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# EVALUATING THE CONTRIBUTION OF INTEGRATED MINE CLOSURE AND POST-CLOSURE IN REALISING THE UNITED NATIONS' SUSTAINABLE DEVELOPMENT GOALS

**By**

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## DECLARATION OF ORIGINALITY

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I, the undersigned, Namatai A. Ruswa, hereby confirm that the attached dissertation is my ownwork and that any sources are adequately acknowledged in the text and listed in the bibliography.

**SIGNATURE** ……N.A.Ruswa…….

Signed: NA Ruswa

Date: 24 March 2023

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## ABSTRACT

In August 2021, a news website article highlighted the disastrous way in which a South African mine; *Blyvooruitzicht* Gold Mine near Carletonville was closed down. This was another trenchant example of disastrous mine closures. The liquidation of *Blyvooruitzicht* Gold Mine and its abrupt closure witnessed the collapse of an entire village and the subsequent collapse of electricity, water and refuse removal services. Mining Operations seized overnight and with it the environmental mitigation and management measures. Thousands of people lost their jobs as it was the only major local source of work. In another part of the world, Singkep Island in Indonesia witnessed its worst historic economic recession due to poor mine closure when the world tin price crashed. This resulted in 8- 25% of the Singkep Island population migrating to find work elsewhere. Much was lost as the tin mine operated and maintained 2 of the 39 primary schools, the hospital, the airport, piped water and power plant. The mine also directly provided employment to an estimated 2,452 out of 8,716 people.

Inadequate mine closure or the complete lack of it is a serious concern for countries around the world. Australia has about 60,000 abandoned mines and in South Africa, it is estimated that there are 4,000 – 60,000 abandoned mines. The United Nations 2030 Sustainable Development Goals (SDGs) which are currently the most important goals as agreed upon globally may be the desideratum needed to prioritise mine closure and its ability to contribute to the interests of society. Mining has a unique position by which it can contribute to the sustainable development agenda and this can be attributed to its ability to convene mining companies, global supply chains, networks, mining's access to technology and capital as well as their planning and technical expertise.

It is not hard to find points of intersection between the needs of the local communities and those of the mining industry. Examples that encapsulate such potential intersections is that both communities and miners benefit from healthy communities and an educated workforce, both need energy and infrastructure and both also need access to water. As venerated by this basic analogy, one can already see a number of the SDGs being addressed. One key stage within mining that has the potential to house many of the benefits as far as the SDGs are concerned, is the mine closure stage. When done properly and adequately through integrated mine closure and post-closure techniques, each mining activity can then realise a number of the SDGs in an extraordinary manner.

The fulcrum of this study is to explore the contribution of integrated mine closure and post-closure towards the SDGs of the United Nations. The study makes findings that warrant integrated mine closure and post-closure's prioritisation as they can contribute to the three dimensions of the SDGs.

## LIST OF ACRONYMS

| | |
|---|---|
| CSO | Civil Society Organisation |
| CSR | Corporate Social Responsibility |
| CSRM | Centre for Social Responsibility in Mining |
| CSV | Creating Shared Value |
| EPFI | Equator Principles Financial Institutions |
| ICMM | International Council on Mining and Metals |
| IFC | International Finance Corporation |
| ISO | International Organization for Standardization |
| LoA | Life of Asset |
| MDG | Millennium Development Goal |
| NGO | Non-governmental organisation |
| OECD | Organisation for Economic Co-operation and Development |
| SDG | Sustainable Development Goal |
| SIA | Social Impact Assessment |
| SLO | Social License to Operate |
| SLP | Social and Labour Plan |
| UN | United Nations |
| UNFCCC | United Nations Framework Convention on Climate Change |
| WEF | World Economic Forum |
| WHO | World Health Organization |


## KEYWORDS

Social closure; Co-production Shared value; Sustainable development; Linkages; Stakeholder

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# CHAPTER 1:

# BACKGROUND AND RESEARCH METHODOLOGY

## 1.1. Background to the research problem

Since the inception of the Sustainable Development Goals (SDGs), there has been a substantial increase in the volume of research that has investigated how the mine life cycle and all its stages can contribute to the SDGs.[1] This has been beneficial for the mining industry to understand how they can play a positive role in the pressing matter of sustainable development. In the past, however, through the broadness of the mine life cycle characterised by many stages; many mining companies and countries chose to overlook and slip out of the specific and critical stage that is mine closure.[2] In a malapropos manner; many companies risk appearing as good ambassadors by explaining their contribution to the SDGs through other stages of the life cycle whilst neglecting or glossing over adequate mine closure. Specificity with a particular focus on why integrated mine closure should be prioritised is warranted here, as failure to realize adequate mine closure may counter all the other stages of the mine's life cycle in realising the SDGs.

