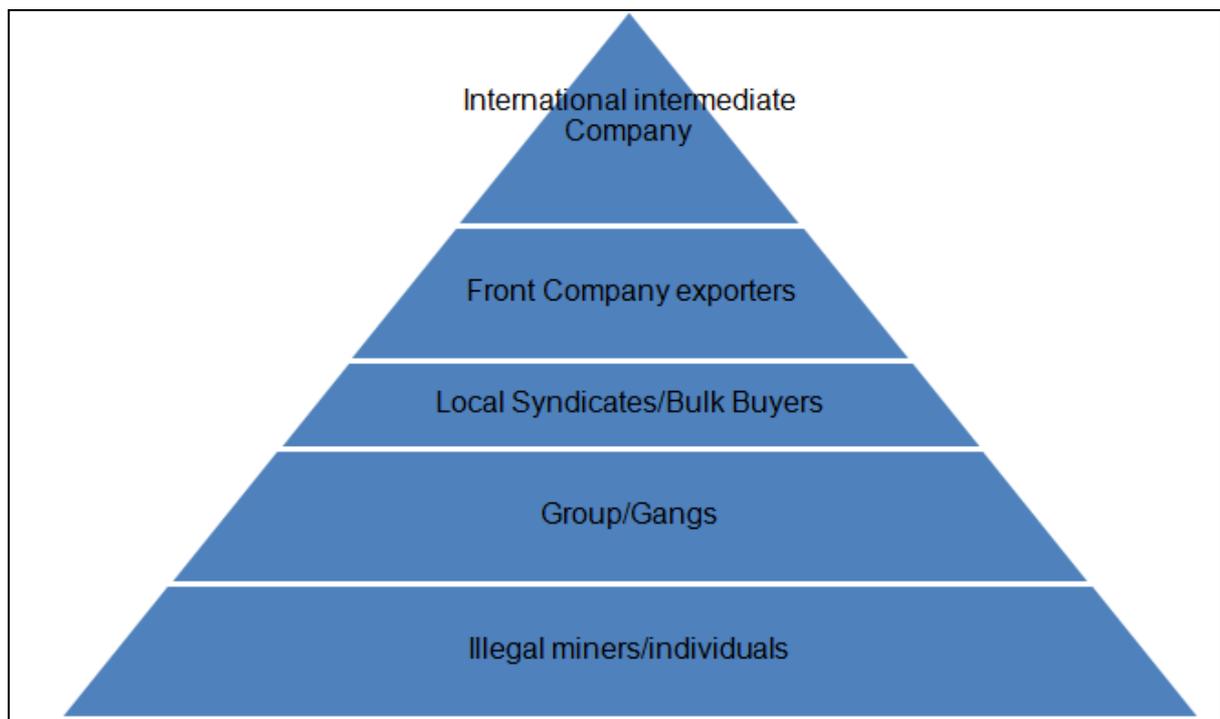


Figure 2.6: Illegal mining levels. Source: South African Human Rights Commission (2013)

Phala, *et al.*, (2017:57) goes on to explain each tier within the illegal mining levels level as follows:

- *Tier 1, Illegal miners/Individuals*

These are the people on the ground, normally ex-mining employees and illegal immigrants who actually go underground to engage in physical digging. They are at the bottom of the illegal mining value chain.

- *Tier 2, Groups/Gangs*

This tier is comprised of groups and gangs who ensure the safety and security of illegal miners against rival groups. These groups are in most instances also responsible for recruitment and to provide basic necessities like food, water and tools to Tier 1, the illegal miners.

- *Tier 3, Local syndicates / Bulk Buyers*

The syndicate within this tier are mainly responsible for establishing local and international network of buyers. Their primary duty is to make sure that the gold are transported, delivered, dispersed nationally and internationally by means of authentic companies.

- *Tier 4, Front Company Exporters*

This group consist of well-connected syndicates who export the gold to larger international syndicates.

- *Tier 5, International intermediate Company*

This group is at the top of the illegal mining value chain. This syndicate group moves the gold between respective countries.

The illegal miners travel as far as 4 kilometres underground, where they live for several days at a time (Chamber of Mines, 2017:1-4). The illegal miners work in small groups between 5 and 10 men. According to Thornton (2014:127-129) these illegal miners have high levels of technical knowledge about the process of extracting gold. The illegal miners methods are easy and effective, their tool-kits consists of no more than a spade, pick, chisel, hammer, plastic bucket, a bowl, plate and towel. Their methods bear striking resemblance to ancient processes that existed when gold was taken from the earth 4500 BCE (Thornton, 2014:127-129). The illegal miners often test the ore while underground using panning and crushing methods. This ore is then brought to the surface to be treated with mercury to extract the gold. It is thus evident

that the barriers of entry for illegal mining are very low especially if considered the pressing needs of society for employment and eliminating poverty. The only barrier would be the actions by law enforcement who are currently overwhelmed by the growing numbers of illegal miners.

2.12 MANAGERIAL IMPLICATIONS RISEN FROM LITERATURE STUDY

The fact that illegal mining is not confined to South Africa alone, implies that managers could also learn from solutions suggested elsewhere. The growing argument in favour of the activity of illegal miners has implications for decision makers to adopt holistic measures to deal with the current problem of illegal mining. The current debate against and in favour of illegal mining reveal gaps that may mean a review of current measures adopted by mining companies.

2.13 CHAPTER CONCLUSION

Gold mining and its future in South Africa has dominated discussions over the last decade, with many people arguing that the industry in South Africa is in serious trouble. Gold mining managers in particular faces huge obstacles such as gold price volatility, rising input costs, lower grades of ore and labour instability which directly effects sustainability. All these generic challenges fails to take into account the extent of illegal mining's impact on the mine's sustainability. Illegal mining seems to add even more pressure on mining companies, threatening the livelihood and sustainability of mining companies. With decreasing profit margins, mining companies still have to fight and compete with illegal miners. The illegal miners have a substantial cost advantage over legal miners, because illegal miners cut corners, pay no statutory costs, abuse people and the environment. This practice can negatively impact mining sustainability and can force legal operations to close down operations (Kolver, 2013). It is true that mining houses do have economy of scale advantage, but with sensitive profit margins, these acts by illegal miners can have damaging effects on the companies' longevity. According to the Chamber of Mines factsheet 2017, illegal mining is a serious threat to operating mines, its employees, safety protocol, shaft infrastructure, equipment and ultimately the business as a whole.

Mining business sustainability is clearly in the interest of the whole country and its fragile economy. According to Nhlengetwa and Hein, (2015:109-112) mining concessions yields taxes for the Government and based on this fact Government has a huge interest in mining activities and the longevity and sustainability thereof. Illegal mining appears to be a negative contributing factor to gold mining sustainability, and according to the Chamber of mines Fact sheet (2016) no single stakeholder can address the challenge of illegal mining alone – collaboration is key.

2.14 CHAPTER SUMMARY

The aim of the study is to provide key decision makers within gold companies with an academic paper which provides studied information on the effects of illegal mining on mining sustainability. Illegal mining is not confined to South Africa alone, it is an international phenomenon. This illegal activity provides livelihoods to some of the world's poorest regions in many countries. In the South African context arguments against and arguments for illegal mining were examined and majority current literature seems to indicate that illegal mining is bad for the country. There currently exist many views as to how the illicit trade of illegal mining can be combatted. Harvey (2014) notes that better governance mechanisms is required in the formal sector to reduce the incentives for illegal miners. Old mining shafts needs to be sealed off properly to restrict access into old shafts; this would be a good start to combatting this illicit trade. According to a former mine engineer Peter Paulson, the problem can be easily averted if mining companies sealed the shafts by blasting the entrance with dynamite when operations are stopped (Molosankwe, 2012). This indeed seems like a viable option, because blasting of the shaft entrance will cause a collapse and tons of material and rocks would block entry into the shaft. This method will also be much cheaper, as mining companies and Government would not need to fence off the area or employ security guards to protect the shaft from illegal miners. Harvey (2014) continues to argue that the profitability of illegal mining exposes inefficiencies from the mining companies.

The increase in illegal mining is a reflection of the country's economy. With South Africa's socio-economic climate and high unemployment, the increase in the number of illegal miners is inevitable. Since gold mining is largely dependent on large capital investments, a rise in illegal mining could see a drop in foreign investments, which could lead to mining companies contracting.

The literature review was conducted by engaging in robust discussion on the main study focus area of illegal mining and the sustainability of a gold mine. Sustainability theories and related literature were examined to establish their influence on the study objectives.

CHAPTER 3

EMPIRICAL RESEARCH

3.1 INTRODUCTION

The literature review in Chapter two of this study provided an overview of the concepts of illegal mining and mining sustainability. Special focus were directed towards advantages and disadvantages of illegal mining as well as South African mining sustainability. The rationale behind this study was to establish the effect of illegal mining on the sustainability of a gold mine.

In this chapter the structure and nature of the enquiry is discussed. The discussion on methodology will include topics such as the research design and approach, data collection, population and sampling, research instrument, data analysis and ethical considerations. The research design is discussed in the next section.

3.2 RESEARCH DESIGN

According to Akhtar (2016:68) a research design can be considered as the structure of the research, it is the “Glue” that holds all of the elements in a research project together. Akhtar (2016:69) further stated that the research design is the concept within which research is conducted. The concept includes the blueprint for the collection, measurement and analysis of data. Walliman (2011:13) stated that the research design provides a framework for the collection and analysis of data and subsequently indicates which research methods are appropriate. Accordingly, the research design can be viewed as a map, developed to guide the study on how the researcher is going to collect measure and analyse the data in order to give an appropriate answer to the research question or problem.

There are a number of ways that data can be collected, measured and analysed to give an appropriate answer to a research problem. There is an extensive body of work on the different types of research designs that could be used in given enquiries. Walliman (2011:13) argued that you can combine two or more types of research

designs, particularly when your subject combines the study of human behaviour with that of, for example, economics, technology, legislation or organizations. Twelve different research designs have been identified which includes action, case, casual, cohort, cross-sectional, descriptive, experimental, exploratory, historical, longitudinal, meta-analysis and observational research designs (University of Southern California, 2016). For the purpose of this study the descriptive, exploratory and cross-sectional designs are relevant.

Walliman (2011:10) noted that descriptive research design attempts to examine situations in order to establish what is the norm and the designs rely on observation as a means of collecting data. Observations can take different forms such as interviews, questionnaires and visual records. The descriptive design provide answers to the questions of who, what, when, where and how associated with the particular research problem. The descriptive design cannot conclusively answer the question of why. Thus a descriptive research design helps the researcher obtain an in depth understanding of the research problem. The effects of illegal mining on the sustainability of gold mines requires an in dept understanding in order to inform policy makers and decision makers who are currently faced with the problem.

According to Manerikar and Manerikar (2014:95) when a researcher has a limited amount of experience with or knowledge about a research issue, exploratory research is useful. Exploratory research is initial research conducted to clarify and define the nature of a problem. Kumar (2011:335) stated that when a study is undertaken with the objective either to explore an area where little is known or to investigate the possibilities of undertaking a particular research study. The relationship between the sustainability of gold mines in the face of growing illegal mining is not well documented in literature. Particularly in the South African gold mining context where artisanal and small scale miners are considered as outlaws. To the end this study will also adopt an exploratory design approach to add to current knowledge as well as to suggest areas for further studies.

Kumar (2011:106) argued that cross-sectional studies is best suited to studies aimed at finding out the prevalence of a certain phenomenon, situation or problem by taking a cross-section of the population. They are useful in obtaining an overall 'picture' as it

stands at the time of the study. The cross-sectional design can only measure differences between a variety of people, subjects, or phenomena rather than a process of change (University of Southern California, 2016). In other words a cross-sectional design gives a snap-shot view of the problem at a particular point in time. The effects of illegal mining on the sustainability of a gold mine has the potential to change over time as variables changes. This study gives a snap-shot view or an overall picture of the problem at the point of data collection. Although a trend can be suggested by the data the utility of the research is limited to the conditions at the point of data collection remaining constant. For an example participants views can significantly change if policy makers decides to legalize artisanal and small scale miners.

