

Integrated closure planning and closure criteria: the road to success ... criteria

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Abstract

Mine closure planning and execution should be from ‘cradle to cradle’, where all mine-planning processes are integrated with closure.

The integrated closure planning system (ICPS), developed in 2014 at Anglo American (AA) mining operations, aimed to provide a consistent approach over projects life cycles for the reporting and management of long-term closure liabilities. ICPS aided in achieving the goal of ensuring that a positive and sustainable legacy is left for host communities after operations have closed.

The AA Mine Closure Toolbox (MCT) was developed in 2007 with an updated version released in 2013 (version 2). A further updated version integrating the ICPS and International Council for Mining and Metals (International Council for Mining and Metals [ICMM]) best practice principles was released in 2019 known as MCT Version 3. These documents together with International Finance Corporation standards form the current industry best practice (IBP) for integrated mine closure planning and emphasises the importance of a multi-disciplinary approach and continuous refinement of both rehabilitation and closure criteria, and success criteria. Ultimately, implementing the closure criteria, dictates the closure liabilities and financial provisions necessary to successfully rehabilitate mining operations, as per various African case studies.

This paper will focus on the road to success by developing closure criteria using a risk-based approach and refined through benchmarking, closure risk assessments, closure gap analyses and closure criteria effectiveness reviews. This will aid the reduction of potential residual risks to acceptable levels and achieving the defined success criteria. Success criteria must complement and fully align with the closure vision, objectives and closure criteria.

In countries lacking mine closure jurisdiction and relevant legal frameworks, IBP for mine closure should be implemented. South African legislation and regulations for mine closure can be seen as world-leading which directly assists integrated closure planning, ensuring the closure criteria would fulfil the defined success criteria and lead to successful rehabilitation and facilitate final site relinquishment.

Keywords: *integrated closure planning, sustainable legacy, rehabilitation and closure criteria, risk-based approach, success criteria, socio-economic closure, industry best practices, mine closure legal frameworks*

1 Introduction

Mine closure planning and execution should be from ‘cradle to cradle,’ where closure planning is integrated in all mine-planning processes during the operational phase. The impact of mining-related harms on the quality of life of affected communities has been increasingly documented and is often severe, wide-ranging and long-term in nature and should be considered and incorporated throughout the mining life cycle.

The International Council for Mining and Metals (ICMM) defines Integrated mine closure planning as an iterative and dynamic process and should be regarded as an integral part of the mine operation’s core

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business. Ideally, the integrated closure planning approach, which considers the physical, environmental, social and economic aspects, should be taken into account throughout the life cycle of the mine from the early stages of planning and construction through to the decommissioning and closure of the mine, or specific areas of the mine. This closure planning is crucial as it promotes full integration of all departments within a mining operation and ensures that all operational activities are working towards the same goal with closure in mind. Integrated closure planning also forms the basis of working smart, avoiding double handling of materials, identification of sustainable use of infrastructure post-mining and ultimately aiming towards reducing the life of mine closure liability.

The three main components that form part of the integrated closure planning process includes the defining of the post-closure land use, development of success criteria and finally the development of the site-specific rehabilitation and closure criteria.

Post-closure land use refers to the use of mined lands after the completion of extractive mining and closure activities. The end land use remains the main driving factor for the rehabilitation and closure criteria as well as the success criteria, as the closure criteria and success criteria are dependent on what the end goal should be and what will be achieved. Closure criteria is defined as definitive actions that will be carried out during implementation of the closure plan (ICMM 2019). Risk-based approach should be followed when defining rehabilitation and closure criteria to ensure potential risks at closure and post-closure are addressed proactively. This would also minimise the amount and magnitude of gaps, assumptions and uncertainties associated with the closure activities to be undertaken. Success criteria is defined as specifications/measurements/requirements that, if met, denote the success of the rehabilitation and closure criteria in meeting closure objectives (ICMM 2019). Success criteria may be numerical or narrative, and they may have a time component and may also be linked to specific management or monitoring activities.