The most significant opportunities for mining firms to express their commitments to the SDGs is by proffering knowledge-sharing activities and conscientiously promoting economic spill-overs to other sectors. [3] Integrated mine closure and post-closure initiatives are one of the most significant stages in mining when it comes to contributing to all sorts of sustainable opportunities and spill-overs. It is noted that "legislative requirements in many jurisdictions require that the mine closure plan include a detailed plan of the post-closure land uses".[4] In many jurisdictions, post-closure is regarded as forming part of mine closure plans as it forms part and parcel of sustainable closure initiatives.[5] Many jurisdictions also require that the intended post-closure land use be sustainable with the basis of the sustainability requirement being community benefit.[6] It is now beyond irrefutable that there is a surging pressure for mines not only to take ownership of the legal compliance facets of mine closure but in ensuring a transition into a post-mining reality that is

[1] Mapping Mining to the Sustainable Development Goals: An Atlas (2016). World Economic Forum. See also, Yakovlevaa, N., Kotilainenb, J. & Toivakkab, M. (2017). "Reflections on the opportunities for mining companies to contribute to the United Nations Sustainable Development Goals in sub – Saharan Africa." Vol. 4. *The Extractive Industries and Society.*

[2] Retrieved from NPR website (accessed 29 October 2022).

[3] Yakovlevaa, Kotilainenb & Toivakkab (2017) 431.

[4] Srk news: Mine Closure: Can closure create opportunities? (2019). Retrieved from the SRK website (accessed on 15 December 2021) 16.

[5] *Ibid*.

[6] *Ibid*.

sustainable.[7]

Mining companies are now being edged to transition into more sustainable operations in order to obtain their Social License to Operate (SLO) which goes beyond a mining company's legal compliance.[8] SLO is achieved when communities are involved in the planning of infrastructure development and municipal service delivery[9] which in turn assists mine closure to realise the SDGs. Allowing communities to be involved negates disastrous examples such as the one of *Blyvooruitzicht* Gold Mine which controlled everything that was crucial for the community's survival such as water and electricity.[10] Integrated mine closure assists against such unwarranted incidents. Integrated mine closure works as a form of anticipatory mechanism to ensure communities become resilient and are able to live independent of the mine despite unforeseen circumstances such as experienced by Singkep Island in Indonesia.[11]

Sustainable development has been an important consideration in the world for a substantial amount of time and the world has come to the realisation that sustainable development should be prioritised as a matter of necessity for the future of the world. In 1987, the UN's World Commission on Environment and Development (also known as the Brundtland Commission) defined sustainable development in its report "Our Common Future" as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."[12] In this expedition for a better and more sustainable world, different goals have been previously designed as the world at large has sought to (with significant strides) become more sustainable.

In 1995, a Copenhagen Declaration on Social Development was produced by the World Summit on Social Development with a complex and long list of commitments based on conclusions reached from previous conferences.[13] Pursuant to the Declaration, a report in 1996 emanating from the Copenhagen Declaration titled "Shaping the 21st Century" then turned several of the Copenhagen commitments into six "International Development Goals" that could be monitored.[14] After this, the UN General Assembly then resolved to hold the Millennium Assembly and a Millennium Summit and tasked Kofi Annan (Secretary-General at the time) to come up with

[7] Edwards, J. & Maritz, A. (2019) "Social aspects of mine closure: the elephant in the room." *Australian Centre for Geomechanics* 311.
[8] See *id* at 310.
[9] See *id* at 311.
[10] Bega, S. 2021. "South Africa's closed mines must not shaft people." 14 August 2021. *Mail & Guardian.*
[11] Syahrir, R., Wall, F. & Diallo, P. (2021) "Coping with sudden mine closure: The importance of resilient communities and good governance." Vol. 8. *The Extractive Industries and Society* 4.
[12] Report of the World Commission on Environment and Development: Our Common Future (1987). World Commission on Environment and Development.
[13] Copenhagen Declaration on Social Development (1995). United Nations.
[14] Shaping the 21st Century: The Contribution of Development Co-operation (1996). The Organization for Economic Cooperation and Development.

proposals for "a number of forward-looking and widely relevant topics".[15] Ultimately, a Millennium Declaration was then issued in September 2000[16] and in the following year September 2001, Annan then presented a "Road map towards the implementation of the United Nations Millennium Declaration" to the General Assembly and this report contained "the Millennium Development Goals" (MDGs).[17]

Fast forward to the current development goals: the SDGs and it is abundantly clear that the core framework for the SDGs expands on the MDGs. What is also clear is that the SDGs are heralded for addressing the shortcomings of the MDGs by incorporating a broader and more transformative agenda.[18]

