

The Importance of Stakeholder Engagement in Progressive Rehabilitation of Large-Scale Open Pit Mines

—A Case Study of Lumwana Mine

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Abstract

Mining globally contributes to the growth of many economies of the world. Since its inception, the Zambian mining industry has contributed largely to the country's economy. The various developments both in technology and knowledge have contributed to the scale at which mining is being done. Challenges in such a setting arise due to the socio-economic and environmental impacts of mining, which create multidimensional problems. The study investigated the importance of engaging stakeholders in progressive rehabilitation programs for large-scale open pit mines, using a case study of the Lumwana Mine and its host community, Manyama. A qualitative approach was used, and data was collected through one-on-one interviews. A combination of convenient and quota sampling was used to engage with host community leaders, professionals and academicians from various fields and institutions. Results showed that most participants had agreed that stakeholder engagement is important for progressive rehabilitation, but the challenge was that the host community and municipal council representatives were not aware of any progressive rehabilitation efforts at Lumwana Mine. This was attributed to a lack of stakeholder engagement and communication of mitigation progress activities by the Lumwana Mine. Results also revealed that the lack of environmental impact assessment regulations to compel companies to involve stakeholders throughout the entire life of the mine other than just at the pre-mining stage led to a lack of compliance and accountability in rehabilitation.

Keywords

Progressive Rehabilitation, Stakeholder Engagement, Open Pit,

1. Introduction

Mines exploit low grades at higher stripping ratios leading to excavations of very large open pit mines. Although mining is a venture that contributes greatly to the development of nations, economies and civilisations, large-scale open pit mines can become an irreversible environmental hazard if not handled well [1]. As mineral exploration and development of new mines have continued to increase there have also been growing socio-economic and environmental concerns which calls for effective planning of mine closure if sustainability is to be achieved [2]. The major environmental impacts of large-scale open pit mines include air pollution, soil contamination, water pollution and siltation, geotechnical issues and land degradation. Unger *et al.* [3] observed that in the past mining companies would state the ultimate outcome of land use and how it would be reclaimed and for what purpose, however they concentrated more on production than on progressive rehabilitation. It is, however, important for mines to work on their closure plans and constantly update them as exploitation of the mineral resource and operations change with the passing time. According to Limpitaw and Brief, 2014 [1], most mining companies wait until mine closure to implement their closure plans and hence some environmental impacts may be irreversible. It has also been observed that changes in ownership of mines affect the way progressive rehabilitation plans are implemented as the new owners might be more focused on production than remediation and rehabilitation of old mining operating sites [4].

Chris Tiemann *et al.* [5] further argued that despite recent legislative developments on rehabilitation, mine closure and relinquishing, rehabilitation outcomes continue to fall short of community expectations. Even though there are examples of successfully rehabilitated mine areas, there are still limited examples of mines closing, relinquishing, and transitioning to another land use. It is therefore expedient that mining firms mitigate the negative impacts that mining has on the environment and promote positive impacts by undertaking progressive rehabilitation programs and involving stakeholders in their programs. Failure to incorporate stakeholders from the onset of mining in the closure design process creates a limitation in meeting the needs of the stakeholders [6]. Lange *et al.* [7] stated that there is a need to ensure that mining companies start operating towards being effectively sustainable in their operations. Weaknesses in stakeholder engagement may lead to ineffective implementations of policies and programs, as the mine's ability to contribute to sustainable development is questionable [8]. Bunda *et al.*, 2020 [3] argued that the lack of implementation of the regulatory frameworks leads to many mines ceasing operations before any rehabilitation is undertaken. This entails stakeholder engagement, which is key to how mining companies plan for progressive rehabilitation and mine

closure. It is therefore important to involve stakeholders at every stage of the mine life if effective progressive rehabilitation is to be undertaken and hence promote accountability, post-mining land use and information dissemination among involved stakeholders [9] [10]. Further, stakeholder engagement could grant a mining company the social licence to operate in a particular community thereby integrating with local communities [3] [11] [12]. **Figure 1** shows how mining companies integrate with various stakeholders in relation to their needs and gives an interaction of the various stakeholders, which include the mining companies, local communities and government.



Figure 1. Integration of key stakeholders in mining [14].

This study aims to investigate the importance of stakeholder involvement in effective implementation of progressive rehabilitation by large-scale open pit mines.

