ENVIRONMENTAL AND SOCIAL IMPACT OF ILLEGAL GOLD MINING ON SURROUNDING COMMUNITIES: A CASE STUDY OF WELKOM

By

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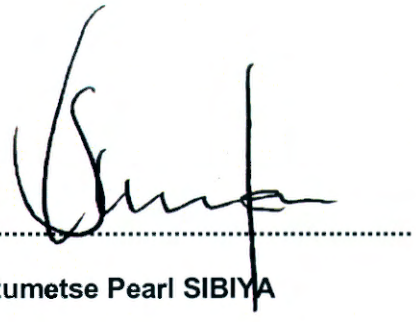
DECLARATION

By submitting my thesis, I confirm that the work submitted for assessment is my own work except where I have explicitly indicated otherwise. I have followed the required convention in referencing the thoughts and ideas of others and I have not previously or in its entirety or in part submitted it for obtaining any qualification.



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11th February 2015

DATE

DEDICATION

I dedicate the achievement of this work to my late brother, Tholang Victor Lekoro, for his encouragement and inspiration towards education.

The most important people in my life, Mrs Rose Mary Mamosebetsi Sibiya and Mr James Sibiya, I would like to thank you for your unconditional love and support; you raised me with love and encouraged me to become a better person, your contribution and encouragement to education is the best gift that you ever gave to me.

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ABSTRACT

The purpose of this study is to explore the environmental and social impact of illegal gold mining on surrounding communities of Welkom. Different stakeholders, government departments and the South African Police Services faced challenges of reducing illegal gold mining activities because the operations undertaken do not resolve the existing problem. Both the environment and human beings are affected by negative effects resulting from unregulated events such as prostitution, conflicts, crime, land degradation, HIV/AIDS, and others. Unemployment is considered to be a contributing factor to poverty in South Africa; however, it is believed to be the root cause of many other problems, such as illegal mining.

In this study qualitative and quantitative research approaches were utilised using illegal miners or panners, stakeholders and the community as sample for the effective findings. Illegal miners comprise of the ones operating underground and above ground, as well as from different areas of operations. 132 respondents were selected to answer the questionnaires which are divided into three annexures which include panners, community and stakeholders; the questionnaires were answered depending on the willingness of the respondents.

Qualitative and quantitative data was collected using questionnaires, observations and interviews in order to get reliable information for the study. Illegal gold mining activities have resulted in grave health hazards linked with mercury utilisation during the process of operation. Lack of ventilation underground during the panning is established to be the cause of death of many panners.

The data was analysed and interpreted using charts and tables. Illegal gold mining activities were found to be contributing to serious future disasters which need mitigation from different stakeholders as well as the community for the protection and sustainability of the livelihood. Despite having only negative effects to human life it was established to have negative effects on the environment as well. Risk impacts are not well recognised by illegal miners because of a lack of awareness to the problem. Community members believed job creation could be the best solution to the problem. Recommendations of the study are that the establishment of a cooperative for panners is envisaged; to enhance the work in safety and where responsible procedures could be introduced; training and awareness of the impacts of illegal

gold mining should be provided as this will minimise the risks that result from panning activities.

Zama zamas or Diroto, as the illegal miners are known by in Welkom, can also play a crucial role by rehabilitating the land after excavating; the training to be provided could be imperative for reducing environmental damages. Disaster management is the coordinated approach thus required by three spheres of government to develop strategies and methods to reduce the impact caused by illegal gold miners, not forgetting community participation during policy formulations. For the establishment of cooperatives the panners need, financial resources; it is thus recommended for government to provide funds for enhancement of the operations.

Key words:

- *Illegal gold miners*
- *Panners*
- *Small scale artisanal mining*
- *Hazards*
- *Risk*
- *Environmental impact*
- *Social impact*

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ACRONYMS

ACAT	: Alaska Community Action on Toxics
ADRC	: Asian Disaster Reduction Centre
ASM	: Artisanal and Small-scale Mining
BBC	: British Broadcasting Corporation
CASM	: Communities and Small-Scale Mining
CommDev	: Community Development
CSIR	: Council for Scientific and Industrial Research
ICMM	: International Council on Mining and Metal
IFC	: International Finance Corporate
ILO	: International labour Organisation
LSM	: Large Scale Mining
SPSS	: Statistic Package for the Social Sciences
SAPS	: South African Police Service
WGC	: World Gold Council
WB	: World Bank
DFID:	Department for International Development
DMR:	Department of Mineral Resources
EIA:	Environmental Impact Assessment
HDSA:	Historically Disadvantaged South Africans
IIED:	International Institute for Environment and Development
MEA:	Millennium Ecosystem Assessment Report
MMSD:	Mining, Minerals and Sustainable Development

MPRDA:	Mineral and Petroleum Resources Development Act
OEWG:	Open Ended Working Group
TB:	Tuberculosis
UNEP:	United Nations Education Programme
UNIDO:	United Nations Industrial Development Organization
WHO:	World Health Organisation

CHAPTER 1: INTRODUCTION

The South African Disaster Management Act #57 of 2002 and the South African Disaster Management Framework of 2005 encourage integrated and coordinated disaster risk reduction measures. Communities have to be informed regarding the hazards within its area and how to reduce them. Its effectiveness in terms of reducing risks depends on the level of the awareness provided and the coping capacity. It has to be taught the understanding of hazards in order to take the correct measures (ADRC, 2003).

Some activities can be considered as threats or a hazard in the community with potential to becoming a disaster. Therefore, community-centred participation is extremely vital in identifying threats and to foresee the effect of potential hazard within their area and has to come up with the ways of being resilient (Proctor, 2000). With regard to the activities susceptible to be a hazard to the community, the illegal mining is found to be one of them even though mining often benefits mostly people living in the community where minerals are found and thus, contribute to the development of the area. It has serious disadvantages that negatively impact on different aspects of life in economy, society, health, education, agriculture and environment (Adjei *et al.*, 2012).

1.2. Background

Gold is a strategic asset and plays a very important role in the economy since it has been used as money by various civilisations for nineteen centuries until the First World War (Michaud *et al.*, 2006:8) and has imposed its currency until today in the whole world. Apart from the economy it finds its importance in jewellery demand which accounts for 1,687 tonnes or 41% of the total gold demanded in the world (WGC, 2010). The prestige of gold has attracted families while gaining importance as subsistence source for the poor although poor mining causes degradation to the environment (Heemskerk, 2002:327).

Generally mineral exploitation creates environmental damage on a scale matched by only few other human activities. It is responsible for deforestation, soil erosion, water pollution and significant air pollution. The environmental impacts are particularly very severe in developing countries, which produce a large portion of the world's minerals (McCarthy, 2011).

Diroto or Zama-zama (which respectively mean rat or hustler) is the nickname given to illegal miners in Welkom. In South Africa illegal gold mining is increasing and the number of people being employed to practice illegal mining is also increasing faster than in the formal mining sector. According to the Southern African Mineral Act, 2006, mining is considered to be illegal if the operators do not have a licence to operate. South Africa has a number of reported cases of illegal mining. People are dying and wounded every day due to the cause of illegal mining. The illegal mining comportment is bringing to a halt sustainable development of our communities (ILO, 2003).

The International Labour Organisation stated that these types of jobs (illegal mining) are unstable and also do not meet the requirements of national and international labour standards. Accident rates to illegal miners are frequently higher than in larger operations, as safety measures are not followed, regardless of the Safety and Health in Mines Convention (No.176), which was adopted in 1995.

1.3. Description of study area

Welkom is one of the administrative cities in the Free State province of South Africa, covering 167.55 km^2; considered to be the second largest city in the Free State after Bloemfontein. It is located 140 km north-east of Bloemfontein, situated between latitude: 27° 59' 41" S (deg min sec), -27.9947° (decimal), 2759.68 S (LORAN) and longitude: 26° 39 (Gladstone, 2014).

Its economical activities consist of uranium and primarily gold mining which started in 1947 and has since established industries and businesses; and this mining activity covers 14% of the total economy of the Free State province (Bolton *et al.*, n.d.) located in mining areas like Alma, Bedelia, Bronville, Dagbreek, Doorn, Flamingo Lake, Flamingo Park, Geduld Gold Mine, Jabulani, Jan Cilliers Park, Jim Fouchepark, Jurgenshof Unisel Gold Mine, Lake View, Naudeville, President Brand Gold Mine, Reitzpark, Rheederpark, Sandania Seemeeu Park, St Helena, St Helena Gold Mine, Voorspoed, Welkom Central, Welkom Gold Mine, Western Holdings Gold Mine (Statistics South Africa, Census 2011).

The Welkom Map

Figure 1.1: Welkom Map **Source: Google Map**

The study area has a population of 64,130. It has 19,000 households which are composed of 60.74% black Africans, 26.86% whites, 11.14% coloureds, 0.90% Indians and Asians, and others 0.36%. Several languages are spoken including Afrikaans, Sesotho, English, isiXhosa, Setswana, isiZulu, Xitsonga, Sign language, Sepedi, isiNdebele, SiSwati, Tshivenda and others (Statistics South Africa, Census 2011). The study area demography is indicated in the consequent tables.

Table 1.1: Welkom Population Distribution by Geography and Gender

Geography	Gender		Total
	Male	Female	
Riebeeckstad	5381	5887	11268
Thabong	61404	64609	126013
Hani Park	5060	4540	9600
Blaauwdrift	17	33	50
Welkom	**33259**	**30871**	**64130**
Free State Geduld Gold Mine	2566	329	2895
Jabulani	194	128	322
Western Holdings Gold Mine	469	631	1100
Rheederpark	1763	1772	3535
Flamingo Park	1696	1847	3543
Dagbreek	3012	3264	6276
Welkom Gold Mine	610	286	896
Alma	24	24	48
Seemeeu Park	876	986	1862
Jim Fouchepark	1015	1094	2109
Bedelia	3707	3967	7675
Welkom Central	610	474	1084
Doorn	1940	2070	4010
Voorspoed	239	105	344
Reitzpark	1693	1820	3514
Sandania	315	382	697
Jan Cilliers Park	1296	1496	2792
Naudeville	1548	1644	3192
St Helena	1532	1651	3183
Lake Veiw	597	551	1148
St Helena Gold Mine	508	293	801
Flamingo Lake	12	5	17
Bronville	4901	5065	9966
President Brand Gold Mine	1715	923	2638
Jurgenshof Unisel Gold Mine	422	63	485

Source: Statistics South Africa, Census 2011

Table 1.2: Population Distribution by Geography and Population Groups

Geography	Population groups					Total
	Black African	Coloured	Indian or Asian	White	Other	
Riebeeckstad	5540	204	31	5452	40	11268
Thabong	125178	363	233	94	144	126013
Hani Park	9564	20	1	2	12	9600
Blaauwdrift	45	-	-	4	-	50
Welkom	**38953**	**7141**	**575**	**17226**	**234**	**64130**
Free State Geduld Gold Mine	2874	8	-	12	1	2895
Jabulani	321	1	-	-	-	322
Western Holdings Gold Mine	1048	36	1	6	9	1100
Rheederpark	3447	34	12	41	-	3535
Flamingo Park	1437	60	14	2026	6	3543
Dagbreek	3675	262	77	2243	18	6276
Welkom Gold Mine	895	-	-	1	-	896
Alma	30	-	-	18	-	48
Seemeeu Park	1213	55	6	579	9	1862
Jim Fouchepark	442	27	212	1400	27	2109
Bedelia	4376	154	19	3094	32	7675
Welkom Central	680	43	95	255	11	1084
Doorn	2331	145	32	1486	16	4010
Voorspoed	226	11	2	103	2	344
Reitzpark	3325	34	9	145	1	3514
Sandania	473	30	-	194	-	697
Jan Cilliers Park	985	36	4	1746	21	2792
Naudeville	1032	67	20	2057	16	3192
St Helena	1658	59	18	1429	19	3183
Lake Veiw	803	14	-	324	6	1148
St Helena Gold Mine	761	11	3	24	2	801
Flamingo Lake	8	-	-	9	-	17
Bronville	3851	6027	46	5	37	9966
President Brand Gold Mine	2595	18	3	20	2	2638
Jurgenshof Unisel Gold Mine	466	10	2	7	-	485

Source: Statistics South Africa, Census 2011

Table 1.3: Employment Status in Welkom

Geography	Employment status			
	Employed	Unemployed	Not economically active	Unemployment rate
Riebeeckstad	5130	624	2261	10.8
Thabong	28342	22254	34893	44.0
Hani Park	1834	1994	2791	52.1
Blaauwdrift	15	6	11	27.6
Welkom	**21660**	**5328**	**19770**	**19.7**
Free State Geduld Gold Mine	79	4	2788	4.8
Jabulani	136	47	56	25.7
Western Holdings Gold Mine	432	142	146	24.7
Rheederpark	717	460	1310	39.1
Flamingo Park	1392	134	954	8.8
Dagbreek	2447	468	1534	16.1
Welkom Gold Mine	307	101	320	24.8
Alma	25	9	2	26.5
Seemeeu Park	611	118	647	16.2
Jim Fouchepark	948	61	435	6.0
Bedelia	3199	599	1656	15.8
Welkom Central	446	18	396	3.9
Doorn	1477	300	1204	16.9
Voorspoed	202	22	70	9.8
Reitzpark	1149	430	913	27.2
Sandania	264	63	172	19.4
Jan Cilliers Park	1170	126	655	9.7
Naudeville	1285	75	938	5.5
St Helena	1305	192	817	12.8
Lake Veiw	462	62	324	11.8
St Helena Gold Mine	287	81	294	22.1
Flamingo Lake	9	1	4	10.0
Bronville	2313	1557	2743	40.2
President Brand Gold Mine	994	258	923	20.6
Jurgenshof Unisel Gold Mine	4	-	471	-

Source: Statistics South Africa, Census 2011

Table 1.4: Number of Households by Main Type of Dwelling (Grouped) and Geography

Geography	Dwelling types				Total
	Formal Dwellings	Informal dwellings	Traditional dwellings	Other	
Riebeeckstad	3685	16	11	60	3772
Thabong	28992	9756	272	690	39710
Hani Park	95	3288	2	11	3396
Blaauwdrift	2	-	-	-	2
Welkom	**18150**	**648**	**67**	**135**	**19000**
Free State Geduld Gold Mine	61	3	-	1	65
Jabulani	106	-	13	-	119
Western Holdings Gold Mine	372	-	2	2	376
Rheederpark	1119	29	4	4	1156
Flamingo Park	1170	6	3	1	1181
Dagbreek	1870	-	6	19	1895
Welkom Gold Mine	184	-	-	-	184
Alma	21	-	-	-	21
Seemeeu Park	499	2	1	4	506
Jim Fouchepark	623	-	2	-	625
Bedelia	2396	7	5	21	2428
Welkom Central	368	-	-	1	369
Doorn	1287	11	9	29	1336
Voorspoed	134	25	-	3	162
Reitzpark	863	1	-	4	868
Sandania	258	-	-	3	262
Jan Cilliers Park	949	1	6	13	970
Naudeville	1027	1	1	2	1031
St Helena	1162	2	4	3	1172
Lake Veiw	380	1	3	4	387
St Helena Gold Mine	288	27	-	-	315

Source: Statistics South Africa, Census 2011

Table 1.5: Educational Status in Welkom

Geography	Highest education level					
	No schooling	Some primary	Completed primary	Some secondary	Grade 12/Std 10	Higher
Riebeeckstad	185	1588	307	2473	3324	2499
Thabong	4888	28484	7192	45101	20978	5218
Hani Park	605	2789	818	3288	876	37
Blaauwdrift	1	17	2	19	2	-
Welkom	**1288**	**9639**	**2142**	**16163**	**15657**	**7556**
Free State Geduld Gold Mine	3	14	7	46	15	-
Jabulani	6	87	21	112	50	7
Western Holdings Gold Mine	25	220	28	243	321	115
Rheederpark	108	801	192	1134	736	150
Flamingo Park	40	485	80	698	1085	814
Dagbreek	120	864	156	1413	1918	966
Welkom Gold Mine	16	132	34	223	153	15
Alma	-	6	1	7	14	14
Seemeeu Park	24	233	42	413	445	262
Jim Fouchepark	31	268	53	366	512	577
Bedelia	103	1201	216	1997	2363	1135
Welkom Central	21	77	32	112	270	207
Doorn	61	437	105	999	1115	752
Voorspoed	13	46	20	151	54	37
Reitzpark	100	649	111	922	925	399
Sandania	36	88	26	193	232	58
Jan Cilliers Park	35	335	83	774	909	491
Naudeville	53	388	78	673	1072	485
St Helena	35	414	88	822	895	549
Lake Veiw	21	174	43	311	369	105
St Helena Gold Mine	26	113	42	211	84	40
Flamingo Lake	2	2	-	7	4	-
Bronville	365	2241	568	3773	1592	203
President Brand Gold Mine	42	362	115	562	523	176
Jurgenshof Unisel Gold Mine	-	4	1	1	2	-

Source: Statistics South Africa, Census 2011

1.4. Problem statement

According to Mc Carthy, (2011), (ACAT, n.d.) gold mines contribute to too much dust in the atmosphere, pollute the water supply and destroy some animal species that should be preserved. It raises the acid level and generates toxic waste by creating some heavy metal, mercury and cyanide which is a chemical used to leach gold from ore. Cyanide is a potent poison susceptible to leech into the ground and consequently poisoning a wide area and adjacent water sources; and together with erosion constitutes the huge environmental effect of gold mining (CSIR, 2009).

We cannot underestimate chemicals used in illegal mining and its dangers as a pollutant of the air, water – such as a change in the taste and colour of water and releasing a bad smell that communities living in Welkom are constantly experiencing; including the reduction of the land fertility to support plant growth. On several occasions the news have reported collapsed caves in the mine areas, killing illegal miners or burying them alive in collapsed pits (Moammed Irshad, 2013). These activities are deteriorating progressively the lands of this community. The pollution is dangerous to human beings including micro organisms supporting human existence; and therefore, contributes to the destruction of the ecosystem. Illegal mining is one of the factors that contribute to the deforestation of the forest reserve of the country and this threat causes a lack of potable water, lack of basic needs and thus lowering the living standard of life and increasing the cost of living that ultimately leads to poverty (Adjei *et al.*, 2012).

Informal miners excavate mineral resources such as gold and frequently live underground in dangerous and precarious conditions. Critical accidents are widespread and underground battles between rival groups have been reported. The illegal diggers also sometimes attack legally operating miners. At least 82 men that have been associated with illegal mining, died after an underground fire at a Harmony gold mine in South Africa during the year 2009 (Aljazeera America, 2014). Poverty, ignorance and a "*get rich quick*" attitude of people have been identified as the factors causing illegal mining activities (Owusu *et al.*, 2012). Prostitution and an influx of illegal foreigners are among the contributing factors. People are still mining illegally in mines that were closed previously.

South African rescue teams are consistently working day and night in abandoned shafts trying to find miners who might be trapped underground. Such illegitimate and hazardous mining operations are ordinary in the country recognized for its rich mineral resources. BBC news Africa, 2014 stated that South Africa's Department of Mineral Resources 2008 study of

the gold sector found that an estimated $509m (£309m) in revenue is being lost per year, as a result of illegal mining.

Moodley (2009) states that illegal mining is also a threat to employees as they are not only working and living underground, but are also attacked to access working tools, mining equipment and food. It has been noted that environmental health problems due to unsafe mining operations, are on the increase.

1.5. Research questions

In order to give direction to our study, the following research questions are posed:

- How information and knowledge can influence active participation of the community in Welkom regarding illegal mining and reduce the vulnerability and hazard?
- What can government do to reduce or stop illegal mining in Welkom?
- What strategies can be used to reduce the impact of illegal mining?
- What are the socio-economic and environmental impacts of illegal mining in Welkom.

1.6. Aim

To identify the risk reduction measures and strategies in order to minimise the impact of illegal mining in Welkom with regard to environment and society that may lead to disaster.

1.7. Objectives

The objective for our study is:

- To identify or examine local communities' perceptions on how illegal mining impacts their social and environmental activities.

- To suggest interventions that can assist in mitigating the negative impacts of illegal mining.

- To investigate the coping strategies and risk reduction measures to be implemented in Welkom to minimise illegal mining.

1.7. Significance of the study

The purpose of this study is to identify the programmes and strategies that will encourage the community to partake in reducing the impact of illegal mining and to encourage the disaster management centres within our municipalities to include, as well as work together with the community while reducing the impact of illegal mining in Welkom and to prevent the likelihood of disaster according to the Disaster Management Act 57 of 2002, which emphasises the issue of cooperate governance for the purpose of disaster management.

This study was of great assistance not only to the community of Welkom but the government, different stakeholders, policy makers and disaster managers in that it presents the importance of sustainable natural resources and economy, as it is encouraging their participation in the sustainability of their livelihood. The investigation strives to identify the elements at risk which illegal gold mining impacts on and will improve their understanding on how the environment, local economy and human health is being affected by illegal mining. The focus and importance of this study is to reduce illegal mining as much as possible; it may assist to community of Welkom as well as community members to become the leading drivers of their own natural resources.

1.8. Research Methodology

According to Leedy and Ormrod (2010:145) and Salkind, 2009, in qualitative research the potential source of data is limited to the researcher's disposition and creativity. Regardless of the kinds of data involved, data collection in qualitative study takes a great deal of time, the researcher should record any potential useful data. The researcher was using the observations, interviews and questionnaires to obtain data for the study. The researcher visited or undertook excursions to other Welkom mining areas. With regard to the observations, the researcher visited some of the Welkom mines and closed shafts to observe how this activity of illegal mining was done in those areas (Owusu *et al.*, 2012). It has been indicated by Salkind, 2009 that interviews can take the form of the most informal questions and answers and can be conducted on the street, or any identified suitable place. The interviews was directed at illegal miners, members of the community, as well as community leaders, the Department of Mineral and Energy in the district, disaster management centre and other relevant stakeholders. English was used as well as local languages to collect data after getting consent from the respondents to answer the questionnaires.

1.9. Ethical considerations

It is essential that every study involving human beings should have an ethical consideration. Thus, the consent was obtained from every respondent to our questionnaire with a clear explanation that they could stop responding in case they should feel uncomfortable. No one was forced to give any answers if he or she was not at liberty to continue. Since panners were engaged in illegal activities, they were put at ease to ensure their participation.