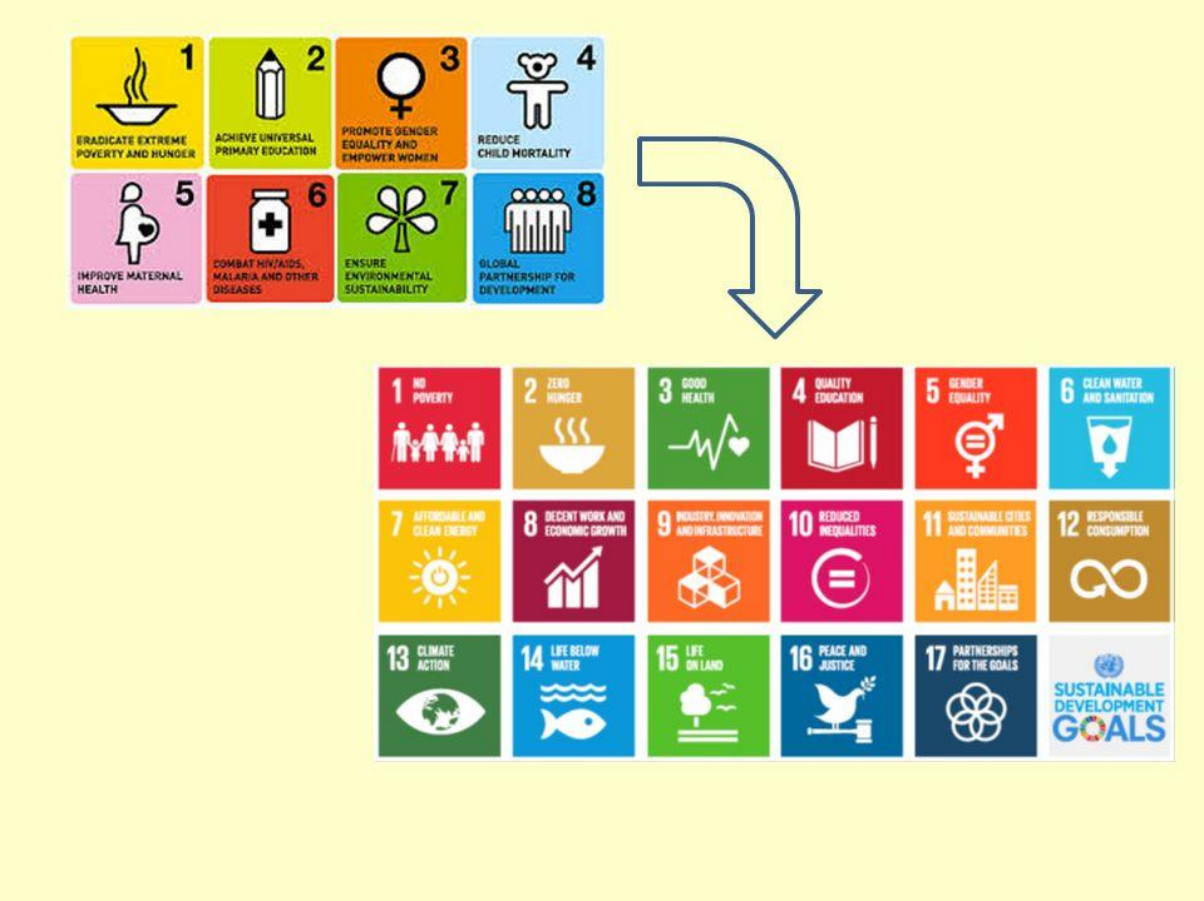


**Fig. 1: From MDGs to SDGs**

Whilst the SDGs affect all countries, developed and developing, as all countries are expected

[15]The Millennium Assembly of the United Nations (1999). United Nations.
[16] We the peoples: The role of the United Nations in the 21st century (2000). United Nations.
[17] Road map towards the implementation of the United Nations Millennium Declaration (2001). United Nations.
[18] Fig. 1. Retrieved from Vandemoortele, J. (accessed 9 December 2021).

to work together to achieve the universal goals, a weakness of the MDGs is that they were largely focused on targets relating to developing countries with the funding coming from developed rich countries.[19] The SDGs are more detailed and through the use of targets and indicators; they are able to break down the silos and work across sectors when compared to the MDGs. Another key difference is that the MDGs had a scant regard for civil society organisations (CSOs) whereas the SDGs have engaged the CSOs from the beginning by consulting them during a three-year post-development agenda.[20] Although the SDGs are interconnected, they can be divided into a Social, an Economic and an Environmental group.[21] The SDGs can also be divided into the 5P's which stand for People, Prosperity, Planet, Partnership and Peace. [22]


**Fig. 2: SDGs- Social group, Economic group and Environmental group**

[19] Hulme, D & Scott J. (2010). "The Political Economy of the MDGs: Retrospect and Prospect for the World's Biggest Promise." *New Political Economy* 5.

[20] About the Post-2015 Development Agenda. Retrieved from the United Nations website (accessed 9 December 2021).

[21] Fig. 2. Retrieved from D'Adamo, I., Gastaldi, M., Imbriani, C & Morone, P. (2021) "Assessing regional performance for the Sustainable Development Goals in Italy." Vol.11. *Scientific reports* 2.

[22] Fig. 3. Retrieved from Wayne Visser website (accessed 9 December 2021).