Thus the descriptive and exploratory designs will provide a viable answer to the main research problem in this study. Research methods are discussed in the next section.

3.3 RESEARCH METHODS

Research methods are specific techniques for collecting and analysing data in such a way that you can come to reliable conclusions (Walliman, 2011:20). Greener (2008:10) posited that research methods usually refers to specific activities designed to generate data. Accordingly, research methods are the interventions, strategies and plans used by the researcher to collect information and data for the purpose of providing an answer to the research question. According to Boncz (2015:22) the research goal is attainable either by qualitative or quantitative methods, or perhaps by using the two together. Greener (2008:35) referred to a combination of the quantitative and qualitative method as a mixed method.

According to Boncz (2015:25) quantitative research methods are based on the assumption that extensive quantitative data collection with a wide range, systematic, regulated and unified measurements and numerical expression are important tools in the process of gaining information as research questions can be answered based on that. Quantitative research method deals with numbers and anything that is measurable in a systematic way of investigation of a problem or phenomena and their relationship. The philosophy underlining quantitative research method is that reality or

knowledge is objective and measurable and the researcher is detached from it. Whereas the qualitative research method is a direct opposite whereby the reality and knowledge cannot be separated from cultural and social construct of those affected by the phenomena. Boncz (2015:26) stated that Qualitative research methods focuses on a qualitative insight into phenomena, collecting and analysing opinions, attitudes and beliefs. Walliman (2011:88) argued that qualitative research depends on careful definition of the meaning of words, the development of concepts and variables, and the plotting of interrelationships between these. In other words while quantitative research method involve collecting and processing numeric data, qualitative data involves collecting and processing words and observation of reactions.

Gaining an in-depth understanding on the effects of illegal mining on the sustainability of a gold mine can effectively be done through a combination of descriptive, exploratory and cross-sectional enquiries utilizing a qualitative research method. Thus this study is designed to collect and analysing opinions, attitudes and beliefs of gold mine employees with regards to the effects of illegal mining on the sustainability of the gold mine. The population and sampling techniques are discussed in the next section.

3.3.1 Population and Sampling

According to Kumar (2011:65) the study population is the entirety of elements in the universal set or participants from whom the required information to find answers to your research questions is obtained. Boncz (2015:24) stated that the population is the theoretically determined totality of elements to be examined, i.e. persons or things that suit the previously defined selection criteria and that conclusions are to be made about. Boncz (2015:24) further added that the target population is a narrower circle meaning all the persons or things of whom/which the actual sample is taken. The target population for this study includes all employees of one gold mine amounting to 1200 employees. These employees can fall into two broad classes of decision makers and implementers.

Researches do not normally collect data from all members of the population, as they are financial and time resources constraint. A sample is normally selected from the target population from which information would be collected to give an answer to the

research question or problem. According to Alvi (2016:11) a sample can be defined as a group of relatively smaller number of people selected from a population for investigation purpose. In a qualitative research method the sample size is not predetermined but is determined at the point of data saturation. Data saturation point is attained when interviewing the next participant does not generate new data and at that point the sample size is determined.

Kumar (2011:176) stated that whenever you are not getting new information or it is negligible, it is assumed you have reached a data saturation point and you stop collecting additional information.

3.3.2 Sampling Techniques

Samples can be either probability samples or non-probability samples. According to Etikan and Bala (2017:1) statistical agencies (quantitative methods) prefer the probability random sampling whilst businesses, companies, marketers mostly rely on non-probability sampling for their research. Rahi (2017:3) noted that non-probability sampling is the sampling approach in which the chance or probability of each unit to be selected is not known or confirmed. Non-probability sampling is a sampling procedure that will not bid a basis for any opinion of probability that elements in the universe will have a chance to be included in the study sample (Etikan and Bala, 2017:1). Alvi (2016:13) argued that probability sampling is also called random sampling or representative sampling where every member of the population has a known (non-zero) probability of being included in the sample. Non Probability sampling techniques are normally associated with the qualitative research method while the probability sampling techniques suit the quantitative research method. Non probability sampling techniques are relevant for this study and are appropriate for the descriptive, cross-sectional and exploratory research designs adopted.

According to Etikan and Bala (2017:2); Rahi (2017:3) probability sampling techniques include simple random sampling, systematic random sampling and stratified sampling. Rahi (2017:3) stated that non-probability sampling techniques include convenience sampling, snowball sampling, quota sampling and judgement sampling. Alvi (2016:33) noted that snowball sampling is when one element of the population is approached at

a time and then is asked to refer the investigator to the other elements of the population. Snowballing sampling is useful when the researcher know little about a group or organisation to study; contact with few individuals will direct him to other group (Etikan & Bala, 2017:2). In this study snowball sampling will not be relevant, the researcher's knowledge of the population group is advanced as he is an employee of the same organization.

Quota sampling method is used when population is heterogeneous so sub groups are formed that are homogenous and the participants are selected non-randomly from each sub group on the basis of quota (Alvi, 2016:31). The population group, in this study, will be sub-divided into decision makers (management) and implementers (general employees) quotas to balance off opinions from the two heterogeneous groups. Along with the quota sampling technique participants from the quotas are sampled using the convenient sampling technique. Convenient sampling techniques depends on the accessibility of participants to the researcher in building the sample. Boncz (2017:26) stated that convenience sampling is when one relies on subjects easily available for the research among their acquaintances or colleagues. The researcher will conveniently select a sample from the two quotas, management and employees up until the point of saturation is reached that determines the sample size.

3.4 DATA COLLECTION METHOD

A qualitative data collection method will be utilised in this research. According to Greener (2008:81) qualitative data collection method includes action research, ethnographic research, focus groups, interviews, life history research, participant's diary and structured observations. Primary data will be collected by way of interviews in this study. Interviews are usually first person narratives that the researcher collects using extensive interviewing of a single individual (Kumar, 2011:124). Interviews can be classified as structured, semi-structured and un-structured. Kumar (2011:138) stated that in a structured interview, the researcher asks a predetermined set of questions, using the same wording and order of questions as specified in the interview schedule. Semi-structured interviews are based on a question guide, however not fully structured the interviewee is allowed to go where they want to with the questions (Greener, 2008:89). Kumar (2011:138) noted that in an un-structured interview the

researcher may formulate questions and raise issues on the spur of the moment, depending upon what occurs to you in the context of the discussion. In the case of this study, semi-structured interviews were relevant, since it allows for a guided interview as well as freedom to probe. The semi-structured interviews provides room to the researcher to highlight critical and emerging areas of the research. The semi-structured interviews was self-administered with the aid of an interview schedule. The interview guide will be structured as follows:

3.4.1 Interview Guide

The interview guide was divided into two sections which are the demographic information section and the research specific questions. The demographics section contains questions that give an appropriate profile of the participants and the research specific questions contain questions whose answers are relevant to the research question and problem. It is important to note that none of this information will be coupled to a name, position or company. Anonymity is guaranteed.

Section A: Demographics profile of Participants

1. What is your Gender?
2. What Management level is your position?
3. What department are you working for?
4. How long have you been employed with the company?

Section B: Research Specific Questions

5. What do you understand by sustainable Gold mining operations? Can sustainability be achieved in a Gold mine?
6. What do you think are the effects of illegal mining on a Gold mining operation?
7. How does a Gold mine attain sustainability?
8. How can illegal mining activities affect sustainability?
9. Which activities of illegal mining are detrimental to the operations of a Gold mine?
10. What can be done to deal with illegal mining activities?

11. Is legalizing the illegal gold mining activities an option? Why?

12. Can the benefits and costs of illegal mining exceed that of legal mining? Why?

3.4.2 Data collection procedure

The interview questions was self-administered by the researcher to the participants. The researcher will utilize the following procedure to collect data once the sample has been assembled.

- Make an appointment with the potential participants.
- Acquire informed consent from participant. Every potential participant will be handed a letter requesting them to participate in the research as well as a consent form that they will have to sign.
- Once informed consent has been established, a specific meeting date and time is then agreed upon.
- On the meeting day the researcher will go through the informed consent, including purpose of the research, rights of the participants, guarantees on confidentiality and anonymity.
- The researcher will also request authority on the use of a digital recorder. The digital recorder assists the researcher to maintain the quality of the research without the burden of having to take manual notes. The contents of the digital recorder will be deleted once transcribing has been concluded.
- Transcribing of the data will be in such a way that no individual data will be linked to any participants using codes in place of identities.

3.5 DATA ANALYSIS

The data collected will be analysed using qualitative data analysis method. According to Bryman (2012:565) there are three approaches to analysing qualitative data which includes; analytic induction, grounded theory and coding. Analytic induction is an approach to the analysis of data in which the researcher seeks universal explanations of phenomena by pursuing the collection of data until no cases that are inconsistent with a hypothetical explanation. In grounded theory, you carry on collecting data by observing, interviewing, collecting documents until you have achieved theoretical

saturation. The objective is to discover theory from data systematically obtained from social research. Coding is the key process in grounded theory, whereby data are broken down into component parts, which are given names (Bryman, 2012:568).

3.5.1 Method of Analysis

All interview data were transcribed. Data was prepared and organized for analysis. According to Williams (2014:48) Qualitative research is interpretative, the researcher makes an interpretation and draws a conclusion about the meaning and uses theory to state the lessons learnt. The researcher screens the data collected through a personal lens, therefore personal interpretation and understanding in qualitative data analysis cannot be evaded. The researcher carried out initial coding and content analysis which led to the creation of themes. In addition to this, transcripts were sent to a qualitative expert to independently perform content analysis and coding. This was done to limit researcher bias in the interpretation as well as ensuring that the researcher did not miss anything important.

According to Creswell (2012:239) qualitative data analysis can be achieved in six steps, which are preparing and organizing the data for analysis, coding, using the codes to develop descriptions and themes; representing the findings through narratives and visuals; making an interpretation of the meaning of the results, and conducting strategies to validate the accuracy of the findings.

Step 1: Preparing and organizing the data.

The researcher transcribed all six interviews. Each interview was titled with the term “participant” and a specific number assigned to each participant from 01 to 06. The conversations in each interview were also coded “Res01” and “Ans01”. “Res” in the code stands for researcher and “01” represents the question number posed to the participant which will grow up until the dialogue ends. “Ans” in the code stands for the participants answer and “01” represent the answer provided from question 1.

Step 2: Coding.

Coding involved engaging in an initial exploration of the data to extract general themes, classes and meanings. The researcher coded the responses question by question placing the data into broad classes.

Step 3: Using the codes to develop descriptions and themes.

The broad classes were broken down into more specific descriptions and themes to develop a more general picture of the data.

Step 4: Representing the findings through narratives and visuals.

The researcher relied on narratives to represent the data, where possible the narratives were backed by verbatim quotes from the participants.

Step 5: Interpretation of the meaning of the results.

Every narrative developed were interpreted in terms of its impact on the research questions and objectives as well as on the literature that might have informed the narrative.

Step 6: Conducting strategies to validate the accuracy of the findings.

The researcher asked the academic supervisor of the project to conduct a thorough review of the study and report back, in writing, the strengths and weaknesses of the project. Upon receipt of outside report, the researcher reviewed and made adjustments where necessary.

3.6 ETHICAL CONSIDERATION

According to Bryman (2012:568) ethical principles can be divided into four sub-sections namely, harm to participants, lack of informed consent, invasion of privacy and deception.

Harm to participant's principle dictates that the researcher should make sure that participants are not harmed by their participation in the study. The researcher must also ensure that there is informed consent from each participant, this means that the participants must be informed about their rights and privileges and understand that participation is voluntary with no compensation. The privacy off the participants must

be protected at any stage of the research. The researcher will use information obtained for the purpose intended and communicated to the participant.