In countries lacking mine closure jurisdiction and relevant legal frameworks, international best practice (IBP) guidelines for mine closure and rehabilitation planning should be implemented (ICMM 2019). There are a few comprehensive guidelines and IBP guidelines for integrated mine closure planning and associated closure liability estimates published by world leaders in the field for mining companies to use, such as ICMM, Anglo American, International Finance Corporation and the World Bank (International Finance Corporation [IFC] 2007; Anglo American 2019; ICMM 2019; World Bank Group 2021). Internationally, the countries at the forefront of effective and structured integrated mine closure planning incorporated into national legislation include Canada and Australia (Kabir et al. 2015), as well as South Africa (van Zyl et al. 2012; Krause & Snyman 2014; Morrison-Saunders, et al. 2016).

This paper will focus on the road to success by developing closure criteria, using a risk-based approach, and refined through benchmarking, closure risk assessments, closure gap analyses and closure criteria effectiveness reviews. This will aid in the reduction of potential residual risks to acceptable levels and in achieving the defined success criteria. Closure criteria must complement and fully align with the closure vision, objectives and success criteria.

Currently mine closure and rehabilitation policies, principles and legislation are less well established in Africa, however, the key focus for mining is more orientated towards improving governance mechanisms related to attracting investment and associated opportunities for harnessing resource development (African Union 2009). Uniquely within Africa, the mine closure planning drivers in South Africa is world-leading and include both IBP guidelines as well as comprehensive and various national legislation which is arguably the most developed and sophisticated arrangements in place for mine closure planning and regulation (Morrison-Saunders et al. 2016). South African legislation and regulations for mine closure can be seen as world-leading which directly facilitates integrated closure planning, ensuring the closure criteria would fulfil the defined success criteria and lead to successful rehabilitation and facilitate final site relinquishment.

2 What is integrated closure planning?

Within the mine closure and rehabilitation planning community, there is an expectation that mine closure planning should be proactive, commence early, and for ongoing planning becoming progressively more detailed as the life cycle of a mining operation approaches closure (ICMM 2019).

The integrated approach to closure planning for mining and metals operations takes into account physical, environmental and social considerations at an early stage of any activity onsite and plays a fundamental role in creating long-term value. Therefore, integrating closure considerations in a mining operation's life cycle planning and engineering processes is a great opportunity to leverage the value created by the mine. The most elementary goal of closure is to minimise future environmental impacts from mining activities and to reduce future financial risk to a company's shareholders (Fleury & Parsons 2006).

All integrated closure planning is based ultimately on the closure principles and objectives that provide a general framework, where the closure objectives provide concrete, site-specific and typically measurable statements of what closure activities or measures aim to achieve (ICMM 2019). A crucial part of the integrated closure planning process is developing a closure vision and site-specific closure objectives by taking the post-closure land use into consideration. The closure objectives indicate in concrete terms what is to be achieved through implementation of the closure activities. While the closure vision provides overarching direction for closure, and the principles provide a general framework, the closure objectives provide concrete, site-specific and typically measurable statements of what closure activities or measures aim to achieve (ICMM 2019).

Generally, the core motivation for integrated closure planning centres around the sustainable development as a goal for the mining industry, which links ultimately to the business case for investing by stakeholders. Therefore, leading companies see integrated closure planning as an opportunity to distinguish themselves in the eyes of stakeholders and investors by showing they make a valuable contribution to sustainable development in the long-term. Additional motivations for integrated closure planning include the financial management and determining the true cost of closure and long-term management of mining sites, leaving a positive legacy and influencing the operational decision-making within the mining operation (Fleury & Parsons 2006). Within an African context however, the motivation for integrated closure planning differs from other countries. This will be discussed in more detail throughout this paper.

2.1 Evolution of international best practice in integrated closure planning

Early in 2006, the ICMM set out to understand the current practices and issues relating to integrated physical, environmental and social closure planning as part of an internal study. Although leading industry practices provide a benchmark of how integrated mine closure should be approached, the study concluded that this is an area where improvements can and need to be made across the sector.