2. Methodology

2.1. Study Area

Lumwana Mine is a large-scale open pit mine located in the North-western province of Zambia” [13]. The mine is about 65 km west from the provincial capital Solwezi, 220 km west of Chingola, and 400 km northwest of the capital Lusaka” [15]. Lumwana Mine Corporation (LMC) operates in a social setting that is

governed by chiefs. The chiefdoms include Mumena, Mukumbi and Matebo. The area covers about 1,355 Km² and is currently one of the largest mines in Africa and the major source of employment for the surrounding communities in north-western province of Zambia. The mine has two major pits namely Malundwe and Chimuwungo whose major product is a copper concentrate. Due to increased mining activities northwestern province is one of the fast-developing mining provinces in Zambia with a population of about 727,044. Farming is the major economic activity for most communities around the Lumwana area. The people of Lumwana have strong ties to various cultural backgrounds and traditions which have created a sense of legacy [13].

2.2. Research Design

The study involved a qualitative approach in order to data. 25 respondents were engaged through non-probabilistic approaches. This was achieved through Convenience sampling and Quota sampling [16]. The two methods were implemented to target a group of professionals in the mining and related fields at Lumwana Mine, including municipal representatives, academicians, and community leaders. The instruments used for data collection included semi-structured questionnaires and interviews. Interview platforms included one on one sessions, zoom meetings and phone calls. Interviews were conducted with host community Leaders, professionals (environmentalists, sustainability managers, academicians and mining and metallurgical engineers), Zambia Environmental Management Agency (ZEMA) and Ministry of Mines representatives.

Field surveys of the ongoing progressive rehabilitation work at Lumwana Mine were also carried out. Secondary data was obtained from published material on stakeholder engagement and progressive rehabilitation, which is available in books, journals, newspapers, internet publications, and periodicals. Once data was recorded and reviewed the data was analysed through the use of Excel packages and Google Forms.

3. Results

From field surveys conducted at Lumwana it was observed that the mine has been implementing progressive rehabilitation as shown in **Figure 3**, although results from interviews reveal that engagements have not been intentionally put in place in order to assure other stakeholders of rehabilitation activities and their progress. The mine has been implementing progressive rehabilitation by covering the mine waste dumps with topsoil and re-profiling the dump to achieve 26-degree slopes as shown in **Figure 2**; however, stakeholders are not aware of these progressive rehabilitation activities.

Despite the lack of engagement in progressive rehabilitation and closure plan programs, most mine engages the community through Corporate Social Responsibility (CSR) programs, which is also the case of Lumwana Mine [17]. Mostly CSR programs are aimed at community and business development, Local Employment

Register (LER), Lumwana Development Trust Fund (LDTF), Local Contractors' Development Programme (LCD) and Agri-food Innovators (AFI). These programs have been key to ensuring development in the host community.



Figure 2. Progressive rehabilitation of Malundwe waste dumps at Lumwana Mine.

3.1. Professional Perspective Towards Stakeholder Engagements to Progressive Rehabilitation

The professional respondents all agreed that stakeholder engagement is important in order to achieve effective progressive rehabilitation stating that it is important to engage stakeholders as this creates a basis for knowledge sharing and consultation. It was observed that while these engagements are important there is a need to ensure that the regulatory authorities and regulation are enhanced. Metallurgical and mining professionals stated that various factors contribute to the causes of non-compliance to progressive rehabilitation as shown in **Figure 3**. The major factor mentioned by respondents as being the reason why mining companies do not undertake progressive rehabilitation was weak laws and regulations accounting for 43%. Government and regulatory authorities can play a role by implementing some of the measures that are outlined in the eighth national development plans for Zambia that allow all stakeholders to actively participate in rehabilitation which would lead to information sharing among stakeholders and promoting a sense of inclusiveness in the decisions that mining companies are making.

It can be seen from **Figure 3** that most respondents felt that stakeholder engagement and compliance are key to decision making in progressive rehabilitation as lack of stakeholder engagement and compliance accounted for 21% of the responses. Other studies have also argued that stakeholder engagement and compliance are key to decision making in progressive rehabilitation [3] [9]-[12].

Another factor mentioned was lack of implementing closure plans by mining companies (15%) despite the EIA for the mining company clearly stating the means through which rehabilitation and closure are to be conducted. Mukupa, 2014 [18] stated that mines plan effectively for rehabilitation and closure but the reality is different once mining commences, as these plans are not effectively implemented.

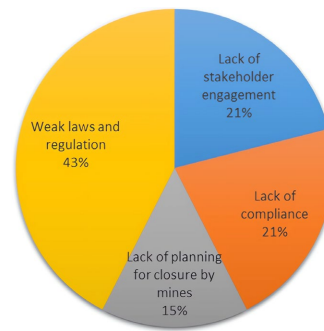


Figure 3.1 Response to “why Mines have not been properly rehabilitated”.