- **Harm to participants**

To minimise the possibility of emotional harm and stress which could arise due to the possible close connection between participants and illegal miners, the researcher will refer any such cases to a professional social worker for de-briefing. No information will be directly linked to any individual using codes to manage down the possibility of participants advancing arguments that contradicts that of the employer which could result in loss of employment.

- **Lack of informed consent**

The researcher obtained signed consent forms prior to making appointments for the interviews. Each participant signed the consent form in response to the letter requesting their participations. The letter requesting participants' participation includes;

- Formal request for participants participation
- An explanation of the title and purpose of the research
- Information that the data collected will be used for academic purposes only and;
- The data will be accessible to the researcher and the academic committee.
- An explanation of the participant's rights, the participation is voluntary and the participant can cancel the interview at any given point before or during the interview.
- The identity of the participant will remain anonymous and information provided would be kept confidential.
- If the participant is in agreement, s/he should sign the consent form.

- **Invasion of privacy**

Care would be taken to use codes in place of participant's identities in transcribing as well as in writing the final report. In other words, the participant will remain anonymous and confidential information will be protected without affecting the outcomes of the research.

- **Deception**

The researcher will ensure the strict implementation of the informed consent outlined in this study. No promises for employment, promotion or any rewards and favours will be made on account of participating in this study.

3.7 RESULTS AND DISCUSSIONS

3.7.1 Introduction

In this section the outcomes from the qualitative data analysis are presented and literature controlled. The research points are discussed to satisfy the research objectives. The presentation of results and discussion begin with the presentation and discussion of the demographic profile of the sample in the next section.

3.7.2 Demographic profile of the sample

The point of saturation was attained by interviewing four participants who are middle to senior management employees of a single mine. An additional two participants were interviewed to confirm and further validate saturation point.

The managers were chosen to participate in the sample because they are decision makers whose decisions directly influence the sustainability of the mining operations. The seventh participant would not be added to the analysis as it constituted a repeat of information. Table 3.1 below shows the demographic profile of the sample.

Table 3.1: Demographic Profile of Participants

Participant	Gender	Management Level	Department	Years of Service
Participant01	Male	Middle Management	Engineering	4 Years
Participant02	Male	Middle Management	Finance	9 years
Participant03	Male	Senior Management	Capital Projects	24 years
Participant04	Male	Middle Management	Security	14 years
Participant05	Male	Senior Executive	Sustainability	4 years
Participant06	Female	Senior Management	Sustainability	4 Months

Of the six participants five were male employees and one female employee. The gender profile of the sample is reflective of the gender profile of senior and middle management at the mine. For every female in senior and middle management, there four males. The sample is equally divided between senior and middle management participants to provide a balanced view from the management of the mine. The participants represents diverse functions, which are critical to managing sustainability of the mine. The departments include Engineering, Finance, Projects, Security and Sustainability. The participants years of service range from four months to 24 years well above the three years minimum cut off years for one to be considered a participant in the study.

The demographic profile of participants is compliant to the unit of analysis set out in this study. The participants, therefore, are expected to adequately inform the study and outcomes. The decision makers' point of view is adequately informed by that of the shop floor workers who interact with illegal miners. Thus the inclusion of shop floor workers in the study may not be necessary particularly in a resources and time constraint study.

3.7.3 Research Specific Outcomes/Results

Nine themes emerged from the data analysis conducted on the research specific outcomes; the themes include Sustainability in Gold mining, Achieving of Sustainability, Effects of Illegal mining, Influence of Illegal mining on Sustainability, Dealing with Illegal mining activities, Legalizing illegal mining and Cost benefits analysis of illegal mining. The theme sustainability in gold mining is presented and discussed in the next section.

3.7.3.1 Theme 1: Understanding Sustainability of a Gold mining operation.

There is a general understanding by participants of what constitutes sustainable gold mining operations although there are a few views that departs from the construct of sustainability of gold mining operations. The majority of participants view aligned with the definition in literature on attaining sustainability in gold mines. One participants had the following to say;

“hahaha... as I understand sustainability it has to do with saving now for future generations, in mining that is actually oxymoronic (giggles)... because we are mining for as much as we can and as fast as we can for a resource that is fast running out, now that does not sound like a sustainable thing to do.. but you know that is part of the game we need to play in order to stay in business...”

And another said;

“My view on sustainable gold mining..? uhhmm my understanding is that we need to mine for resources in a sustainable manner, what I mean is, we must operate in such a manner that we do not do harm to the environment to such an extent that it will negatively affect present and future life in the country...”

This views align with arguments from Bergquist (2017:5) that industries for many years have taken advantage of natural resources to meet their immediate needs, but most

resources have a depletion date. Thus, Berguist (2017:5) defined sustainability of a mining operation as mining responsibly to prolong mining activities for future generations. Responsible mining may include taking care of the environment by using environmentally friendly mining methods and dumping of waste even if we deplete the resources today. The mine resources and the waste in a safe environment can be availed to future generations' technology and innovations for re-mining and waste recovery. In a sense attaining sustainability.

The participants whose views departed from the working definition of sustainability in gold mining in this study, cherry picked elements in the definition with the result that their views were insufficient to confirm their understanding of the construct. One participant was of the view that sustainability in gold operations referred only to creating value for shareholders in the long term. The participant had the following to say:

“(pause) I think uhmmm... if I understand the word sustainability, uhhhhmm, it's more about creating value for the shareholders over a long period...”

Another participant picked more elements that included costs, safety and environment. The participant had the following to say;

“What I understand about sustainability ... Basically is to provide people with work in a sustainable manner but also look at the safety aspect and the environmental aspect and the cost aspect and if it can be done in a good principal manner...”

Therefore, the finding is that sustainability in gold mining is broad and not limited to shareholders interest or the welfare and safety of employees. In addition to these factors sustainability also encompasses the treatment of the environment and a range of other stakeholders.

Theme two, achieving sustainability, is presented and discussed in the next section.

3.7.3.2 Theme 2: Achieving of Sustainability

Participants were asked if they think Sustainability in a Gold mine can be achieved. The general consensus by participants was that sustainability can be achieved in a gold mine but only if certain conditions prevailed. The conditions identified by participants include mining safely, intelligently, environmentally friendly, beneficiation, technology, training and innovatively. One participant had the following to say;

“Can sustainability be achieved in a gold mine? Yes, I think it can, but we need look at the factors mentioned previously, which is safety, environmental and costing. If cost is too high than you cannot basically continue, safety risks, if people die than you also can’t mine in a sustainable way”.

Another participant added the following;

“I think that sustainability can be achieved if we start acting and mining responsibly and intelligently”.

The mining industry has made great strides in technological advancements, a lot of capital investment is made into technology projects in order to secure a longer life of mine. One participant had the following to say;

“However I do think sustainability can be achieved in a gold mine... uhhmmm but I think smarter future generations will come up with new innovations to re-mine our old tailings facilities, they will be getting less gold, but I think by then gold would be more scarce and the price will be sky high making it worth it to mine lesser gold”.

Another participant added that revisiting old tailings facilities might be the way to go;

“Uhhmm in the context of South Africa. To answer that, ahhh there are other options, other new ventures that we are venturing into... aahh basically the type of surface mining that is happening throughout the country, that creates

value 'cause gold gets recovered.. eemmm it might not be considered as hard core mining but it still creates value for the shareholders”.

One participant mentioned that innovation is needed and emphasis should be placed on the beneficiation process. The participant had the following to say;

“I think we need to be more innovative and think outside of the box, instead of saying we are miners, we go underground we go get gold and bring it up. And also I think we need to start bringing in the beneficiation process because that is actually one thing that we are lacking, we have the resources in South Africa but we don't have beneficiation and ahhh that is actually where we are losing it, because with beneficiation you can actually teach somebody a skill and leave them with a skill which is sustainability”.

Another participant concurred that we need to mine smarter, and also mentioned that we need to retain our experts who has a lot of experience in the field. The participant had this to say;

“This in my view can only be done if we start working smarter, we need to try and retain our talent, especially long service employees with a wealth of expertise... “.

According to Feil and Schreiber (2017:667) sustainability is a response for the solution to the deterioration of the human environmental system. This echoed in the responses of two of the participants, who placed emphasis on mining safely and being environmentally friendly. One of the participants had this to say;

“...for a mine to attain sustainability you basically need to look at methods to reduce costs, take care of the environment, look at training people so that everybody in the environment benefits and the country can move forward and also assist people in the mining community to increase their livelihood”.

Another said;

“...only way a mine can attain sustainability is through mining safely, responsibly and environmentally friendly. People’s lives and the environment must come before profits and shareholders interest”.

Above responses by participants indicates that sustainability can be attained if factors like innovation, safety, intelligence and environmental consideration receives high priority. Responses from all participants provides clear indication that sustainability is indeed achievable, it is hardly being achieved in current operations which are currently marked by a race towards extracting more in less time. It is clear also from the responses that certain conditions must be met like safe mining, innovation, leaning towards more environmentally friendly operations and the use of technology before current operations can be sustainable. Participants agreed with the three overlapping circle model in Flint (2013:33) that sustainability exists at the intersection of meeting economic, environmental and societal needs. Participants further characterised sustainability of gold operations as safe, intelligent, environmentally friendly and innovative mining although they admit that it is currently a challenge to gold miners. Theme three, effects of illegal mining, is presented and discussed in the next section.

3.7.3.3 Theme 3: Effects of illegal mining

When posed with the question on what participants thought on what the effects of illegal mining on a Gold mining operation was, they provided a variety of negative factors that included safety, health, crime, operational complexity, increased costs, conflict and destruction of infrastructure. Safety and endangerment of people’s lives was a common effect identified in all responses. The effects of illegal mining on gold mining operations provided by participants in this sample are compatible with the ones provided in The Minerals Council of South Africa, (2018) and Steenkamp and Mostert (2012:2) who identified them as mostly negative. Safety is a topical issue within South African mining industry, and some participants added that the mine endure extra costs in security to safeguard the lives of their employees. One participant had the following to say;

“I think the effects is pretty bad, Anglo’s first and most important value is safety, and we spent millions on making sure that safety standards is kept. Current pressure from Government and unions to make sure our employees are safe also adds to our problems, but we as a company have a very good track record when it comes to safety. But illegal mining puts this record of ours in danger, because the way they operate places our workers in danger and they place us and further costs pressure to try and contain them”.

One participant focussed on the criminal element that illegal mining exposes the mining operation to and the costly consequences of the illegal miners’ actions. The participant had the following to say;

“Directly for us it is the destruction of our infrastructure, and there seems to be a huge criminal element emerging within the illegal mining activity, where most Zama’s are not interested in mining but more in stealing copper cables, steel, aluminium and other operational costly equipment. All this has a ripple effect on the costs of the company... because we need to replace stolen goods, hire extra security and not even mentioning the standing time it is costing the mine due to cable and pipeline theft”.

Another participant made mention that illegal mining have the potential to give mining a bad reputation, especially in cases were mining companies failed to close of old mining shafts properly. The actions by illegal miners has the potential to generate substantial conflict. The participant had this to say;

“Bad Perception of mining companies can exist, where people enter into old shafts that mining companies did not close of properly, and that can basically give the company a bad name or reputation”.

Data gathered from participants indicated strongly that the effects of illegal mining on mining operations is negative, mostly from a safety, security and cost perspective. However, Debrah, Watson and Quansah (2014:913) argued that if made legal, artisanal and small scale miners (ASM) can contribute to the national income, to sustainable development and aid development of rural areas. The decision makers

participating in this research did not identify any positive effect. In other words illegal miners has the potential to contribute negatively to the three spheres of sustainability, namely economic, environment and societal. The outcome reflects the current narrative of gold miners which is restricted to only seeing the negatives of the phenomenon of illegal mining. It is possible that if decision makers in the mining sector could allow themselves to consider the positive effects of illegal mining viable solutions to the problem could be achieved. The prevalent narrative can easily amount to a missed opportunity to Government, the mining sector and society. Theme four, how to achieve is presented and discussed in the next section.