Since the investigation into integrated mine closure planning by ICMM, both the ICMM and AA have published various guidelines (Grant & Lacy 2016). In 2008, the ICMM published a document named *Planning for Integrated Mine Closure: Toolkit* which provided practical guidelines to its members regarding the latest approaches to responsible mine closure and related planning. In 2019, the ICMM published an updated *Good Practice Guide for integrated mine closure* which provides guidance needed to effectively integrate closure across the mining life cycle (ICMM 2019).

The Anglo American mine closure toolbox (MCT) was developed in 2007 with an updated version released in 2013 (Version 2) for all AA mining operations. The integrated closure planning system (ICPS), developed in 2014 at AA mining operations, aimed to provide a consistent approach within AA operations over projects life cycles for the reporting and management of long-term closure liabilities. ICPS aided in achieving the goal of ensuring that a positive and sustainable legacy is left for host communities after operations have closed. A further updated version integrating the ICPS and ICMM best practice principles was released in 2019 known as MCT Version 3 (Anglo American 2019).

These documents together with International Finance Corporation (IFC) standards form the current industry best practice (IBP) for integrated mine closure planning (ICMM 2019) and emphasise the importance of a multi-disciplinary approach and continuous refinement of both rehabilitation and closure criteria, and success criteria. Ultimately, implementing integrated closure planning, drives the accurate calculation of closure liabilities and financial provisions necessary to successfully rehabilitate mining operations.

2.2 Integrated closure planning in an African context

Within an African and South African context, integrated closure planning should be adjusted to the specific context (physical, environmental and socio-economic) within which the operation is situated. A variety of African countries such as Ghana, Kenya, Nigeria, Mozambique, South Africa, Tanzania and Zambia have legislation governing mine closure planning, along with accompanying financial sureties most commonly in the form of bonds. South Africa however is seen as the leading country in terms of legislation and provisions with respect to integrated mine closure planning (Morrison-Saunders et al. 2016).

Site-specific closure objectives are developed taking into consideration the overall vision for the site and closure principles that may be applicable to a broad range of sites. While different companies may use different terminology for these concepts, the underlying approach is usually similar. It should be noted that the challenges identified within the African mining context in terms of integrated closure planning is significantly different from first-world mining countries such as Canada, Australia and the United States of America. For many mining countries within the African continent, mining represents an opportunity for much needed socio-economic development, but awareness of the importance of managing environmental resources to promote sustainable mining is acknowledged (African Union 2009).

Therefore within an African context, effective mine closure planning and implementation should place considerable focus on the site-specific views, concerns, aspirations, efforts and knowledge of internal and external stakeholders to identify mutually beneficial closure outcomes for the company and its host communities.

3 Statutory and legislative requirements for closure

3.1 International context

Integrated mine closure planning should be an intrinsic element of the entire life cycle of mining from initial project design to assessment for mining approval purposes; continuing through implementation, decommissioning and fine rehabilitation and closure (ICMM 2019). Generally, the effective management of integrated mine closure planning should be dictated by the country-specific legislation and statutory requirements related to the mining operations (Krause & Snyman 2014).

With mine closure planning being a relatively new practice only starting in the 1970s compared to the long history of mining, internationally, not all countries have comprehensive legislation regulating mine closure. A variety of soft laws (codes, guidelines and toolkits) on the international best practice for mine closure have, however, grown significantly over the last three decades. The IFC, which forms part of the World Bank Group, issued a set of mining-specific environmental health and safety guidelines which includes a sub-section on mine closure and post-closure practices (IFC 2007). The World Bank multi-stakeholder initiative has produced a guide for government departments overseeing rehabilitation. This guide identifies five critical components of decommissioning and closure namely stakeholders, consultation and engagement, monitoring and enforcement, financial assurance tools and guarantees, environmental and social best practice (management systems) and policy, legal and regulatory framework (Scalon 2014).

In the absence of country-specific mine closure regulations, mining companies should consider applying requirements for integrated closure planning that are consistent with international good practices (i.e. ICMM, IFC and AA MCT) in more mature regulatory environments. Companies should also engage regulators early in the process to improve alignment on expectations, understand regulator objectives and communicate mine closure processes and objectives to reduce uncertainty (ICMM 2019).