1.10. Research Rationale

The main purpose of this study was to conduct research to determine the social and environmental impact of illegal gold mining in Welkom in order to develop different strategies to eradicate negative effects. The undertaking of this research could help government and community to elaborate the development of strategy and mitigation measures to reduce illegal gold mining activities.

1.11. Conclusion

This study introduces the research, outlines the objectives, aim, research questions, problem statement, and significance of the study as well as the study area. Illegal gold mining activities are escalating in South Africa. Communities and the environment are affected negatively by the activities. Unemployment and a "*get rich quick*" attitude have been considered to be the reasons behind the gold panning activities. The study explored the main reason behind the activities. Welkom, for many years, has been known for its gold as the livelihood which needs to be protected and kept sustained for future generations. The number of people migrating to practice illegal mining in Welkom is, however, increasing. Therefore, the main reason for the study was to reduce the illegal gold mining activities; the necessary strategies and programmes for eradication of the activities were needed. The exploitation of minerals creates environmental damage like few other human activities. The experience of deforestation, soil erosion, water pollution and air pollution might be even larger if no mitigation could be taken to diminish operations. South African Disaster management policies are available for the utilisation and implementation by coordinators, who might be able to assist in diminishing the activity. The following chapter is the literature review in order to help with the understanding of other researchers' insightful contributions about illegal mining.

CHAPTER 2: LITERATURE REVIEW

2.1. INTRODUCTION

South Africa is considered to be the largest producer of gold in the world (Eislir, 2002). For many years Welkom has been known by its mining as the main sector of its economy and most of the people going there were looking for employment; that is the other reason why it has been named Matjhabeng (meaning: where nations gathered). Mining is a major economic activity in many developing countries. Operations, whether large-scale or small, are disruptive to the environment, producing huge amounts of waste that have had harmful impacts over decades (Kitula, 2005:405). The environmental deterioration caused by mining takes place mostly as a consequence of inappropriate and wasteful practices and treatment measures. The social and environmental impacts are all-encompassing in areas where operations are newly recognized or are shutting down.

Nhlengetwa, 2014 mentions that illegal miners get access to the abandoned underground mines through old access entrances and waste dumps. They operate outside the existing South African mining laws, together with those linked to surface-owners' rights, prospecting and mining rights and authorization, payment to the state, trespassing on permitted land, environmental impacts, occupational health and safety as required by South Africa Minerals Petroleum Resource Development Act of 2002.

The possibilities for any disaster to strike are huge due to the activities or hazards caused by illegal mining practices in Welkom.

2.2. Overview of Disaster

Disaster is a serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses, which exceed the ability of the affected community or society to cope, using its own resources (UNISDR, 2004). A disaster happens when a hazard impacts upon a vulnerable population and causes damage, casualties and disruption.

2.3. Overview of disaster management

Disaster management is the measure or activities taken to reduce, avoid or recover from the losses and the impact of disaster, it can be before, during, or after disaster has occurred.

Disaster management includes carrying out awareness campaigns by means of educating the community to perform emergency response activities with the aim of recovering and rehabilitation of the communities affected (Khan *et al.*, 2008:12).

Tatulm *et al.*, (2003 - 2013) states that disaster management is the process, strategy or measure taken or implemented before, during or after any disaster takes place. This disaster plans can be initiated whenever anything threatens to disrupt normal operations or put peoples' lives at risk. Government departments, non-governmental organisations and private entities have to have their own disaster plans that will help to overcome any disruption.

Disaster management entails community involvement in taking responsibility in any disaster that might occur, this will include capacitating the community in terms of participatory preparedness as our community do have certain skills and knowledge to be used in order to prevent and respond to disaster that may occur in their area. The measures should be taken before, during and after a major accident has occurred with the purpose of minimising or reducing the loss to life and properties.

2.4. Overview of Illegal Mining, Artisanal and Small-Scale: Does it mean the same thing?

Illegal gold mining is the process of extracting minerals from the ground without land rights, mining license, exploration or mineral transportation permit or any document that rightfully gives consent to the operation and is subject matter to directives or regulations. Mining without regulation and registration is illegal due to the reason that the perpetrators are unregulated and operate without following the law (Amoah-Frimpong, 2013).

The other criteria used to define illegal mining is the operation without land rights, mining license, exploration or mineral transportation permit or any document that could lawfully permit the operations. Illegal mining can be operated on the surface or underground but (Dozlome, 2014) describes artisanal mining as something not to be considered as to be the same as illegal mining. Legal small-scale artisanal mining continues to take place in many countries along with large-scale mining. However, most illegal mining is categorized by the small operation size. The occurrence of large-scale illegal mining operation is unusual and is more likely related to unregulated rights (Dozlome, 2014).

The word artisanal small-scale mining includes mainly most of the activities which challenge defining. This term depends on how to define it and categorisation depends on the size of

the operation, wheather, small-scale or large-scale mining or whether they are legal or illegal (formal or informal), including as well methods used in operations. The informal (illegal) small-scale mining or artisanal mining point to those miners that are not registered as required in terms of the Mines and Minerals Act, therefore, they operate illegally. (Phiri, 2011; Dozlome, 2014)

According to Wikipedia artisanal miners are comprised of three kinds: peripheral or part-time miners, 'illegal' miners, artisanal miners (IIED, 2013; Fischer, 2007). Artisanal miners who get access to formal mines through abandoned shafts are called *zama zamas* or illegal miners. They compete together with formerly legal mine workers in large gold mines (IIED, 2013; Hentschel *et al.*, 2003).The zama zamas mostly live underground for a few weeks, while gathering an adequate quantity high grade ore to be processed. They are frequently miners with formal mining techniques, but they are no longer working. They opt to conduct illegal mining for the utilisation of their skills (UNIDO, 2006).

Artisanal and small-scale mining ASM refers to informal mining activities carried out using low technology or with minimal machinery. It is estimated that millions of people are depending on this sector for earnings, mainly in developing nations. In some areas ASM takes place alongside large-scale formal mining, thus leading to conflict. The term artisanal and small-scale mining AMS generally refers to mining practised by a group, individuals, or communities often informally (illegally) and in developing countries. This sector has not been designated a common definition as its legal status that defines the criteria as well as local definitions, differ from country to country (Mining facts, 2014).

2.5. Environmental, Mines and Minerals legislations in South Africa

2.5.1 South African Constitution Act of 1996

(SADC Environmental Legislation Handbook, 2012 and, Mineral and Petroleum Resources Development Act 2002) quoted that environmental requirements are incorporated in the Bill of Rights, Chapter 2 of the Constitution of South Africa Act, No. 108 of 1996. Section 24 of the Act, says everyone has the right:

a) To an environment that is not harmful to their health or well-being; and

b) To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:

- promote conservation;
- prevent pollution and ecological degradation;
- Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

2.5.2 Minerals Petroleum Resource Development Act 2002

According to Nhlengetwa (2014) the Minerals Petroleum Resource Development Act is a current part of legislation that is aiming to facilitate unbiased exploitation and distribution of the South African mineral resources. It is clarified that the resources belong to the people of South Africa under the custodianship of the state. The state maintains the only entity with the right to manage the mineral resources of the Republic of South Africa for the benefit of its people. The Minerals Act 50 of 1991 and all laws that preceded it and the Minerals Petroleum Resource Development Act do not mention artisanal and small-scale mining.

In fact, it describes micro, small and medium-scale mining. These systems insist on contractual agreement and partnership among rightful stakeholders at all stages, with local communities and other affected parties, as well as by focusing at rectifying the historical inequalities inherited from the apartheid period. In this situation, *Zama-Zama* or Diroto miners are not among the current legislative framework as legitimate stakeholders, meaning they are considered or classified as illegal miners (Nhlengetwa, 2014).

The South African government, as it is stated in (mining charter 2) is exceptional with numerous mineral resources; thus, mining resources are the legacy of the people of South Africa and it is the duty of the government to ensure that it is beneficial to all South Africans. In order for an individual to mine, the requirement is to apply for mining rights or permits to the government for utilization and exploration of the mining resources. The authorised person has to comply with the policies that promote avoidance of recklessness that is harmful to the South African economy (Department of Mineral Resources, 2011).

In section 39(1) of MPRDA, 2002 it is specified that every individual who has applied for a mining right in accordance with stipulations of section 22, ought to carry out an environmental impact assessment, and section 50(2) articulates that everyone who place an application for investigation authorization, prospecting right or mining permit, must submit an environmental management plan as prescribed. An environmental management plan must

be in place to ensure the protection of the environmental counteractive measures, environmental management objectives and environmental awareness plan.

2.5.3. South Africa Mining Health and Safety Act 29 of 1996

Mining health and safety in South Africa is governed by Act 29 of 1996, the Mine Health and Safety Act. The groundwork of the Act is to ensure that the owners are accountable for health and safety through the formation of codes of practices, spotting the potential hazards, training, founding techniques of medical attention, recruiting hygienists for the industry and recording for the site; Furthermore, to protect the rights of workers and to move away from any area which is potentially unsafe or is currently unsafe.

2.5.4 Environmental impact assessment (EIA)

EIA as a legislated framework for incorporating environmental concerns and sustainability matters in development plans derives from the USA's national environmental Policy Act (NEPA) National environmental Policy ACT of 1996 and consequent legal decisions and practices. EIA is now administered by section 23 and 24 of (NEMA) National environmental Management ACT of 1998 as amended in 2002. The EIA set of laws based on the provisions of NEMA were promulgated in 2006.

The EIA is a well-intentioned policy instrument that has some benefits to the environment and society as a whole; although its implementation could incur several difficulties which, if not dealt with, could make EIA lose its significance in a developmental setting. From the beginning of the 1960's there has been an increasing understanding of the unfavourable environmental impacts of the developmental projects (Policy briefing, 2010). The result of this has been concentrated efforts to recognize an exact formula to avoid or minimise such environmental impacts and EIA is the most acclaimed tool in this regard. It has outdated techniques such as risk assessment and cost benefit analysis as tools that takes into consideration socioeconomic and bio-physical environmental factors. The concern of EIA is not to set up new environmental standards but rather to ensure that active standards and protecting measures are well-adapted to the precise conditions of the project application (Policy briefing, 2010).

Table2.1: Environmental Authorizations

Act, Regulation or By law	Permit or licence	Requirements	Implementing agency
National Water Act, No. 36 of 1998, as amended	Water Use Licence	A licence is required for the Storage, abstraction, use, diversion, flow reduction and disposal of water and effluent.	DWA
National Environmental Management: Air Quality Act, No. 39 of 2004	Atmospheric Emission Licence	No listed activity in terms of the Act can take place without a licence.	Municipalities
National Environmental Management: Waste Act, No. 59 of 2008	Waste Management Licence	A licence is required to establish and operate a waste disposal site. The Waste Management Series Guidelines issued by the former Department of Water Affairs and Forestry (DWAF) must be followed in order to obtain a licence.	DEA: Directorate: Integrated Pollution Prevention and Waste Management
National Forests Act, No. 84 of 1998	Forest Licence	A licence is required to cut, damage or destroy any listed indigenous trees.	Department of Agriculture, Forestry and Fisheries
Mineral and Petroleum Resources Development Act, No. 28 of 2004	Prospecting Right Mining Right Mining Permit	Authorisation is required to explore, prospect for and mine any mineral.	Department of Mineral Regulation (DMR)
Mineral and	Reconnaissance	Authorisation is required to carry	DMR

Petroleum Resources Development Act, No. 28 of 2004	Permit Exploration Right Production Right	out reconnaissance and exploration activities for oil and gas and to produce such oil and gas.	
Mineral and Petroleum Resources Development Act, No. 28 of 2004, and the Mine	Blasting Permit	A permit is required for any blasting activity.	DMR
Health and Safety Act, No. 29 of 1996			
National Heritage Resources Act, No. 25 of 1999	Permit	Permits are required for any development that may affect heritage resources, such as Graves, wrecks and old buildings.	South African Heritage Resources Agency

Source: Adopted from SADC Environmental Legislation Handbook, 2012

Regardless of the environmental, Mines and Minerals legislations in South Africa, illegal gold mining is still widespread. Small-scale miners disinter tonnes of gold each year, most of which is being sold on the informal market and equal to half the amount legal mining is accountable for. Police investigations and as well as prison sentences do not discourage people to enter into illegal gold mining activities. The preference of illegal gold miners is to sell gold on the black or informal market where they will attain a better price, rather than to the Reserve Bank (Bhebhe *et al.*, 2013).

2.5.5. Components of vulnerability and coping capacity

There are three components for both vulnerability and coping capacity, namely, economic, social and environmental (Jordaan, 2012).

Social dimension: Defined as the tendency for human well-being to be damaged by a disturbance to individual mental, collective health, physical health, education services, social systems and their characteristics such as gender and marginalization of social groups (Birkmann *et al.*, 2013).

Economic dimension: a tendency for value loss of an economic kind from the damage to physical assets and/or disturbance of productive capacity (Birkmann *et al.*, 2013).

Environmental dimension: the potential damage to all bio-physical systems, ecological and their different purposes. This comprises of particular ecosystem functions and environmental services but leave out cultural values that can be attributed (Birkmann *et al.*, 2013).

2.6. Overview of Social impacts

Illegal mining has also social impacts. These include displacement and unemployment, child labour, accidents, and theft. The opening of illegal mines in Welkom has resulted in a high number of influx migrants looking for jobs. This, however, has resulted in increased occurrence of banditry, prostitution, increased competition among local residents for natural resources and changes to the indigenous lifestyle (Kitula, 2005:410).

2.6.1. Overview of Poverty as a factor to illegal mining

According to Hilson, 2007, the United Nations and bilateral agencies such as the UK Department for International Development (DFID) have acknowledged that the cause to artisanal and small-scale mining is poverty. Illegal mining provides employment to retrench large-scale mine workers; according to Hilson, 2003, Dondeyne *et al.*, 2009:45 artisanal and small-scale mining sectors are poverty-driven because of a lack of alternative economic activities, many are depending on artisanal small-scale mining to provide for family members. Security and health protection in these mining operations are hardly ever taken into account and more often, children are involved. It was stated by Tom Derry, 2012:675 that mining activities are disturbing the natural environment within its surroundings and he further said small-scale mining is a subsistence activity which is commonly developed and carried out by poor people.

Table 2.2: Provision of Estimated Number of People working at Artisanal and Small-Scale Mining

Country	Total number of workers in thousands
Bolivia	72
Brazil	10
Burkina Faso	100 to 200
China	3000 to 15000
Ecuador	92
Ghana	200
India	500
Indonesia	109
Malawi	40
Mali	200
Mozambique	60
Peru	30
Philippines	185.4
PNG	50 to 60
South Africa	10
Tanzania	550
Zambia	30
Zimbabwe	350

Source: adopted from MMSD, 2002

In several parts of the world artisanal or small-scale mining activities are as significant as large-scale mining activities, predominantly in relation to the statistics of people engaged in employment (MMSD, 2002:3). Many people keep on viewing it as dangerous, unprofitable and basically unsustainable, but ASM can be able to play a crucial role in poverty reduction and rural development; most of those involved in illegal mining are underprivileged and mining signifies the most advantage or creates a hope of an available income opportunity. With all these difficulties, it is significant that humankind reconsiders its actions on earth to an additional sustainable pattern. The reconsideration of activities creates a challenge to the reputable industrial sectors such as the gold mining industry (Makuluma, 2011:25); nevertheless, the sector is possibly identified for its high environmental disadvantages and poor health and safety activities (MMSD, 2002:3).

The international donor agencies have recognized the relationship between ASM and poverty; the ASM sector is receiving increased attention. ASM is currently included in mitigating plans of many national governments, multilateral and bilateral donor organizations, and different assistance programs have been or are currently carried out. The (CASM) Collaborative Group on Artisanal & Small-Scale Mining initiative of the World Bank is a step ahead of other organisations as far as planning for ASM is concerned. (MMSD, 2002:3).

While ASM has the possibility to contribute to poverty reduction, it often contributes to a continuation of poverty through high physical hazards, accidents and illness, as well as being deficient in knowledge about efficient, safer, and environmentally friendly methods. These issues tend to keep miners trapped in a vicious cycle of poverty and vulnerability (Owusu, 2012:86).

Poverty in terms of sustainable development still remains a huge challenge. The tremendous poverty ravages the lives of one person in four in the developing countries. Illiteracy, hunger and disease are still widespread. Social and economic inequality within nations is a blockage to sustainable poverty reduction. Globalisation recommends promising avenues for encouraging growth and reducing poverty, but extraordinary effort will be essential to ensure poor countries and poor people share sufficiently in its opportunities and benefits (OECD, 2001).

2.6.2. Mercury as contributing factor

According to Russel, 2012 mercury harm is very difficult to notice in humans until long after it has been experienced, and most illegal miners are not aware of the hazards. Currently thousands continue to flock to the illegal mining trade, hoping to become rich. They often operate as teams or groups (Lee, 2010:68, Amoah-Frimpong, 2013). The global gold boom has driven the demand for mercury upwards; for it is still utilised to collect and extract gold from the water, rocks and soil. Mercury is extensively obtainable, affordable and easy to use; it is also extremely toxic. For each kilogram of gold subtraction, 2.5 kilos of mercury and other chemicals are dumped in soils and rivers (Russel, 2012). Beside water pollution, land degradation, danger to health and safety, deforestation and indefensible disasters have also become more perturbing subjects. With the uncontrolled performances of illegal mining, many farms and agricultural lands are being polluted due to the use of various other chemicals as well as mercury; furthermore, uncontrolled excavation of soil causes infertility, erosion and loss of land for grazing.

Opolot *et al.*, 2014 says agricultural produce such as fresh vegetables and food items are also affected by the activities of illegal mining. Mercury particularly, is harmful to children as mercury attacks the nervous system by poisoning, which result in a range of neurological conditions, for example: headaches, including tremors, coordination problems, vision impairment, kidney failure, damage, pain, nausea and diarrhoea; and also affects the brain and can cause memory loss (Opolot *et al.*, 2014; Human rights watch, 2011; Kusi-Ampofo, and Boachie-Yiadom 2012:16). Methyl mercury is easily conveyed from women to unborn children, with effects ranging from infertility, unprompted abortion; and may be found at eminent absorption in higher levels of the food supply, particularly in water systems.

2.6.3. Poor residing structures

An influx of gold miners in Welkom put more stress on the city's infrastructure and illegal mining activity close to the city was viewed as dangerous and harmful to humans. Illegal miners are living under poor infrastructure conditions (Bhebhe *et al.*, 2013, Lee, 2010:68) which is hazardous and may lead to disastrous situations such as tuberculosis (TB) disease. Lee (2010:68) reported that illegal miners in Ghana share a room of 500 square feet with innumerable others; he described the place as hardly a living space, just walls to hide them from the villagers. Each and every day the group slept on the concrete floor.

2.6.4. Safety of the illegal miners

Mining health and safety in South Africa is governed by Act 29 of 1996, Mine Health and Safety Act, but regardless of that the miners disregard health and safety methods in their operations; they do not make use of any protective mechanisms, and are thus exposed to the unintentional risks of dust pollution (Bakia, 2013). Gold mining, particularly the informal labour section, is hazardous and linked to numerous economic, physical and social risks.

Miners not only have to cope with the ambiguity of yields and therefore, the unpredictability of income, but also social risk related to disputes and thefts, and many physical risks related to damage to health, alcohol abuse and accidents (Grätz, 2009:14). Although what *Zama Zama* people are doing is considered to be Illegal, these illegal miners benefit from costly helicopter evacuations during emergency calls and even receive most favourable treatment by specialists (Nacher *et al.*, 2013:2).

Toxic levels of carbon monoxide and explosive methane, rock instabilities in the failing mine infrastructures that are weakened further as old support pillars are undercut or stripped by activity, and underground fires are among the risks that Nhlengetwa (2014) identified. Nhlengetwa (2014) further argued that in the Welkom goldfields, there is a reportedly high risk from rival illegal miners' gangs who battle for working space in an increasingly explosive illegal mining situation, resulting in a rising death toll. The hard work by the Department of Mineral Resources and the Council of Geosciences to seal holes and shafts has failed to bring illegal mining activities to a halt.

2.6.5. Impact in education

Education is highly valued in South Africa and many families and the government are providing a basic education for the children. Reports on ASM have noted the negative effect where ASM is attracting students to the mines in search of a quick income rather than attending school. Conversely Teschner, (2014:144) stated that in other countries artisanal miners probably have at least a primary education and sometimes even a tertiary education. ASM sometimes provides families with money which enable other family members to pay their school fees.

Illegal gold miners tend to dwell in areas that is lacking appropriate sanitation and cleanliness facilities and away from social structures such as schools and clinics. Residing

conditions can be extremely poor and under particular conditions in the long-term, lack of correct education and health for the kids become challenging issues (Bhebhe *et al.*, 2013).