3.7.3.4 Theme 4: Influence of Illegal mining on sustainability.

The Minerals Council South Africa (2018) argued that illegal miners present major risks to themselves and to the health and safety of employees of legal mining operations. Therefore, sustainability cannot be achieved if the health and safety of people are under threat. OHSWA (2016:3) argued that employers are only truly sustainable when the health and safety of their workers are ensured. The participants' response to the question of how illegal mining can affect sustainability is mostly negative due to safety concerns. The participants had the following to say;

"...if you cannot work safely, you cannot be sustainable, and as I said previously Illegal mining is threatening the safety of the people on surrounding mines and communities..."

Another said;

"I think the biggest one here is the risk of people, and basically what effect it has on the different shafts where people can basically injure each other, especially where legal and illegal miners meet each other..."

Two participants added another dynamic besides the safety and endangerment of lives. The participants mentioned that illegal miners might hinder sustainability, because their actions closes the door on any hope of re-vitalising old abandoned mines. This view of the participants is shared by Steenkamp and Clark-Mostert

(2012:1-5) who argued that the extent of damage done by illegal miners on abandoned shafts is such, that any attempt to revitalise these old mines will be uneconomical. In other words illegal miners negatively impacts sustainability, crudely defined as meeting the needs of the present without compromising the ability of future generations to meet their own needs. For the future generations to meet their needs of a depleting resource their hope is in re-mining, waste recovery and recycling which seems to be affected negatively by illegal miners. One participant had this to say;

“You know, it basically kills our chance of going back and revitalising old areas and that’s where you are losing value, because you start looking at the old areas and start saying. Nahhhh, there is gold, but not really worth going back for, so actually sustainability is affected in that way”.

Another added that;

“...they don’t care about safety or the environment. Their mining methods places themselves and surrounding communities in grave danger. They also kills any hope of old shafts being re-opened by vandalising these old shafts, although future generations will be smarter in mining, these illegal miners closes the door on future generations access to these old mines”.

The influence of illegal mining on the sustainability of gold mines was reviewed as negative by participants on account of safety concerns, destruction of re-mining and waste recovery opportunities. There is a view that the positive influence to sustainability of gold mines by illegal miners is outweighed by the negative influence. Theme 6 is presented and discussed in the next section.

3.7.3.5 Theme 5: Detrimental Activities by illegal miners.

Gathered from participants’ responses thus far, it appears that illegal miners and legal miners are on two opposite ends and co-existence does not seem to be a possibility. The views of the sample here contradicts arguments in Crowley (2014), that in some instances legal mine workers are working in cahoots with illegal miners. Participants were also asked to identify particular activities by illegal miners that are detrimental to

legal mining operations. The activities identified, by the sample participants, as detrimental to mining operations include killings due to conflicts, use of explosives, poor handling of hazardous materials, associate violence, harm to the geology and environment. One participant had the following to say, which basically summarise the sample responses;

“three things stands out for me... one: the killings, I mean the killings of zamas amongst themselves as well as the killing and injuring of mine employees, two: the harm that is caused to the environment, I mean the way the dispose of some of the toxic materials they use for extracting, things like mercury and acid and thirdly the fact that sit with a lot of explosives which can be detrimental if placed in the wrong hands, which exposes the surrounding communities and mine at great risk”.

The detrimental activities identified by the participants can be summarized into the possibility for the illegal miners to harm themselves, threaten the safety of legal miners, placing the community in harm's way and precipitating the damage to the environment. One participant argued that the fact that illegal miners are operating from legal mines is on its own a detrimental activity. This statement concurs with Harvey (2014) who stated that illegal miners has moved on from operating only in abandoned mines, and appears to be especially prevalent where improperly sealed, abandoned tunnels meets operational tunnels of current gold mining companies. The participant had the following to say;

“...mining of current operating shafts, which can lead to death of people, including security people can have a huge influence at the end of the day...”.

Another participant raised concern on illegal miners' understanding of the geology when blasting. This according to the participant can have dire consequences to the community, the illegal miners themselves and to the environment. The participant had the following to say;

“I think below ground is the blasting, which can be detrimental, the question is do they have the right skill and understand geology and related blasting, and do they have safety checks and risk assessments...”

One frustrated participant mentioned that the illegal miners are turning mining towns into war zones. The participant had the following to say;

“...they turn our mining towns into war zones, not only the fact that they place mining employees life in danger, but also the fact that they have violent fights and shoot-outs between themselves, I have seen a lot of video footage of Zama’s shoot outs and they are merciless. If this is allowed to continue mining towns will suffer and mining will be very difficult.”

Thus the activities of illegal miners are believed to be having profound negative impact on the mining communities as well. The views of participants in this study are consistent with arguments against the activities of illegal miners as stated in a number of studies on the subject matter (Molosankwe, 2012; Steenkamp and Clark-Mostert, 2012:1-5 and Mzamo, 2017). Theme 7 is presented and discussed in the next section.

3.7.3.6 Theme 6: What action can be taken against illegal mining?

The actions that can be taken against illegal mining were listed as, mining companies to properly seal old mining shafts, Government to increase its involvement in resolving the issue, creation a special task force, increase law enforcement and miners to take a leading role as Government does not have capacity. Conspicuously absent from the list is the issue of legalizing small scale and artisanal miners. According to Debrah, Watson and Quansah (2014:913) if made legal, artisanal and small scale miners (ASM) can contribute to the national income, to sustainable development and aid development of rural areas. The failure by the participants to consider legalizing ASM miners may amount to missed opportunities in the mining sector. All participants had an opinion on what actions should be taken to curb illegal mining. The one participant was not sure what can be done but ended up suggesting increased law enforcement. This is what the participant had to say;

“ I am not really sure how we can deal with it, but key is that, it is an illegal activity and it needs to be dealt with”.

However, increasing law enforcement presents its own challenges. Government does not have enough capacity to prioritise illegal mining and the South African Police force does not have jurisdiction nor the appropriate training to operate underground. The current decline in the mining sector works against capacitating Government through increased law enforcement against illegal mining. In the response to the current prevailing situation, miners seem to have costed in the phenomena of illegal miners as their solution. The response by miners has dire consequences for mine safety, environment and mining communities as sustainability in mining operations may not be guaranteed.

One participant felt that Government needs to play a bigger role and that police jurisdiction should be extended to go underground. The participant also felt that a special task unit be established by SAPS. The participant said the following;

“Firstly Government need to increase their involvement... I mean they seriously need to look at setting up a special unit which only deals with illegal miners, I mean we need trained officers that will jurisdiction to go underground. The mining sector is a big client for the Government an employer of the people and a huge tax payer, so it is in there interest that the mines are sustainable and operating profitably.”

Another participant was of the view that it is incumbent on the mining companies to ensure that old mining shafts are sealed properly. According to Molosankwe (2012) the problem can be easily averted if mining companies sealed the shafts by blasting the entrance with dynamite when operations are stopped. The participant had the following to say;

“Firstly the shafts must close off all old shafts correctly, so that there’s no illegal miners can gain entry and there would be no way for them to go underground and start mining. Uhhmm I think security needs to basically go asses the entry

points and assess the situations and see if they can intervene and make sure people don't get access..."

Most mines are funded by foreign investment with very little interest beyond the closure of the mine. The situation is worsened by the fact that when most shafts were closed, regulation then allowed these miners to seal off mines in a way that may be deemed improper today under the pressure of illegal miners. The liability of properly sealing these mining shafts falls back on the incapacitated Government with a declining resources sector.

One of the participants was of the view that Government and the police force does not have the capacity or competence to take appropriate action. The participant said the following while laughing sarcastically;

"... law and order must be restored, but I honestly don't think Government has the smarts or capacity to deal with this problem, and it is spiralling out of control".

Theme 7 is presented and discussed in the next section.

3.7.3.7 Theme 7: Legalizing illegal miners.

When the participants were faced with the question of whether legalizing illegal mining is an option only one participant said that it might be an option, but more research is needed beforehand. The participant also made mention of the fact that the issue of illegal immigrants needs to be addressed. Crowley (2014) mentioned that the rise in illegal mining is partly due to the countries amount of illegal immigrants. The participant had the following to say;

"it is an option, but there needs to be a thorough thinking of how this will work. There is an opportunity to look at formalising, but first more research have to done as to say how we are going to manage it, because illegal mining is not just about South Africans, there are other people who are illegal immigrants. As long as we have that dynamic, you can formalise it, but the illegal

immigrants will still be there because you have not dealt with illegal immigrants from outside. The problem basically is that the legacy of SA is we brought immigrants to work on the mines and now we don't have jobs for them and mining is the only skill that they have and they get recruited by the big bosses of illegal miners and they see an opportunity to survive. So as long as there is the illegal immigrant issue, it will threaten the chances of formalising”.

The rest of participants' responses was that legalizing illegal miners is not an option at all, citing problems such as safety compliance, irresponsible mining and corruption. The participants had this to say;

“No, not at all, this will only cause fertile ground for even more corruption, and will affect responsible mining negatively”.

Another said;

“I don't think it's an option... because how can you compare a legal miner to an illegal miner and how can the safety aspects be compared between each other”.

Another participant commented that it might work in theory, but not in reality;

“...in theory yes it is, but the practicality of it might be very challenging. I mean how will legalization work? Will the department of minerals police these smaller miners in the same way they scrutinize the mining companies? They will have... because the first priority should be keeping people safe and protecting the environment. And with implementation of all the statutory requirements, most of these small miners will fall off the wayside. I honestly don't think the department of minerals has the capacity to deal with a lot of small mining companies effectively”.

Theme 8 is presented and discussed in the next section.

3.7.3.8 Theme 8: Illegal mining benefits versus Legal mining benefits.

All participants agreed that there are no benefits to illegal mining, especially when compared to legal mining companies. Below are responses from participants;

“... never, I honestly don't think so, the way SA mining laws and rules works is tried and tested, besides, I don't think illegal mining has any benefits except for themselves”.

“...not sure if there are many benefits of illegal mining, especially for the country, but legal miners have far more benefits, for being the top employer for many years and are a huge contributor to the national economy. So no, I really don't think costs and benefits of illegal mining can exceed that of legal miners”.

“not sure if there are many benefits of illegal mining, especially for the country, but legal miners have far more benefits, for being the top employer for many years and are a huge contributor to the national economy. So no, I really don't think costs and benefits of illegal mining can exceed that of legal miners.

“I would probably say no, and if one need to comply with the health and safety standards, that's going to cost money too, resistance is going to be high”.

The economic value of illegal mining will be difficult to quantify, thus making it difficult to conclude what benefits there is and its magnitude. On the other hand PWC (2016:93) estimated that illegal mining is costing the industry and economy a staggering R 7 billion annually.

3.8 CONCLUSION

Sustainability in gold mining is broad and not limited to the interest of shareholders or the welfare of employees alone but also to safety, the environment and a range of other stakeholders. The conditions conducive to sustainability in gold mining were identified as mining safely, intelligently, environmentally friendly, ensuring beneficiation, and use of modern technology, continuous training and maintaining a culture of innovation. Illegal mining is viewed to negatively affect mining operations mostly from a safety, security and cost perspective. Illegal miners present major risks to themselves and to the health and safety of employees of legal mining companies. Activities associated with illegal miners that are detrimental to sustainability were identified as unregulated killings, hazardous handling of explosives, unsustainable handling of the geology and damage to the environment.