A variety of countries have mine closure requirements within their mining laws or the associated implementing rules and regulations for mining laws, or within specific environmental legislation that is applicable to the mining sector, with varying degrees of quality and effectiveness. While there has been a trend since the late 20th century towards increased regulation for mine closure planning, the general pattern is still of sparse and vague regulations and many do not have specific legislation and provisions for mine closure in their mining laws (Morrison-Saunders et al. 2016). Internationally however, the countries at the forefront of effective and structured integrated mine closure planning incorporated into national legislation include Canada and Australia (Kabir et al. 2015), as well as South Africa.

3.2 African and South African context

To stay abreast of the best practices within the mining industry and to address the environmental and social impacts as well as associated financial burden emanating from past mining legacies and to prevent same from recurring, South Africa's legislature has made great efforts to regulate mine closure and rehabilitation. The current legislative framework is underpinned by section 24 of the Constitution of the Republic of South Africa, 1996 ('Constitution') (Government of South Africa 1996) which generally proclaims a healthy environment by, inter alia, entitling every citizen to an environment that does not harm their health or wellbeing.

The South African legislature has developed mechanisms to promote sound management of mine closure and rehabilitation by mining companies through various legislation. The Mineral and Petroleum Resources Development Act (MPRDA) (Government of South Africa 2002) promulgated in 2008, requires mining rights holders to set aside a financial guarantee for rehabilitation. This financial provision is set aside for the eventual discharge of their rehabilitation obligations and liabilities, which can be returned to the mining right holder on the issuing of a closure certificate by the state regulating authority. The State requires an application for a closure certificate on the closure or abandonment of the mining operation. As per the relevant legislation, the closure certificate can only be granted if the required documents, including a closure plan and a closure environmental risk report, have been compiled and the environment has been rehabilitated to the desired and satisfactory state as per the approved mine closure plan. Additionally, another critical South African legislation facilitating the effective, sustainable and successful closure and rehabilitation of mining operations include the National Environmental Management Act (NEMA) (Government of South Africa 1998), which provides the general principles, standards and procedures for environmental management. NEMA is also supplemented by a suite of sector-specific laws such as the National Environmental Management of Biodiversity Act (NEM:BA) (Government of South Africa 2004), National Environmental Management of Waste Act (NEM:WA) (Government of South Africa 2008).

The specific principles related to the rehabilitation obligations for mineral rights holders in South Africa under NEMA include the pursuit of environmental justice, so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons (Section 2(4)(c) of NEMA 1998), responsibility for the environmental consequences throughout its life cycle (Section 2(4)(e) of NEMA 1998), the 'Polluter pays' principle (Section 2(4)(p) of NEMA 1998), and the participation of all interested and affected persons and vulnerable and disadvantaged persons in particular, in environmental management (Section 2(4)(f) NEM 1998).

These South African legislative drivers arguably distinguish South Africa as one of the most developed and sophisticated arrangements for mine closure planning and regulation worldwide. Specifically, the financial provisioning regulations under NEMA provide an excellent framework and stipulates that three crucial documents need to be updated annually for closure planning purposes namely an Annual Rehabilitation Plan; a Mine Closure, Rehabilitation and Decommissioning Plan; and a Latent and Residual Risk Assessment Report. The annual rehabilitation plan focuses on evaluating the rehabilitation committed to date as well as the rehabilitation planned for the coming 12 months. The combination of these reports enables the mining operations to constantly identify the areas available for rehabilitation, assists in the tracking of progressive and concurrent rehabilitation, and holds companies accountable where areas are available, but no rehabilitation is being conducted.

4 Closure and success criteria

Mine closure and rehabilitation cannot follow a one-size-fits-all approach (Krause & Snyman 2014), and should always take into account the site-specific baseline conditions for each operation (whether mining on large-scale or smaller mining operations). When evaluating rehabilitation and closure criteria as well as the site-specific success criteria, the main driver will be the committed post-closure land use (use of mined lands after the completion of extractive mining and closure activities) for the mining operation post-closure. This post-closure land use would have been committed to within the environmental management plan (EMP) within the Southern Africa context, prior to the start of the mining operations or potentially amended during the operations. Thus, if the committed end land use was grazing, all rehabilitation measures will be developed to achieve this end land use and the success criteria will be measured against achieving the committed end land use.