2.7. Economic loss factored by illegal mining

Russel, 2012 says although Government has identified that illegal miners are not contributing to income or sales tax; informal miners are still not paying it. An overvalued currency means that domestic producers receive less by the way of the local currency from their export of output that they would if the market related exchange rate were used (Hilson et al, 2003). Illegal activities have led to huge economic losses by interfering with the normal operation of the mines and have outburst of business the surrounding environment and the stability of the mined area (Maowei *et al.*, 2011). Known about logistic challenges to control mining and, recognising its significance for the local economy, it has been recommended that efforts be made to regulate, rather than to eradicate, artisanal and small mining activities (Dondeyne *et al.*, 2009:49)

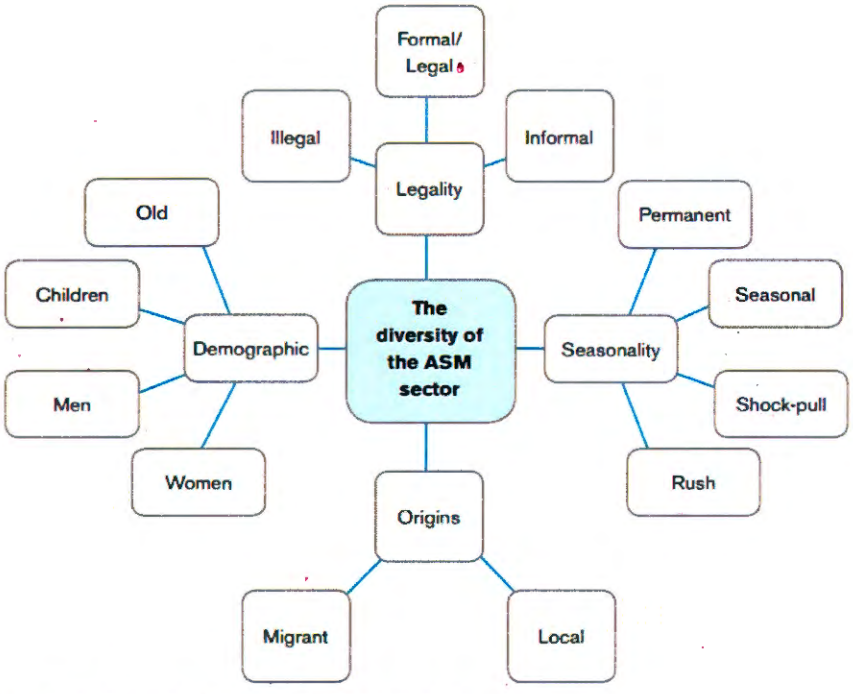

Figure 2.1: Diversity in Poverty-Driven ASM (IIED, 2013)

Most of the people involved in mining illegally are immigrants from Lesotho, Zimbabwe and Mozambique. They form part of a significant group of people comprised of organised previously legal miners and a growing gold interest group that includes trained professionals. The network is involved in the dealing with gold, prostitution, the mercury trade, suspected

money-laundering and growing levels of violence. The amount of gold recovered is currently unknown (Nhlengetwa, 2014).

2.8. Overview of environmental impact factored by illegal mining

Some of the typical environmental impacts caused by artisanal mining activities include distraction of rivers, landscape degradation, deforestation, water siltation, the destruction of water life locale, and extensive mercury contamination (Kitula, 2005; 410). Of major concern is deforestation which has been one of the major factors leading to climate change. Encroachment and destruction to our land savannas has brought many adversities to society. Indiscriminate cutting down of trees for illegal activities without replacement, even years after the illegal mining activities took place, has resulted in serious land degradation (Opolot *et al.*, 2014). Desertification and land degradation are two closely interconnected processes. Land degradation refers to the progressive loss of the natural quality of the land; if this process occurs in dry or semi dry areas it is called desertification (Tom Derry, 2012:678).

Makuluma, (2011:24) stated that according to the Millennium Ecosystem Assessment Report (MEA) (2005) each person in the world is depending totally on the earth's ecosystems and what they provide such as water, food, disease management, spiritual fulfilment, and climate regulation. Humans have recently changed these ecosystems rapidly and extensively, more than in any other period before in human history, largely to meet rapidly growing demands for food, fresh water, timber, fibre, and fuel (MEA, 2005). The activities of both the mining companies and illegal miners degrade the natural environment and destroy the ecosystem – especially the open-cast method being used now has a shocking effect on the environment. (Kusi-Ampofo and Boachie-Yiadom, 2012).

As stated by Makuluma (2011:24) the findings of the MEA are more encouraged by the Ecological Footprint Indicator, which evaluates human environmental impact with the number of productive land and sea areas available to provide main ecosystem services. This evidently shows that humanity now use natural resources unsustainably; although socially and economically they have improved human well-being, on the other hand it is impacting negatively on the environment which human and animals are depending on. Global consumption has risen, more fossil fuels, minerals, and metals have been mined from the earth, more trees have been cut down.

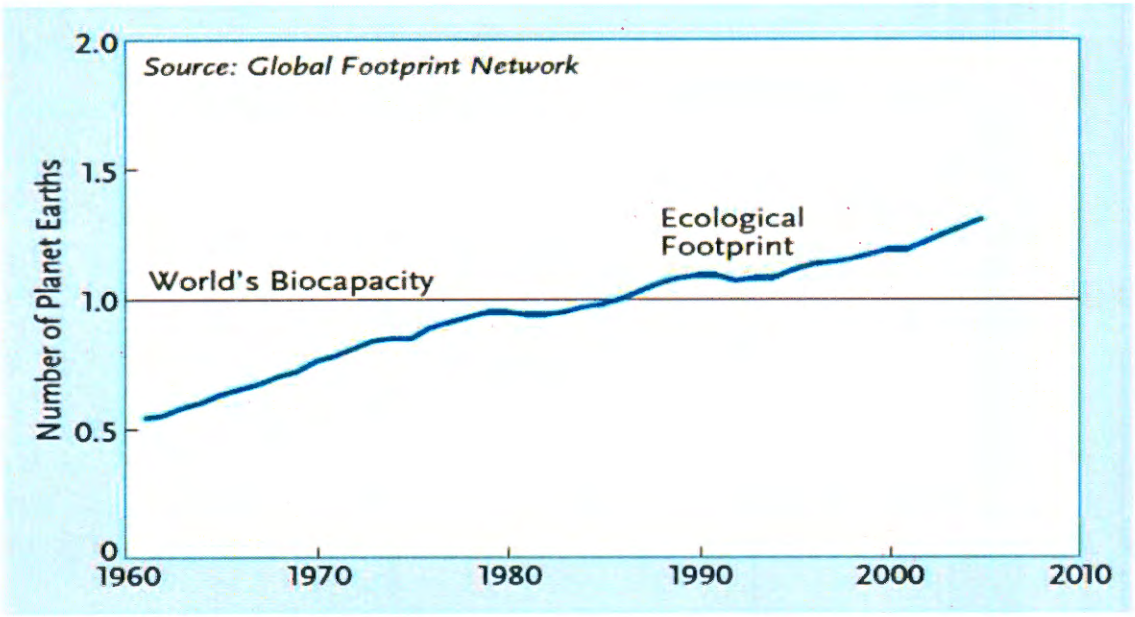

Figure 2.2: Humanity`s Ecological Footprint, 1961-2005 (Makuluma, 2011:25)

The illegal gold miners' operations often cause major environmental damage by the utilisation of mercury for processing, which pollute the environment. They function on the surface or underground and usually the majority functions in concealed places. It does not require any educational qualification or experience; it is run by different groups of persons that might include women, men, and children. They make use of shovels, pick-axes, barrels, and nets and the miners work in groups (Amoah-Frimpong, 2013).

Once the miners deplete the gold from one mine or area, they usually move to another and start destruction where the vegetation still exists and where there are currently productive lands and fragile vegetation. As illegal mining is increasing it is also contributing to the high level of congregating iron buildings, like hostels, prostitution, drugs, and booze (Russel, 2012). Social costs of the gold explosion do not seem to be excessive, but if government decline to act timely, the gold explosion will end a sustainable part of the area's economy and environment. Small-scale gold mining exposes the needed minerals by removing the fundamental vegetative cover (Derry, 2012:677)

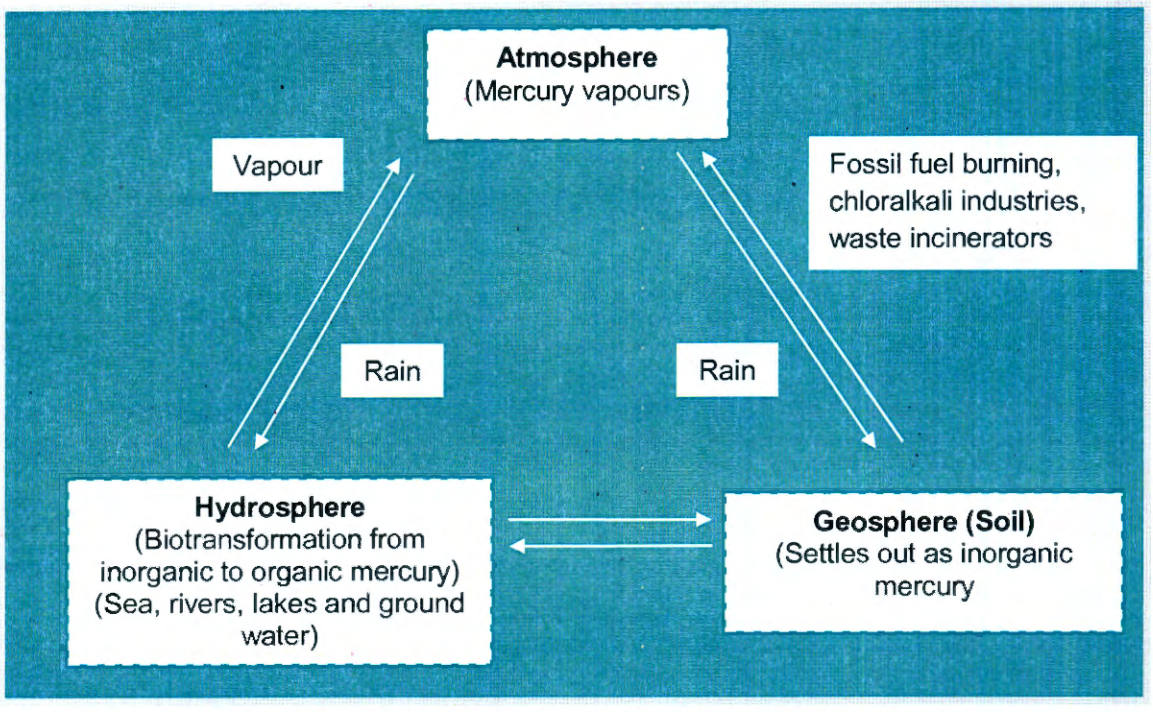

Figure 2.3: Mercury and Environment (Zahir, 2005)

2.9. ASM characteristics caused by numerous conditions (MMSD, 2002)

- Lack or reduced degree of mechanization, great amount of physically demanding work.
- Low level of occupational safety and health care.
- Deficient qualification of the personnel on all levels of the operation.
- Inefficiency in the exploitation and processing of the mineral production (low recovery of values).
- Exploitation of marginal and/or very small deposits, which are not economically exploitable by mechanized mining.
- Low level of productivity.
- Low level of salaries and income.
- Periodical operation by local peasants or according to the market price development.
- Lack of social security.
- Insufficient consideration of environmental issues.
- Chronically lack of working and investment capital.
- Mostly working without legal mining titles.

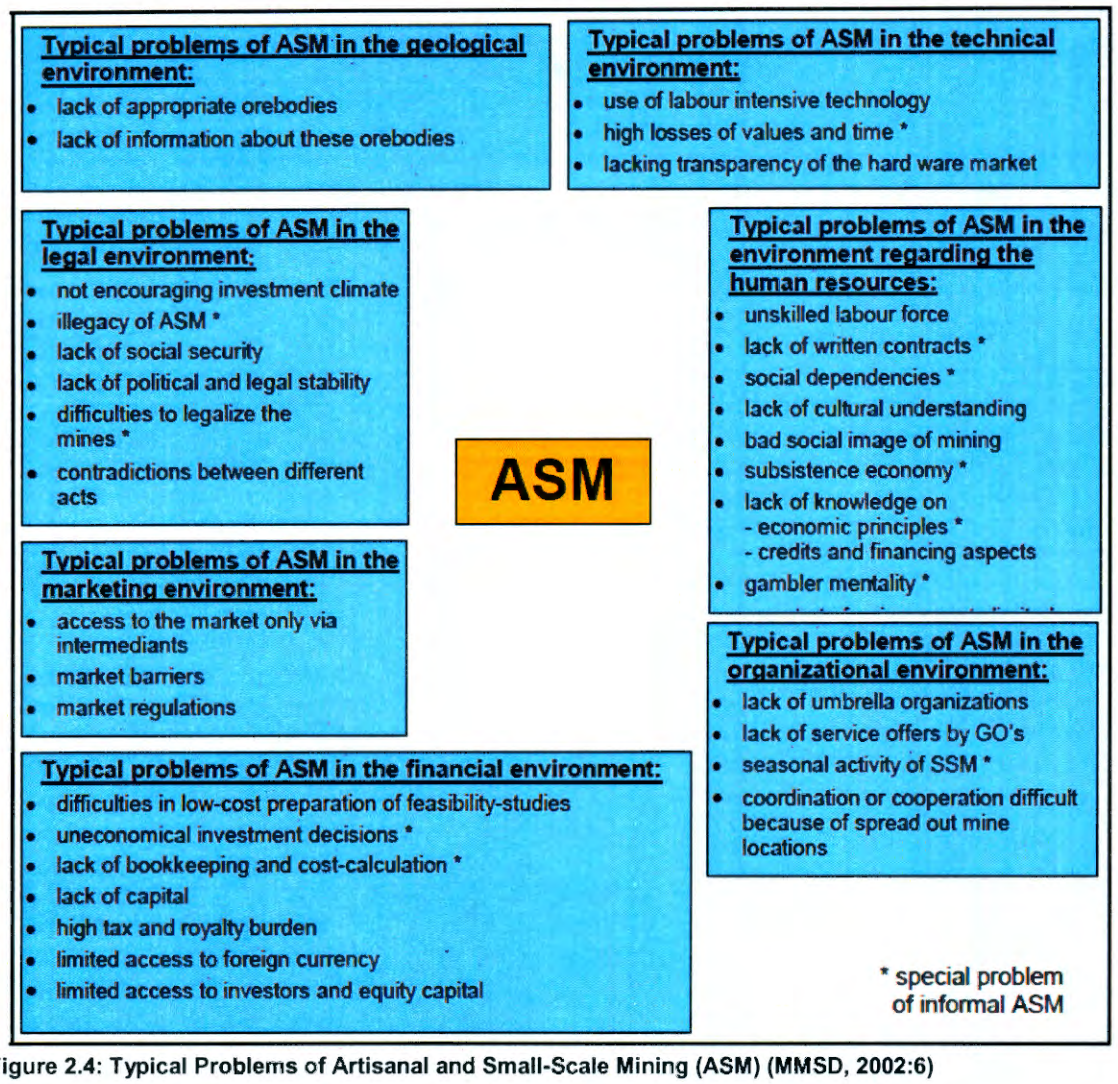

Figure 2.4: Typical Problems of Artisanal and Small-Scale Mining (ASM) (MMSD, 2002:6)

2.10. Factors determining the Vulnerability for illegal mining in Welkom

The impact of each hazard is considered in three categories which impact on the population as social, impact on environment and impact on the economy. Vulnerability has two components: external risks, shocks and stress to which a structure, individual, house- hold, community or nation is subject to, as well as an internal side – the lack of resources to cope without damaging loss and exposure to hazard (Jordaan, 2012).

To determine vulnerability of the community or certain populations to disaster is important elements to manage disaster and promote developmental involvement in emergency relief. Vulnerability assessment provides role players with relevant information on which interventions are required in order to reduce disaster as well as giving signs of which and what disaster risks exist in a particular location.

The vulnerability in Welkom can be determined by frequency and severity of disaster within the population. An effective strategy is required to manage disaster risk but firstly it has to begin with identifying the hazards and the areas within the community that are vulnerable. Reducing disaster risk requires the role player's observation and actions to place a main concern on safety in planning, development and that change should take place at national, provincial and local levels (Wisner *et al.*, 2004).

Exposure is one element of disaster risk and refers to the one affecting natural disasters, experienced by people and property. Risk can be defined as expectation value of losses such as deaths, loss of property and sustained injuries that may be caused by the hazards; and disaster can be identified as a function of hazard, exposure and vulnerability which means we can say that after defining those two we can conclude by say disaster risk is identified by this equation.

$$\text{Risk} = \frac{\text{Hazard x Vulnerability}}{\text{Manageability x Capacity}}$$

2.11. Conceptual Framework to address the vulnerability

2.11.1. DFID

The introduction of the new terminology "Sustainable livelihood" (SL) by the authors rose many controversies instead of progressing the literature. The concise definition regarding sustainable livelihood and its application added more confusion during Chambers and Conway's call where the brainstorm aggravates the discussion while trying to interpret and assess the concept (Chambers and Conway, 1991). Sustainable livelihood initially advocates a "people-centred development approach", progressing the positive conception of change as response of governance as leading from the local perspective to the way rural development is understood (Twyman and Slater 2005: 2).

Livelihood sustainability puts more prominence on equity, capability and sustainability and involves strategies to reduce poverty (Chambers and Conway, 1991: 5), understand the way poor people live their lives and issues related to the institutions (Ashley and Carney, 1999: 4).

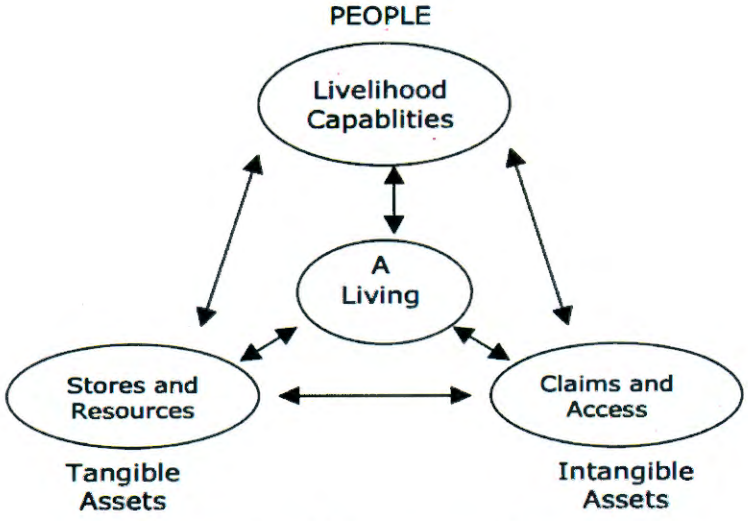

Figure 2.5: Components and Flows in livelihoods (Chambers and Conway, 1991)

The definition of livelihood has been given by the organization as "capabilities, assets including both social resources and material, and activities which require for a means of living while looking at it as a possibility to cope from shocks, stress or improve or maintain the capability and assets or both in the present or future with consideration to the natural resources base" (Carney, 1998). A changing condition as one of the strategies developed by DFID plays an important role in vulgarising the livelihoods concept then deployed to poor populations in order to maintain well-being after the recognition of the poverty as dynamic and having many dimensions (Norton and Foster, 2001: 12). The insurance of livelihood sustainability, environment protection and management of those are valuable and the key to eradicate poverty (Knutsson, 2006; Krantz, 2001). In order to change the realities and policies formulations in the decision levels, CARE and OXFAM developed their own framework based on DFID's lead (Hilson, 2007:4).

Several approaches can be applied to respond to the question regarding sustainable livelihoods; even though the concept of sustainability is differently understood. Roe (1998) noted a common idea from different approaches as the reduction of uncertainty and complexity in the first place is susceptible to increase the demand for a sustainable livelihood. Therefore, a sustainable livelihood was defined as a thought about the scope, objectives and priorities leading to development in order to improve poverty suppression.

The sustainable livelihood is viewed as a holistic approach which searches the causes and provides means to understand and analyse the reason of poverty in the community and also

provides strategies to address the issues which outcome will allow prioritisation effectively to an operational level (Ashley and Carney, 1999; Knutsson, 2006).

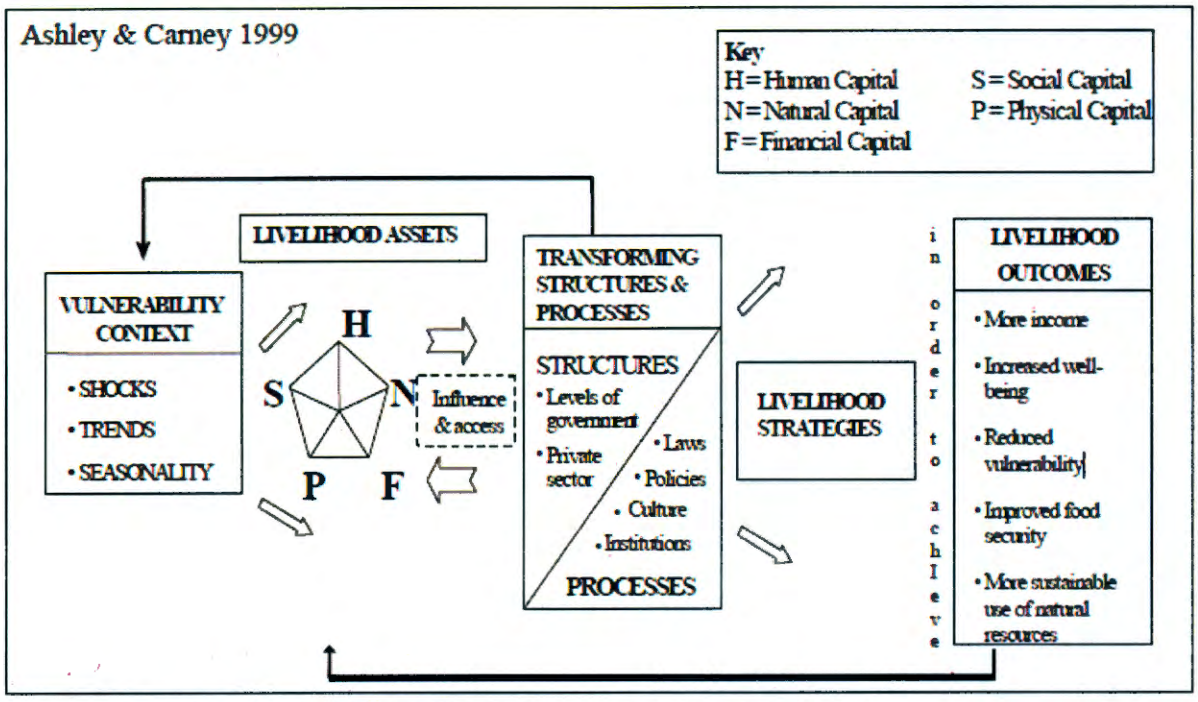

Figure 2.6: DFID Model (Sustainable Livelihoods Frameworks) (John Twigg, 2001)

Sustainable Livelihoods and vulnerability to disasters

A sustainable livelihood views individuals in the context where they can access all measures as means which can be financial, social or human resources in order to reduce poverty (Roe,1998; Knutsson, 2006). The mentioned assets only have significance and become valuable through the existing social, institutional and organisational environment according to policies, institutions and processes.

