RESEARCH ARTICLE

Community Perceptions on Environmental and Social Impacts of Mining in Limpopo South Africa and the Implications on Corporate Social Responsibility

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ABSTRACT
Perceptions of communities about mining and its impacts influence their relationship with mining companies in their vicinity. This study investigated the perceptions of communities on environmental and social impacts of nearby mines in Limpopo South Africa. Data was collected using a questionnaire administered to male and females above 18 years living in five villages located around the mine, and key informant interviews. Scores for perceptions on environmental impacts (3.17–3.26) were lower than those for perceptions of social impacts (4.86–4.89) on a scale where 1 represented positive perceptions, and 5, negative perceptions. Factors affecting perceptions on environmental impacts and social impacts differed but length of stay in the village was a common denominator. These negative perceptions may affect the relationship between the mine and surrounding communities and stand as a hindrance to the accomplishments of the goals of corporate social responsibility which forms the principle of operations of mines in the country.

1. Introduction
Mining makes a significant contribution to the Gross Domestic product (GDP) of countries where it is practiced and it also plays a major role in consumer-driven societies as most resources needed in these societies are either made from or need the mined minerals for their production. In South Africa for example, the Mining industry has been the major driving force behind the economic success of the country with up to eight percent (8%) of the South African GDP contributed by the mining sector (STATS-SA 2017). However, mining, especially during the extraction and processing stages can be a major source of pollutants to the environment as huge volumes of waste with varied composition, characteristics, and impacts on the environment are generated. Mining activities and inefficient management of mining wastes are major causes of water quality degradation, increased concentration of heavy metals in surrounding soil and water resources, air pollution, loss of biodiversity and reduction in soil microbial population and diversity around mining areas (Bebbington 2008; Zota et al. 2011; Qu et al. 2012; Ngole-Jeme and...
Fantke 2017; Ferronato and Torretta 2019). The impacts of mining are not only reflected in the environment but there are also social impacts on communities in their vicinity. (Kitula 2006) highlights marginalization of host communities, relocation of communities, and oppression of local low-income citizens as negative social impacts caused by mining. This paper focuses on the perceptions of communities around mines on the impacts that these mines have on their environment and social aspects.

According to (Davis and Tilton 2003) and (Morris and Baartjes 2010), the existence of a mine in an area is expected to change the lives of surrounding communities through the provision of employment opportunities and basic services such as water, electricity, clinics/health centres, and schools, and road network. Studies by (van der Plank et al. 2016) have mentioned various economic, social and environmental expectations of communities around mines. Disputes arising between mining companies and surrounding communities reported globally have been associated with lack of provision of water and sanitation services, environmental degradation, the introduction of different cultures and beliefs, human rights violations, and inequitable distribution of benefits obtained from the mine (Bebbington 2008; Mensah and Okyere 2014).

The co-existence of mining operations and indigenous populations necessitates a cordial relationship between mines and surrounding communities. Corporate social and environmental responsibility has in recent times guided mining activities around the globe. Corporate social responsibility (CSR) according to (Jenkins 2004) and (Dahlsrud 2008) aims to balance the demands of communities, protect the environment and make profit at the same time. It enables companies to frame their attitude and strategies towards surrounding communities and the relationship that they have with these communities. In South Africa like many other Southern African countries, CSR is not driven by any legal framework (Mostert et al. 2016) but by efficiency and company image as well as branding with its main goal being to develop the country and its citizens such that inequality is eliminated among the population. According to (Siyobi 2015), CSR is used in the mining sector of South Africa as a vehicle for restorative justice to redress some of the destructive mining issues which occurred pre democracy. The mining industries in the South Africa are leaders in the implementation of CSR. According to (Jenkins and Yakovleva 2006), CSR is important in the mining sector because of the negative public opinion about mines.