A risk-based strategy should be followed to develop the rehabilitation and closure criteria for physical, biophysical and socio-economic aspects, to ensure potential risks at closure and post-closure are addressed proactively. This would also minimise the number and magnitude of gaps, assumptions and uncertainties associated with the closure activities to be undertaken. These criteria refer to the definitive actions that will be carried out during the implementation of the closure plan (ICMM 2019). The rehabilitation and closure criteria with associated closure risk assessments consider the potential future risks and how much risk the company is willing to incur. Risks can be reduced by the removal of impacted materials or by in-place remedial closure methods. The long-term post-closure care and maintenance, especially those associated with impacts from closed facilities, need to be considered in the closure strategy and demonstration of responsibility for a social license. The term social license to operate was first coined in 1997 and then developed in the mining industry and is usually used to refer to the level of acceptance or approval by local communities and stakeholders of mining companies and their operations. Success criteria, defined as specifications/measurements/requirements that, if met, denote the success of the rehabilitation and closure criteria in meeting closure objectives (ICMM 2019) is directly linked to the rehabilitation and closure criteria and should be developed concurrently.

Both these criteria are refined throughout the mine life cycle as more information becomes available through benchmarking, closure risk assessments, closure gap analyses and closure criteria effectiveness reviews (Anglo American 2019; ICMM 2019). This will aid in the reduction of potential residual risks to acceptable levels and achieving the defined success criteria. Closure criteria must complement and fully align with the closure vision, objectives and success criteria.

A critical component to good closure planning is local community and other stakeholder input, as this engagement from an early stage of the mine life cycle increases the chances of ending up with a 'good' closed site where the outcomes are supported by all parties. Crucial interested and affected parties include regional and local authorities, regulators and community leaders. However the amount of detail and terminology shared in terms of the long-term closure planning should be carefully considered based on the site-specific conditions. For example, should detailed information and closure planning strategies be shared with local communities too early during proactive engagement, communities could interpret this as the mining operations closing and potentially provoke community outrage. This is especially an important consideration within the African and South African context, as unemployment rates are high and generally settlements are predominantly dependent on the mining operations within the area. Therefore careful proactive stakeholder engagements would ultimately influence the rehabilitation and closure criteria (practicality and as well as the success criteria when the operation closes).

Therefore, taking into consideration the physical, biophysical and socio-economic context of mining operations, site-specific, informed and carefully risk-based rehabilitation and closure criteria should be developed and continuously refined to ensure the level of accuracy increases as the mining operation moves closer to closure. Ultimately, implementing the closure criteria, dictates the accuracy of closure liabilities and financial provisions necessary to successfully rehabilitate mining operations (ICMM 2019).

5 Current integrated mine closure planning within an African context

Currently mine closure and rehabilitation policies, principles and legislation are less well established in Africa compared to countries like Australia and Canada, with the key focus for mining being more orientated towards improving governance mechanisms related to attracting investment and associated opportunities for harnessing resource development (African Union 2009; Morrison-Saunders et al. 2016). In terms of integrated mine closure planning in Africa, South Africa currently provides a good benchmark within the African context for rehabilitation and closure criteria in terms of the alignment of national legislation and IBP, and emphasises the need for identifying and addressing the site-specific challenges, with a specific focus on the socio-economic conditions and challenges.

5.1 Integrated closure planning within African and South African context

In countries where no concrete mine closure and rehabilitation legislation is available, IBP guidelines such as the ICMM are key in terms of Statutory and Corporate requirements and the whole closure planning process. Such case studies and examples are discussed below for a few African countries such as Lesotho, Rwanda, Botswana, Zimbabwe and South Africa. Generally within the African context, socio-economic challenges such as poverty, food security and unemployment in surrounding communities need to be carefully considered when planning external stakeholder engagements as expectations from surrounding communities could influence the operation's social license to operate and could negatively influence operations.