The resilience and capability of the particular individuals, households and the community are called by the sustainable livelihood in order to assure the long and short term of well- being in a particular environment. This can create a coping capacity which can prevent external or internal threats (Twigg, J. 2001).

The reduction of poverty is the key to sustainable livelihood which also contributes to the vulnerability reduction hence reducing disaster. As emphasized by DFID (2000) sustainable livelihood should also support and encourage individuals and communities and be used as a

driving force to reduce disaster. Sustainable livelihood and development have been recognized as methods with factors influencing each other.

The approach regarding sustainable livelihood theories composes essential problems where sustainable and community development can reduce poverty. This implies and justifies the implication of an important organization like the United Nations Development Program (UNDP) and the Department of International Development (DFID) to adopt sustainable livelihoods.

Sustainable livelihood theory recognises some assets which are summarized as follows (McLeod, 2001):

- Social Capital: Social resources (relationships of trust, membership of groups, networks, access to wider institutions).
- Physical Capital: Basic infrastructure (water, sanitation, energy, transport, communications), housing and the means and equipment of production.
- Financial Capital: available financial resources (savings, pensions or regular remittances, supplies of credit).
- Natural (Environmental) Capital: Natural resources (biodiversity, environmental resources, land, wildlife, water).
- Human Capital: skills, health, ability to labour, information, knowledge.

2.11.2. BBC conceptual framework

BBC is a conceptual model which emphasizes risk reduction strategy as a key element susceptible to reduce vulnerability on one hand; on the other hand finds all measures to reduce frequency and magnitude of the event in case it occurs (e.g.: landslide, drought, flood, drought, etc.) as the system encompasses vulnerability measures (Birkmann, 2006).

The BBC conceptual framework is analysing and addressing vulnerability economically, sociologically and environmentally, considered being the three identified spheres and pillars of sustainable development, while some approaches observe the vulnerability as the degree experienced in economic damage or life loss.

It demonstrates the relationship and overlapping link existing between the society and nature without any limitation to the hazard sphere while taking into consideration the importance of human life and physical and environmental sphere. The BBC model views the environment as the starting point of the hazard which negatively impacts into a disaster with consideration to culture which determines the understanding of dividing environmental and human issues. Environmental degradation can be the result of vulnerability in the urban area with a rapid

growth pattern in rural areas and brings fragmentation in urban agglomeration, especially in megacities (Birkmann, 2006).

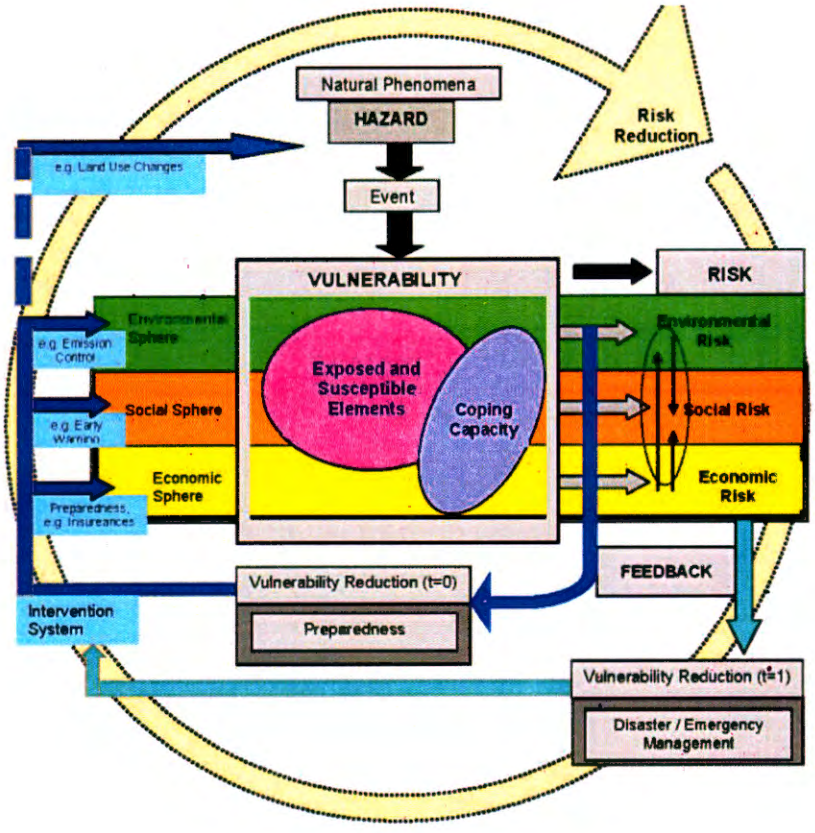

Figure 2.7: The BBC-Conceptual Framework (Birkmann, J 2006)

The BBC conceptual model emphasizes that coping capacities and susceptible elements should be taken into consideration while doing vulnerability assessment which may impact on livelihood and causes harm and injury due to a hazardous event.

The BBC framework anticipates the occurrence of the impact by taking action and reducing the risk reason why it has (t = 0) and (t = 1). The maximization of the opportunity and reduction of various vulnerabilities before turning into a catastrophe is the main advantage of the BBC conceptual framework; therefore, the investment in preparedness and mitigation have a higher return rather than covering the cost of recovery and relief.

The system is declared to be at risk when it is exposed or elements are exposed to potential phenomenon which makes it vulnerable. Thus, the exposure is viewed by BBC as partially

related to vulnerability; once the vulnerability is understood as a susceptible factor of the community to the impact of hazard (Birkmann, 2006).

The change of vulnerability to thematic dimensions should be encouraged and taken into consideration and viewing the problems since they are shifted and imply vulnerability reduction; this viewpoint is emphasized by the BBC framework (Birkmann, 2006).

2.12 Conclusion

Different reasons contributing to illegal mining activities have been identified by different researchers. Illegal mining activities, are however, considered to be beneficial for providing food to poor people regardless of hazardous situations related to it. The fact of the matter is that a stop has to be put to the illegal activities contributing to possible future disasters. Different researchers have indicated the reasons for illegal gold mining operations, of which unemployment is but one, but safety measures are not undertaken by illegal miners, particularly during the panning and they work under difficult conditions. Policies guiding utilisation of mineral resources and the environment have been formulated by the government but it is difficult to reduce the impact caused by illegal mining activities. Some of the panners are immigrants from Lesotho, Zimbabwe and Mozambique. They form part of an important group of individuals who include organised, previously legal miners who lost their jobs during closing of mines. The next chapter would be discussing methodology used to collect data which comprised of methods and techniques; data collection procedure is also discussed, as well as ethical procedures.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The main objective of this chapter is to discuss procedures and methods utilised to gather data. Leedy and Ormrod (2010); Salkind, (2009) says in qualitative research the potential source of data is limited to the researcher's disposition and creativity. Regardless of the kinds of data involved, data collection in qualitative study takes a great deal of time for the researcher to record any useful data.

Methodology is discussed by Rajasekar (2013) as a systematic technique to resolve a particular problem. It is a procedure of studying how to conduct research; an essential way which researchers take to complete, explain and predict phenomena and others describe it as methods used by researchers to gain knowledge. The researcher spent time with illegal miners at various levels of operations, observing their behaviour at work and conducting various interviews to assess their understanding on how their activities impact on the surrounding communities, as well as on the environment.

The researcher used observation, interviews and questionnaires to obtain data for the study. English was used and other local languages such as Sesotho and isiXhosa to collect data. Interviews were held with different stakeholders, illegal miners or panners, household heads, community leaders, South African Police Services (SAPS), mining departments, Non-Governmental Organisations (NGOs) involved in community work and the disaster management centre of the district.

The questionnaires were disseminated to selected members of the community, illegal miners as well as local stakeholders. The degraded land was also captured on film where illegal mining is taking place; the holes in closed mining shafts used by gold panners to get underground was photographed as well. The data was primarily collected through observation.

The research is based on both qualitative and quantitative data. The difficulties were experienced due to the fact that the respondents were panners who are involved in an illegal operation, as others were not willing to participate in the research, despite the fact that the researcher set up good relations with illegal miners to allow the collection of valid and reliable data.

3.2. Population and sampling

The convenience sampling method was utilised in this study (Salkind, 2009:96); sampling depended on the willingness of the illegal miners to talk to the researcher because they do not trust anyone. (Owusu *et al*,2012). The convenience sampling method was utilised which allowed the researcher to collect data based on inclusion and exclusion criteria (Cronin P *et al*., 2008). Useful sampling is valued at the time when the researcher chooses the best possible sample from those obtained. In research information which can be of good value is important for the purpose of the research.

3.3. Sample Techniques and Sample Size

In the first stage, 103 households were selected which are close to the operation area. In the second stage, 22 illegal miners were selected; the selection was based on convenience sampling technique as miners were not comfortable to disclose any information with regard to illegal mining. This was based on affected miners. In the third stage 7 stakeholders were selected; the selection was based on their close involvement with the community. A subtotal of 132 respondents was interviewed.

3.4. Data Analysis

Data collected were summarized and stored in digitally, i.e Statistical tables, graphs and maps. Software such as SPSS was used (Leedy and Ormrod 2010:319), bar charts and frequency distribution tables. Analyses were interpreted using qualitative and quantitative results.

3.5. Research design and research instruments

3.5.1. Qualitative

Qualitative research is usual; it tries to gather the information regarding the lives of different people within the community as it is predominantly helpful in conducting studies for educational processes. Qualitative research involves an interpretive approach of its focus subject; it interprets phenomena clearly in a manner in which people presented it. The aim of qualitative research is to explore and discover subjects about the particular problem on hand. Qualitative research is intended to assist researchers to value the cultural and the social contexts within their communities (Huberman, M. and Matthews, 2002; Athanasiou

Thanos *et al.*, 2010). Qualitative data sources include observation, interviews, questionnaires, documents and manuscripts, and the researcher's interpretation and response is vital.

3.5.2. Quantitative

Quantitative research shows statistical outcomes represented by numerical or statistical data. Quantitative research makes use of questionnaires, experiments and surveys to collect data that is amended and tabularized in numbers, which permitted the data to be categorised using statistical analysis (Mohd Ridzuan and Farida Hazwani, 2013; Ritchie Jane et al, 2014).

The main differentiation between this is that quantitative research is deductive and qualitative research is inductive (Casebeer, A.L. and Verhoef M.J.1997). In qualitative research, a hypothesis is not important to start the research; it utilizes inductive data examination to give a clear understanding of how to interact with researcher and participants.

It permits a design to be developed and it is important to have a good and complete design from the commencement of the study as it will be difficult to predict beforehand what the outcomes of connections will be, due to the different opinions of the participants and the researcher's interpretation of reality and the outcome of the study. Though, in quantitative research, hypothesis is required before the research can commence.

Table 3.1: Summarised between Quantitative and Qualitative Research

Orientation	Quantitative	Qualitative
Assumption in relation to the world	A single reality that can instrument measured	Many realities
Purpose for Research	Relationship among measured variables	Social situation from participants has to be clear and understood
Methods and processes of Research	- Established procedures prior research commencement - Formulation of hypothesis before research can start	- Changing and flexible strategy - Design materialize as data is collected - No need for hypothesis in order to start with the research -It is inductive in nature
Researchers responsibility	The researcher plays a role of being ideal and neutral observer who does not take part or influence any decision of studies	The researcher participates and becomes immersed in the research/ social setting
Generalizability	Context free generalisation	comprehensive context based generalizations

Adopted from (Thomas, 2010)

3.6. Research instruments

3.6.1. Observation

According to Kawulich (2005) observation is described as the systematic description of events and behaviours in the social setting selected for the particular study. Observations allow the researcher to illustrate existing circumstances utilising the five senses. With regard to the observations, the researcher visited some of the Welkom mines and closed shafts to observe how this activity of illegal mining is being done and the impact of degraded land

where the operation is occurring (Owusu *et al.*, 2012). The researcher also observed the process illegal miners used when extracting the gold from the ore.

3.6.2. Interviews

The purpose of the research interview is to explore the views, experiences, beliefs and/or motivations of individuals on specific matters (e.g. factors that influence their attendance at the dentist). Qualitative methods, such as interviews, are believed to provide a 'deeper' understanding of social phenomena than would be obtained from purely quantitative methods, such as questionnaires. Interviews are, therefore, most appropriate where little is already known about the study phenomenon or where detailed insights are required from individual participants. They are also particularly appropriate for exploring sensitive topics, where participants may not want to talk about such issues in a group environment (Gill P *et al.*, 2008).

The researcher visited Welkom mining areas. It has been indicated by Salkind, 2009 that interviews can take the form of the most informal questions and answers that can be conducted on the streets, or any identified suitable place. The main focus of the interview was on illegal miners, members of the community, community leaders, the Department of Mineral and Energy in the district and other relevant stakeholders, as well as the SAPS.

a. Advantages of interviews

The main advantages of the interview method of data collection are (Thomas, 2010)

- Essential when obtaining comprehensive information;
- Not too many participants needed when gathering detailed information

b. Disadvantages of interviews

- Fear of giving own opinion;
- Difficult to assess the accuracy of the information since they are self-reporting information that is collected;
- Declining during interview process.

3.6.3. Type of interviews

Interviews can be unstructured, structured, and semi-structured.

a. Structured interviews

Structured interviews are, essentially, verbally administered questionnaires, in which lists of predetermined questions are asked, with little or no variation and with no scope for follow-up questions to responses that warrant further elaboration. Consequently, they are relatively quick and easy to administer and may be of particular use if clarification of certain questions are required or if there are likely to be literacy or numeracy problems with the respondents. However, by their very nature, they only allow for limited participant responses and are, therefore, of little use if 'depth' is required (Gill *et al.*, 2008).

b. Unstructured Interviews

The unstructured interviews permit the interviewer to question interviewees using open-ended questions and allowing them to express their opinions freely. There is a need for a standardised interview because each interview can take its own set-up. Despite everything it is highly important to produce rich data. The researcher has to be observant as the interviewees can change issues raised to suit themselves, it could be time-consuming and make it difficult to analyse the data.

c. Semi-structured interviews

Semi-structured interviews consist of several key questions that help to define the areas to be explored, but also allows the interviewer or interviewee to diverge in order to pursue an idea or response in more detail. This interview format is used most frequently in healthcare, as it provides participants with some guidance on what to talk about, which many find helpful. The flexibility of this approach, particularly compared to structured interviews, also allows for the discovery or elaboration of information that is important to participants but may not have previously been thought of as pertinent by the research team (Gill P *et al.*, 2008).

3.6.4. Questionnaires

The advantage of a questionnaire is that it is easy to take it to a wider range of participants in comparison to interviews; the disadvantage is that it does not allow any possibility of tailoring it to individuals as other methods of data collection gives that possibility. In this study three questionnaires structured in terms of annexures, were used to collect data.

- Annexure 3.1

Annexure 3.1 is the questionnaire for illegal miners or panners. This questionnaire also attempted to determine their attitude and reason behind the participation in illegal mining activities and to find out if they have an understanding of the impacts caused by their activities. Their expectations from government to enhance or support what they are doing are also being assessed.

- Annexure 3.2

The aim of this questionnaire is to interact with community members and find out from them their view off illegal mining and their understanding of its impact on their lives as well as on the environment. The government expectations by community, is assessed as well.

- Annexure 3.3

Stakeholder's participation in terms of educating and minimising the illegal mining activities in relation to environmental and social impacts is also assessed. The process, procedures, and strategies planned to alleviate the negative impact of illegal mining is questioned as well.

3.6.5. The use of records, files, and existing evidence

Limitations

Despite most of the groups being interviewed, it is not possible to generalize the results with great confidence as other shafts were never visited, due to the fact that it was dangerous to interview the panners in closed shafts. In this study the samples are limited to 132 respondents of which it is divided into 103 community members, 7 stakeholders and 22 illegal miners.

Reliability and validity

Validity and reliability are necessary in a way that the research is evaluated. Reliability is the degree to which results are dependable over time and precise representation of the total population under study is referred to as reliability and if the result of a study can be replicated under one comparable methodology, afterwards the research instrument is measured to be reliable. The validity and reliability of the study was evaluated when interviewing the panners, communities and stakeholders involved in illegal mining activity. The study was done to measure the impact caused by illegal mining on the environment and human beings.

The research obtainable in this study may under any other methodology be replicated. The validity, generalization and reliability can only be limited to the study. The data was gathered from different areas in Welkom where illegal mining is taking place; convenience sampling was used for panners and a simple random technique approach for 103 community respondents which may reproduce the universal trends of illegal mining in Welkom.

3.7. Ethical Considerations

The researcher has to interrelate intensely with the participants and several ethical concerns were raised to be addressed for the duration of the research and after the research has been conducted (Thomas, 2010; Ritchie *et al.*, 2014). The obligation of the researcher is to take into cognisance the needs, rights, desires and values of the informants.

Some of the main ethical concerns involved are the following (Thomas, 2010):

- Informed consent (The participants must fully understand what the research involves)
- Harm and risk (The study must not be harmful or of any risk to the participants)
- Honesty and trust (The researcher must present truthful data)
- Privacy and confidentiality (The study must not intrude too much into the Participants' conduct. Privacy and confidentiality must at all times be maintained)
- Intervention and advocacy (The researchers should act responsibly and wisely when the participants display harmful or illegal behaviour)

3.8: Ethical concerns below describe procedures considered when collecting data:

- Informed consent

The researcher explained the procedures, intentions, and the importance of data collection methods, as well as the degree of the research before the commencement. The researcher continued by explaining to the participants their roles and responsibilities during the time of research.

- Harm and risk

During the time of research the researcher assured participants that no one will be in danger situations such as harmful and risky places during their participation in the research (DiCicco-Bloom, 2008; Ritchie Jane *et al.*, 2014) either physical or psychological.

- Honesty and trust

Honesty and trustworthiness during the time of data collection and the time when data will be analysed is very essential to the entire research.

- Privacy and confidentiality and anonymity

The researcher made certain that the confidentiality (Cassell and Symon 2004) and privacy of the participants were maintained as stated in questionnaires. The confidentiality and anonymity were preserved to those having concerns of remaining anonymous (DiCicco-Bloom, 2008; Ritchie Jane *et al.*, 2014). The researcher made it completely clear that the participants' names would only be used for research and academic purposes.

- Voluntary participation

No one was pressurised or forced to partake in the completion of the research. The researcher clarified to the participants that the research and data was collected only for academic purposes and their participation in it was absolutely voluntary (Ritchie Jane *et al.*, 2014).

3.9. Conclusion

In this chapter focus was based on the research methodology adopted while conducting the study. Therefore, different methods were used on related topics, such as interviews, questionnaires and observation by the researcher. To get a full understanding of the study the researcher visited some of the operation areas for panners. The purpose of this study was to get an understanding of the problem and its impact; the research acquired in the form of qualitative questionnaires and interviews on the basis of qualitative questionnaires as well as observation. Interpretative research methods utilised to narrate to the intention behind accurate data were gathered.

CHAPTER 4: ANALYSIS AND PRESENTATION OF DATA

4.1 Introduction:

In this study the data is presented in facts, table and graphs to give a clear understanding of the findings. It is important to obtain solutions to the study questions by interpreting the meaning of the data. The researcher has aligned the data interpreted with the facts found while conducting the research. The data was obtained about the impact of illegal mining in Welkom after interviews with stakeholders, community members and illegal miners from different sites of operations. Questionnaires, interviews and observations were used to interpret and analyse data.

Questionnaires were specifically utilised to draw graphs using occurrences and percentages in order to make it user-friendly for the better understanding of data collected. Graphs and tables were used for the analysis of quantitative analysis, whereas interviews and observations were used for the analysis of qualitative analysis. The interpretation and analysis of the study was based on data obtained from respondents of 132 questionnaires distributed to stakeholders, community members and illegal miners.

Table 4.1: Distribution according to age and category

		Category			
		Panners	**Stakeholders**	**Community**	**Total**
Age	18-25	2	0	50	52
	26-35	12	3	30	45
	36-50	8	3	13	24
	51-60	0	1	6	7
	above 60	0	0	4	4
Total		22	7	103	132

Table 4.2: Distribution according to Age, Gender and Category

Age	Category	Gender			
		Male	N %	Female	N %
18-25	Panners	2	1.5%	0	.0%
	Stakeholders	0	.0%	0	.0%
	Community	40	30.3%	10	7.6%
26-35	Panners	9	6.8%	3	2.3%
	Stakeholders	3	2.3%	0	.0%
	Community	26	19.7%	4	3.0%
36-50	Panners	6	4.5%	2	1.5%
	Stakeholders	2	1.5%	1	.8%
	Community	9	6.8%	4	3.0%
51-60	Panners	0	.0%	0	.0%
	Stakeholders	1	.8%	0	.0%
	Community	4	3.0%	2	1.5%
above 60	Panners	0	.0%	0	.0%
	Stakeholders	0	.0%	0	.0%
	Community	3	2.3%	1	.8%
Total	Panners	17	12.9%	5	3.8%
	Stakeholders	6	4.5%	1	.8%
	Community	82	62.1%	21	15.9%

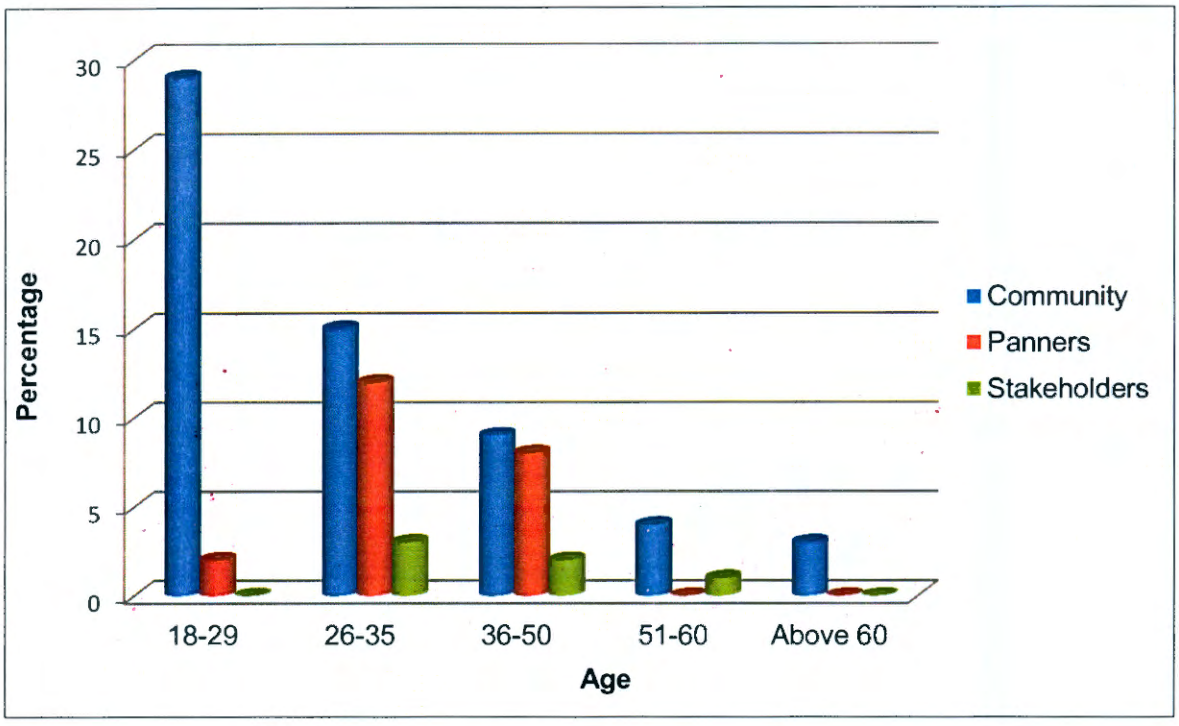

Figure 4.1: Representation by Age of the Respondents

In the study it emerged that most of the illegal miners were older and strong enough to carry out the panning activities; no child labour has been indicated as customary. The respondents from the community are between 18 and 35 years old. According to the research that has been conducted with the community members of Welkom, most of the participants are young people who are desperate to get jobs and they are concerned about sustainable development of the country. In South Africa an individual above the age of 18 is considered to be old enough to take legal decisions and be accountable.