Government does not have enough capacity to police illegal mining and the South African Police force do not have jurisdiction to operate underground. Mining companies feel that Government, although incapacitated, should play a bigger role in curbing the pandemic. It is established that the matter of legalizing illegal miners is not an option for mining companies.

3.9 CHAPTER SUMMARY

This chapter described the research methodology used in this study. A qualitative research method was adopted involving the use of semi-structured interviews as the research instrument to provide a viable answer to the research questions. A convenient sample of 6 participants attained the point of saturation and data was subjected to qualitative analysis. The maximum possible ethical standards were achieved following an ethical committee approval.

The outcomes from the qualitative data analysis were presented. Interview data from six participants were transcribed and related back to existing literature.

CHAPTER 4

CONCLUSIONS AND RECOMMENDATIONS

4.1 INTRODUCTION

There is a general understanding of what sustainability in gold mining entails. Sustainability in gold mining can be attained on condition that mining is done safely, intelligently with beneficiation, in an environmentally friendly manner, utilizing technology, training and innovating.

The dominant view is that illegal mining has overly negative effects which threatens safety of miners and communities, destroys the environment and along with it the socio-economic well-being of the surrounding communities. The dominant view does not recognize benefits of illegal mining which has resulted in other countries legalizing artisanal and small scale miners. The rigidity of failing to recognise some benefits from illegal mining that is pervasive in the mining sector could amount to a missed opportunity. Thus the influence of illegal mining on sustainability is overly negative, because without guaranteeing safety, the environment and economic well-being, sustainability can be achieved and maintained.

Detrimental activities by illegal miners include; unregulated conflicts that results in killings, hazardous handling of explosives, unsustainable handling of the geology and damage to the environment. Sustainability of the mines is severely hampered in the case were illegal miners actions on old shafts makes revitalising of these shafts uneconomical.

Legalizing illegal miners does not appear to be a viable option. Legalisation of these small scale miners will put great amount of strain on the South African mining regulatory body the Department of Minerals and Resources (DMR). The DMR will have to significantly increase their complement in order to ensure that health, safety and environmental laws are enforced. There is also the fear that should illegal miners be formalised that a great deal of unrefined gold would not go through the South African Rand Refinery. This unrefined or gold bearing material would find its way into illicit trading activities which could encourage widespread corruption. Government need to

address the illegal immigrant pandemic in the country. A large number of illegal miners in the country are illegal immigrants from neighbouring countries and this is one critical aspect for Government to address before thinking about legalizing the illegal miners.

4.1.1 Summary Conclusions

The objectives posed in this study are answered in summary as follows;

RQ1 - What is the effect of illegal mining on the sustainability of a Gold mine in South-Africa?

Illegal mining is concluded to have a negative effect on the sustainability of a South African gold mine. Illegal mining actions has negative effects on the environment and threatens the health and safety of employees and communities, thus threatening sustainability.

RQ2 - What does sustainability mean to a Gold mine?

Sustainability in a gold mine means that mining activities needs to be conducted in a safe and environmentally friendly manner. Mining activities should done intelligently and efficiently within the beneficiation process and ample training must be provided.

RQ3 - What aspects of sustainability are susceptible to illegal mining activity?

The health and safety of mining employees, surrounding communities and the irreversible damage done to the natural environment.

RQ4 - What specific activities of illegal gold miners are detrimental to the sustainability of Gold mining companies?

The violence and killings displayed around illegal mining activity hotspots and also the irresponsible handling of hazardous materials like explosives, mercury and cyanide.

RQ5 - What can be done to deal with illegal mining activities in a sustainable way?

The research question is satisfied by the recommendations section that follows next.

4.2 RECOMMENDATIONS

The research findings from the research questions provided insight from individuals who are decision makers within a gold mine. Through this research, stakeholders were identified and illegal mining's effect on sustainability was tested. Along with a management framework, this study suggests the following recommendations.

- The problem of illegal miners require that miners be more engaged in working out the solution to the problem. It is not enough to cost in the problem and expect the incapacitated Government to resolve on its own. Gold miners can explore models were they can work alongside small scale miners to starve off illegal mining.
- The existence of illegal miners reveals the inefficiencies in large scale gold mining. Greater gold mining efficiency would mean lesser resource available for illegal miners to explore. Gold mining companies can achieve better efficiencies if they embrace digital mining and new software technologies, converting conventional mining practices to mechanisation and automation, improve the economics of low-grade and residual ore bodies and make use of advanced analytics. The modernisation is imperative, if gold miners do not adapt modernisation its survival will be threatened and it will not be sustainable in the future.
- The high number of abandoned mine shafts encourages illegal mining. Mining companies could invest in the sealing of these abandoned shafts in partnership with the Department of Minerals and Resources. Mining companies could also offer their expertise to the Department to assist in critical thinking as to how to seal off these shafts effective and efficiently.
- Mining companies should revise their current mine security structures and should start working closely with organised labour and the South African Police Service to increase success rate of convictions for crimes related to illegal

mining. In partnership with SAPS, mining companies can focus on visible policing in illegal mining hotspots and affected communities.

4.3 MANAGERIAL IMPLICATIONS

The empirical outcomes have, to a large extent mirrored the outcomes already in literature which reflect the current views on the effect of illegal mining on the sustainability of a gold mine. However, the current views fail to consider the opportunities in addressing the positives associated with formalising small scale and artisanal mining. The implication for management is that flexible managers will seek new inclusive measures to deal with the phenomena and enhance sustainability in their operations. Management should avoid the silo mentality and embrace a collective framework with a holistic view of all possible scenarios.

Sustainability of gold mines is clearly in the best interest of mining companies, Government and socio-economic conditions of communities. In an effort to combat the threat to sustainability caused by illegal miners, these stakeholders need to collaborate.

A collective framework that decision makers, policy makers and managers can use in managing the illegal mining problem has been developed through this research. Figures 4.1 below represents a graphical illustration of the framework, which can advise all stakeholders on how best to focus their attention and resources in managing this pandemic.

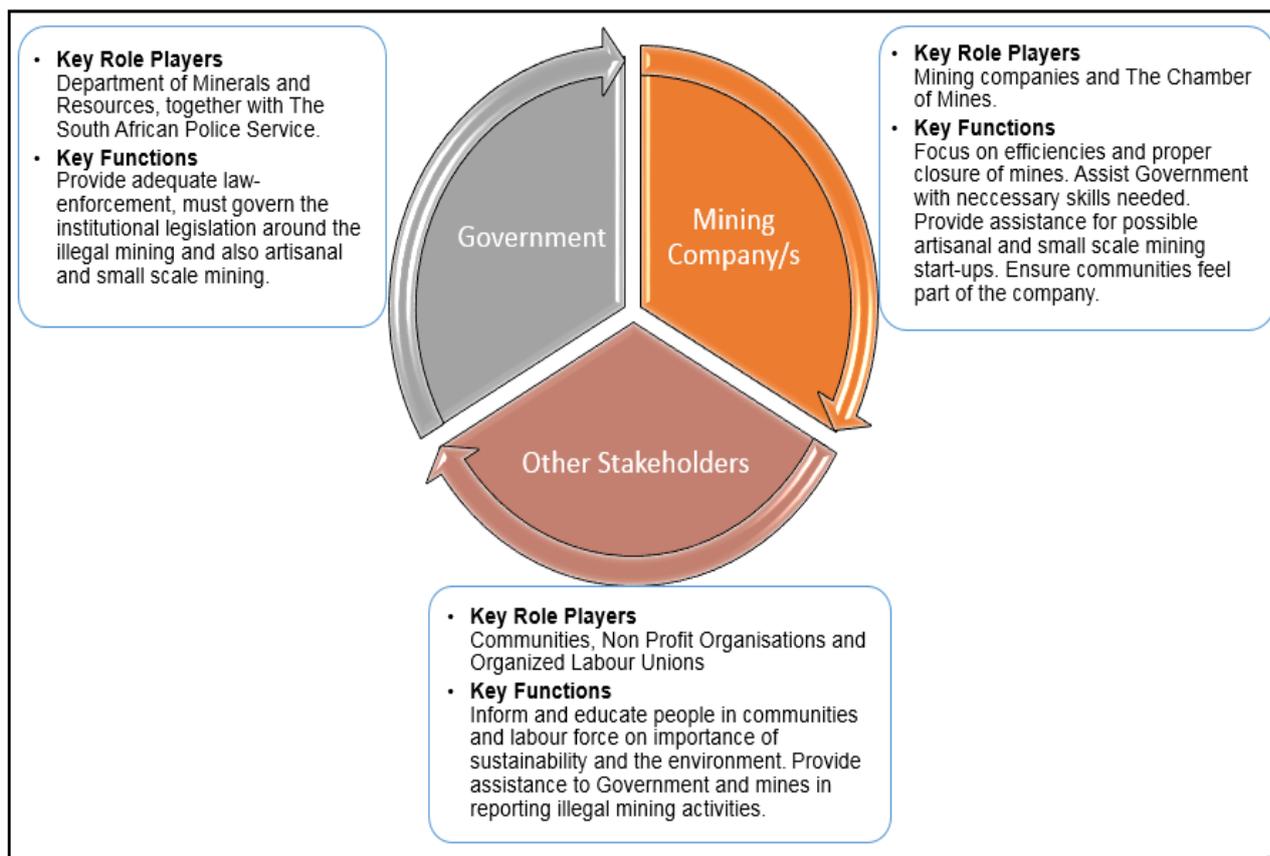


Figure 4.1: Collective Framework

The framework in figure 4.1 depicts the interdependence of all the stakeholders involved. The framework is an illustration of the relationship between the stakeholders and how their collaboration can positively contribute towards mining sustainability. In this relationship, Government, Mining companies and other stakeholders have an equally important contribution to make in order to receive the benefits that stems from mining sustainability. Government needs gold mines to be sustainable, this will yield better revenue collection. Mines need Government to ensure a conducive business climate and communities needs mines to provide income and better livelihoods. Mines need communities in order to obtain a social license and communities need Government for protection, health and safety. Based on this it is clear that synergy between these different entities is vital to win the fight against illegal miners.

4.4 RECOMMENDATIONS FOR FUTURE STUDIES

- The utility of this study could be expanded in the future to include data from managers, employees, regulatory officials and the community.
- The qualitative research approach employed in this study generated theories which may require future testing utilising quantitative research approaches.
- Empirical studies focussing on the benefits of illegal mining against benefits of legal mining may be required in the future to help understand the phenomena of illegal mining.

4.5 FINAL CONCLUSION

The study sought to gain an enhanced understanding into how illegal mining activities effects the sustainability of a gold mine. The results of the study showed that all respondents indicated that illegal mining has vastly negative effects on the company. To successfully combat this pandemic, the gold mining industry needs visionary leadership, with agile and critical thinking approaches towards amicable solutions. The gold mining industry has to act in unison with all stakeholders, Government, employees, communities and organized labour in its approach to combat illegal mining in order to secure sustainability. There is a need to have one national vision with mutual benefit which all stakeholders will work towards.

4.6 CHAPTER SUMMARY

This chapter concludes the research through summarising key findings, providing recommendations based on the findings, provide managerial implications of the findings and highlighting potential areas for future research. The study also proposed a framework that may assist in the quest for a remedy to the illegal mining problem. The researcher is of the view that the primary and secondary objectives of this study have been met. Arguments for and against illegal mining have been objectively debated and the study concluded that mining sustainability is hampered by illegal miners and their illicit activities.

REFERENCES

Akhtar, I. 2016. Research Design. *Research in Social Science: Interdisciplinary Perspectives*: 68-81.

Alvi, M. 2016. *A Manual for Selecting Sampling Techniques in Research*.
https://mpr.ub.uni-muenchen.de/70218/1/MPRA_paper_70218.pdf. Date of access 2 Aug. 2018.