5.1.1 Lesotho

In Lesotho, there is limited legislation guiding mine closure planning and therefore IBP is being followed. In Lesotho, there is a diamond mine at 3,200 metres above mean sea level (mamsl) with its unique challenges. From the first conceptual closure plan and closure criteria defined and developed in 2010, a comprehensive set of rehabilitation and closure criteria have been refined annually based on the site-specific conditions. For example, rehabilitation and closure criteria also take into account the varying climatic conditions such as snow and high elevation where only specific vegetation can establish and thrive.

5.1.2 Rwanda

A variety of mines across Rwanda focus on the mining of tin, tungsten and potentially lithium, which have unique challenges, specifically as formalised mining in Rwanda is a relatively new concept. Rehabilitation and closure planning legislation is still in its infancy and integrated closure planning needs to follow the IBP as a listed company and to attract crucial funding from relevant investors and stakeholders. Although there is high-level legislation available guiding mine closure planning in Rwanda specifically, IBP forms part of a detailed planning approach. Rehabilitation and closure criteria at these mines need to take into account the unique and challenging topography with very steep mountainsides and limited space to place mined-out materials. Rwanda, being close to the equator, has the additional challenge of monsoon seasons which proves to be another management challenge in terms of stormwater management and health and safety within the underground workings. Additionally, most of the mining operations are situated within concessions given by the government, and are situated directly within, around and under the communities. All these factors together with major illegal mining activities by thousands of people within the boundaries of the mining operations, community agriculture and poverty, require a different and unique approach to developing a site-specific comprehensive set of rehabilitation and closure criteria. As artisanal mining has been done for generations within various areas, well-planned stakeholder engagements with communities in terms of closure planning can either make or break these operations.

5.1.3 Botswana

Various open pit diamond mines in Botswana have site-specific risks where rehabilitation and closure criteria need to be tailor-made for the onsite conditions and differ from other diamond operations. Although there is high-level legislation for closure and rehabilitation within Botswana, detailed regulations and legislation is

currently not in place, and IBP together with company guidelines are being followed. Climatic conditions such as low annual rainfall and very high temperatures force the almost sole use of groundwater for mining operations which has its own risks and challenges. At some of these expansive open pit mining operations in terms of both size and production, there are additional major socio-economic issues such as closed towns which could become ghost towns post-closure as there is potentially no economic use for this infrastructure. The development and refinement of the rehabilitation and closure criteria within these mining operations therefore need a different approach to accommodate extreme weather and continuously take into account the major physical, biophysical and socio-economic impact of these operations on the surrounding communities and cattle farmers.

5.1.4 Zimbabwe

A platinum mining operation within Zimbabwe also has its unique challenges when it comes to developing and refining the site-specific rehabilitation and closure criteria. Specifically for Zimbabwe, there is only one law that mentions mine closure and rehabilitation which is not necessarily updated to the IBP standards. Therefore the integrated closure planning approach based on IBP is being followed, where site-specific risks and challenges unique to Zimbabwe such as climate and socio-economic factors (poverty, food security and political instability) need to be fully understood and addressed throughout the process.

5.1.5 South Africa

Integrated mine closure planning within South Africa is however well advanced with sound legislative drivers and sophisticated regulations specifically applicable to all mining operations. Various excellent examples can be found within South Africa where both international best practices and national legislation are combined to produce a comprehensive integrated mine closure planning process. The various legislation ensures and promotes sound management of mine closure and rehabilitation by mining companies, which is aligned to IBP guidelines. All mining companies within South Africa should submit on an annual basis an annual rehabilitation plan (both evaluating the rehabilitation conducted within the previous 12 months and identifying areas available for rehabilitation within the coming 12 months), a mine closure, decommissioning and rehabilitation plan as well as a residual and latent closure risk assessment report which aligns with IBP such as ICMM and IFC. For example, closure planning at a specific diamond mine within South Africa needs to adhere to a combination of the AA MCT Version 3, the ICMM Good Practice guideline as well as the comprehensive applicable South African legislation. The combination of these guidelines and legislation lead to the development and refinement of a very comprehensive and world-leading integrated closure plan and associated rehabilitation and closure criteria and success criteria. This closure plan provides an excellent example and benchmark of the level of detail possible within the African context, and confirms the successful combination of international best practices and national legislation.