Though there is no legal framework for CSR, there are steps in place to ensure that companies take responsibility of their environmental and social impacts. For example, an Environmental Impact Assessment (EIA) must be carried out before mining rights are awarded to any company and the submission of an Environmental Management Plan is required before the issuance of Environmental Authorization to carry out mining. Further to this, a social and labour plan (SLP) must accompany every application for mining rights. In this SLP must be included a number of developmental projects including human resource development aimed at developing the surrounding communities, infrastructure development, poverty eradication plan, and education projects (Mostert et al. 2016). Considering that mining companies are not legally bound by any framework, their involvement in societal initiatives is however voluntary. For these initiatives to be successful, there needs to be collaboration between the mines and the communities in their vicinity among other stakeholders. However, the complexity that exists in surrounding communities present a major challenge in this drive. Part of this complexity is fuelled by the divergence of community expectations which shape their perceptions about mines.
Community perceptions of mines and their social and environmental impacts influence the way they behave towards these mines. Increasing access to information and awareness about mining in surrounding communities, as well as politicizing of issues about mining have all contributed to increased community sensitivity to actual and perceived mining impacts. In addition to the aforementioned, (Wang et al. 2016) have highlighted environmental and social impacts, governance, and community demographics as additional factors influencing the perceptions of communities about a mine. Studies carried out by (Viveros 2016) and (Miller and Sinclair 2011) indicate that the social and environmental impacts of mines are generally perceived negatively whereas the economic perceptions are positive. The negative perceptions of communities are the root of most conflicts between mining companies and local communities (Barbieri et al. 2014; Dagvadorj et al. 2018). Corporate social responsibility is used by the mining sector to redeem this negative image by instituting various initiatives. Knowledge on the perceptions of local communities on the impacts of a mine on their environment could go a long way to foster a better relationship between the two and enhance the positivity associated with CSR. This study investigated how the perceptions on social and environmental impacts of communities around a platinum mine varied in an endeavour to understand how communities living in mining areas perceive these mines, and to understand the factors that may affect the behaviour and attitude of the communities towards the mine. This knowledge is vital in the development of trust between the local communities and the mine and the sustainability of the mining operations in any local community.

2. Description of the study area

The Bokoni platinum mine is one of the many mines in South Africa and has been in operation since 1963. The mine is situated about 80 km southeast of Polokwane City in Limpopo Province of South Africa with site coordinates of 24°17′35.78″S and 29°51′58.11″E (Figure 1). The mine sits on an undulating plain between a range of hills to the north and low mountains to the south. The area is known for its unreliable rainfall, frequent drought and periodic flooding (Mpandeli et al. 2015). According to Mpandeli and Maponya (2014), the area experiences less than 600 mm of rainfall annually. Mean annual temperatures in the area range from 18°C to 28°C with average summer temperature of 23°C whereas in winter, average temperature is 13.5°C (Mpandeli and Maponya 2014). The topography around the Bokoni Platinum Mine is characterized by an open valley between hills and small mountains running parallel to the escarpment. The area has short open to closed thornveld vegetation and Aloe spp. as the main vegetation types (Mucina and Rutherford 2006).

Besides mining, the main activity in the area is agriculture which is hampered by the prevailing climatic conditions. Currently, Bokoni Platinum Mine is the only mine that is operating around that area. The presence of the mine has transformed the surrounding villages into semi-townships because of the emergence of small-scale economic activities. The mine is surrounded by twenty-two (22) villages, five of which were considered in this study. According to (STATS-SA 2017), the population of the five villages chosen are 4722 for Ga-Selepe, 1197 for Monametsi, 1020 for Malomanye, 758 for Mogabane and 604 for Maropeng.
3. Research methods

3.1 Sampling of study population

The study population comprised of an equal number of adult males and females between the ages of 18 and 40 years. Cluster sampling was used to recruit participants for this study. According to (Bluman 2007), cluster sampling ensures that all target population have an equal probability of being selected and provides the benefits of randomness and unbiased sampling. The clusters in this study comprised of the five different villages namely Ga-Selepe, Monametsi, Malomanye, Mogabane and Maropeng. These five villages were chosen because of their proximity to the mine. Each village was further sub-divided into five sections and 10 participants (five males and five females) randomly chosen from each of the five sections. Fifty participants were therefore recruited from each village, making a total number of 250 participants for the study, 125 of which were males and 125 females. The study also made use of Key Informants (KI). According to (Merriam 1998), key informants understand the culture of an area and are able to reflect and articulate what is going on in the area. The KI interviewed in this study comprised five traditional leaders, 10 miners and five (5) community members evenly distributed among the five villages. A total of 20 key informants were interviewed in the study.