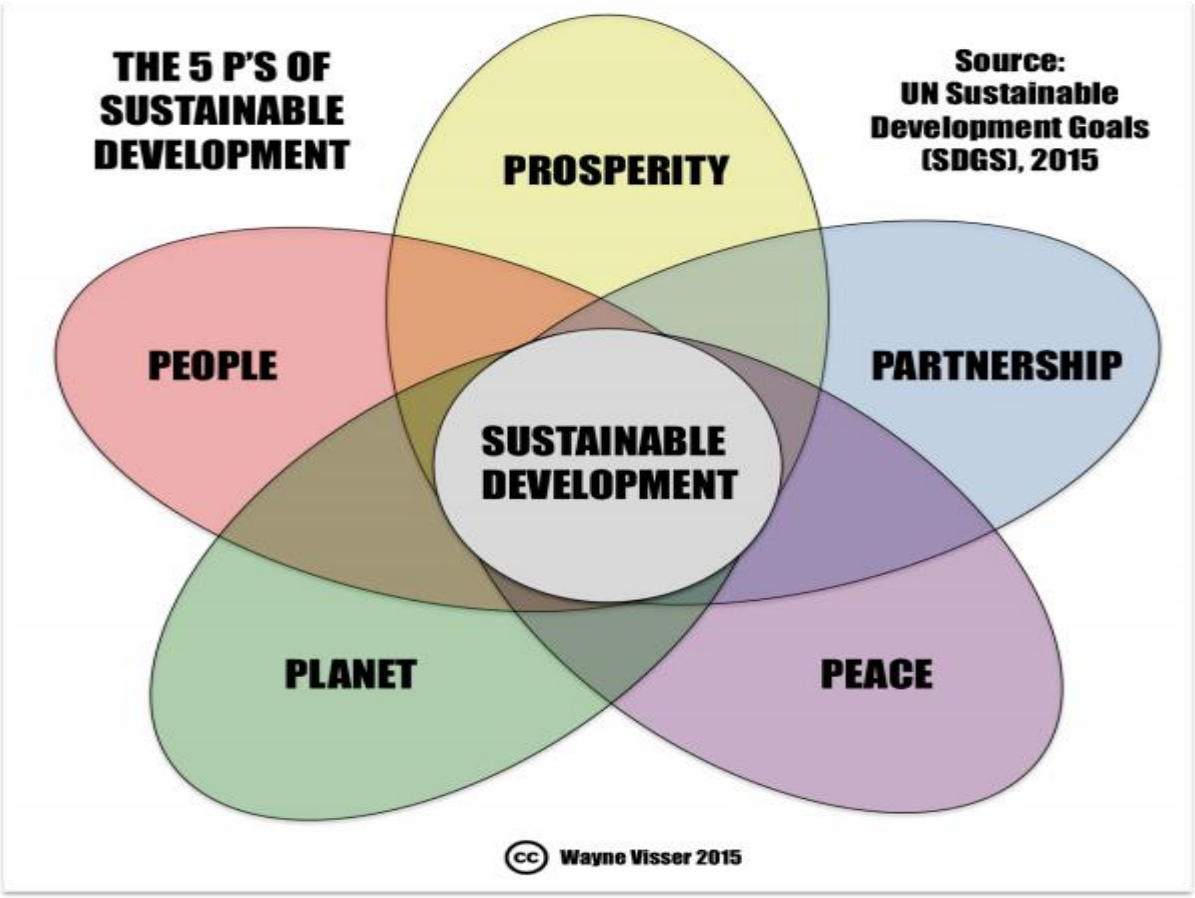


**Fig. 3: SDGs-The 5 Ps of Sustainable development**

## 1.2. Research problem

As evident in the culmination that has led to the SDGs; it is clear that the SDGs are a priority according to the world at large and have the potential to affect every facet of the functioning world in a positive manner. Even so, a problem still stands, mine closure is not being done properly even though it is such an imperative stage in mining in terms of its potential to address many of the SDGs and mitigate the obstacles to their realisation. As acknowledged by the World Economic Forum (WEF), despite mining having contributed to a lot of the problems that the SDGs seek to address, mining is also positioned uniquely to contribute to the sustainable development agenda. [23] Therefore, the problem statement of this study is why mine closure is not taking place in a correct manner and not being prioritised.

## 1.3. Aim and objectives

[23] Scoping Paper: Mining and Metals in a Sustainable World (2014). World Economic Forum.

### *1.3.1. Research aim*

The aim of the research is to illustrate why integrated mine closure and post-closure should be prioritised. Mine closure can largely contribute to what is currently and globally the most important goals that we should be seeking to achieve as a global village- the Sustainable Development Goals. If one understood how important mine closure is in terms of the SDGs, one would then come to an understanding of why it is imperative and should be prioritised.

### *1.3.2. Research objectives*

The objectives of the study are to:

- Examine how integrated mine closure and post-closure can contribute to the social group of the SDGs.[24]
- Examine how integrated mine closure and post-closure can contribute to the economic group of the SDGs.[25]
- Examine how integrated mine closure and post-closure can contribute to the environmental group of the SDGs.[26]
- Draw conclusions regarding the contributions of integrated mine closure and post-closure towards the SDGs and whether these conclusions warrant for adequate mine closure to take place and for its prioritisation.