Anon. 2007. *Framing Sustainable Development The Brundtland Report – 20 Years On*. http://www.un.org/esa/sustdev/csd/csd15/media/backgrounder_brundtland.pdf. Date of access: 28 Aug. 2017.

Anon. 2014. *What is Sustainability?*
<https://www.mcgill.ca/sustainability/files/sustainability/what-is-sustainability.pdf>. Date of access: 2 Aug. 2018

Anon. 2016. *Mine SA 2016, Facts and Figures Pocketbook*.
<http://www.chamberofmines.org.za/industry-news/publications/facts-and-figures>. Date of access: 1 Oct. 2017.

Anon. 2017. *Illegal Mining Fact sheet 2017*. [www.chamberofmines.org.za/illegal-mining-factsheet-31-01-20170%20\(3\).pdf](http://www.chamberofmines.org.za/illegal-mining-factsheet-31-01-20170%20(3).pdf). Date of access: 19 Mar. 2017.

Anon. 2017. *Mercury and health*.
<http://www.who.int/mediacentre/factsheets/fs361/en/>. Date of access: 28 Sept. 2017.

Anon. 2017. Tough times for small town blighted by mine closure. *News24*, 29 May.
<https://www.news24.com/SouthAfrica/News/tough-times-for-small-town-blighted-by-mine-closure-20170529>. Date of access: 28 Sept. 2017.

Anon. 2017. *Top Gold Producing Countries in the World*.
<http://www.worldatlas.com/articles/top-14-gold-producers-in-the-world.html>. Date of access: 20 Mar. 2017.

Anon. 2018. *Gold Production through History*.
<https://www.goldfeverprospecting.com/goprthhi.html>. Date of access: 2 Aug. 2018.

Anon. 2018. *Mining in South Africa*. <https://www.projectsiaq.co.za/mining-in-south-africa.htm>. Date of access: 7 Jul. 2018.

Berquist, A. 2017. *Business and Sustainability: New Business History Perspectives*. New York: Harvard Business School. (Working paper 18-034).

Boning J. 2015. *Illegal Mining in South Africa: What are the Impacts and Threats?* <https://bgv.solidariteit.co.za/en/illegal-mining-in-south-africa-what-are-the-impacts-and-threats/>. Date of access: 20 Mar. 2017.

Boncz, I. 2015. *Introduction to research methodology*. Szechenyi: Faculty of Health Sciences of the University of Pécs. 22-26.

Bryman, A. 2012. *Social Research Methods*. 4th ed. London: Oxford University Press. 565-568.

Chamber of Mines South Africa. 2016. *Integrated Annual Review*. Johannesburg:

Chamber of Mines South Africa. 2016. *Mines SA 2016 Facts and Figures Pocket Book*. Johannesburg

Crowley, K. 2014. *Deadly Illegal Mining Booms below South African City of Gold*. <https://www.bloomberg.com/news/articles/2014-04-23/deadly-illegal-mining-booms-below-south-africa-s-city-of-gold>. Date of access: 19 Mar. 2017.

Dozolme, P. 2016. *"What is Illegal Mining"*. <http://christianillegalmining.blogspot.com/2016/10/what-is-illegal-mining-by-philippe.html>. Date of access: 29 Aug. 2018.

Etikan, I. & Bala, K. 2017. Sampling and Sampling Methods. *Biometrics & Biostatistics International Journal* 5(6): 1-2.

Eyewitness News. 3 March 2017. *Decriminalise Informal Mining* – Oxfam SA.
<http://ewn.co.za/2017/03/09/decriminalise-informal-mining-oxfam-sa>. Date of access:
7 Jul. 2018.

Debrah, A., Watson, I. & Quansah, D. 2014. Comparison between artisanal and small-scale mining in Ghana and South Africa: lessons learnt and ways forward. *Journal of the Southern African Institute of Mining and Metallurgy*. 114 (11): 913-921.

Feil, A. & Schreiber, D. 2017. Sustainability and sustainable development: unravelling overlays and scope of their meanings. *Cad. EBAPE.BR*. 14 (3): 667.

Flint, R. 2013. Chapter 2, Basics of Sustainable Development. In: Dekker, M. *Practice of Sustainable Community Development*. New York: Springer-Science + Business media. 33-35.

Glenn, V., Doley, D., Unger, C., McCaffrey, N., McKenna, P., Gillespie, M. & Williams, E. 2014. Mine Rehabilitation Mined land rehabilitation – is there a gap between regulatory guidance and successful relinquishment? Rehabilitation guidelines – mine planning and regulatory context.
<https://www.researchgate.net/publication/263506865> Date of access: 20 Aug. 2018.

Greener, S. 2008. *Business Research Methods*. London: Ventus Publishing ApS. 10-138.

Harvey, R. 2014. *The Economics of Illegal Mining*. : <http://www.saiia.org.za/opinion-analysis/the-economics-of-illegal-mining>. Date of access: 20 Mar. 2017.

Hosken, G. & Bornman, J. 2017. *Dungeons of Gold*.
<https://www.pressreader.com/south-africa/the-times-south-africa/20170522/textview>.
Date of access: 1 Oct. 2017.

Jaiye, D. 2013. The Environmental Implication of Illegal Mining Activities in Nigeria, a Case Study of Pandogari and Barkin Ladi/Buruku Surface Mines in Niger/Plateau States. *Journal of Humanities and Social Science*. 13 (5), 13-19.

Kocmanová, A. & Dočekalová, M. 2011. Corporate Sustainability: Environmental, Social, Economic and Corporate Performance. *ACTA Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*. 7 (LIX): 203.

Kolver, L. 2013. *Illegal mining threat to lawful operations*.

<http://www.engineeringnews.co.za/print-version/illegal-mining-in-south-africa-a-growing-problem-that-has-to-be-stopped-2013-08-16>. Date of access: 24 Mar 2017.

Kumar, R. 2011. *Research Methodology a step-by-step guide for beginners*. 3rd ed. London: SAGE Publications Ltd. 65-335.

Love, J. & Kariuki, A. 2015. SAHRC study: 30,000 involved. *Pfanelo*. 37 (1):9-12.

Lukasiewicz, M. 2013. Reinvestigating Southern African stock markets: The making of the Johannesburg Stock Exchange. 1880--1889. Graduate Institute of International and Development Studies: Geneva. (Thesis – PhD).

Mabuza, E. 2018. Mining companies must be more transparent about rehabilitation funding: report. <https://www.timeslive.co.za/news/south-africa/2018-06-20-mining-companies-must-be-more-transparent-about-rehabilitation-funding-report/>. Date of access: 29 Aug. 2018.

Manerikar, V. & Manerikar, S. (2014). A Note on Exploratory Research. *A Peer Reviewed Research Journal*. 17 (1):95.

Masweneng, K. 2017. A look inside illegal mining in Matholeville. *The Times*, 26 Jul. <https://www.timeslive.co.za/news/south-africa/2017-07-26-a-look-inside-illegal-mining-in-matholeville/> Date of access: 4 Sept. 2017.

Mills, G. 2016. *Take a Chance: Welcome to the golden underground world of Zama-Zamas*. <https://www.dailymaverick.co.za/article/2016-07-05-take-a-chance-welcome-to-the-golden-underground-world-of-zama-zamas/#.WNgm2k99601>. Date of access: 20 Mar. 2017.

Milne, M. & Gray, R. 2013. W(h)ither Ecology? The Triple Bottom Line, the Global Reporting Initiative, and Corporate Sustainability Reporting. *Journal of Business Ethics* 118 (1):13-29.

Moffat, K., Lacey, J., Zhang, A. & Leipold, S. 2015. The social licence to operate: A critical review. *Forestry - An International Journal of Forest Research*:1-12.

Mohanty, M. 2018. *Law update in the works to clarify illegal mining*. <https://economictimes.indiatimes.com/industry/indl-goods/svs/metals-mining/law-update-in-the-works-to-clarify-illegal-mining/articleshow/63390464.cms>. Date of access: 20 Aug. 2018.

Molosankwe, B. 2012. *Illegal mining: high risk, high reward*. <https://www.iol.co.za/news/crime-courts/illegal-mining-high-risk-high-reward-1259644>. Date of access: 1 Oct. 2017.

Mzamo, P. 2017. *Mine shafts become killing fields in syndicate turf wars*. <http://www.miningne.ws/2017/03/08/mine-shafts-become-killing-fields-in-syndicate-turf-wars/>. Date of access: 1 Oct. 2017.

National Planning Commission. 2011. *National Development Plan 2030*. Pretoria: Government Printer. ISBN 978-0621-40475-3. RP270/2011

Neingo, P. & Tholana, T. 2016. Trends in productivity in the South African gold mining industry. *The Journal of the Southern African Institute of Mining and Metallurgy*. 116 (1): p283-290.

Nhlengetwa, K. & Hein, K. 2015. Illegal Mining versus Informal Mining - Some Fundamental Differences Learnt from Johannesburg's Durban Deep/Roodepoort Area. *Africa Australia Technical Mining Conference 2015*. 3 (1): 109-112.

Nzimande, Z. & Chauke, H. 2012. Sustainability through responsible environmental mining. *The Journal of The Southern African Institute of Mining and Metallurgy*. 112 (1): 135.

Odhiambo, E. 2015. Factors Influencing Sustainability of Gold Mining Projects in Rongo Sub County, Migori County. Nairobi: University of Nairobi. (Dissertation – Masters).

Phala, A., Mistry, D. & Matlala, R. 2017. Implications of illegal mining in Gauteng Province. *International Journal of Humanities and Social Science Invention*. 6 (4), 56-63.

PWC. 2017. SA MINE. 9TH Edition: *Highlighting Trends in The South African Mining Industry*. Pretoria

Rahi, S. 2017. Research Design and Methods: A Systematic Review of Research Paradigms, Sampling Issues and Instruments Development. *International Journal of Economics & Management Sciences* 6(2): 3.

Samuel, A., Oladejo, N. & Adetune, I. 2012. The Impact and Effect of Illegal Mining (galamsey) towards the Socio-economic Development of Mining Communities: A Case Study of Kenyasi in the Brong Ahafo Region. *International Journal of Modern Social Sciences*. 1 (1): p38.

Solomons, I. 2017. *Govt to 'amend and relax' laws for small-scale miners in bid to combat illegal mining*. <http://www.miningweekly.com/print-version/govt-rules-out-granting-mining-licences-to-zama-zamas-as-it-seeks-solutions-to-illegal-mining-2017-03-24>. Date of access: 7 Jul. 2018.

South Africa. 2002. The Mineral and Petroleum Resources Development Act No.28 of 2002.

South African History Online. 19 Sep 2017. *Second Anglo-Boer War 1899 – 1902*. <http://www.sahistory.org.za/article/second-anglo-boer-war-1899-1902>. Date of access: 28 Aug. 2018.

South African Human Rights Commission. 30 Sep 2015. *Pfanelo: Illegal Mining on the Rise*. <https://www.sahrc.org.za/home/21/files/Pfanelo%20September%202015.pdf> Date of access: 23 Jun. 2017.

South Africa. South African Police Service. 2017. Annual Crime Report 2016/2017. Pretoria.

Steenkamp, N. & Clark-Mostert, V. 2012. Impact of Illegal Mining at Historic Gold Mine. *International Mining History Congress*. 9th (1): 1-5.

Strydom, E. 2016. *Illegal mining*. <http://www.mineralscouncil.org.za/reports/2016/download/CM-IR16-focus-illegal-mining.pdf>. Date of access: 7 Jul. 2018.

Sukitsch, M., Engert S. & Baumgartner, R. 2015. The Implementation of Corporate Sustainability in the European Automotive Industry: An Analysis of Sustainability Reports. *Sustainability*. 7 (1): 1505.

The Federation for a Sustainable Environment. 10 Feb 2018. *The Impact of Mining on the South African Economy and Living Standards*. <http://fse.org.za/index.php/item/593-the-impact-of-mining-on-the-south-african-economy-and-living-standards>. Date of access: 28 Aug. 2018.