Figure 1. Villages close to bokoni platinum mine (Credit belongs to PL Seloa).
3.2 Data collection

Data collection made use of a questionnaire survey, KI interviews, and observation of the environment around the villages. The questionnaire comprised of a section that requested demographic information such as race, gender, employment, education status and other critical information that would provide an understanding of the demographics of the participants, another section which requested information related to their perceptions on various environmental attributes such as soil, water and air pollution, vegetation cover and wildlife populations among others, and a third section which dealt with aspects related to social issues like provision of schools, health care facilities, roads, water, employment and skills training programmes. The questionnaire made use of a Likert scale consisting of five levels (Bishop and Herron 2015). The five levels that were used to evaluate the perceptions of the participants on the impact of the mine on the various environmental and social attributes in their communities were; significantly increased, increased, no change, reduced and significantly reduced-. The Likert scale was used because it is not binary in nature, it is closed ended, and is able to operationalize complex issues by breaking down abstract topics into recordable observations.

Before administering the questionnaire to the participants, it was piloted with 15 individuals. The reliability of the piloted questionnaire was tested using Cronbach’s alpha. The value of Cronbach Alpha in all questions tested was above 0.80 (George and Mallery 2003; Taber 2018). A corrected and validated questionnaire was used to collect data from the 250 participants recruited for the study. Key informant discussions guided by an interview guide were held separately for each village to further probe the issues raised by the participants during the questionnaire survey. Simple observations were also made at the different village sites to correlate information obtained from the questionnaire survey, KI interviews and the real situation on the ground.

3.3 Data Analyses

The responses from the questionnaires were coded and captured in Statistical Package for Social Science (SPSS) version 25.0. Descriptive statistics were used to summarize the responses from the different participants. To determine the perceptions of the participants on the different attributes, scores of 1–5 were assigned to the responses for the different attributes with the highest score allocated for negative perceptions as it applies to the attribute and the lowest for positive perception. Based on this, the scores used to determine perception of the community on water pollution, soil pollution, soil erosion and air quality were 1 = significantly reduced, 2 = reduced, 3 no change, 4 = increased, and 5 = significantly increased because an increase in these attributes signify environmental degradation. The scores were reversed for attributes like indigenous vegetation, vegetation cover, crop yields, availability of grazing and arable land where a reduction indicates degradation. The same principle was used to analyse the perceptions of social attributes where increase in provision of schools, health care facilities, roads, water, employment, and skills training programs for example indicated a positive perception and were scored as 5 = significantly reduced, 4 = reduced, 3 no change, 2 = increased, and 1 = significantly increased. The scores allocated to the responses were then normalized based on the percentage of participants in the category of response. For perceptions on
each of the environmental and social attributes therefore, a score of 5 indicated a very negative perception whereas a score of 1 indicated a very positive perception.

To determine the overall perception of the different villages on environmental and social impacts of the mine, factor-based scores were determined using principal components with common factor extraction in exploratory factor analyses for all questions on the questionnaire which addressed issues related to the environment. The same was done for all questions on the questionnaire which addressed social issues. According to (Distefano et al. 2008) factor scores are composite variables which provide information about an individual’s placement on the factors which in this study were environmental and social impacts. The means of the factor scores for each participant for all the environmental and the social attributes were calculated for the different villages and compared using one-way ANOVA to determine whether there were any variations in perceptions with villages. The relationship between the demographic characteristics of the respondents and their perceptions on environmental and social impacts were also determined.

4. Results and Discussions

4.1 Demographic characteristics of participants

Most of the participants who took part in the survey were between the ages of 26–35, followed by those between 36 and 45 (Table 1), which reflects a higher population of the working age group compared to other age groups in the villages studied. It would be expected that many of them were employed but the unemployment rate among the participants was very high, being up to 92.4%. The level of unemployment was similar in all five villages. Provision of employment by mines is among the expectations of communities located around mines according to studies by (van der Plank et al. 2016). The findings from this study indicate that the mine has not met this expectation in the study area as the level of unemployment is still very high. According to (Siyobi 2015), CSR could help in the alleviation of poverty and reduction of inequality among society. The prevailing high rate of unemployment in communities around the mine raises concerns regarding the ability of CSR to assist surrounding communities improve their quality of life. Many of the participants were single with more females being either married (32.8%) or cohabiting (8.8%) compared to the males (21.6% and 8% respectively). Many more males were however single (69.6%) compared to the females (56.8%). Those who were married were mostly above 46 years of age whereas the unmarried were between the ages of 26–45 years. There were no differences in marital status among the five (5) communities studied. Among the 250 participants, up to 96.8% had undergone some form of formal education, especially secondary education (Table 1). Whereas mostly the males had attained tertiary level of education, primary and secondary schools had mostly been attended by the females. The level of education among the five villages was also similar. Most of the participants (84.4%) had resided in their respective villages for over twenty years. More females (19.2%) had been living in the village for <20 compared to males (12%). Among the different age groups, those who had lived in the various areas for <20 years were mostly between the ages on 18–25 years (60.55%) whereas for those who had been living in the respective areas for more than 20 years, those between the ages of 26–35 were more (38.4%).
4.2.1 Perceptions