## 1.4. Research questions

### *1.4.1. Primary research question*

The study will explore the primary question: What is the contribution of integrated mine closure and post-closure to the SDGs?

### *1.4.2. Secondary research questions*

Whilst analysing the primary question, the study will seek answers to the following secondary questions:

- What is integrated mine closure and post-closure's contribution to the social group of the SDGs?
- What is integrated mine closure and post-closure's contribution to the economic group of the SDGs?

[24] See Fig. 2 in Appendix A: Infographic. Retrieved from D'Adamo, Gastaldi, Imbriani, & Morone. (2021).
[25] *Ibid*.
[26] *Ibid*.

- What is integrated mine closure and post-closure's contribution to the environmental group of the SDGs?

## 1.5. Research method

This research study is based on a grounded theory approach. A comprehensive list of sources has been utilised for the literature review. Academic publications and articles based on real lived experiences within the extractive industry have been utilised to analyse the previous and current state of mine closure whilst conducting a parallel study on the SDGs and how their realisation can positively benefit the globe. An Infographic has also been furnished, comprising of a few figures which have been used to visually espouse what is being communicated.

The study has further analysed how mine closure converges with the SDGs and how successful mine closure can contribute towards the realisation of the SDGs. The study also investigates and calibrates some of the successful mine closure examples and how they have effectively contributed to the SDGs. The SDGs have been separated into different categories in order to address integrated mine closure and post-closure's ability to realise the three main dimensions of the SDGs as recognised by the UN which are the social, economic and environmental dimensions.[27] The categorisation into chapters is also for the digestive purposes of the study as a whole. This approach will aid in a better understanding of the study through the use of necessary milestones and chapter breaks whilst exploring the SDGs and their relevant dimensions.

Essentially, the study follows a structured and systematic analysis in which every single SDG is addressed as a subsection of the relevant chapter in which each SDG is classified under. Therefore, this grounded theory approach makes sure to thoroughly explore how mine closure can possibly contribute to each of the SDGs.

### *1.5.1. Delineations and limitations*

The literature investigated in this study is to a large extent contextual to a certain geographic area and/ or a particular time. This means that certain mine closure cases may emphasise certain goals over others depending on the context of that relevant community. For example, the International Council of Mining and Metals' (ICMM) Planning for integrated Closure Toolkit elucidates this point by saying**: "**a target closure outcome for an industrial city in Western Europe might include such phrases as best practice environmental compliance and sustainable urban land use, whereas a target closure outcome for a rural area in sub-Saharan Africa might include concepts such as community development and health care. It may be as conservative or as ideological as the company wishes, but

[27] Retrieved from the United Nations website (accessed 9 December 2021).

it should, at a minimum, portray the elements of lasting community benefits locally."[28] However, this research has been approached in such a manner that one is able to see the positive contribution of mine closure for each SDG as the research will address mine closure's possible contribution towards each goal. This approach also works best to cater for those SDGs that are not necessarily contextual such as climate action and will therefore assist mining companies and governments to also see how they may contribute to the less-contextual SDGs.

It is also important to understand that, with the focal point of this study being mine closures' contribution towards the SDGs, the extractive industries as a field will essentially have more profound influences on certain goals as compared to others. As visually elucidated by the indicative priorities diagram: mining may enhance the positive impacts of certain SDGs whilst mitigating the negative impacts of other SDGs.[29] Nonetheless, what will be made clear by this study is that as far as all the SDGs are concerned; it is better to do adequate mine closure than not to do it.