Thelwell, E. 2014. *Six things to know about the illegal mining boom*. <http://www.news24.com/SouthAfrica/News/Six-things-to-know-about-the-illegal-mining-boom-20140626>. Date of access: 28 Sept. 2017.

Thornton, R. 2014. Zamazama, “illegal” artisanal miners, misrepresented by South African Press and Government. *The Extractive Industries and Society: An International Journal*. 1 (2): 127-129.

Todorov, V. & Marinova, D. 2009. *Models of Sustainability*.
<http://mssanz.org.au/modsim09>. Date of access: 29 Aug. 2018.

United States of America. Department of Labour. 2016. Sustainability In The Workplace. A new Approach for Advancing Worker Safety and Health. New York.

University of Southern California. 2016. Organizing Your Social Sciences Research Paper: Types of Research Designs. California.
<http://libguides.usc.edu/c.php?g=235034&p=1559832>. Date of access 17 Jul. 2018.

Walliman, N. 2011. *Research Methods the basics*. London: Routledge. 10-88.

Williams, G. 2014. Environmental and organisational drivers for the nature of the relationship between illegal miners and mining companies. Pretoria: GIBS. (Mini-dissertation).

Ethics informed consent form**North-West University****Researcher: Timothy Williams****South Africa****Cell: 082 707 7867****Email: tiwilliams@anglogoldashanti.com**

Dear Interviewee

This **Informed Consent Statement** serves to confirm the following information as it relates to the MBA mini-dissertation on Illegal mining's effect on the sustainability of a South-African Gold mine.

The sole purpose of this study is to obtain information from experts (such as yourself) employed and/or operating in the mining industry in an attempt to determine the nature of your everyday experience related to the research topic.

1. The procedure to be followed is a qualitative research design, which includes structured, controlled and prescriptive questions but also open-ended questions where you will have the opportunity to communicate your views on the relevant topic during a face-to-face in-depth interview. Basic background information related will be asked e.g. your name, academic qualifications and related experience to the topic.
2. The duration of the interview will take no longer than a maximum of 1 hour.
3. If at any point during the interview you should feel uncomfortable, you will be provided with the opportunity to make your discomfort known or immediately have the option to end your participation.
4. This interview takes place on a voluntary basis.
5. The confidentiality of the interview data is guaranteed. Fictitious names will be utilised when quoting statements in the dissertation.
6. Any confidential information that prohibits the researcher to publish it in the final dissertation should be communicated during the interview.
7. A list of questions to be asked in the interview will be made available to the interviewee prior to the interview. This is done to ensure a mutual understanding of what will be asked to avoid confusion during the interview.
8. A summarised copy of the final dissertation will be made available to the interviewee upon request.
9. The data gathered from the interview will only be used for research purposes.

I, _____ (name and surname), hereby declare that I have read and understand the contents of the Informed Consent Statement, and give my full consent to Mr. TG Williams to progress with the interview on _____ (date) and use the information communicated by myself to him in his MBA dissertation.

<u>Name and designation</u>	<u>Signature</u>	<u>Date</u>
Interviewee		

APPENDIX B: Interview Guide

Section A: Demographics profile of Participants

1. What is your Gender?
2. Are you currently in a Management position?
3. What department are you working for?
4. How long are you employed with the company?

Section B: Research Specific Questions

5. What do you understand by sustainable Gold mining operations? Can sustainability be achieved in a Gold mine?
6. What do you think are the effects of illegal mining on a Gold mining operation?
7. How can a Gold mine attain sustainability?
8. How can illegal mining activities affect sustainability?
9. Which activities of illegal mining are detrimental to the operations of a Gold mine?
10. What can be done to deal with illegal mining activities?
11. Is legalizing the illegal gold mining activities an option? Why?
12. Can the benefits and costs of illegal mining exceed that of legal mining? Why?

APPENDIX C: Interview Transcripts

Interview 1

Section A: Demographics profile of Participants

R01 - What is your Gender?

P01 – I am a male

R01 - What Management level is your position?

P01 – I am currently in Middle management

R01 - What department are you working for?

P01 – I work in Geotechnical Engineering

R01 - How long are you employed with the company?

P01 – I've been with AngloGold Ashanti for 4 years

Section B: Research Specific Questions

R01 - What do you understand by sustainable Gold mining operations? Can sustainability be achieved in a Gold mine?

P01 – (pause) I think uhmmm... if I understand the word sustainability, uhhhhmm, it's more about creating value for the shareholders over a long period, the question is, with the current mining conditions that we have.... where resources are being depleted with no new resources, can that be sustained? Uhhmm in the context of South Africa. To answer that, ahhh there are other options, other new ventures that we are venturing into... aahh basically the type of surface mining that is happening throughout the country, that creates value 'cause gold gets recovered.. eemmm it might not be considered as hard core mining but it still creates value for the shareholders.

R01 – So what you are saying is that innovation is providing sustainability.

P01 – That is correct.

R01 - What do you think are the effects of illegal mining on a Gold mining operation?

P01 – (breathes heavily)... uhmmm, it is quite a complex issue, because you have to take into consideration not just from a sustainability point of view, but also from a legal point of view, in terms of the mines health and safety. The illegal mining brings obvious crime, that's one and threats to people's lives, also it makes the mining

complexed, because if you know that you have illegal miners in a certain area your teams won't go there, and uhhhh it becomes a threat to your normal operations. But at the same time eehhmm the gold that they extracting or the ore that they extracting is part of the resource... (laughs) the question is that, it might be a smaller quantity, but over a longer period we might be losing a lot. There may be an argument to say, look ... probably the illegal miners are actually in the areas where you have abandoned mining, but if technology improves and you have to go back to those areas you would have lost.... a lot, that you could have recovered. There is aaahhh... what we call technology projects, that's getting tried at Tau Tona shaft, we don't get a lot of gold, but you can get 10kg's... uuuhhh which is quite a substantial amount if you are stretched. So ... aahh the illegal mining is actually a threat to the mining operations, and its putting burden on the mining operations, where you have to provide additional security, protection of the employees, and that is additional costs that you are bringing in although you are stretched, because the gold price is not really in a favourable position, and in that it brings dynamics and financial constraints to the mining industry itself.

R01 - How can a Gold mine attain sustainability?

P01 – (sigh)... look, the most important thing, we know that we have limited resources that will not last forever and although we have access to some of the areas that we have mined... and ahhh because of the previous mining actions and for safety reasons we left some of the areas, the question is that can we go back to some of these areas with innovation and extract that gold.. as I said that there is what we call technology projects to allow us to maybe go back and extract that gold and still create value for the shareholders. With the current TSF reclamation, how far can we mine those, because even though now we are mining those TSF's there is still a portion gold in terms of efficiency and recovery that goes to the TSF, can we later re-mine those that we have re-mined..(laughter). I think we need to be more innovative and think outside of the box, instead of saying we are miners, we go underground we go get gold and bring it up. And also I think we need to start bringing in the beneficiation process because that is actually one thing that we are lacking, we have the resources in South Africa but we don't have beneficiation.. and ahhh that is actually where we are losing it, because with beneficiation you can actually teach somebody a skill and leave them with a skill which is sustainability.

R01 - How can illegal mining activities affect sustainability?

P01 – (silence)... obvious a loss commodities, of which is quite major. Especially where you start talking about illegal miners.. not talking one or two, I am talking about thousands of people, and if one guy can get one gram every month.. (laughs) you know, it basically kills our chance of going back and revitalising old areas and that's where you are loosing value, because you start looking at the old areas and start saying.. nahhhh, there is gold, but not really worth going back for, so actually sustainability is affected in that way.

R01 - Which activities of illegal mining are detrimental to the operations of a Gold mine?

P01 – uhhmmm... look, I think we need to break it into two, the first is below ground and above ground. I think below ground is the blasting, which can be detrimental, the question is do they have the right skill and understand geology and related blasting, and do they have safety checks and risk assessments. In terms of surface above ground, we are losing a lot of infrastructure due to illegal miners which needs continuous replacement. So your operational and capital costs just doubles up and costs is starting to spiral out of control.

R01 - What can be done to deal with illegal mining activities?

P01 – (smiles).. what are you trying to say? (laughs) it is an illegal activity, and illegal activities needs to be dealt with by law. . I am not really sure how we can deal with it, but key is that, it is an illegal activity and it needs to be dealt with.

R01 - Is legalizing the illegal gold mining activities an option? Why?

P01 – it is an option..... but there needs to be a thorough thinking of how this will work. There is actually a case in Kimberley, where a court case was in favour of the people, where illegal mining area was given to the community to mine, I think it's called eKappa's, and similar case in Zambia where people were given land to mine but resulted in a fatality because of lack of safety standards. So, the question is, if you formalize the illegal miners, do they comply to the same safety standards are you holding accountable to the same standard as major companies. You can't say because they are small so rules must be relaxed, because a life is a life. There is a opportunity to look at formalising, but first more research have to done as to say how we are going to manage it, because illegal mining is not just about South Africans, there are other people who are illegal immigrants. As long as we have that dynamic, you can formalise it, but the illegal immigrants will still be there because you have

not dealt with illegal immigrants from outside. The problem basically is that the legacy of SA is we brought immigrants to work on the mines and now we don't have jobs for them and mining is the only skill that they have and they get recruited by the big bosses of illegal miners and they see a opportunity to survive. So as long as there is the illegal immigrant issue, it will threaten the chances of formalising.

R01 - Can the benefits and costs of illegal mining exceed that of legal mining? Why?

P01 – silence..... look, the fact is that you would expect these people to pay tax..

uhhh you expect these people to formalise their business and support communities.

The fact is, if I am an illegal miner for me it's about survival, I am not thinking about the second person, it's me and my family and that's it. And if I am thinking that way,

and you want to tell me I have to pay a portion of my money to tax... (smile) I would probably say no, and if one need to comply with the health and safety standards,

that's going to cost money too, resistance is going to be high. One dynamic is.....

they don't have the overheads, but how you going to manage them to make sure that

they comply with the south African law. I think the legacy of big mining houses is

major overheads, I think that's a negative. If the companies can actually streamline,

there overheads I don't think illegal mining will be better than legal mining. Another

question is, who will they be selling their mined gold to, and at what price, because

they are small, they cannot sell to Rand refinery direct, they have to sell to

somebody and that person will sell to Rand refinery with a charge of cause

decreasing their profits, at the end they won't make money, but will only mine to

survive.

End!

Interview 2

Section A: Demographics profile of Participants

R02 - What is your Gender?

P02 - I am a male

R02 - What Management level is your position?

P02 - -- I am currently in Middle management

R02 - What department are you working for?

P02 – I am currently in the Finance Department

R02 - How long are you employed with the company?

P02 – I am employed now 9 years

Section B: Research Specific Questions

R02 - What do you understand by sustainable Gold mining operations? Can sustainability be achieved in a Gold mine?

P02 – what I understand about sustainability .. basically is to provide people with work in a sustainable manner but also look at the safety aspect and the environmental aspect and the cost aspect and if it can be done in a good principal manner. Can sustainability be achieved in a gold mine? Yes I think it can, but we need look at the factors mentioned previously which is safety, environmental and costing. If cost is too high than you cannot basically continue, safety risks, if people die than you also can't mine in a sustainable way.

R02 - What do you think are the effects of illegal mining on a Gold mining operation?

P02 – uuhhhmm... firstly I think uhhmm people lives are being placed in danger, risks is high something can go wrong. Bad Perception of mining companies can exist, where people enter into old shafts that mining companies did not close of properly, and that can basically give the company a bad name or reputation.

R02 - How can a Gold mine attain sustainability?

P02 – for a mine to attain sustainability you basically need to look at methods to reduce costs, take care of the environment, look at training people so that everybody in the environment benefits and the country can move forward and also assist people in the mining community to increase their livelihood

R02 - How can illegal mining activities affect sustainability?