Table 1. Demographic characteristics of participants in the study.

| Demographic variable | Ga-Selepe | Malomanye | Monametsi | Mogabane | Maropeng | Percentages |
|----------------------|-----------|-----------|-----------|----------|----------|-------------|
| Age group (years)    | 18–25     | 8(3.2%)   | 10(4%)    | 11(4.4%) | 5(2.4%)  | 6(2.4%) 50(20%) |
|                      | 26–35     | 16(6.4%)  | 12(4.8%)  | 20(8%)   | 17(6.8%) | 24(9.6%) 89(35.6%) |
|                      | 36–45     | 13(5.2%)  | 11(4.4%)  | 8(3.2%)  | 13(5.2%) | 11(4.4%) 56(22.4%) |
|                      | 46–55     | 4(1.6%)   | 11(4.4%)  | 6(2.4%)  | 5(2%)    | 8(3.2%) 34(13.6) |
|                      | 56+       | 9(3.6%)   | 6(2.4%)   | 5(2%)    | 0(0%)    | 1(0.4%) 21(8.4%) |
| Marital status       | Single    | 27 (10.8%)| 30(12%)   | 39(15.6%)| 32(12.8%)| 30(12%) 158(63.2%) |
|                      | Married   | 17(6.8%)  | 16(6.4%)  | 7(2.8%)  | 14(5.6%) | 14(5.6%) 68(27.2%) |
|                      | Cohabiting| 5(2%)     | 4(1.6%)   | 2(0.8%)  | 4(1.6%)  | 6(2.4%) 21(8) |
|                      | Divorced  | 1(0.4%)   | 0(0%)     | 2(0.8%)  | 0(0%)    | 0(0%)    3(1.2%) |
| Level of Education   | Never been to school | 3(1.2%) | 1(0.4%) | 1(0.4%) | 1(0.4) | 2(0.8%) 8(3.2%) |
|                      | Primary | 8(3.2%)   | 10(4%)    | 4(1.6%)  | 9(3.6%)  | 11(4.4%) 42(16.8%) |
|                      | Secondary| 34(13.6%) | 34(13.6%) | 40(16%)  | 39(15.6%)| 34(13.6%) 181(72.4%) |
|                      | Tertiary | 5(2%)     | 5(2%)     | 5(2%)    | 1(0.4%)  | 3(1.2%) 19(7.6%) |
| Employment status    | Employed | 3(1.2%)   | 1(0.4%)   | 5(2%)    | 6(2.4%)  | 4(1.6%) 19(7.6%) |
|                      | Unemployed| 47(18.8%) | 49(19.6%) | 45(18%)  | 44(17.6%)| 46(18.4%) 231(92.4%) |
|                      | < 20     | 4(1.6%)   | 7(2.8%)   | 13(5.2%) | 8(3.2%)  | 7(2.8%) 39(15.6%) |
|                      | > 20     | 46(18.4%) | 43(17.2%) | 37(14.8%)| 42(16.8%)| 43(17.2) 211(84.4%) |

The demographic characteristics of the participants mirror that of the study area and the country generally. According to (STATS-SA 2017), poverty is one of the prevalent issues in South Africa and more than half of the population from Limpopo Province (67.5%) where the study area is located are living in poverty. The inequalities that exist between males and females with regards to access to education is currently being addressed by various initiatives from the government and non-governmental organizations.

4.2 Perceptions of the communities on environmental degradation and its causes

4.2.1 Perceptions on water quality

All participants from all 5 villages (100%) believed that the water in their communities was polluted. This belief was reflected in the perception score for water pollution which was 4.0 (Table 2) with all participants associating the perceived water pollution to the mine (Table 2). The perception of the participants in the community regarding the effect of the mine on water quality was therefore negative. These results concur with the findings of (Maest et al. 2006; Bud et al. 2007) who all linked water pollution with mining activities. Changes in the odour and taste of water were cited by participants and the KI as evidence of water pollution.