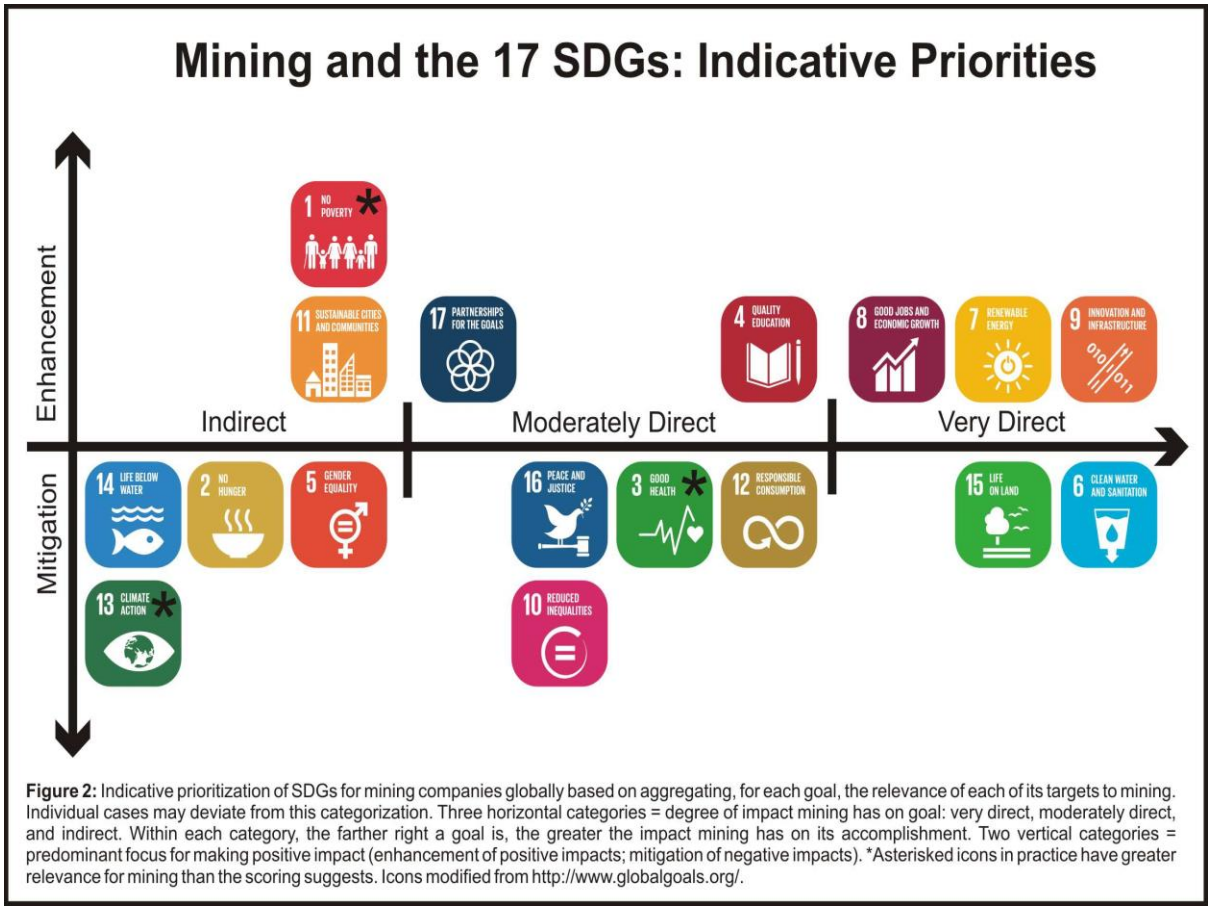


**Figure 2:** Indicative prioritization of SDGs for mining companies globally based on aggregating, for each goal, the relevance of each of its targets to mining. Individual cases may deviate from this categorization. Three horizontal categories = degree of impact mining has on goal: very direct, moderately direct, and indirect. Within each category, the farther right a goal is, the greater the impact mining has on its accomplishment. Two vertical categories = predominant focus for making positive impact (enhancement of positive impacts; mitigation of negative impacts). *Asterisked icons in practice have greater relevance for mining than the scoring suggests. Icons modified from http://www.globalgoals.org/.

**Fig. 4: Mining and the 17 SDGs- Indicative Priorities**

[28] Planning for Integrated Mine Closure: Toolkit (2019). International Council on Mining and Metals 26.
[29] Fig. 4. Retrieved from United Nations website (accessed 9 December 2021).

As already mentioned; the SDGs are complex, interdependent and interrelated.[30] This being said, as each subsection will focus on each SDG, one must keep in mind that other SDGs may also be evident to a certain degree when discussing a particular subsection. This will, in turn, work positively to highlight the Partnerships aspect which besides being an SDG in itself; runs as a golden thread throughout the study as it emphasises the need for cross-sector engagement and collaboration.

### 1.6. Relevance of the research study

The relevance of this study could be that due to the nature of the study addressing and evaluating mine closure's contribution to each sustainable development goal, this study could therefore assist mine companies and relevant stakeholders to broaden their horizons on how mine closures, tailored to their unique context, could assist in making the world more sustainable. This research could also help assist policymakers, mine companies and other relevant stakeholders with a honed understanding when it comes to evaluating their economic, social and environmental dimensions as well as determinants for success in relation to mine closure. This study can also assist by critically exploring and providing much-needed clarity on mine closure's contribution towards the SDGs.

The study could make community stakeholders more motivated to engage and collaborate with mining companies due to the fact that the projected outcomes present more tangible benefits to the community in the form of the SDGs. Furthermore, by showing how mine closure could address community issues through the realization of the SDGs; mining companies could potentially earn more trust in order to be viewed as more of a valuable partner in the sustainable development goals and a valuable partner in potential projects.

As evident from the history of sustainable development, the core objectives of what the world has been trying to achieve from the MDGs to the SDGs have not fundamentally changed. Basal Human rights, economic influences and environmental concerns have continued to remain a priority. Bearing this in mind, this study may largely remain relevant for future development goals in relation to the extractive industries.