Table4.3: Distribution according to Gender and Category

		Category			
		Panners	Stakeholders	Community	Total
Gender	Male	17	6	82	105
	Female	5	1	21	27
Total		22	7	103	132

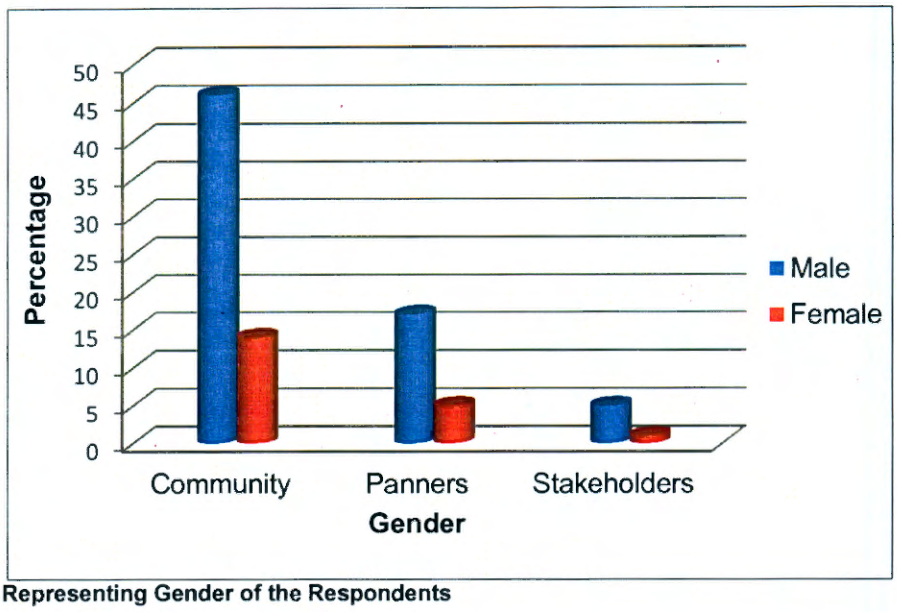

Figure 4.2: Representing Gender of the Respondents

Most of the respondents are male, relating to the fact that mining was previously associated with being a male's responsibility. Although females are currently involved, the majority are not interested in mining as they regard it as a man's world. Most of the women were not showing interest in responding to the questionnaires. The findings show that the majority of our respondents undertaking panning activities are men, because women consider it to be risky and difficult to perform. The ones involved are doing undemanding work such as blazing of gold, not being aware that the work is hazardous to their health. The majority of the community member respondents to the questionnaires were men (80%) as represented by the graph, and women are only (20%).

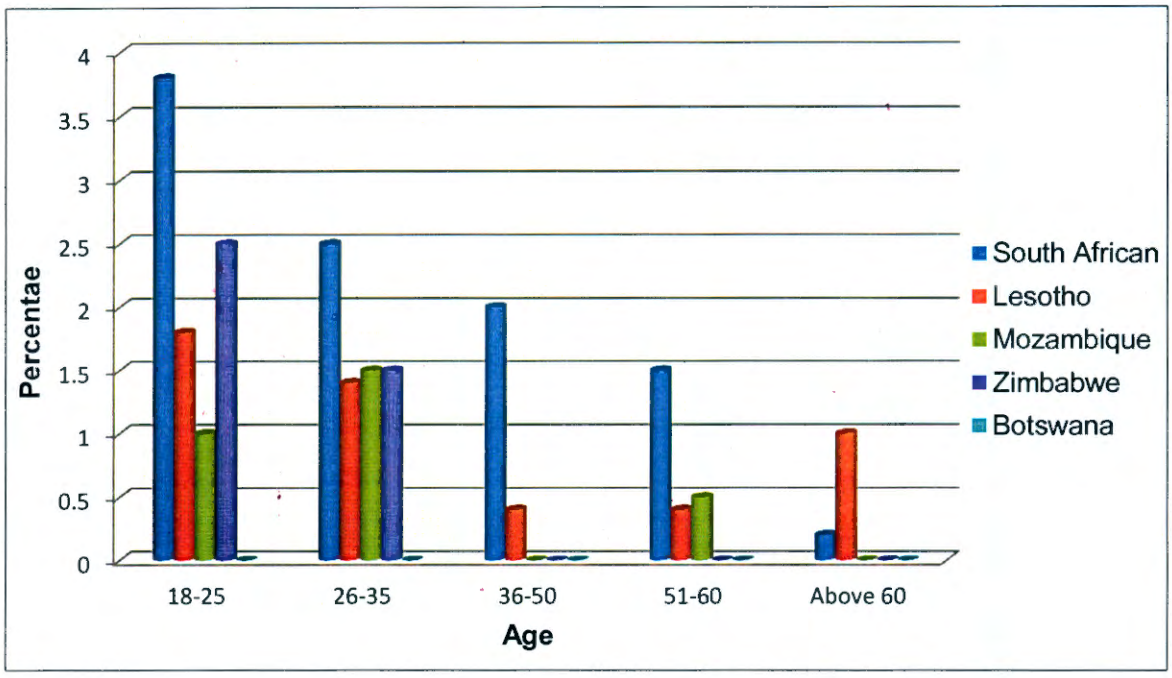

Figure 4.3: Showing Nationalities of Communities and their involvement in illegal mining

The city is being known as a multi-cultural area, "*where nations meet*" as it is called Matjhabeng. People from neighbouring countries are also relocating to the area to search for a means of living, despite the fact that currently most of the community members and panners interviewed were South African. Some of the panners from other countries, such as Lesotho and Zimbabwe, Mozambique were not confident to respond to the questionnaire. Previously panning activities were considered to be done by people from other countries, but South African residents are currently involved in large numbers in illegal mining and it is regarded as a source of income for their households.

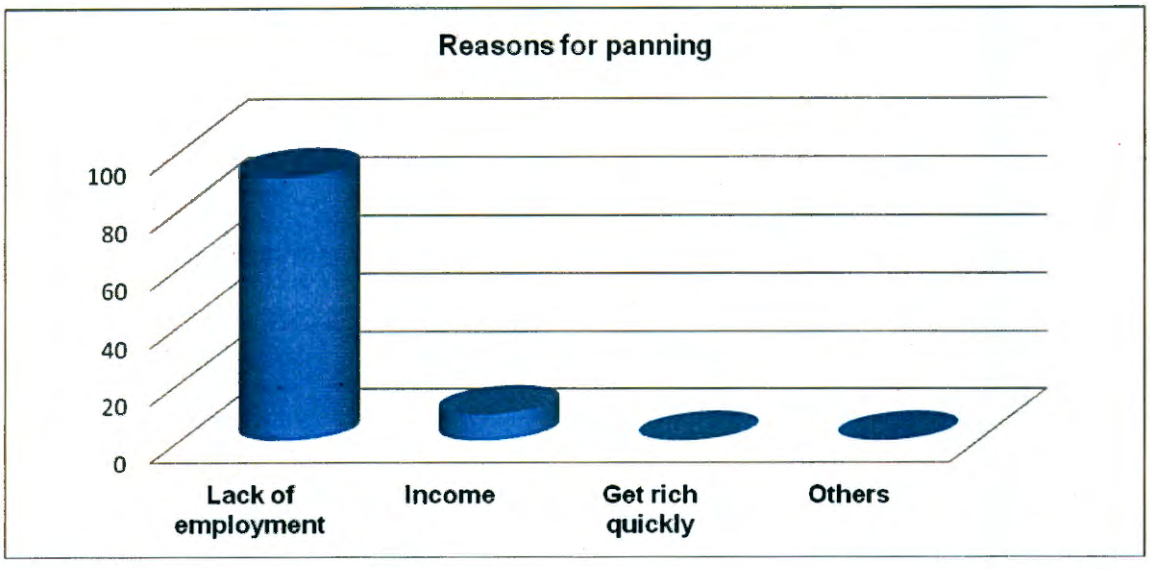

Figure 4.4: Reasons for being in illegal Mining Activities.

The main reason for people being involved in illegal mining activities is due to the closing of many mines in Welkom. People lost their jobs and job creation is very slow. Unemployment is considered to be a key factor (80%) for illegal mining activities resulting from the closing of shafts as mines were no longer extracting profitable gold to sustain their businesses. Unemployment and shortage of income in the households are the burning factors. During the time when mines were busy functioning well, illegal mining activities were not as visible as it is currently occurring.

The desire of illegal miners interviewed is that their activities be legalised to avoid being detained and charged by police officers while operating. The impression is that when the activity is legalised they will be able to sell the extracted gold at a profitable price rather than what they are getting from the street market. Most of the respondents believe that this dilemma of illegal mining can be addressed by the reopening of shut mines and adequate job creation.

The main cause of illegal mining is poverty and unemployment. This is a serious challenge not only in South Africa but also in other countries. Other people are getting involved in this activity because they want to be wealthy and others are former mine employees who have been retrenched. They employ vulnerable people to work for them. They provide them with food, shelter and other commodities; most of them are foreigners from neighbouring countries. They are paying those people very little money which does not auger well for future sustainability. Street markets are depriving people of having valuable lives and do not contribute to a sustained economy.

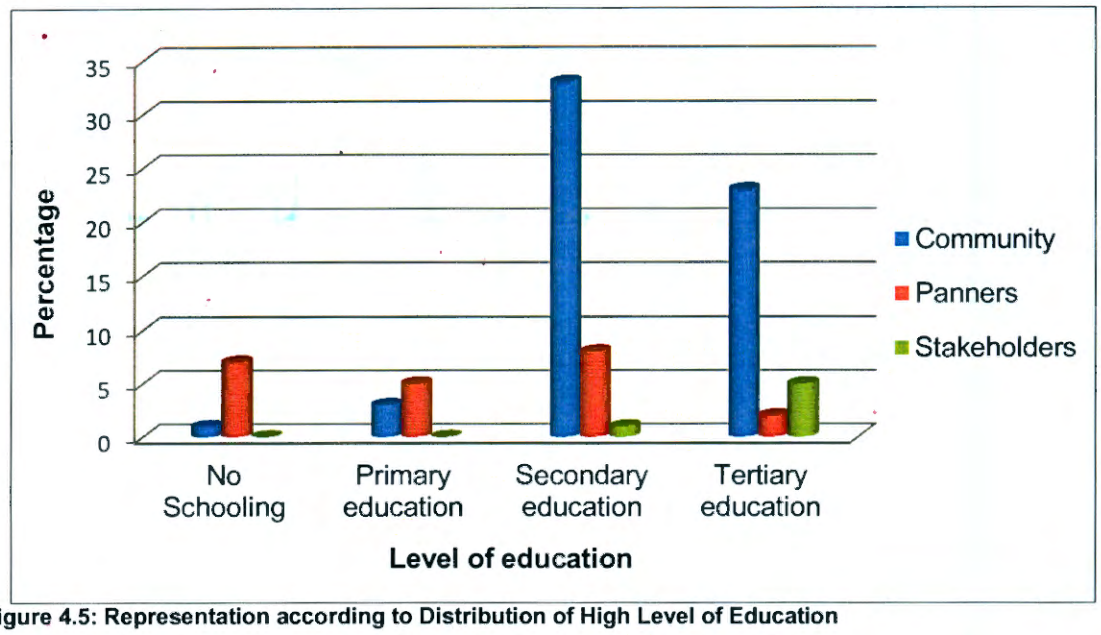

Figure 4.5: Representation according to Distribution of High Level of Education

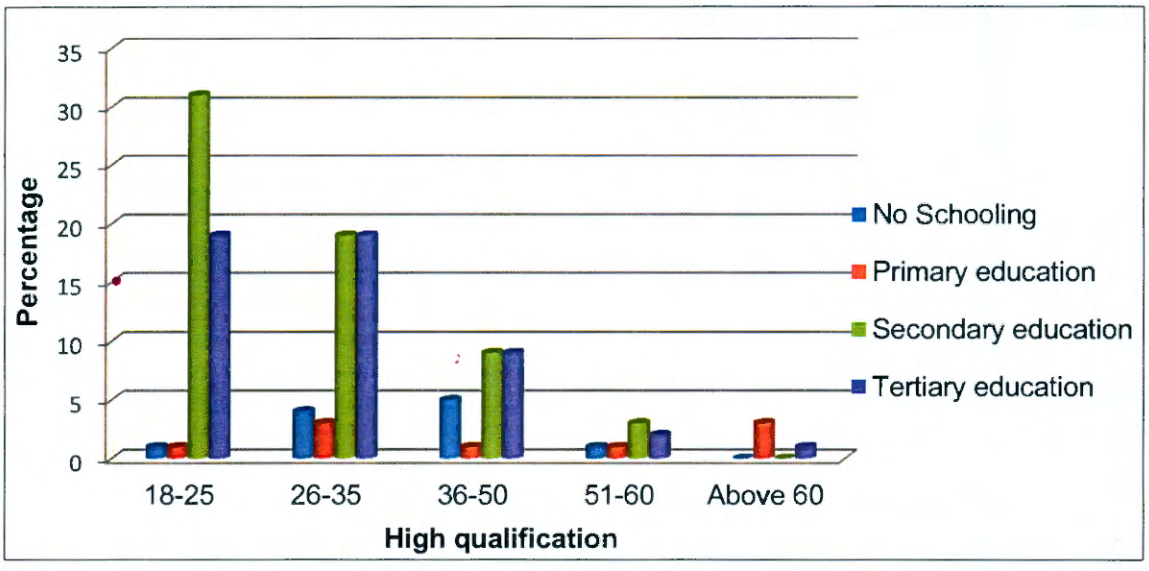

Figure4.6: Representation by Distribution according to High Level of Education and Age

Pupils leaving school at primary level to get quick cash were not identified as a majority, but people who are trying to provide for their households for survival were identified to be in the majority. The majority of the respondents are at suitable ages to perform this kind of work. The study illustrates that most of the illegal miners did not receive tertiary education as most drop out during secondary school.

Education is considered to be an important tool as it exposes people to a lot of activities but in this regard many panners never went to tertiary school, meaning they could be involved in dangerous situations like dangers caused by chemicals used during mining. According to the education and age graph most of the community members between the age of 18 to 25 (24%) reached as high as secondary school level and only (15%) per cent went to a tertiary school.

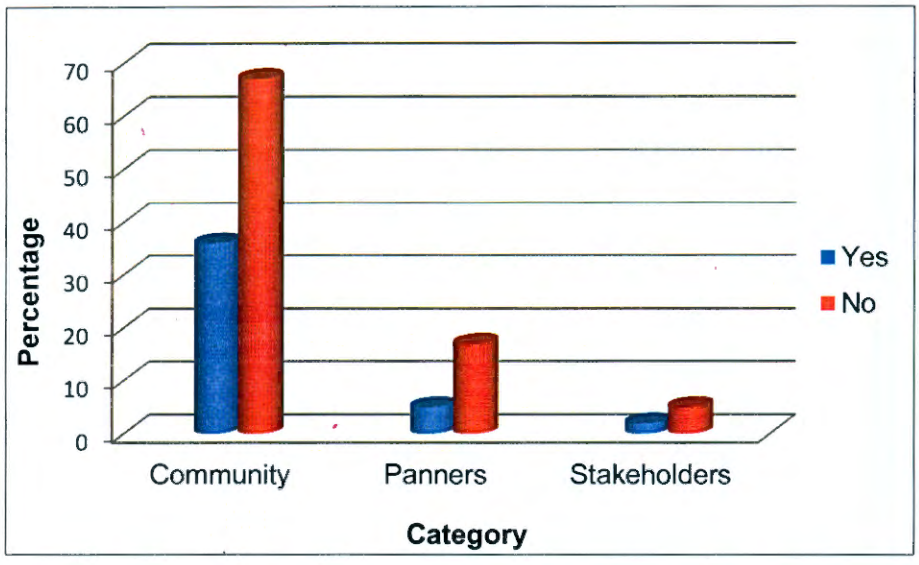

Figure 4.7: Representation by knowledge regarding Environmental Degradation due to illegal Mining

The graph established the knowledge community members have in relation to environmental degradation. About 59% of community members are aware of environmental degradation as one of the illegal mining impacts. Few of the panners indicated that they have any knowledge about the impact of their activity on the environment. All stakeholders interviewed are aware about environmental degradation caused by illegal mining. The pictures below show the environmental degradation caused by illegal miners while digging to get gold. The conclusion in this regard could be illegal miners are undertaking the activity because they are not aware of the consequences of their activity to the environment because only 7% of the panners is knowledgeable about environmental degradations.

Figure 4.8: Environmental Impact (Sibiya R.P., 2014)

Environmental degradation is one of the hazards identified by community members and stakeholders in Welkom being hazards caused by illegal mining activities; the majority of people are aware that illegal mining activities could seriously damage and result in a disastrous situation. Few of illegal miners are aware that their activities are impacting negatively on the environment but due to the reason that they are undertaking it for the benefit of their families, they have indicated while being interviewed, the difficulties of stopping the operations – even though it is impacting on the environment. Other panners indicated that no one has offered them training in relation to the management of the environment while undertaking the mining activities. Natural resources like fauna and flora would be disturbed in future by illegal mining taking place and animals would not have a place to graze.

Figure 4.9: Environmental Impact (Sibiya R.P., 2014)

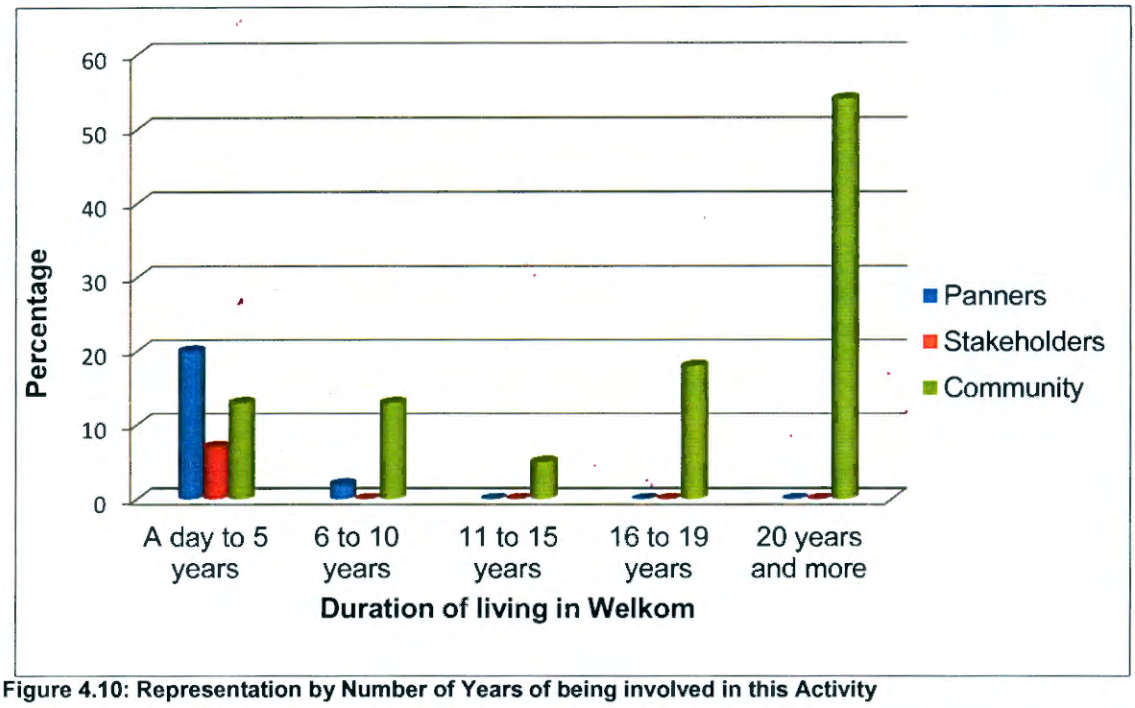

Figure 4.10: Representation by Number of Years of being involved in this Activity

The graph provided the realisation that the panning activity became seriously active after the closing of mines in Welkom. According to the graph presentation the majority of panners have less than 10 years experience performing this kind of work as the majority are between (0 and 5 years experience) and few were previously employed by mines; as a result they are the ones providing informal training to upcoming panners. Most of the panners are intending to spend another few additional years whilst nothing is being provided by government as they consider the work they are doing to be the only helpful source of income. Most of the community members, specifically South Africans3, have been dwelling in Welkom for more than 20 years (40%) as presented by the graph; this proves their awareness relating to illegal mining activities – they have been watching this escalation and being affected by its impacts. Stakeholders have for a few years been involved working closely with the community and in organisations with a mission to reduce the illegal mining.