“... “Yes, they are many impacts here. First is dust from their dam and salty water. We think the saltiness of water is caused by chemicals that the mine is using...”.

Generally, mines contribute to the deterioration of water quality in their vicinity through the introduction of various chemical contaminants like Al, Cd, Co, Mn and Zn which could affect the taste, colour, and odour of the water (Ochieng et al. 2010). The perception of the participants on water pollution in the area may therefore not be unfounded.
4.2.2 Perceptions on soil erosion and soil pollution

All 250 participants (100%) indicated that there was an increase in soil erosion and soil pollution in the area. The perception scores for soil erosion and soil pollution in the area were of 4.17 and 4.19 respectively (Table 2) which highlights the negative perception of the community regarding these aspects of the environment in their community. The role of mining in soil chemical pollution has been reported in several studies (Lin et al. 2005; Ngole-Jeme and Fantke 2017; Fashola et al. 2020). According to (Wuana and Okielmen 2011) soil contamination around mining areas occurs because of mine drainage, sprinkling of oily substances on un tarred roads to supress dust, and seepage of leachate originating from the tailings dam into surrounding soils during heavy rains. Mining may contribute to soil erosion through the destruction of soil structure as heavy mine vehicles move on un tarred roads, increasing the erodibility of the soil. Similar observations have been made in Botswana by (Madyise 2013). In addition, Mining activities also alter the topography of the area from flat to gently undulating, which further increases the erodibility of the soils. The percentages of community members who attributed the increase in soil erosion and pollution to mining were 95.6% and 97.6% respectively with the remaining members indicating natural causes to be responsible.

4.2.3 Perceptions on vegetation cover

All participants (100% as indicated in Table 2) believed that there has been a reduction in crop yields and vegetation cover with 97.6% of the participants highlighting a reduction in the abundance of indigenous plants around their communities. These negative perceptions were reflected in the perception scores presented in Table 2. Observations during the study revealed vast areas of land with sparse vegetation (Figure 2). Soil pollution and soil erosion negatively affects plant growth and yield (Yao et al. 2003). The results of this study are similar to the findings of others which have also shown that clearing of land can affect vegetation cover and soils and could result in desertification (Schoenholtz et al. 2000). There were however differences in opinions with regards to the cause of the reduced vegetation in the communities. Decrease in vegetation according to the key informant participants was due to dryness and pollution of the soil with chemicals generated from the mining processes. Observations indicated that the area around the mine has been transformed to dryland farming. Removal of vegetation to make available land for cultivation exposes the soil to high-intensity rainfall and wind that increases the

| Environmental parameter          | Perception score | Percentage (%) of respondents |
|----------------------------------|------------------|-------------------------------|
|                                  |                  | Natural causes              |
| Water pollution                  | 4.00             | -                             | 100 |
| Soil pollution                   | 4.17             | 2.4                           | 97.6 |
| Extent of soil erosion           | 4.19             | 4.4                           | 95.6 |
| Indigenous plants                | 4.15             | 20.4                          | 79.6 |
| Wildlife population              | 4.01             | 16.8                          | 83.2 |
| Air Pollution                    | 4.00             | -                             | 100 |
| Vegetation cover                 | 4.14             | 20.4                          | 79.6 |
| Crop yields                      | 4.00             | -                             | 100 |
| Availability of arable land      | 4.00             | -                             | 100 |
| Availability of grazing land     | 4.00             | -                             | 100 |
rate of runoff which detaches soil particles and causes soil erosion (Egbai et al. 2012). The changes in vegetation cover may therefore be as a result of the farming activities rather than the mine as indicated by the respondents. Whereas 100% of the respondent attributed the reduction in crop yields to mining in the area, only 79.6% of the community members associated decrease in abundance of indigenous plants and vegetation cover with mining, the remaining members believing that natural causes were responsible.

4.2.4 Air pollution
All participants (100%) believed that the level of air pollution in their respective villages had increased. The perception score of the participants with regards to increase in air pollution was 4.0 (Table 2) which indicates a negative perception with all of participants (100%) attributing the increase in air pollution to mining. (Lloyd 2011; Mathe and Phiri 2016), and (Munnik et al. 2009) in their respective studies all found that the quality of air around areas with mines are adversely affected. Air pollution around mining areas is attributed to the movement of mine trucks, vehicles and wind erosion from mine tailing storage facility by the participants.