### 1.7. Chapter overview

The study will commence in Chapter 2 by providing an overview of the concept of integrated mine closure and its interplay with the SDGs. Chapter 3, 4 and 5 will then engage with the SDGs according to the three dimensions of sustainability as recognized by the United Nations which is the social, economic and environmental dimensions.[31] Chapter 3, therefore, examines how integrated mine

[30] Fraser (2019) 789.
[31] Retrieved from the United Nations website (accessed 9 December 2021).

closure and post-closure can contribute to the social group of the SDGs. Chapter 4 examines how integrated mine closure and post-closure can contribute to the economic group of the SDGs. Chapter 5 examines how integrated mine closure and post-closure can contribute to the environmental group of the SDGs. Chapter 6 will then evaluate the information obtained against the research questions and the formulated objectives from the first chapter and proceed to provide a summary of the viewpoints in regard to the possible contribution of integrated mine closure and post-closure in realising the UN sustainable development goals. The study will conclude in Chapter 7 by summarising the research findings, and addressing the primary research question.

## CHAPTER 2:

## INTEGRATED MINE CLOSURE AND ITS INTERPLAY WITH THE SDGS

### 2.1. Introduction

In light of the above, the objective of this chapter is to define the concept of mine closure and how it interacts and contributes to the SDGs. Accordingly, Section 2.2 will consider the concept of mine closure and what it entails. This will be followed in Section 2.3 by an examination of the positives of integrated mine closure. In turn, Section 2.4 will highlight the value of the SDGs in the mining industry. Section 2.5 will then highlight the important impacts of integrated mine closure and why it is warranted. The chapter will conclude in Section 2.6 by summarising the chapter findings and addressing the question of whether mine closure should be prioritised.

### 2.2. Concept of mine closure

While the terminology may differ; mine closure can be defined through the contours of general principles that are naturally applicable to various sites and conditions. Mine closure can be defined and characterised as follows:

- Safety: mine closure includes the promotion of physical safety of a closed mine site by making sure that it is safe for humans and animals from pits and any potentially physically harmful structure;[32]
- Physical stability: mine closure includes promoting and creating the physical stability and sustainability of a mine site by limiting the potential of long-term erosion and the long-term degradation of the environment; [33]
- Chemical stability: mine closure includes preventing adverse impacts on the quality of the local environment through chemical contamination that may arise from the site;[34]
- Socioeconomic transition: mine closure includes promoting a smooth transition from previous socioeconomic conditions that existed during the life of the mine to those that will be present post-mining activities. The aim here is that the net socioeconomic impact on the affected region must be positive as much as possible;[35]
- Ecological stability: mine closure includes making sure that the post-closure ecosystem at the closed site remains in a sustainable state as desired in relation to its compatibility with the planned post-closure land use. This may entail goals for biodiversity and the viability of

[32] Integrated Mine Closure: good practice guide (2019). International Council on Mining and Metals 17.
[33] *Ibid*.
[34] *Ibid*.
[35] *Ibid*.

a self-sustaining ecosystem which does not need the support of the mining company in the long term and [36]

- Long-term care: mine closure also seeks to minimise or eliminate as much as possible the need for long-term post-closure care and maintenance.[37]

Integrated mine closure essentially entails incorporating these characteristics and beginning the process of mine closure during the life of the asset (LoA).[38]

## 2.3. Positives of integrated mine closure

There are many benefits that come with integrated mine closure when it has the contingent goal of making positive contributions that go beyond mining. Incorporating a balanced closure approach during mine planning activities leads to improved outcomes including safety, health, environmental, social, legal, human resources and governance.[39] Integrated mine closure and Sustainable post-mining land use hold the possible benefit of bolstering socioeconomic transitions and creating opportunities for future and current stakeholders.[40] Another positive of integrated mine closure is that due to forming part of the mining operations; progressive rehabilitation is realised as mine closure is planned from an early stage and implemented as part of the mining operations.[41] This is evidenced by Vedanta Zinc International's (VZI) integrated mine closure approach for its Lisheen mine in Ireland, as it began the closure process while still in production; now its closure endeavours may be considered best practice for the industry.[42]

When looking at the positives of integrated mine closure, one inextricably has to include social closure which entails involving the communities through a form of collaboration and co-production during a mine's operations. This prudentially benefits the community to participate, learn and develop a future that does not solely depend on mining.[43] Integrated mine closure, therefore, helps to create a more sustainable future by building confidence and capacity in local partners who collaborate with the mine which results in the local partners taking ownership of their economic and social well-being.[44] When mining companies employ a Creating Shared Value (CSV) strategy which naturally comes with a socially sustainable form of integrated mine closure approach, this enables mining companies to deliver outcomes that support the priorities of local stakeholders and advance

[36] *Ibid*.
[37] *Ibid*.
[38] Closure Maturity Framework (2020). International Council on Mining and Metals 18.
[39] Retrieved from International Council on Mining and Metals website (accessed on 15 December 2021).
[40] Srk news: Mine Closure: Can closure create opportunities? (2019) 1.
[41] Financial Concepts for Mine Closure (2019). International Council on Mining and Metals.
[42] Bizcommunity News. 2021. "Best practice mine closure achieved." 27 August 2021. Bizcommunity.
[43] Edwards & Maritz (2019) 311.
[44] *Ibid*.