P02 – I think the biggest one here is the risk of people, and basically what effect it has on the different shafts where people can basically injure each other, especially where legal and illegal miners meet each other... uhhmm it can be very very dangerous

R02 - Which activities of illegal mining are detrimental to the operations of a Gold mine?

P02 – mining of current operating shafts, which can lead to death of people, including security people can have a huge influence at the end of the day

R02 - What can be done to deal with illegal mining activities?

P02 – firstly the shafts must close off all old shafts correctly, so that there's no illegal miners can gain entry and there would be no way for them to go underground and start mining.. uhhmm I think security needs to basically go asses the entry points and assess the situations and see if they can intervene and make sure people don't get access

R02 - Is legalizing the illegal gold mining activities an option? Why?

P02 – I dont think it's an option... because how can you compare a legal miner to an illegal miner and how can the safety aspects be compared between each other

R02 - Can the benefits and costs of illegal mining exceed that of legal mining? Why?

P02 – the benefits of illegal mining I don't think can exceed that of illegal mining, because the problem is we sitting with illegal activities, you sitting with the black market. As to cost of illegal mining it can be lower than that of legal mining, but that all depends on what they are paying people that work for them, the method of mining and most of it contravenes health and safety regulations. Ya.. I don't think the benefits of illegal mining exceeds that of legal mining.

Interview 3

Section A: Demographics profile of Participants

R03 - What is your Gender?

P03 – I am male

R03 - What Management level is your position?

P03 – Senior management

R03 - What department are you working for?

P03 – Projects (Capital)

R03 - How long are you employed with the company?

P03 – this year I will be employed for 24 years

Section B: Research Specific Questions

R03 - What do you understand by sustainable Gold mining operations? Can sustainability be achieved in a Gold mine?

P03 – hahaha... as I understand sustainability it has to do with saving now for future generations, in mining that is actually oxymoronic (giggles)... because we are mining for as much as we can and as fast as we can for a resource that is fast running out, now that does not sound like a sustainable thing to do.. but you know that is part of the game we need to play in order to stay in business. However, I do think sustainability can be achieved in a gold mine... uhhmmm but I think smarter future generations will come up with new innovations to re-mine our old tailings facilities, they will be getting less gold, but I think by then gold would be more scarce and the price will be sky high making it worth it to mine lesser gold.

R03 - What do you think are the effects of illegal mining on a Gold mining operation?

P03 – directly for us it is the destruction of our infrastructure, and there seems to be a huge criminal element emerging within the illegal mining activity, where most Zama's are not interested in mining but more in stealing copper cables, steel, aluminium and other operational costly equipment. All this has a ripple effect on the costs of the company... because we need to replace stolen goods, hire extra

security and not even mentioning the standing time it is costing the mine due to cable and pipeline theft.

R03 - How can a Gold mine attain sustainability?

P03 – only way a mine can attain sustainability is through mining safely, responsibly and environmentally friendly. People’s lives and the environment must come before profits and shareholders interest.

R03 - How can illegal mining activities affect sustainability?

P03 – ohh boy... (sighhh) illegal miners can affect sustainability really badly, because for them it is all about the here and now, they don’t care about safety or the environment. Their mining methods places themselves and surrounding communities in grave danger. They also kill any hope of old shafts being re-opened by vandalising these old shafts, although future generations will be smarter in mining, these illegal miners close the door on future generations access to these old mines.

R03 - Which activities of illegal mining are detrimental to the operations of a Gold mine?

P03 – three things stand out for me... one: the killings, I mean the killings of Zama’s amongst themselves as well as the killing and injuring of mine employees, two: the harm that is caused to the environment, I mean the way the dispose of some of the toxic materials they use for extracting, things like mercury and acid and thirdly the fact that sit with a lot of explosives which can be detrimental if placed in the wrong hands, which exposes the surrounding communities and mine at great risk.

R03 - What can be done to deal with illegal mining activities?

P03 – firstly government need to increase their involvement... I mean they seriously need to look at setting up a special unit which only deals with illegal miners, I mean we need trained officers that will jurisdiction to go underground. The mining sector is a big client for the government an employer of the people and a huge tax payer, so it is in their interest that the mines are sustainable and operating profitably

R03 - Is legalizing the illegal gold mining activities an option? Why?

P03 – My personal opinion.... (smiles) in theory yes it is, but the practicality of it might be very challenging. I mean how will legalization work? Will the department of minerals police these smaller miners in the same way they scrutinize the mining companies? They will have... because the first priority should be keeping people safe and protecting the environment. And with implementation of all the statutory requirements, most of these small miners will fall off the wayside. I honestly don’t

think the department of minerals has the capacity to deal with a lot a of small mining companies effectively.

R03 - Can the benefits and costs of illegal mining exceed that of legal mining?

Why?

P03 – not sure if there are many benefits of illegal mining, especially for the country, but legal miners have far more benefits, for being the top employer for many years and are a huge contributor to the national economy. So no, I really don't think costs and benefits of illegal mining can exceed that of legal miners.

Interview 4

Section A: Demographics profile of Participants

R04 - What is your Gender?

P04 – last time I checked I was a male.. laughs!!!

R04 - What Management level is your position?

P04 - Middle

R04 - What department are you working for?

P04 - Security

R04 - How long are you employed with the company?

P04 – 14 years

Section B: Research Specific Questions

R04 - What do you understand by sustainable Gold mining operations? Can sustainability be achieved in a Gold mine?

P04 – my view on sustainable gold mining..? uhhmm my understanding is that we need to mine for resources in a sustainable manner, what I mean is, we must operate in such a manner that we do not do harm to the environment to such an extent that it will negatively affect present and future life in the country. I think that sustainability can be achieved if we start acting and mining responsibly and intelligently.

R04 - What do you think are the effects of illegal mining on a Gold mining operation?

P04 – uhhhmm (smile)... I think the effects is pretty bad, Anglo's first and most important value is safety, we spent millions on making sure that safety standards is kept. Current pressure from government and unions to make sure our employees are safe also adds to our problems, but we as a company have a very good track record when it comes to safety. But illegal mining puts this record of ours in danger, because the way they operate places our workers in danger and they place us and further costs pressure to try and contain them.

R04 - How can a Gold mine attain sustainability?

P04 – this in my view can only be done if we start working smarter, we need to try and retain our talent, especially long service employees with a wealth of expertise,

R04 - How can illegal mining activities affect sustainability?

P04 – if you cannot work safely, you cannot be sustainable, and as I said previously Illegal mining is threatening the safety of the people on surrounding mines and communities,

R04 - Which activities of illegal mining are detrimental to the operations of a Gold mine?

P04 – (seems frustrated) they turn our mining towns into war zones, not only the fact that they place mining employees' life in danger, but also the fact that they have violent fights and shoot-outs between themselves, I have seen a lot of video footage of Zama's shoot outs and they are merciless. If this is allowed to continue mining towns will suffer and mining will be very difficult.

R04 - What can be done to deal with illegal mining activities?

P04 – (sarcastic laugh)... law & order must be restored, but I honestly don't think government has the smarts or capacity to deal with this problem, and it is spiralling out of control.

R04 - Is legalizing the illegal gold mining activities an option? Why?

P04 – No, not at all... this will only cause fertile ground for even more corruption, and will affect responsible mining negatively.

R04 - Can the benefits and costs of illegal mining exceed that of legal mining? Why?

P04 – hahaha... never, I honestly don't think so, the way SA mining laws and rules works is tried and tested, besides, I don't think illegal mining has any benefits except for themselves

Interview 5

Section A : Demographics profile of Participants

R05 - What is your Gender?

P05 – I am Female

R05 - What Management level is your position?

P05 – Senior Management

R05 - What department are you working for?

P05 – sustainability

R05 - How long are you employed with the company?

P05 – I am still new at Anglo... 4 months

Section B : Research Specific Questions

R05 - What do you understand by sustainable Gold mining operations? Can sustainability be achieved in a Gold mine?

P05 – The sustainability concept has all to do with acting responsibly, doing business in a manner that prolong value for company and society. I do believe we can achieve sustainability, but we need to focus on sustainable development first.

R05 - What do you think are the effects of illegal mining on a Gold mining operation?

P05 – The effects of the illegal miners on our mine and any other mine for that matter is very bad. These illegal miners hampers all our efforts in trying to be sustainable. They give mining, gold mining especially a bad name and reputation.

R05 - How can a Gold mine attain sustainability?

P05 – There is a lot we can do, like mining more efficiently and environmentally friendly... aahhh but rooting out illegal miners will help a lot.

R05 - How can illegal mining activities affect sustainability?

P05 – The activity is unregulated and unsafe, and once safety is in jeopardy sustainability can never ever be achieved.

R05 - Which activities of illegal mining are detrimental to the operations of a Gold mine?

P05 – There is a couple... the crime factor, they steal and destroy infrastructure..
ahhh they pose risks to our employees, they give the business a bad name, and the
list can go on and on.

R05 - What can be done to deal with illegal mining activities?

P05 – We need to enforce the law, we cannot allow this lawlessness to continue

R05 - Is legalizing the illegal gold mining activities an option? Why?

P05 – Might be in diamond mining, but definitely not in gold mining... the process in
gold mining is just too complex and rightfully needs a lot of regulation.

**R05 - Can the benefits and costs of illegal mining exceed that of legal mining?
Why?**

P05 – no ways.

Interview 6

Section A : Demographics profile of Participants

R06 - What is your Gender?

P06 - Male

R06 - What Management level is your position?

P06 - Executive

R06 - What department are you working for?

P06 – Sustainable development

R06 - How long are you employed with the company?

P06 – 4 years

Section B : Research Specific Questions

R06 - What do you understand by sustainable Gold mining operations? Can sustainability be achieved in a Gold mine?

P06 – I'd rather talk about sustainability in general mining not only gold... because sustainability applies to all types of mining. Technically mining can not be sustained, because you start mining and you finish and you close the shaft.. resources gets depleted. So sustainability in mining should focus on how mining can impact people in a positive way, that will be sustainability. Mining and farming is what we call primary industries meaning mining can trigger other industries to happen.

Johannesburg would have not been Johannesburg if it wasn't for mining, gold mining specifically. But mining is gone from Johannesburg but it left behind a whole series of different industries. So the answer to the question can sustainability be achieved is yes and no, yes.... Through leaving something positive behind and no... resources gets depleted.

R06 - What do you think are the effects of illegal mining on a Gold mining operation?

P06 – Its bad... anything illegal is bad, whether it be driving, mining..aahhh anything that is against the law is bad. Illegal mining tend to fuse other bad activities, money laundering, prostitution, drugs and wars. Where there is no transparency or above board activities, it cannot be good.

R06 - How can a Gold mine attain sustainability?

P06 – I have already covered this in question 5, mining needs to make an impact on communities.

R06 - How can illegal mining activities affect sustainability?

P06 – illegal mining is unsustainable and unlawful, illegal miners do not care for the environment, they use child labour. It is bad news for sustainability.

R06 - Which activities of illegal mining are detrimental to the operations of a Gold mine?

P06 – The one thing we should be worried about is where the money go, this money could easily go to fund bigger criminal activities like guerrilla movements.

R06 - What can be done to deal with illegal mining activities?

P06 – We doing a lot already, for instance Ghana has banned it already, and they are doing a good job with the process so far. There is a lot that is currently being done around the world to curb this illegal activities. Proper closures of mines needs some attention in South Africa.

R06 - Is legalizing the illegal gold mining activities an option? Why?

P06 – No, to risky, will not be able to regulate properly.

R06 - Can the benefits and costs of illegal mining exceed that of legal mining? Why?

P06 – Illegal mining has no benefits, the action is illegal, and so you cannot even touch on any benefits. It only benefits the criminals