4.2.5 Perceptions on land availability
All participants (100%), agreed that the land available for farming and grazing in their respective villages has reduced. The perception score for reduction in the availability land for grazing and arable farming was 4.00 which also indicates a negative perception. All participants associated the decrease in available land to mining (Table 2). According to the participants, the mine occupies a larger area of land than the land available for farming and farming has been limited to soil of poor quality. Participants also highlighted the infertility of the land as being responsible for low crop yields. Challenges highlighted by the participants and key informant as affecting the land in their villages include the presence of steel mine pipes, and pits to name a few. Mining removes vegetation from the

Figure 2. Study area showing sparse vegetation cover (Picture credit belongs to Lally PS).
mining site using heavy equipment, creating pits and dumps that result in the degrada-
tion of the land. Similar environmental damage caused by mining has been reported in
India (Mehta 2002) and Tanzania (Kitula 2006). The responses from the different com-
unities are therefore like what has been reported in other areas.

4.2.6 Perceptions on wildlife

All participants (100%) also agreed that the wildlife population in the area has been
reduced. The perception score for wildlife in the area was also negative as reflected in
Table 2. Whereas 83.2% of the participants associated the decline in wildlife population to
mining, the remaining 16.8% indicated that natural causes might have been the reason.
(Aigbedion and Iyayi 2007) concur that mining may scare wildlife away from mining
environments through the noise produced by blasting, quarrying and crushing of rocks.
Elderly participants from key informant observed that the major animal species that had
experienced a decline in population included birds like vultures and owls, antelopes
(impala and springbok), rabbits, rock rabbits and monkeys. Wild animals in the area
might have relocated to areas with more vegetation as the lack of vegetation for grazing
in areas around the mines might no longer be conducive for their survival. The KI also
explained that the decline in wildlife population could be as a result of the increased level
of hunting which is now going on in the villages since income levels are low.

The negative effects cited by participants and KI included increases in air, water and
soil pollution, and decreases in wildlife population, vegetation cover, crop yields,
indigenous plants and arable and grazing land, progressive decrease in body mass of
cattle.

“...But you can see our animals are suffering, this environment has neither grass nor trees.
Not forgetting the water problems to animals because we also don’t have water. The land is
dry; the soil is loose because the mine cleared the environment ........ ..”

Corporate Social Responsibility is related to sustainable decision making as it
encourages the preservation of the environment for future generations (Fallah Shayan
et al. 2022). According to (Carvalho 2017) integrated sustainable decision making requires
mining companies to consider environmental issues. The implementation of CSR in the
mining industry is expected to reduce the effects of mining on the environment because
it encourages responsible use of resources (Lulewicz-Sas and Godlewksa 2015). However,
the perceptions of the communities around the mine on the impacts of mining on their
environment indicate that there is some deterioration of the environment as a result of
mining activities.

4.3 Perceptions of communities on social impacts and its causes

Of the 250 participants in the study, 228 (91.2%) indicated that they were frequently sick
while 22 (8.8%) said they were not. A list of illnesses such as common cold/flu, cough,
chest pains, skin and breathing problems commonly reported among residents in mining
environments was presented to the participants for them to indicate which ones they
suffered from most often. The most common health complaints among the participants
were common cold/flu (36%), cough (24%), chest pain (12%), skin related problems (9.6%)
and breathing problems (8.8%). (Adu-Yeboah and Obiri-Yeboah 2008), (Aghilinejad et al.
2006; Nwibo et al. 2012) and (Lemle et al. 1994) have all reported high prevalence of
respiratory illnesses such as cough and chest pains among mine workers in Nigeria, Ghana, Brazil, and Iran. This high prevalence has been associated with inhalation of dust originating from mining activities by (Nkosi et al. 2015). This was also the opinion of the participants and KI as they all believed that the prevalence of these illnesses in their communities is caused by exposure to contaminated dust originating from mining activities.

“Yes, the mine is increasing poverty. People are sick because of the mine and mostly these are the breadwinners in the families . . . They have TB, asthma and cancer . . .”

“I think it is the dust that they are inhaling . . .”