Figure 4 shows that when asked to state (participants were allowed to choose more than one option) when rehabilitation and stakeholder engagement can be done during the different stages of the life of mine most participants (92.9%) indicated that stakeholder engagement for progressive rehabilitation should be implemented before mining is initiated as the initiation of stakeholder engagement at the start of the mine would promote effective planning of progressive rehabilitation measures. Respondents felt that while closure plans are strictly left to the developer, more efforts are needed to make sure that there is input from the stakeholders. The score of 92% in favor of having stakeholder engagement at pre-mining preparations stage showed that before any activity of mining is implemented, it is important to engage the stakeholders in progressive rehabilitation, closure and reclamation. It can be observed from the interviews with professionals that stakeholder engagement is key to propelling the efforts being made to greater heights if sustainability is to be attained beyond post mining activities. Bunda *et al.* [3], argued that there is a growing need to incorporate a variety of stakeholders in closure planning and rehabilitation processes so that mines do not make decisions without consultation as this will help mining companies make strategic plans for the future of the industry that benefits all. Meanwhile, 57% of respondents agreed to incorporation of stakeholder engagement during the development and exploitation stages of the mine life while 50% responded that stakeholders should be involved in rehabilitation and closure programs post mining activities.

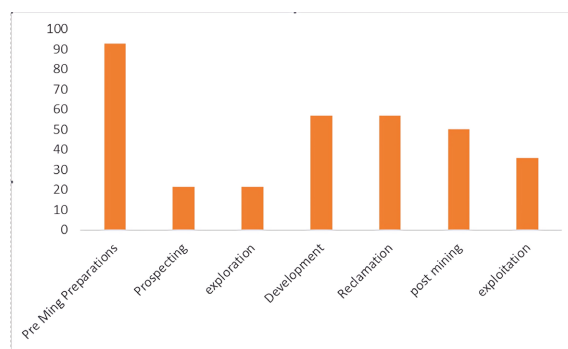


Figure 4. Responses (in percentages) for when rehabilitation and stakeholder engagement can be done during the life of a mine.

3.2. Community Perspective Towards Stakeholder Engagements to Progressive Rehabilitation

78% of community participants agreed that stakeholder engagement was beneficial for effective progressive rehabilitation while 22% of participants claimed that the engagements had not been fruitful as their needs and partly the objectives of the meetings were not met as shown in **Figure 5**. The results from the survey and interviews revealed that participants had not been engaged in any consultative meetings with regard to progressive rehabilitation. Results also showed that the municipality, local community participants and leaders engaged in interviews and surveys had no idea of environmental impacts associated with mining. It is, therefore, clear that while Lumwana Mine is implementing progressive rehabilitation the local municipal, host community and their leaders are not involved. Most participants highlighted during interviews that while the mining company engages stakeholders in CSR programmes, community development projects, they never involve the community in their progressive rehabilitation and closure plans.

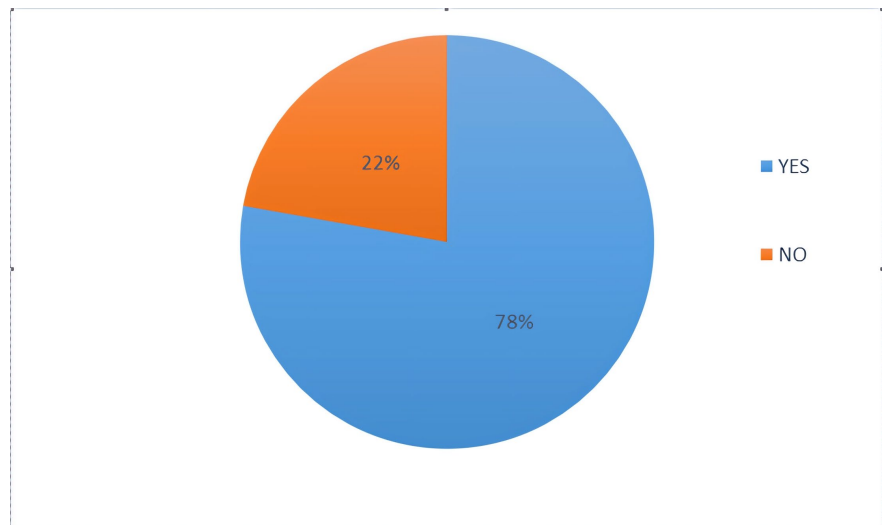


Figure 5. Responses to effectiveness of meetings for LCM with community participants.