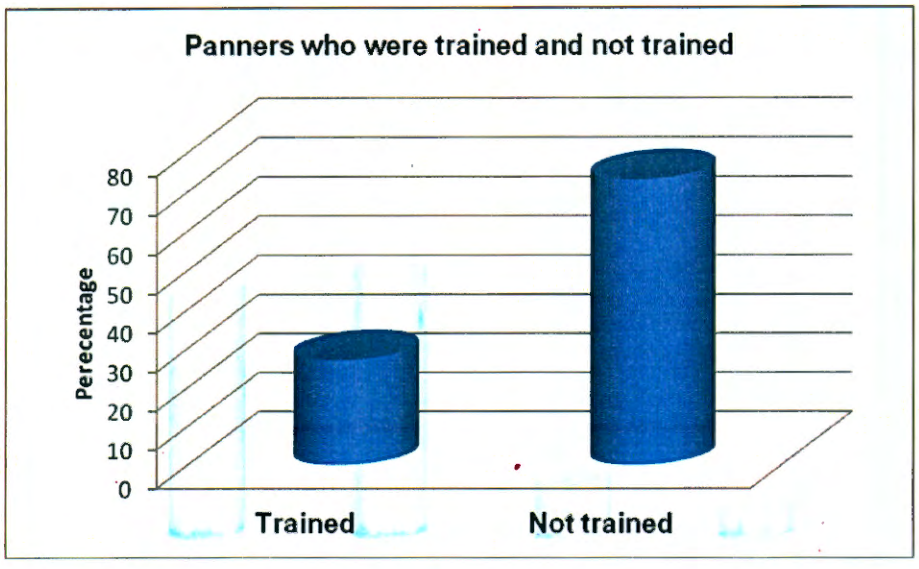

Figure 4.11: Indication of Training and Not trained received by Panners

No formal training was provided to the illegal miners; the only training they obtained came from previously-employed mine workers with the experience they have gained from mines and their knowledge of how mines operate underground. Their only disadvantage is that they use shovels and hammers to perform the work. Chemicals dangerous to the environment and to human lives are also being used by illegal miners without appropriate knowledge or training from professionals. Training provided by previously-employed mine workers is considered not to be beneficial, because it is not reducing any risks or hazards facing illegal miners.

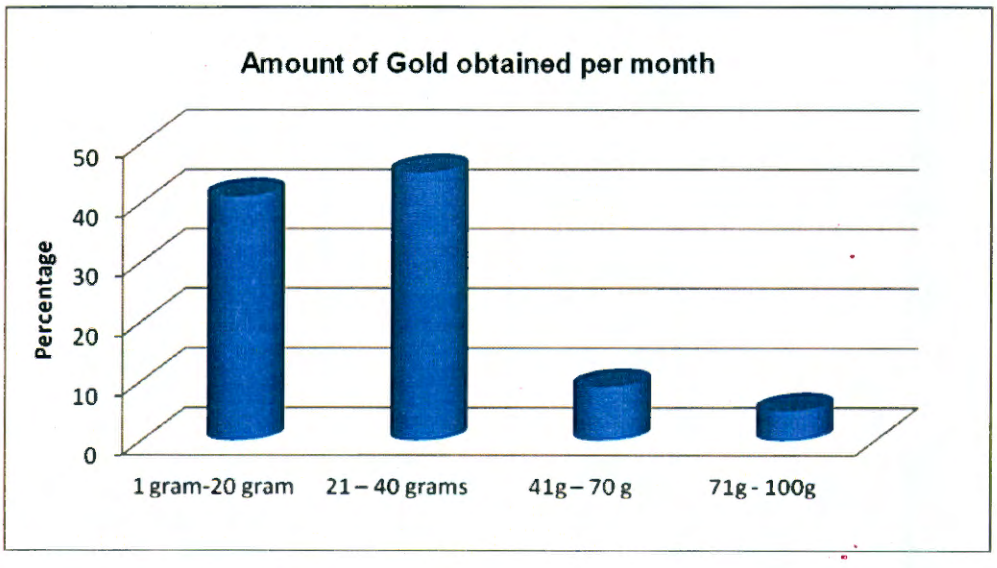

Figure 4.12: Showing amount of gold received per month

The amount of gold that can be obtained from ore depends on where the panner is placed or operating from because it depend on the richness of the soil; for example, the group that is operating from the closed shafts in mines are obtaining more than panners operating near G hostels. The panners from President Steyn mine shaft no 2 indicated that they obtain 5 gm of gold and more per day and the ones operating from near G hostels indicated that they receive from ½ of 5 gram or more per day. It is believed, although it could not be ascertained, that the ones operating from underneath are making a considerable amount more than others because they are operating from closed shafts where gold is considered to be more readily available.

The picture below shows the amount of gold received by panners before it can be burned. The one in the picture is considered to be ½ of 5gm. This panner indicated that the area where they are operating from is not rich as they fled because of conflicts and crime from the mine areas where they were previously operating and obtaining more gold. They indicated that panners are jealous of each other when some are obtaining more gold than others and because of that they kill each other.

Figure 4.13: Gold size received (Sibiya R.P., 2014)

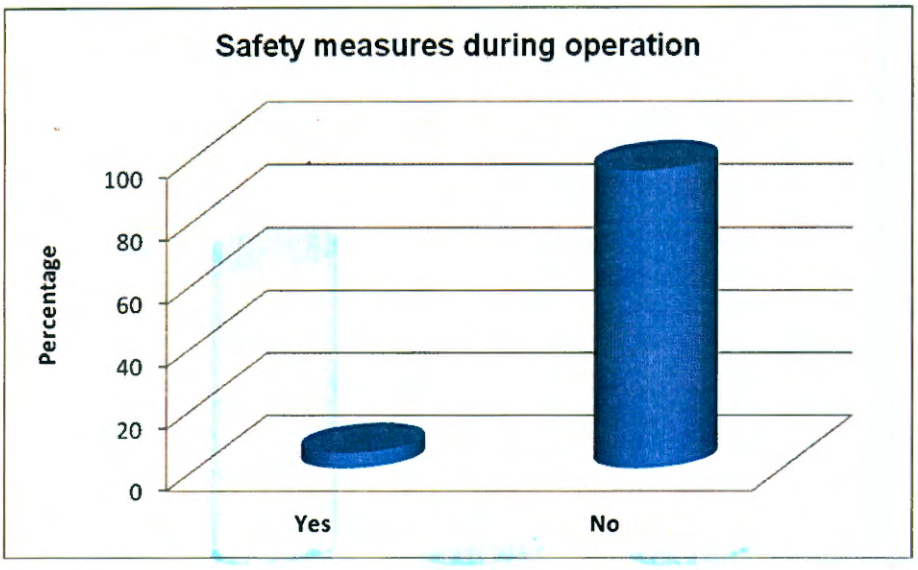

Figure 4.14: Availability of Safety Measures during illegal operations

The study shows that miners are exposed to a number of dangerous situations because there are no safety measures in place while operating. Those who were previously employed by the mines remembered that while they were executing their duties they used to have helmets, safety boots, gloves, masks, safety glasses and overalls; they were regularly examined to ascertain that they were fit and suitable to execute underground work. Because of unavailability of safety measures to illegal miners they are exposed to many diseases; one of the panners who has had long service in this activity is experiencing an eye problem, due to the reason that there are no safety measures in place while executing the work.

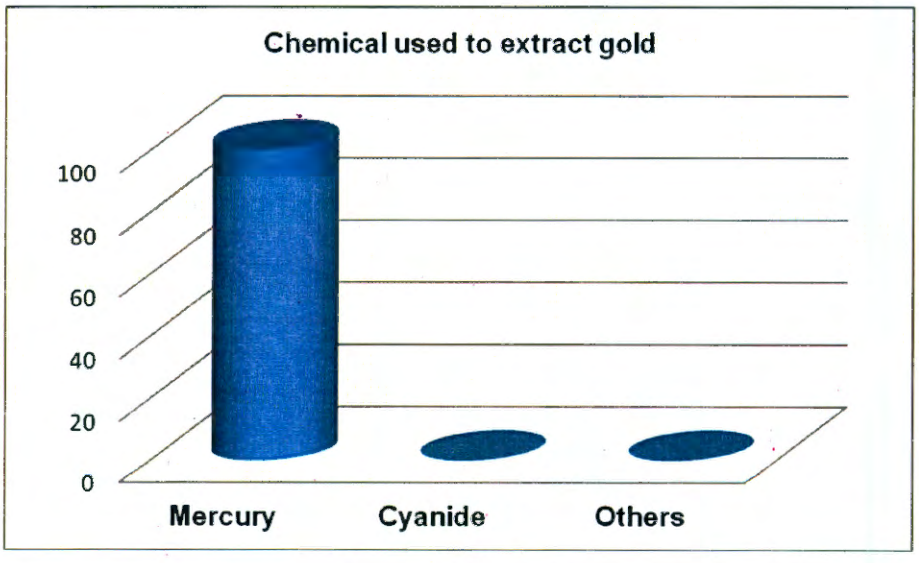

Figure 4.15: Chemical used to extract gold

The results show that mercury is the only chemical utilised to extract gold from ore by panners in Welkom. It is easily accessible as anyone can go to a supermarket and buy it. It is being bought with money amounting to less than R150.00 for one bottle. For other panners the amount is too expensive. It has been established that they wait and use any remaining mercury after the more affluent ones have finished extracting gold. Most of the panners are not aware of the dangers caused by mercury to the environment as well as to human lives. After illegal miners are done using the mercury they spilt it fairly amongst themselves and consequently the environment becomes affected.

Figure 4.16: Gas Bottle called Liphendoka used to extract gold (Sibiya R.P., 2014)

The old gas bottle in the picture is named liphendoka by illegal miners; the bottle is used to extract gold from the soil using mercury. The soil and the mercury is being mixed in the Liphendoka and be gyrated to extract gold. Liphendoka is isiXhosa name meaning "turning it". Liphendoka will be rotated in order to mix the soil and the mercury and after that the panners are splitting it in the land.

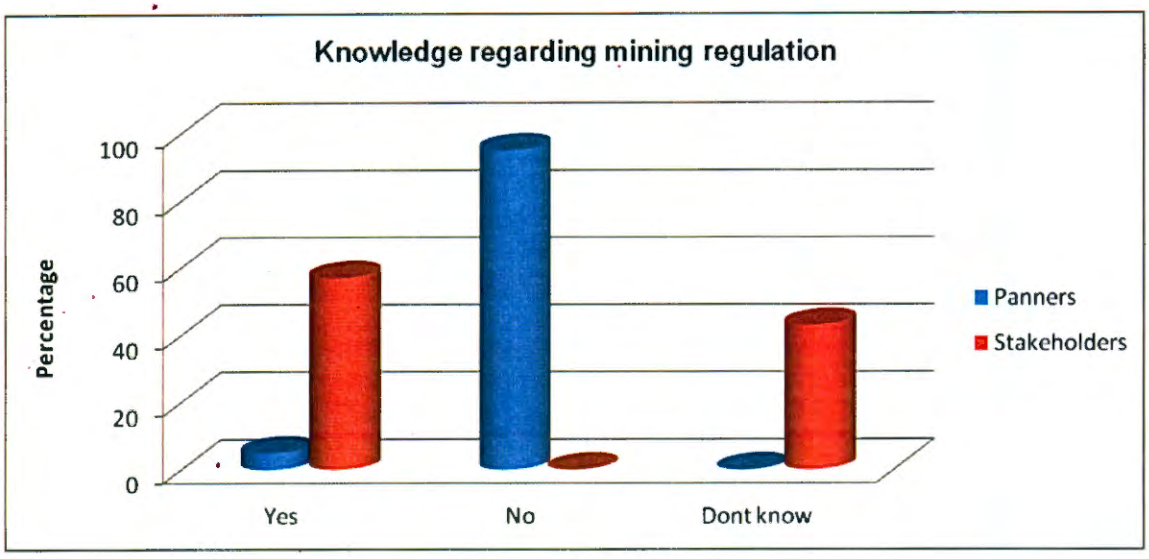

Figure 4.17: Knowledge regarding Mining and Environmental Legislations

Despite the fact that some of the illegal miners were previously employed by mines, all panners interviewed (100%) were unaware of legislation governing environmental impacts. The majority of these people are not aware of the hazards they are causing to the environment and that they put peoples' lives in danger. They lack the information regarding environmental management. At all sites where the operations are taking place only a few are aware of management of the environment and mining legislations. Still others were not aware or have never heard of legislations governing the environment and mining.

4.2 Assistance required from Government:

The question relating to enhancement of operations by government as assistance could not be analysed because people were giving different opinions (qualitative data); no coding was done since no graph was implemented. But when analysing data the majority (60%) has indicated the kind of support needed from government by illegal miners as to enhance their operations is considered to be employment and job creation in mining industries. It has been established that the illegal mining activities commenced mainly during the closing of mines. The majority indicated that it will be of paramount value if government can reopen closed mines and legalise the panning activity, as the Welkom economy is relying on mining. Although other community members said government has to get rid of these operations, a few of the community members indicated that illegal miners have to be arrested; government should force measures by deploying the Defence Force in order to get rid of the operations. The indication of those few was that there is nothing government can do to enhance operations, while others were not sure of what government can do.

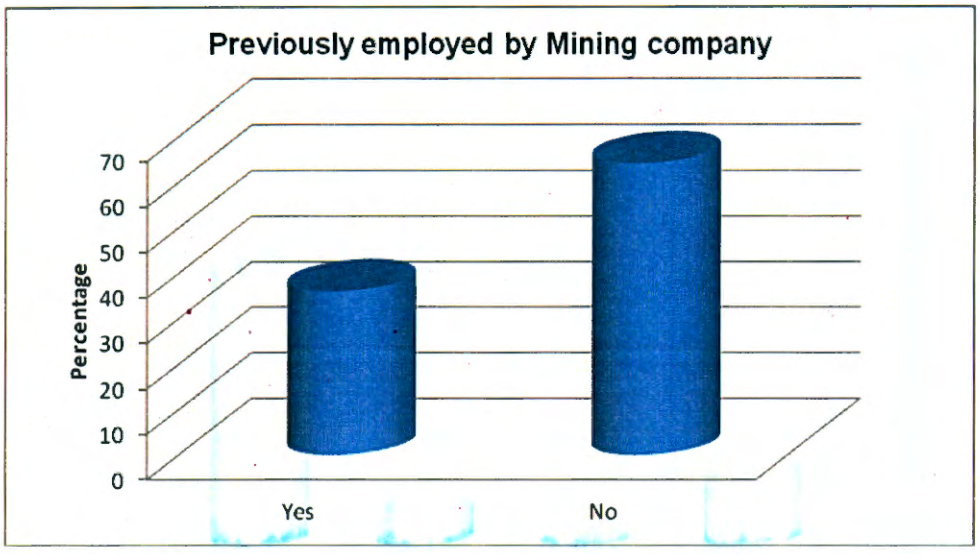

Figure 4.18: People who were previously employed by Mines

The study shows that (40%) of panners interviewed started panning activities because they were previously employed by mines. They started the activity when they realised there is nothing to take home as source of income. The illegal miners specifically who are operating in closed shafts as they have clear understanding of the happenings in underground, it was established that they are aware of access areas to tunnels that will direct them to mines where they used to work where they are aware of where gold can be attained. Study shows that about (60%) did not work for mines before but they are currently being trained by previous mine workers.

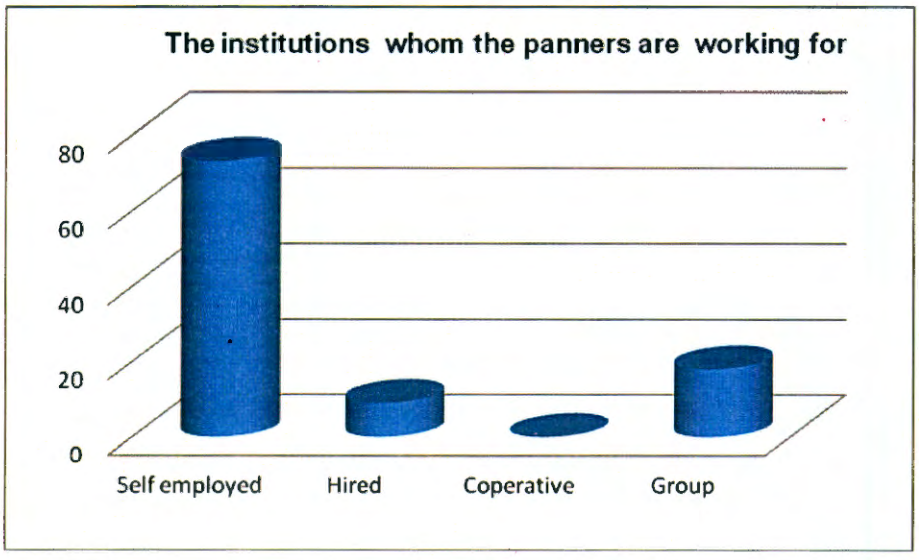

Figure 4.19: Determining who panners are working for

Most of the illegal miners indicated that they are not working under supervision of any boss they are doing that for themselves (80%). But even if we could not ascertain due to dangerous mine areas where we could not get access to interview illegal miners, it was indicated by those who were previously working on those sites, such as St Helena, that they are working for other people who will pay them after completion of the work, but the number is less. The ones working in groups are about (15%), groups are formed to get money quicker and for more production.

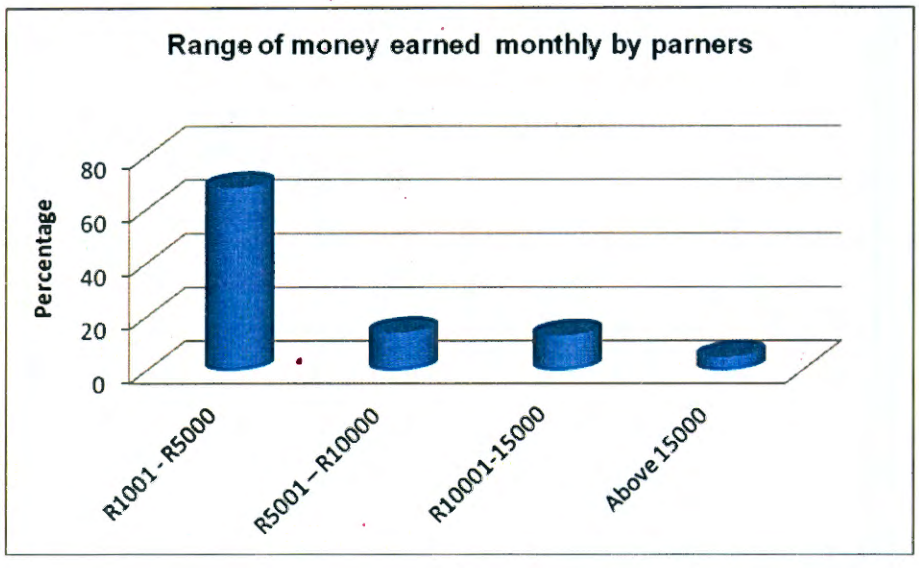

Figure 4.20: Money earned monthly

The illegal miners indicated that 5gm of gold is sold for R350.00, it can take them a day or two to make this money. This is received when selling it to street market specifically at "G hostel" in Thabong location. They make approximately R7,000 per month. The calculations are not constant as there are miners making less than that because they are working in groups and they have to divide it among themselves; others are making more than that. The constant of the amount received per month depends again on the area of operation.

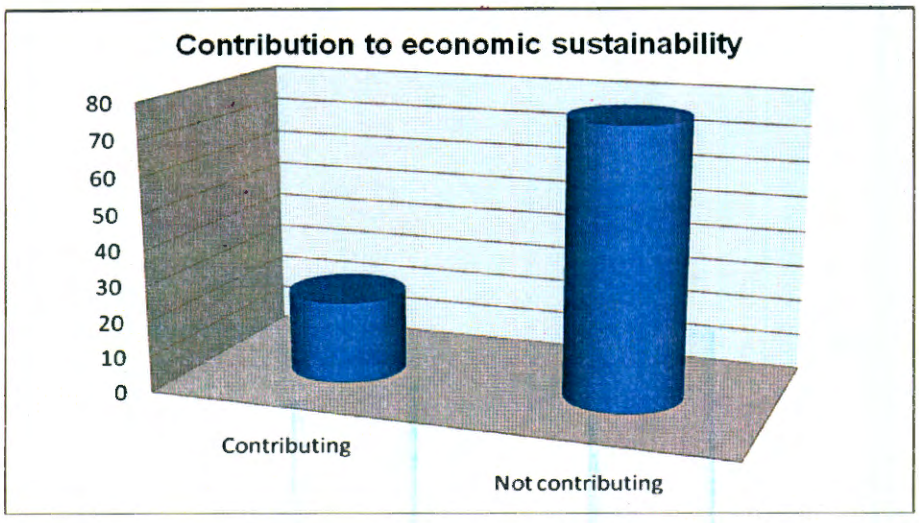

Figure 4.21: Illegal mining contribution to local economic sustainability

The contribution by panners to economic sustainability of the country was not recognised because the majority of panners are not paying any tax. They are however benefiting from the tax contributed by others due to the fact that they are making use of ambulances when they are sick as they are operating in unsafe and unhygienic environment they also benefit from hospitals freely. Few of local business people indicated the illegal mining activities being a contributor to economic stability as they said illegal miners buy from their shops with balks and it helps business activeness. One of the transport business men said for transportation of food to closed shafts mines where panners are operating he receive money amounting to R4000.00 for one trip travelling for about 20 kilos.