All participants believed their standard of living had deteriorated since the inception of the mine. This, they associated with the deterioration of the fertility of soil in the area (100%), lack of potable water (100%), lack of healthcare facilities (100%), poor road infrastructure (100%), no capacity building programmes (100%), and no employment opportunities (100%). The communities in this study practice subsistence farming which could have been compromised by the lack of arable land, soil pollution and decreased soil fertility. The consequence would be a reduction in crop yield and the need to purchase foodstuff which they previously grew, further affecting their income and expenditure. Participants believed the mine was responsible for the poor road infrastructure in the communities due to constant movement of heavy trucks on the untarred roads. Housing is usually a contentious issue around mining environments especially around areas where unskilled workers are accommodated. In addition to lack of accommodation, the cracking of existing structures (Figure 3) was also highlighted as a major challenge in the area due to constant vibration from blasting going on in the mine and movement of heavy vehicles in the area. Similar observations were made by (Florkowska 2014)

Up to 96% of the participants believed their cultural attributes including language, lifestyle, and patterns of behaviour have been eroded by non-indigens hired by the mine. According to participants, the employment of non-indigens has also resulted in overpopulation of the area with a consequent increase in competition for available jobs and other resources. Studies by (Chan 2004) also highlight the fact that an influx of individuals from other regions of a country or another country usually results in the introduction of new lifestyles and patterns of behaviour, which often arouses resentment from the local communities. The negative perception of the villages in this study regarding the mine is therefore explained.

Unlike environmental concerns, social and community concerns around mining environments are more complex because several stakeholders with varying interest must be taken into consideration. The surrounding communities do not believe that their quality of life has improved since mining started. This is not uncommon in mining environments as the prevalence of negative opinions about mining usually dominate. This has been the main reason for the implementation of CSR in the mining sector. However, studies in other countries (Viveros 2016) indicate that CSR is also perceived negatively as mere rhetoric, or simply as a marketing campaign which does not benefit the local communities. According to (Mabuza et al. 2010), there is a potential for CSR to be misused by companies to increase publicity and boost their reputations, although very little might have been done on the ground. The perceptions of the participants on the various social attributes evaluated in this study may validate this statement.
4.4 Variations of perceptions on environmental and social impacts with communities

There were no differences in the perceptions of the different villages on environmental impacts of the mine. The responses of the participants on the environmental attributes indicated in Table 2 showed that their perceptions of the mine on their environment were very negative but when the means of factor scores for each participant in the different villages for each environmental attribute were determined, their scores ranged from 3.17 for Malomanye to 3.35 for Monametsi (Figure 4). These scores indicates that though the participants had a generally negative perception of the impact of the mine on the different environmental attributes, their perception on the impact of the mine on the environment as a whole was not very negative. There were significant differences in perceptions on the environmental impact of the mine between Monametsi and Malomanye villages ($p = 0.03$) and between Malomanye and Mogobane villages ($p = 0.01$) but the differences were negligible as reflected by the scores in Figure 4. Differences among the other villages were insignificant. The slight differences observed in perception between villages may be explained by the distances between the villages and the mine. The distances from the communities to the mine were 6.2 km for Ga-Selepe, 1.9 km for Monametsi 3.7 km for Malomanye, 2.5 km for Maropeng and 3.8 km for Mogabane. Monametsi which is closest to the mine (1.9 km) had the highest score (3.35) indicating the most negative perception. (Dagvadorj et al. 2018) has also reported an increase in negative perceptions of the environmental impact of mines in communities with decreasing distance from the mine. Communities closest to the mines are expected to experience the most environmental impacts. With regards to the social impacts, all five villages strongly agreed that the mine
has negatively impacted on them socially as the mean factor scores for social impacts ranged between 4.86 and 4.89. No significant differences in perceptions of the social impacts of the mine existed among the different villages ($p = 0.341$).

4.5 Variations of perceptions with community demographics

The perceptions of the participants on environmental impacts of the mine did not differ between males and females which had scores of 3.21 and 3.22 respectively ($p = 0.39$), neither did it differ with levels of education which all had scores of 3.2 ($p = 1.00$), nor with age groups ($p = 0.053$). However, the length of stay of the participants in the different villages influenced their perceptions of the ecological changes in the environment. Most of the participants in this study were born and raised in their respective villages and have been in the communities long enough to experience and notice any changes caused by mining activities. Those who had stayed in the villages for longer periods had a slightly more negative perception (3.31) about the ecological impacts of the mine compared to those who had been in the villages for <20 years (3.11). These differences in perceptions on ecological impacts were significant ($p = 0.02$).