Interviews with community leaders indicated that the leaders had participated in some form of stakeholder engagement meetings with the mine ranging from CSR programs to empowerment programs. While the Lumwana sustainability committee actively engages the community in sustainability (social-economic) dynamics, the community has not been sensitized and engaged in progressive rehabilitation, as shown in **Figure 6**. **Figure 6** gives an indication that most participants had engaged in sustainable discussions before mining operations, which focused on the environmental impact assessment surveys and community engagement only. The participants that had never been part of any meeting (44%) concerning Lumwana Mine had clearly stated that at no point had they been part of the meetings involving progressive rehabilitation of the mine.

From the findings, it became clear that while the mine had engaged the community

before the establishment of the mine through the EIA process and stakeholder engagements they had not been involved in implementation of progressive rehabilitation and closure plans. It is by law that an EIA is required and that through the process the community is engaged. Although part of the EIA process requires engagement of the community before the start of the mine it does not provide means through which stakeholders can review the progress made on mitigating the environmental impacts stated while establishing the EIA.

Figure 7 shows that 88.9% of community participants agreed to not being involved or informed about progressive rehabilitation efforts by the mine. 11.1% agreed to having been consulted but their knowledge of rehabilitation was informally obtained from employees.

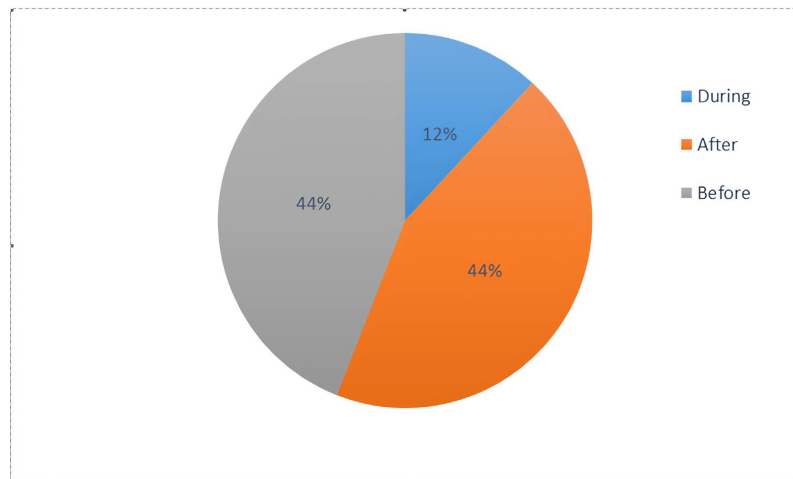


Figure 6. Community response to involvement in rehabilitation of Lumwana Mine.

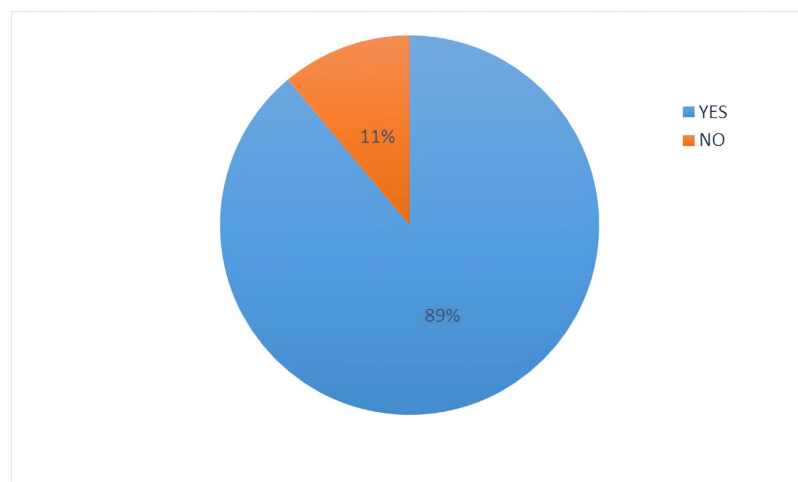


Figure 7. Community engagement on progressive rehabilitation.

3.3. Regulatory Authorities

After interviewing former employees of ZEMA and the Ministry of mines, it was noted that stakeholder engagement is important, but all stakeholders need to

clearly understand their role. Participants from regulatory authorities recommended the following: that the Ministry of mines needs to ensure that there is compliance with progressive rehabilitation; the community should be informed about environmental impacts of mining. Government needs to make frequent audits on progressive rehabilitation to allow for effective implementation of mitigation measures and that mines should communicate progress and challenges in implementing progressive rehabilitation measures so that stakeholders are well informed.