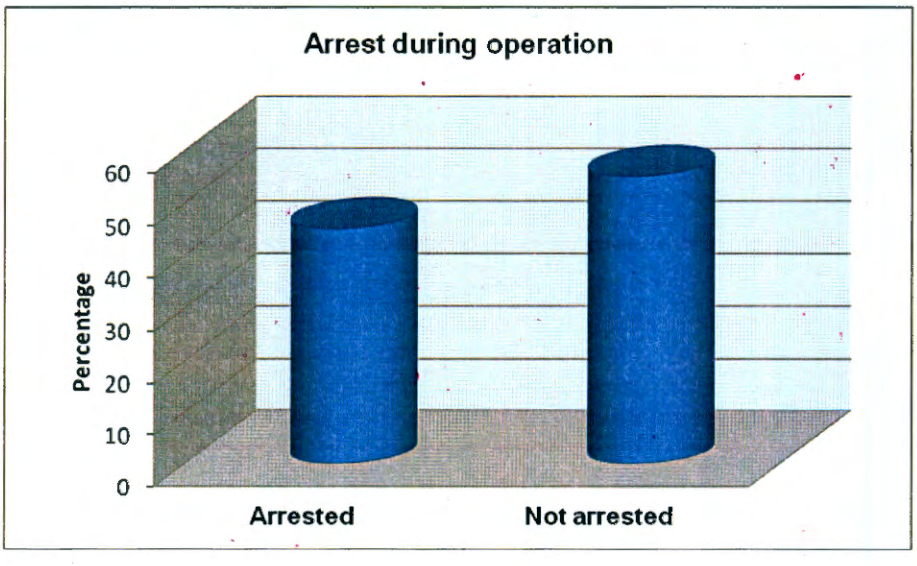

Figure 4.22: Number of illegal miners arrested by police officers

The study established that (40%) of panners have been arrested by police; reasons being that they are not South Africans and others has been arrested for trespassing, not because of any wrong doing, but it is considered to be illegal. Later, when they produce evidence to the police that they are South African citizens they are released, and non-South Africans, when they fail to produce the documents indicating that they are permitted to be in the country, they are deported to the countries of origin. The difficulties remain with the fact that they come back later to carry out and continue with the work. The study shows the majority of panners not being arrested before (60%).

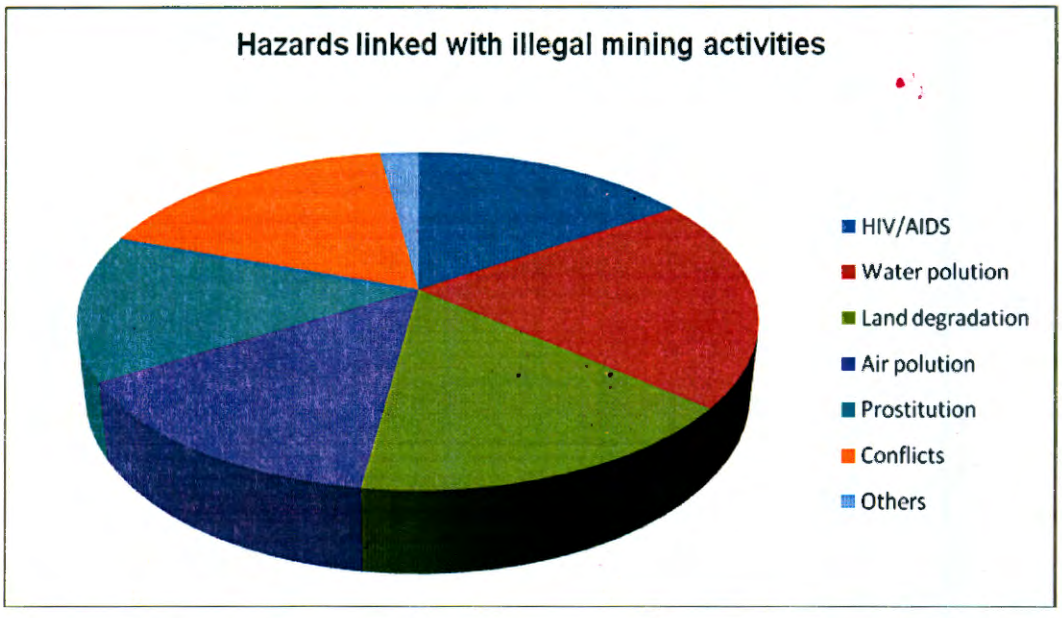

Figure 4.23: Hazards identified to be linked with illegal gold mining

This diagram is representing the hazards identified to be linked with illegal gold mining activities; as in Welkom conflicts, water pollution, land degradation, prostitution, HIV /AIDS, fires and TB are associated with illegal mining.

Conflicts: Conflicts between different nations have been stipulated to be a grave hazard linked to illegal miners. Basotho people from Lesotho are considered to be violent, fighting over gold with other nations. Although in the above graph it has been envisaged that water pollution is the main hazard according to the community and stakeholders, during our interview with panners the indication was that conflict is the major threat among themselves, because they normally fight and kill each other for the locations to perform this activity.

Crime: Illegal mining is causing crime, people are stealing from each other; specifically panners receiving lots of money after extracting are being killed and their belongings are being stolen.

Deaths: Police officers are among the people being killed when responding to the conflicts and crime perpetrated by illegal miners. Illegal miners also shoot and kill each other fighting for gold and terrain and because they spend months underground without ventilation, without clean water, without sanitation, they end up by getting sick and dying. Illegal miners are not the only ones under risk of being sick; even emergency medical services personnel, when they have been interviewed, indicated that during rescue operations the risk of dying is high due to the occurrence of explosions underground and insufficient ventilation. Illegal miners are dying and others have to be sent home to their countries of origin while others are unidentifiable.

Land degradations: Land degradation is experienced when panners are busy digging and splitting mercury over the land.

Prostitution: Illegal miners contribute in promoting prostitution. They take time to have sexual intercourse while working hard underground. It has been established that some women saw a business opportunity, to go underground to prostitute. These women indicated that they are making huge amounts of money by going underground instead of waiting for their clients in the streets at night.

HIV and AIDS: Illegal mining is also contributing towards the spreading of HIV and AIDS, because it is a result of prostitution where they do not have access to condoms.

Fires: It has been established that lack of knowledge and training by illegal miners caused explosions underground while they were busy digging.

Water pollution: Water is polluted by illegal miners who are operating near pipes channelling water to the community; they even disconnect water pipes for utilisation of the activities as panning required a lot of water and after utilising water they leave pipes unconnected with the resultant water loss. The community is also affected by water shortages because of illegal mining activities.

According to hazard identification done in Welkom it was established that water pollution is the main hazard identified by the community. After hazards identification the researcher completed a risk assessment by assessing hazards, vulnerability, manageability and capacity. The risk was calculated following certain steps of risk assessment. The steps appeared in annexure 5.1 to 5.5 including risk equations. The assessment of illegal mining in Welkom was completed in order to determine the risk. The conclusion of risk assessment was determined using risk equation.

$$\text{Risk} = \frac{\text{Hazard x Vulnerability}}{\text{Manageability x Capacity}}$$

After doing risk assessment in annexure 5.5 conflict was regarded as the hazard with mean risk that could result in a disaster. Not putting aside the fact that water pollution was identified by the community as a main hazard, but conflict is considered to have a high risk of disaster occurrence when doing the risk assessment. The following keys were used to assess the impact; we found that the impact is between or moderate as conflict ranks 2.1 while doing risk assessment.

Key

Low- less than 2.0

Moderate- between 2.1- 2.5

High- above 2.6

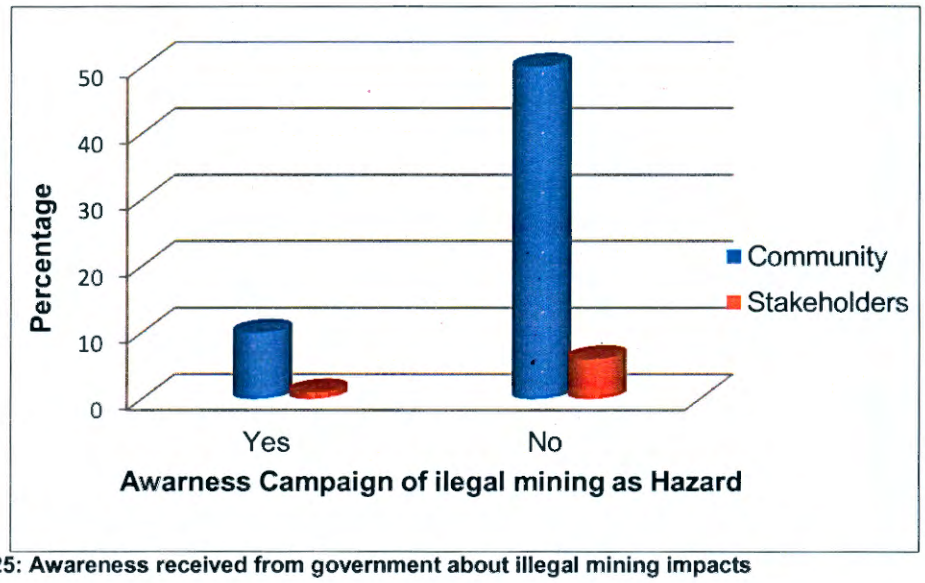

Figure 4.25: Awareness received from government about illegal mining impacts

The research that has been conducted indicates that the government is doing less to educate the community members about the impact of illegal mining. Awareness considered being important by the community in order to prevent elements to be at risk and hazards compromising their lives. The government, together with different stakeholders also indicated low awareness provision to the community looking at the graph presented above;

only 20% of community members received awareness in relation to the hazards of illegal mining.

Community members are only aware of the operations undertaken by the South African Police Service to stop and reduce the impact of illegal mining, particularly at G hostel. Although operations are considered on one occasion to be undertaken after a very long time, sustainable mitigation is considered to be needed. Other stakeholders interviewed indicated the importance of having the strategic plan of the government departments' mitigation measures aiming at reducing the impact of illegal mining.

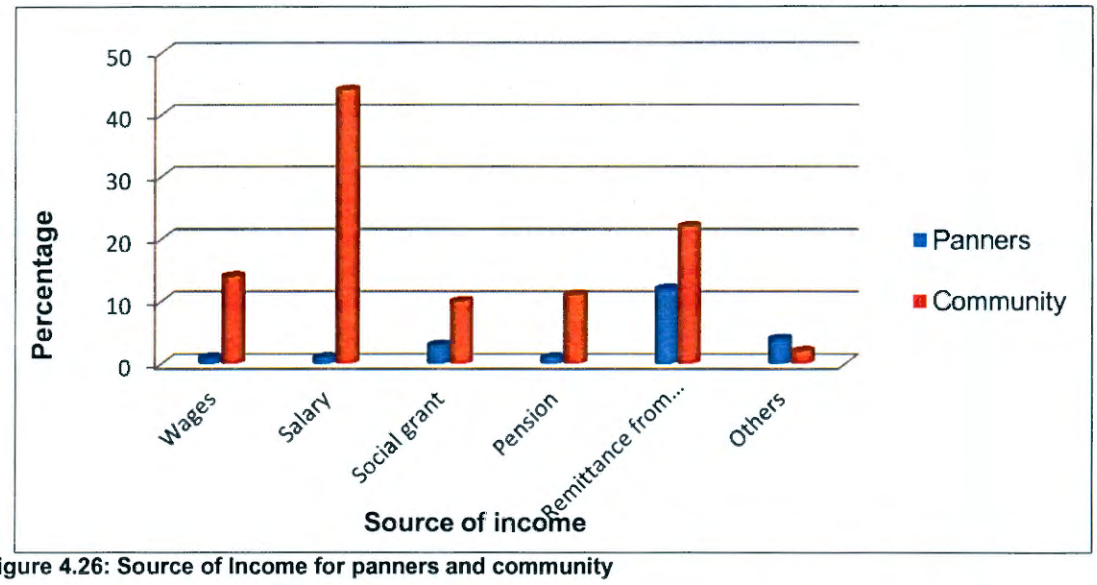

Figure 4.26: Source of Income for panners and community

The source of income for most of the panners comes from the illegal mining activities. The study shows that panners are doing the job to provide for their families where many are the heads of the household. Others are providing for children whose parents are deceased. The income received is helping to sustain their households.

This kind of job and income received by panners are considered to be better than stealing from other community members. Many are under the impression that the work is beneficial to their households because they go to sleep with full stomachs. Although illegal miners have been chased by police, most of the time it is their unwillingness to stop due to the reasoning that their household members will starve and they would not be able to send their children, brothers and sisters to school.

Figure 4.27: Method used for Sieving (Sibiya R.P., 2014)

Different methods of sieving gold from the soil are used by illegal miners in this picture; the blankets are used for the soil with gold is considered to remain in the blankets and will be washed to take out the soil believed to contain gold.

Figure 4.28: Method used for sieving (Sibiya R.P., 2014)

Every morning illegal miners are preparing blankets to start with their daily operation. Plastic bags and blankets are also utilised to make this bed in order to be able to sieve gold from ore.

4.3 Conclusion

Audacious methods are required to ensure that panning activities are contributing to the economy of the country and it should be done in a socially acceptable and environmentally responsible manner and must prove sustainability of livelihoods. Methods used by illegal miners for doing their activities are considered to be dangerous, not only to themselves but to the environment and society as a whole. The main reason behind panning activities is considered to be unemployment; this was established after analysing data in the form of tables and graphs. To avoid future disasters resulting from illegal mining activities adverse impacts have to be reduced. Gold is the main mineral resource found in Welkom and the source of livelihood which is being utilised in a way that does not contribute to the economic stability of Welkom. Identified hazards in this study have to be minimised by integrated participation of the different stakeholders and the community.

CHAPTER 5: RECOMMENDATIONS AND CONCLUSION

5.1 Introduction

This chapter is about recommendations and conclusion of the research that was conducted on the social and environmental impact of illegal mining in Welkom. Recommendations result from the findings of the study as it has been presented by the illegal miners, community members and stakeholders and different government departments. From the findings the researcher will be in competent to make recommendations to local government, different government departments such as Cooperate Governance and Traditional Affairs (National disaster management centre), and the Department of Mineral and Energy and policy makers to submit strategies and plans that will assist community members to benefit from their livelihoods.

5.2 Recommendations:

By legalising this activity and granting permits to the panners and the establishment of cooperatives are some of the proposals encouraged in order to allow and empower panners. Regulating South African borders, relooking at policy formulation, training, awareness and education are also suggested as some of the mitigation strategies to allow effective development of our communities and ensuring sustainable utilisation of our resources and environment.

5.2.1 Policies

The South African Constitution is amongst the legislations and policies that preside over environment, health and human rights, as well as other South African legislation but they are not clearly referring to illegal mining. Illegal mining activities are escalating daily within the country and community members are concerned by the impact of these activities.

It is thus significant for policy makers to engage community members where this activity is happening to for the formulation of policies aimed at reducing illegal mining. There is a need for guiding preventative and mitigation strategies for these illegal panning activities taking place in Welkom. Disaster management is considered to be of everybody national concern; it is therefore, essential for the policy makers to generate clear strategies and regulations in order to ensure sustainability of their livelihoods.

Currently there are no clear policies governing gold panning operations as illegal activities in South Africa; as mandatory body the Department of Mineral Resources has to oversee the

effectiveness and utilisation of minerals by South Africans as it is stipulated clearly in its policies that minerals belong to the citizens of the country.

5.2.2 Training, awareness and education

According to the Disaster Management Act, Act 57 of 2002, and the National Disaster Management Framework of 2005, there are PRAs and Enablers that should be considered when preventing disasters. Some of them are training, awareness and education. It is imperative for community members to be aware of the impact and effects that can endanger their lives and have the advantage of contributing to disaster management. Awareness campaigns have to be held in Welkom talking to illegal miners regarding mining impacts, and government departments have to be the drivers of those campaigns.

Illegal miners need to be trained on how to operate safely in relation to utilisation of chemicals and on how it affects their lives and the lives of the surrounding community at large, as well as protection of the sustainable environment. Education is important to the community, specifically on how to protect the environment. Government has to equip miners with the skills in relation to safe operations.

5.2.3 Regulating RSA borders

South Africa is experiencing an influx of migrating people from our neighbouring countries more than ever before; some come looking for job opportunities and when failing to obtain jobs they turn to illegal activities. Others are being manipulated by South Africans to be involved in illegal activities. It is recommended by the researcher that government must reassess the regulations regarding the South African Borders, particularly for people coming from neighbouring countries, and reinforce security at the border about border jumpers, as a mechanism to stop and reduce illegal mining.

5.2.4 Funding

The government has to avail funding for the cooperatives as it is a requirement by the Department of Mineral Resources for panners to be of good financial state, before issuing the licences and permits. To be permitted the following are essential: financial competencies, environmental management, social labour and mining health and safety. The government must reach an agreement with the mine owners, e.g. Harmony, for the utilisation of their land and resources for the implementation of the cooperatives. It is essential for the government to proffer assistance to miners by buying or providing them with protective clothings and machinery as to advance the kind of work they are doing.

5.2.5 Legalising, permitting the illegal mining

The government's commitment for the period of 2012 – 2022 is to promote cooperatives. The Department of Trade and Industry (DTI) are playing a controlling role in promoting co-operatives and directing all hard work relating to cooperatives development in South Africa. The obligation for the relevant implementation of the cooperatives by government as Integrated Strategy on the Development and Promotion of Co-operatives remain with stakeholders such as at the national, provincial and local levels (DTI, 2012 – 2022).

The Co-operatives Act, No. 14 of 2005 and framework for the Co-operatives Development Policy of 2004 is being implemented. Government has to ensure that throughout the utilisation of different integrated models, they connect in combined initiatives with all pertinent stakeholders, for promotion of the self-sustaining, strong, self-reliant, viable, and independent co-operatives group in Welkom. The strategic objective covers both active and up-and-coming co-operatives, including the following: micro, small including medium co-operatives (DTI, 2012 – 2022).

The strategy was established after a consultation procedure with all pertinent stakeholders, internal and external of government. Three spheres of government were the main stakeholders consulted. The organised labour and worldwide organisations, the co-operatives associations, Community-Based Organisations (CBOs), Non-Governmental Organisations (NGOs); disabled persons, youth organisations, and women's rights organisations, National Economic Development and Labour Council (NEDLAC) and local communities; as well as the private sector. Subsequent to visits to different countries by government and other NEDLAC constituencies they embarked on an international study; the results was used to inform strategy (DTI, 2012 – 2022).The South African foundation Study of Cooperatives by DTI was conceded in March 2009, the results have as well been included in this strategy as well.

The strategy is intended to promote co-operatives, to give free reins to their creative possibilities and expand the generation of income, decent and sustainable employment, and the reduction of poverty, develop human capital capacities, sustainability, savings and investment, improve social and economic well-being and contribute to sustainable human development.

Consequently, in relation to this strategy it is recommended that government should consider using citizens that are currently operating as illegal miners to form cooperatives that will benefit the Welkom community; when cooperatives are formed it will be easy for community

members to care and protect their livelihood and they will inform SAPS about illegal mining activities taking place in the area as well.

It is currently difficult to report any illegal activity because there is no benefit from the mining; when cooperatives are formed and closed mines are reopened for effective use by community members, it will be of great value. Mines were closed due to the fact that sufficient gold was no longer produced; illegal miners are getting a diminutive quantity of gold from the ground, which is better than nothing. The little they receive after forming cooperatives will be beneficially contributing to the economic stability of the city as well as contributing to tax, as they will be directed to the correct procedures for trading gold profitably and not to black markets.

The establishment of cooperatives will improve job creation, decrease unemployment and reduce poverty. The establishment of cooperatives will allow community members to employ people from our nearby countries officially as expected by the South African laws. There are three stages of cooperatives which are primary, secondary and tertiary cooperatives; the tertiary cooperative will assist different cooperatives by trading gold in tonnes.

5.2.6 Community participation and development

Cooperatives have the potential to mobilise and develop the entire community and encourage a culture of saving within communities. Through this method, investment is circulated among the cooperatives and remains within the community. Cooperatives are naturally tending to encourage education and training amongst their members, as these factors flow downwards to the total community. Societal services, which would otherwise not be easily accessible to the community, can also be more easily accessed (DTI, 2012 – 2022).

5.2.7 Environmental Rehabilitation

When illegal mining has been legalised and permitted, the panners still need to be trained in terms of environmental requirements and procedures; training may also focus on education in relation to levelling the ground after excavating and planting of grass as well as trees and filling of all open holes while working.

5.3 DFID framework to be used as strategy to minimise the impact of illegal gold mining

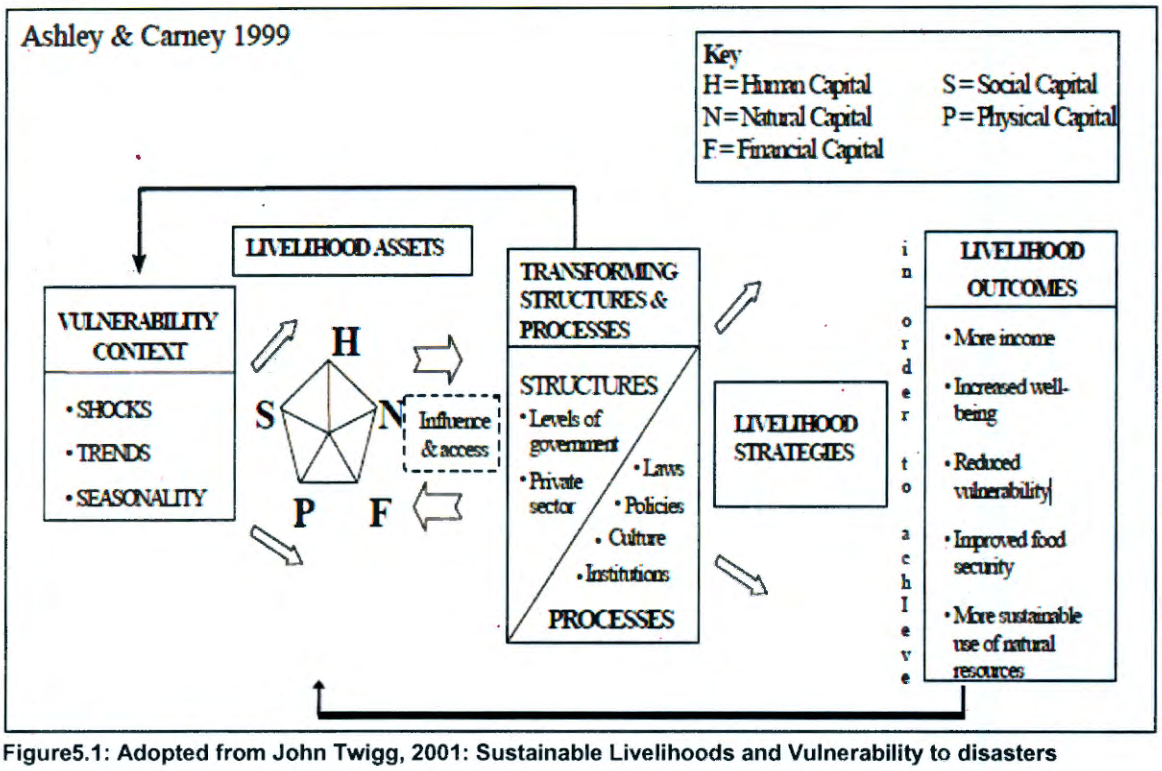

Figure5.1: Adopted from John Twigg, 2001: Sustainable Livelihoods and Vulnerability to disasters

DFID framework can be used as strategy by the government to assess and minimise the impact of illegal gold mining in Welkom. This strategy will assist in terms of utilising gold as livelihood in Welkom for the betterment of the community as well as reducing vulnerability, it is vital for the government to ensure that this kind of strategy is considered when intervening and reducing the illegal mining activities in Welkom.