There were also no differences in perceptions of social impacts of the mine on the communities between males and females as they each had a social impact score of 4.87 ($P = 0.94$). The age groups, however, had different opinions. Whereas all participants agreed that the mine had caused some social changes in their communities, the degree of agreement was stronger among those between ages 26–35 (factor score = 4.89) compared to those between ages 18–25 (factor score = 4.27), 36–45 (factor score = 3.85), 46–55 (factor score = 3.85) and above 55 years (factor score = 3.86). However, only differences in community perception of social effects of the mine between ages 26 – 35 years and ages 46 – 55 years ($P = 0.039$) and between ages 26 – 35 years, and ages 36–45 years

![Figure 4](image-url)  
**Figure 4.** Variation of community perceptions of environmental impacts of the mine.
(P = 0.005) were significant. The age group 26–35 years comprise mostly those who had been to tertiary institutions and possibly had better cognitive skills to determine the social changes that have occurred in their communities. This is further justified by the differences in perceptions among the participants with different levels of education (Figure 5). The perception of the social impact of the mine was more negative among those with tertiary education than among those with primary education (Figure 5). The differences in perceptions could be because of the fact that those who had been to tertiary institutions are more aware of what the socioeconomic implications of the mine are on them compared to those who had attained lower levels of education.

There were also differences in perceptions of social effects on communities among the different employment levels. Those who were employed had a less negative perception of the social impacts of the mine (score = 3.93) compared to those who were unemployed (score = 4.73). The differences in perceptions among different employment status were significant (P = 0.00). Those who are employed (7.6%) are normally able to afford the basic services needed for everyday life. The social challenges they experience are likely to be less than those who are unemployed (92.4%). This may account for the difference in perceptions observed among the different participants from the different employment statuses. The length of time during which the participants had stayed in the community also influenced their perceptions as those who had been there for longer periods (20 + years) (84.4%) also had more negative perceptions of the social impacts experienced (Factor score = 4.88) than those who had lived in the various villages for a shorter period of time (15.6%) (factor score ranges between 3.92).

4.6 Implications of the community perceptions

Provision of potable water, healthcare facilities, schools, and road infrastructure are some of the social benefits that communities around mines expect the mines to provide for them (van der Plank et al. 2016). The complaints advanced by the communities have also been reported in other mining areas in and outside South Africa (Kapelus 2002; Kitula
5. Conclusion

The role of the perceptions of surrounding communities on mines and their activities has been cited as the major source of conflict between mines and communities in their environment. The results from this study indicate that 93.6% of members is communities in the vicinity of mines have negative perceptions about the platinum mine in their environment. Factors that seem to influence perceptions in this study varied. Whereas perceptions of environmental impacts were influenced by the distance of the village from the mine and the length of stay of participants in the village, perceptions of social impacts were influenced by the age, level of education and employment status of the participants and their length of stay in the area. The general perception of the participants is that the presence of the mine has not improved on their livelihood but has rather presented them with environmental and
social challenges. Efforts need to be made to establish a more trusting relationship between
the mine and the surrounding communities. These results indicate a similarity with other
studies in terms of the negative perceptions associated with social and environmental
aspects in communities around mines but provides further information on the role of the
demographic characteristics of communities on these perceptions. The mining sector needs
to come up with a way of evaluating whether the mines are meeting their commitment
towards uplifting the livelihood of the communities in their surroundings. This would further
highlight the importance and role of CSP in improving community-mine relations. This study
however focused on a platinum mining environment. Similar studies need to be carried out
in communities surrounding other types of mines such as gold, copper and nickel to name
a few, to see whether there are any differences or similarities in perceptions.

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Availability of data and material

All available data have been included in the manuscript.

Ethics approval

An Ethical clearance certificate with reference number 2018/CAES/096 for the study was issued
by the UNISA CAES Ethics committee. Permission to carry out the study was obtained from the
local authorities (tribal chiefs) of the communities and Municipality where the research was
carried out. Consent was obtained from each participant before administering the questionnaires. They were assured of their anonymity throughout the study and could withdraw from the study at any time.

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