5.2 Key challenges related to integrated closure planning within African and South African Context

Mining operations in Africa face a variety of different challenges such as poverty, food security and unemployment in surrounding communities, compared to other operations situated in countries like Canada, the United States of America and Australia. For example, where full stakeholder engagement is encouraged throughout the mine life cycle in first-world countries, a different approach needs to be followed within the African context.

For many mining countries within the African continent, mining represents an opportunity for much needed socio-economic development, but awareness of the importance of managing environmental resources to promote sustainable mining is acknowledged (African Union 2009). Country-specific issues such as poverty, food security, unemployment and threats to rural livelihoods play a crucial role in the approach, development and refinement of success criteria and rehabilitation and closure criteria for a specific operation within the African context. For example in other countries, a significant focus would be placed on climate change as a major challenge whereas this would potentially be seen as a less important within the African context.

Another very important and characteristic occurrence within the mining industry in Africa, is the prevalence of artisanal and small-scale mining (ASM) and the amount of people dependent upon these activities for their livelihoods (African Union 2009). Generally within an African context, people are impelled by growing economic crises such as unemployment and decreasing rural livelihood choices which are exacerbated by natural (i.e. climate change challenges such as droughts and floods) and man-made disasters (i.e. conflicts and wars). Although working conditions within the ASM industry are labour-intensive, it provides more employment than large-scale mining, however, potentially not sustainable (African Union Commission et al. 2012). A crucial goal set out in the African Mining Vision is:

'To create a mining sector that harnesses the potential of ASM to advance integrated and sustainable rural socio-economic development' (African Union 2009).

A key challenge linked to the ASM is the prevalence of illegal mining issues which are common within the African context. For example, illegal mining within Rwanda is common and the accepted industry best practice for rehabilitation and closure criteria should be adjusted and refined to accommodate this major challenge. Although these illegal miners are not aggressive, the same cannot be said for other African countries such as South Africa where these illegal miners are often very aggressive and armed (due to the ease of obtaining illegal firearms).

These challenges within the African context, such as the absence of comprehensive rehabilitation and closure legislation and socio-economic conditions, are key to developing and refining site-specific rehabilitation and closure criteria and success criteria. They provide the basis for effective and successful integrated closure planning across the African and South African mining operations. These challenges are addressed in the African context by accurately defining the baseline information (i.e. physical, biophysical, socio-economic and legal aspects) of each operation and applying the site-specific risk-based approach as provided in the IBP guidelines, specifically the ICMM (ICMM 2019).

6 Conclusion

Combining country-specific mine closure planning legislation and IBP such as IFC, ICMM and AA MCT, provides the basis for successful integrated mine closure planning. The impact of mining-related harms on the quality of life of affected communities has been increasingly documented and is often severe, wide-ranging and long-term in nature. Taking these into account together with the site-specific risks and challenges of each individual mining operation within an African context, successful integrated closure planning in terms of post-closure land use, rehabilitation and closure criteria, and success criteria remains a challenge and requires a tailor-made closure planning approach for each operation. Where legislation on mine closure and rehabilitation is still high-level, IBP could prompt the refinement of national legislation.

Mining operations in Africa face a variety of different challenges such as poverty, food security and unemployment in surrounding communities, compared to other operations situated in countries like Canada, the United States of America and Australia. For example, where full stakeholder engagement is encouraged throughout the mine life cycle in first-world countries, a different approach needs to be followed within the African context in terms of when external engagements should be included within the process as well as the phrasing of closure planning, level of detail shared and what stage of the planning process.

Therefore when developing and refining rehabilitation and closure criteria together with success criteria, the statutory, environmental and socio-economic context within which the mining operation is situated is of utmost importance and should be fully understood and appreciated as a one-size-fits-all approach would not be successful. This site-specific approach would directly facilitate integrated closure planning, ensuring the rehabilitation and closure criteria would fulfil the defined success criteria, reduce potential residual risks to acceptable levels, lead to successful rehabilitation, and ultimately facilitate final site relinquishment and a positive legacy being left by mining operations within the African context.

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