5.3.1 VULNERABILITY CONTEXT

5.3.1.1 Shocks

In this regard conflict, deaths and crime, land degradation, prostitution, HIV and AIDS are considered hazards experienced by the Welkom community originating from illegal mining activities and all this is contributing to future disaster.

5.3.1.2 Trend

Illegal mining is currently escalating in South Africa where mining is taking place and all risks and hazards found in Welkom will rapidly be spreading to cover the entire country.

5.3.1.3 Seasonality

Illegal mining activities are taking place continuously and there is no specific season that is considered to be a more intense working time for miners.

5.3.2 LIVELIHOOD ASSETS

5.3.2.1 Natural Capital

Mining is the primary economic activity in Welkom and gold is considered to be the most important resource and livelihood asset that can create a living for the Welkom citizens. Each and every South African has to benefit from this livelihood and must be utilised in a manner that is sustainable for the future generations. It is the government and community's obligation to ensure that the livelihoods are utilised in a manner which is sustainable. Land is the natural capital that Welkom citizens are depending on; this land being degraded will in future have serious negative impacts to the entire community.

5.3.2.2 Human capital

Human capital has to be free from any harm caused by illegal mining activities as well; our findings demonstrated that among other hazards, people are suffering from the effects of water pollution, HIV and AIDS, conflict and crime caused by the illegal mining. It is thus imperative for the government to eradicate all these hazards by training and making the community at large aware of these hazards.

5.3.2.3 Financial Capital

Mining is contributing to the financial stability of the Welkom area because it is through mining that people are receiving income for their households; gold is also contributing to the economy of the country. It is through effective utilisation of gold that people have employment.

5.3.2.4 Social Capital

This includes social networks, clubs and societies, culture, traditional structures, as well as political access and establishment of cooperatives by members of community.

5.3.2.5 Physical Capital

The Welkom community has a right to fair accessibility to education and health. Currently panners are not obliging to any health and safety measures; it is thus recommended that government has to buy safety clothes and equipment for illegal miners.

5.3.4 LIVELIHOOD STRATEGIES

Livelihood strategies in this regard is one of the strategy the government can use to establish cooperatives that will minimise the poverty level, increase job creation and decrease unemployment as well as controlling the influx of migrating or illegal miners to the area.

5.3.5 TRANSFORMING STRUCTURES AND PROCESSESS

All structures such as government departments, NGOs, private companies and leaders in the community are to be provided with equivalent or sufficient opportunities to engage in minimising the impact caused by illegal mining activities; Furthermore, to involve community members to partake in policy-making processes that would converse to illegal mining activities, environment and utilisation of chemicals.

5.3.5 LIVELIHOOD OUTCOMES

Formulation of cooperatives relating to illegal mining activities in Welkom would reduce vulnerabilities such as land degradation, crime, conflicts and deaths. It will increase the well-being of the community such as good health, job creation and decrease unemployment and gold as a natural resource will be used in a manner which contributes to sustainability of the community.

5.4. Conclusion

Disaster risk reduction initiatives must be led by transparent research and a vigilant development plan and is obliged to demonstrate confirmed evidence to the significance of the intended interventions. It is to advance harmonization in all services and lessens the possibility that resources are exhausted for a period of time. (National disaster management framework, 2005) Processes that can lessen the likelihood of critical losses by avoiding hazardous activities or minimising susceptibility to preserve sustainable development chances are required.

This study is about social and environmental impact caused by illegal mining on surrounding communities of Welkom. The main aim for this study was to present the negative impact and hazards caused by illegal gold mining activities associated with disaster in order to devise strategies and mitigation measures to minimise and prevent illegal gold mining activities, so as to encourage good social and environmental management.

Government, stakeholders and the community should not only focus on arresting the panners as the only strategy to protect people and the environment from the negative impact as that alone does not solve any difficulties while the root causes, which are poverty and unemployment still exist. Consequently, it is recommended to the government to train and develop people that are currently practicing this illegal mining so that they continue managing this activity but in a way that will sustainably benefit the community.

Illegal mining in South Africa is increasing on a daily basis and future disasters are unavoidable; the impact it caused to the environment and human beings is becoming critical. People are vulnerable due to the hazards caused by illegal mining activities. South Africa has resources and the capacity to reduce the hazards but the difficulties remain with the government for implementation of strategies; if all strategies recommended in this study could be adopted and implemented by government the reduction of illegal mining activities will be perceptible in Welkom.

Disaster management is everyone's responsibility; all stakeholders and government departments – national, provincial and local – have to work together to fight against illegal activities by ensuring an empowered, motivated, dedicated community for the sustainable development of our citizens. Mitigation measures have to be taken before the disaster can strike; it is vital to act before serious damage occurred.

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HAZARD ASSESSMENT:

	FREQUENCY			INTENSITY			OVERALL RANK			ADD	DIVIDE by 3
Hazard	**What do you think is the chance that this disaster will occur?**			**Usually how strong or severe is this hazard in a single event**			**What do you think is the overall importance of the hazard?**				
	Certainly	***may occur***	***not likely***	***Very***	***moderate***	***not very***	***High***	***moderate***	***low***		
Conflict	(3)	2	1	3	(2)	1	3	(2)	1	7	2.3
Crime	(3)	2	1	3	(2)	1	3	(2)	1	7	2.3
Deaths	3	(2)	1	(3)	2	1	(3)	2	1	8	2.7
Land degradation	3	(2)	1	(3)	2	1	3	2	(1)	6	2
water pollution	(3)	2	1	3	(2)	1	(3)	2	1	8	2.7
Air pollution	3	(2)	1	3	(2)	1	3	(2)	1	6	2
Prostitution	3	(2)	1	3	2	(1)	3	(2)	1	5	1.7
HIV and AIDS	3	(2)	1	3	(2)	1	3	(2)	1	6	2
Fire	(3)	2	1	3	(2)	1	3	2	(1)	6	2

Annexure 1: Hazards Assessment

VULNERABILITY ASSESSMENT: Impact on:

Hazard	Human population			Building: government housing; commercial			Infrastructure such as roads, water supplies, electricity			Resource such as forest, farm lands, mines, watershed			Economy e.g. revenue, damage, lost employment etc			Add	Divide by 5
	High	*medium*	*low*	*High*	*medium*	*low*	*High*	*medium*	*low*	*High*	*medium*	*low*	*High*	*medium*	*low*		
Conflicts	3	(2)	1	3	(2)	1	3	(2)	1	(3)	2	1	3	(2)	1	11	2.2
Crime	3	2	(1)	(3)	2	1	(3)	2	1	3	(2)	1	3	2	(1)	10	2
Deaths	3	(2)	1	3	(2)	1	(3)	2	1	(3)	2	1	(3)	2	1	13	2.6
Land degradation	(3)	2	1	3	(2)	1	3	2	(1)	3	2	(1)	3	(2)	1	9	1.8
Air pollution	3	2	(1)	3	(2)	1	3	(2)	1	(3)	2	1	(3)	2	1	11	2.2
Water pollution	(3)	2	1	3	(2)	1	(3)	2	1	3	2	(1)	3	2	(1)	10	2
Prostitution	(3)	2	1	3	2	1	3	2	(1)	3	2	(1)	3	2	(1)	7	1.4
HIV and AIDS	3	(2)	1	(3)	2	1	3	2	(1)	3	(2)	1	3	(2)	1	10	2
Fire	(3)	2	1	3	2	(1)	3	2	(1)	3	2	(1)	3	2	(1)	7	1.4

Annexure 2: Vulnerability Assessment

MANAGERABILITY ASSESSMENT:

Hazard	What is the overall awareness of the public?			How are the legislations that govern this hazard?			How well is the awareness or prediction that this hazards will occur?			How well does the government respond to an event?			How well does the government anticipate and prepare for an event?			Add	Divide by 5
	good	*modest*	*poor*	*good*	*modest*	*poor*	*good*	*modest*	*poor*	*good*	*modest*	*poor*	*good*	*modest*	*poor*		
Conflicts	3	2	(1)	(3)	2	1	3	(2)	1	(3)	2	1	3	2	(1)	10	2
Crime	3	2	(1)	(3)	2	1	3	(2)	1	3	(2)	1	3	2	(1)	9	1.8
Deaths	3	2	(1)	(3)	2	1	3	2	(1)	(3)	2	1	3	(2)	1	10	2
Land degradation	3	(2)	1	(3)	2	1	3	(2)	1	3	2	(1)	3	(2)	1	9	2
Air pollution	3	2	(1)	(3)	2	1	3	(2)	1	(3)	2	1	3	(2)	1	11	2.2
Water pollution	3	(2)	1	(3)	2	1	(3)	2	1	3	2	(1)	3	2	(1)	10	2
Prostitution	3	2	(1)	(3)	2	1	3	(2)	1	3	2	(1)	3	2	(1)	8	1.6
HIV and AIDS	3	(2)	1	(3)	2	1	3	(2)	1	3	(2)	1	3	2	(1)	10	2
Fire	3	(2)	1	3	(2)	1	3	(2)	1	3	2	(1)	3	2	(1)	8	1.6

Annexure 3: Manageability Assessment

CAPACITY ASSESSMENT:

Hazard	What is the overall awareness of the public?			How are the legislations that govern this hazard?			How well is the awareness or prediction that this hazards will occur?			How well does the government respond to an event?			How well does the government anticipate and prepare for an event?			Add	Divide by 5
	good	*modest*	*poor*	*good*	*modest*	*poor*	*good*	*modest*	*poor*	*good*	*modest*	*poor*	*good*	*modest*	*poor*		
Conflicts	3	2	(1)	3	2	(1)	3	2	(1)	3	(2)	1	3	2	(1)	6	1.2
Crime	3	(2)	1	(3)	2	1	3	(2)	1	3	(2)	1	3	2	(1)	10	2
Deaths	3	(2)	1	(3)	2	1	3	(2)	1	(3)	2	1	3	(2)	1	12	2.4
Land degradation	3	(2)	1	(3)	2	1	3	2	(1)	3	2	(1)	3	(2)	1	9	1.8
Air pollution	3	(2)	1	(3)	2	1	3	(2)	1	(3)	2	1	3	(2)	1	12	2.4
Water pollution	3	(2)	1	(3)	2	1	(3)	2	1	3	2	(1)	3	2	(1)	10	2
Prostitution	3	(2)	1	(3)	2	1	3	(2)	1	3	2	(1)	3	2	(1)	9	1.8
HIV and AIDS	3	(2)	1	(3)	2	1	3	(2)	1	3	(2)	1	3	2	(1)	10	2
Fire	3	2	(1)	3	(2)	1	3	(2)	1	3	2	(1)	3	2	(1)	7	1.4

Annexure 4: Capacity Assessment

RISK ASSESSMENT:

Hazard	Hazard Assessment (H)	Vulnerability Assessment (V)	Manageability Assessment (M)	Capacity Assessment (C)	R = H XV/MXC
Conflicts	2.3	2.2	2	1.2	**2.1**
Crime	2.3	2	1.8	2	**1.3**
Deaths	2.7	2.6	2	2.4	**1.5**
Land degradations	2	1.8	2	1.8	**1**
Air pollution	2.7	2.2	2.2	2.4	**1.1**
Water pollution	2	2	2	2	**1**
Prostitution	1.7	1.8	1.6	1.8	**1.5**
HIV and AIDS	2	2	2	2	**1**
Fire	2	1.4	1.6	1.4	**1.2**

Annexure 5: Risk Assessment

Annexure 6: Questionnaire for Panners

Introduction:

The questionnaire forms part of fulfilment of the master degree qualification in Disaster Risk Management. This questionnaire explores the social and environmental impact of illegal mining in Welkom. The results obtained will be used to make recommendations regarding illegal gold mining activities. The information received will be used for research and academic purpose only. Your name will not be disclosed, participation is voluntarily and confidentiality is preserved, should you wish to withdraw from interview you are free to do so. Your participation is highly appreciated.

(NB: indicate by ticking the applicable box bellow)

Personal information:

1. Gender : 1. ☐ Male
   2. ☐ Female

2. Age group in years: (Tick where applicable)

   1. ☐ 18 - 25 2. ☐ 26 - 35 3. ☐ 36 - 50
   4. ☐ 51 - 65 5. ☐ ≥ 66

3. Highest Qualification

   1. ☐ No schooling 2. ☐ Primary education
   3. ☐ Secondary education 4. ☐ Tertiary education

4. Sources of income for the household

   1. ☐ Wages 2. ☐ Salary 3. ☐ Social Grant
   4. ☐ Pension 5. ☐ Remittance from any house hold member
   6. ☐ If other, specify: .....

5. What is your nationality?

   1. ☐ South Africa 2. ☐ Lesotho 3. ☐ Mozambique
   4. ☐ Zimbabwe 5. ☐ Botswana
   6. ☐ If other, specify: .....

Research questions:

6. What is the reason that you are involved in these activities?

1. ☐ Lack of employment 2. ☐ Income
3. ☐ Get rich quickly 4. ☐ Other specify : .....

7. How many years have you been involved in this gold panning?

1. ☐ A day – 5 years 2. ☐ 6 – 10 years 3. ☐ 11 – 15 years
4. ☐ 16 – 19 years 5. ☐ ≥ 20

8. Are you aware of any environmental damages caused by this activity?

1. ☐ Yes 2. ☐ No

9. Were you trained before you can start this work?

1. ☐ Yes 2. ☐ No

10. Any safety measures in place when operating

1. ☐ Yes 2. ☐ No

11. What chemical do you use to extract your gold from ore?

1. ☐ Mercury 2. ☐ Cyanide 3. ☐ Other
If others state.....

12. Indicate the amount of gold that can be obtained from ore per month:

1. ☐ 1 gram-5 gram 2. ☐ 6 – 9 grams 3. ☐ 10g – 40 g
4. ☐ 50g - 100 g 5. ☐ > 100g

13. Are you aware of the danger of chemicals you use to yourself and the community?

1. ☐ Yes 2. ☐ No

14. Do you have permit to carry this work

1. ☐ Yes 2. ☐ No

15. Are you familiar with legislations governing mining and environment?

1. ☐ Yes 2. ☐ No

16. Is there any support you need from government to enhance with the operation?

1. ☐ Yes 2. ☐ No

17. If you given opportunity for other job, will you accept

1. ☐ Yes 2. ☐ No

18. Are you are aware of any other dangers/effects caused by this activity to people's lives

1. ☐ Yes 2. ☐ No

19. Are you are aware that your operations is considered to be illegal

1. ☐ Yes 2. ☐ No

20. Were you previously employed by any mine company?

1. ☐ Yes 2. ☐ No

21. Who are you working for?

1. ☐ Self employed 2. ☐ Hired 3. ☐ Cooperative
4. ☐ Group 5. ☐ Other specify : .....

22. How much are you making or earning per month from this work?

1. ☐ Less than R500 2. ☐ R500- R1500 3. ☐ R1501 – R5000
4. ☐ R5001 – R10000 5. ☐ Above R10000

23. Do you think you are contributing to economic sustainability of this country?

1. ☐ Yes 2. ☐ No

24. Did you ever been locked by Police because of your operation

1. ☐ Yes 2. ☐ No

Annexure 7: Questionnaire for Community Members

Introduction:

The questionnaire forms part of fulfilment of the master degree qualification in Disaster Risk Management. This questionnaire explores the social and environmental impact of illegal mining in Welkom. The results obtained will be used to make recommendations regarding illegal gold mining activities. The information received will be used for research and academic purpose only. Your name will not be disclosed, participation is voluntarily and confidentiality is preserved, should you wish to withdraw from interview you are free to do so. Your participation is highly appreciated.

Questions for community members:

(NB: indicate by ticking the applicable box bellow)

Personal information:

1. Gender : 1. ☐ Male
   2. ☐ Female

2. Age group in years: (Tick where applicable)

   1. ☐ 18 - 25 2. ☐ 26 - 35 3. ☐ 36 - 50
   4. ☐ 51 - 65 5. ☐ ≥ 66

3. Highest Qualification

   1. ☐ No schooling 2. ☐ Primary education
   3. ☐ Secondary education 4. ☐ Tertiary education

4. Sources of income for the household

   1. ☐ Wages 2. ☐ Salary 3. ☐ Social Grant
   4. ☐ Pension 5. ☐ Remittance from any house hold member
   6. ☐ If other, specify: .....

5. What is your nationality?

   1. ☐ South Africa 2. ☐ Lesotho 3. ☐ Mozambique
   4. ☐ Zimbabwe 5. ☐ Botswana
   6. ☐ If other, specify: .....

Research questions:

6. How long you have lived in this area

   1. ☐ A day – 5 years 2. ☐ 6 – 10 years 3. ☐ 11 – 15 years

4. ☐ 16 – 19 years 5. ☐ ≥ 20

7. Do you think illegal gold mining is the alternative for job creation?

1. ☐ Yes 2. ☐ No

8. Can you encourage others to do this kind of work?

1. ☐ Yes 2. ☐ No

9. Are you aware of environmental effects caused by illegal mining?

1. ☐ Yes 2. ☐ No

10. Are you aware of social effects caused by illegal mining?

1. ☐ Yes 2. ☐ No

11. Do you think government is doing its best to stop illegal mining?

1. ☐ Yes 2. ☐ No

12. What do you think could be done to reduce illegal mining?

1. ☐ . Be formalised 2. ☐ Get rid of operations
3. ☐ Other specify : .....

13. Does community members benefit from illegal mining activities

1. ☐ Yes 2. ☐ No

14. What do you think government could do to assist to enhance the operation considered to be illegal mining?

.....

.....

15. Indicate hazards or risks that can be linked with illegal mining activities? (You can tick more than one)

1. ☐ HIV and AIDS 2. ☐ Water pollution 3. ☐ Land degradations
4. ☐ Air pollution 5. ☐ Prostitution 6. ☐ Conflicts
7. ☐ Other specify.....

16. Any awareness you received from government about the effects of illegal mining

1. ☐ Yes 2. ☐ No

Annexure 8: Questionnaire for Stakeholders

Introduction:

The questionnaire forms part of fulfilment of the master degree qualification in Disaster Risk Management. This questionnaire explores the social and environmental impact of illegal mining in Welkom. The results obtained will be used to make recommendations regarding illegal gold mining activities. The information received will be used for research and academic purpose only. Your name will not be disclosed, participation is voluntarily and confidentiality is preserved, should you wish to withdraw from interview you are free to do so. Your participation is highly appreciated.

(NB: indicate by ticking the applicable box bellow)

Personal information:

1. Gender : 1. ☐ Male
   2. ☐ Female

2. Age group in years: (Tick where applicable)

   1. ☐ 18 - 25 2. ☐ 26 - 35 3. ☐ 36 - 50
   4. ☐ 51 - 65 5. ☐ ≥ 66

3. Highest Qualification

   1. ☐ No schooling 2. ☐ Primary education
   3. ☐ Secondary education 4. ☐ Tertiary education

Research Questions:

4. What is your position in the organisation?

   1. ☐ ..... 2. ☐ .....
   3. ☐ ..... 4. ☐ .....
   5. ☐ Other specify: .....

6. Indicate how long you have been holding this position:

   1. ☐ A day – 5 years 2. ☐ 6 – 10 years 3. ☐ 11 – 15 years
   4. ☐ 16 – 19 years 5. ☐ ≥ 20

7. Are you aware of any illegal mining activities taking place in this area?

   1. ☐ Yes 2. ☐ No

8. Do you think illegal gold mining has positive impacts on the people?

1. ☐ Yes 2. ☐ No

9. What can be the hazards and risks linked with illegal gold mining activities? (You can tick more than one)

1. ☐ HIV and AIDS 2. ☐ Water pollution 3. ☐ Land degradations
4. ☐ Air pollution 5. ☐ Prostitution 6. ☐ Conflicts
7. ☐ Other specify.....

10. Are there any mitigation strategies in place against the hazards and risks above?

1. ☐ Yes 2. ☐ No

If yes, specify.....

11. Are you aware of any environmental difficulties caused by the illegal mining activities?

1. ☐ Yes 2. ☐ No

12. Are awareness campaigns in place to educate the society about the hazards caused by illegal mining activities?

1. ☐ Yes 2. ☐ No

13. Is it important for illegal miners to acquire knowledge on environmental social impact caused by their activities?

1. ☐ Yes 2. ☐ No

14. Are there in place any regulations and policies governing panning activities?

1. ☐ Yes 2. ☐ No
3. ☐ Don't know

15. Are community members involved in any way in the formation of these policies?

1. ☐ Yes 2. ☐ No
3. ☐ Don't know

16. Indicate what the government can do to improve gold panning operations?

.....