3.4. Municipal Council

The municipal council representative stated that most of them had no idea about progressive rehabilitation plans by the mine. The only interactive platforms with the mining companies were on empowerment and CSR programs. They argued that they did not understand their role in progressive rehabilitation and closure of the mine, hence creating a challenge in contributing ideas towards effective progressive rehabilitation and closure of the mine. It was noted that the council has the ability to organize the community and its leaders and engage with them in a practice that, if implemented properly can promote stakeholder engagement towards progressive rehabilitation and mine closure.

Therefore, it is important that while efforts have been made by the Zambian government through the Ministry of Mines via Vision 2030 and the eighth national development plan to check on compliance with environmental damage mitigation, efforts from all stakeholders are needed if mines and mining across the country are to objectively work towards sustainability. The involvement of all stakeholders would promote circulation of information, a sense of inclusion and an obligation to be part of progressive rehabilitation. The potential of the models of engagement among stakeholders will help mitigate challenges that arise from changes in mine ownership and lack of knowledge by most external stakeholders. **Figure 8** shows outcomes of good stakeholder engagement such as legacy building and knowledge sharing.

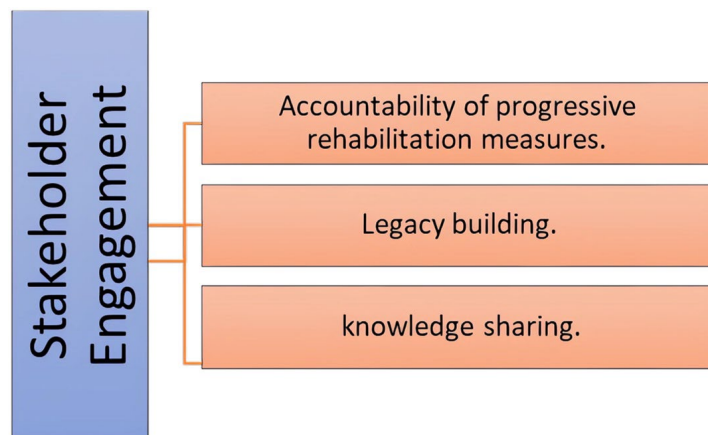


Figure 8. Outcomes of good stakeholder engagement towards progressive rehabilitation.

As earlier noted, that Lumwana Mine has put in place platforms for stakeholder engagement. CSR programs have been put in place through the sustainability department. The Host community has been a beneficiary through establishment of schools, farming assistants, community projects and employment opportunities. While these platforms have been effective challenges still exist in communicating progressive rehabilitation progress. The same platforms of engagement can be used to establish progressive rehabilitation progress establishing a sense of belonging and building host communities with a strong awareness of environmental challenges associated with mining. As various stakeholders become well informed and knowledgeable, there can then be a gleamer of hope for effective progressive rehabilitation and closure. This would promote accountability and effective implementation of progressive rehabilitation measures, which are mostly left to the mining companies. Progressive rehabilitation is key to ensuring that the land is put to good use at the end of the mine's life and, hence, reducing the impact on the community after the mine is closed. In order to address the challenges of no involvement of stakeholders in progressive rehabilitation and during the life of the mine and eventually closure the EIA process could be expanded to include provisions for reviews of proposed rehabilitation measures.

4. Conclusion

The importance of stakeholder engagement in progressive rehabilitation programs for large-scale open pit mines was investigated. It was observed that the lack of effective progressive rehabilitation implementation was largely due to a lack of stakeholder engagement, lack of compliance, lack of planning for closure by mines and weak laws and regulations that is, lack of implementation and review of regulations by the government and regulatory authorities. Effective progressive rehabilitation and closure entail the continuous engagement of the mine, host communities, government and regulatory authorities. The involvement of all stakeholders promotes awareness of activities by the mine, a sense of inclusion and an obligation to be part of progressive rehabilitation processes. Each stakeholder's contribution becomes key to ensuring that future large open pit mines are not abandoned and left to host communities and the government to carry the burden of the mines that have not been rehabilitated (liabilities). This can be achieved through regulatory authorities deliberately revisiting the EIA process and creating feedback mechanisms for engagements. Progressive rehabilitation programs should involve stakeholders such as the host community, the Zambia Environmental Management Agency, the municipal councils and the Ministry of Mines.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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