the SDG agenda.[45]

## 2.4. SDGs and the mining industry

The SDGs pertinently offer the mining industry an avenue to rebuild trust in the mining sector[46] by realigning mining's endeavours with the values of society.[47] Imperatively, the SDGs offer mining companies an opportunity to benefit from improved relationships with communities and governments as well as greater access to financial resources if the mining companies commit to the SDGs.[48] Therefore, being orientated towards realising the SDGs is likely to help mine companies obtain their SLO from the communities in which they operate in as mine companies will be more aligned with the values of society. However, those that fail to meaningfully take part in realising the SDGs will consequentially put their operations in jeopardy in the short and long term.[49]

The SDGs are likely to offer more sustainable outcomes[50] as they are likely to influence more stakeholders to be willing to be part of collaborations as they resonate with the goals. This is accentuated by the fact that the SDGs have been agreed upon by a wide range of stakeholders such as national governments of UN member countries, civil society groups, development agencies, business and industry and ultimately reflects a shared agreement from a diverse group of stakeholders.[51] By parity of reasoning, community stakeholders may be more willing to collaborate with mining companies if the SDGs are the projected outcome as they present more tangible benefits to the community due to the fact that they are widely known and clear.[52]

## 2.5. Realising the SDGs in the context of mine closure

As an important cog, local context is a salient matter when it comes to mine closure. Mine companies need to analyse each relevant community and strategize with relevant stakeholders in order to sustainably develop each relevant community in its context. This is in essence what integrated mine closure is about and the SDGs are broad enough to bring forth some form of positive sustainability change whether the mine company finds itself in a developed or developing country.

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[45] Fraser, J. (2019). "Creating shared value as a business strategy for mining to advance the United Nations Sustainable Development Goals." Vol. 6. *The Extractive Industries and Society* 789.
[46] *Ibid*.
[47] Fraser (2019) 790.
[48] Retrieved from United Nations website (accessed on 15 December 2021).
[49] *Ibid*.
[50] Fraser, J. (2021). "Mining companies and communities: Collaborative approaches to reduce social risk and advance sustainable development." Vol. 74. *Resources* Policy 2.
[51] *Ibid*.
[52] *Ibid*.

In a bid for greater clarity, an example of how integrated mine closure and post-closure initiatives have realised the SDGs is the example of Ivanhoe's Kamoa-Kakula mine in southern DRC. Ivanhoe established a sustainable livelihoods project around 14 communities (SDG 11) surrounding the Kamoa-Kakula mine.[53] To Illustrate integrated mine closure in practice, Ivanhoe had early engagements (SDG 17) and began mine closure during the early development phase of their Kamoa-Kakula mining operations.[54] As early as this stage, Ivanhoe had already handed over a number of the initiatives to the communities who have been operating them without the assistance of the mine (SDG 8).[55] Ivanhoe only makes sure to monitor the implementation progress.[56] The design of this programme by Ivanhoe has witnessed environmental conservation through resource-efficient agriculture (SDG 12) and rehabilitation through tree-planting to combat degradation (SDG 15).[57] Farmers were taught to build resilience against eventual mine closure through irrigation techniques and market gardening (SDG 9) for an all-year round food production (SDG 2). Furthermore, solar-powered dryers (SDG 7) are being utilised for the storage of vegetables and fruits.[58] This example serves as a highlight of how integrated mine closure can contribute to the SDGs.

## 2.6 The need for mine closure in relation to the SDGs from a legal-framework perspective

A clear example of a legal framework which has improved its mine closure provisions to address many challenges that the SDGs seek to solve is the newly proposed Mines and Minerals Amendment Bill of Zimbabwe.[59] Zimbabwe is a big player in Sub-Saharan Africa and will likely continue to be a big player due to its Platinum and Gold reserves as well as its large reserves for battery minerals.[60]

The current Mines and Minerals Act of 1961[61] is an outdated legislation and does not ensure closure and rehabilitation provisions and therefore does not cover vital SDG objectives. The outdated legislation does not adequately ensure the protection of people, and environmental aspects such as the land itself as well as the flora and fauna of an area. This pre-SDG era legislation does not include a fund with an amount of capital to be set aside for mine closure and rehabilitation purposes and

[53] Edwards & Maritz (2019) 314.
[54] *Ibid*.
[55] *Ibid*.
[56] *Ibid*.
[57] *Ibid*.
[58] *Ibid*.
[59] Mines and Minerals Amendment Bill - H.B. 19, 2015.
[60] Retrieved from the International Trade Administration website (accessed 24 March 2023).
[61] Mines and Minerals Act of 1961.

this is one of the reasons why communities have suffered from the adverse impacts of mining.[62]

The Mines and Minerals Amendment Bill of Zimbabwe impressively illustrates a progressive prioritisation of mine closure and as a result- a prioritisation of the SDGs. The Bill is more legally prescriptive and includes a number of environmental management bench marks as well as a fund that is to be set aside for mine closure and rehabilitation under the "Safety, Health and Rehabilitation Fund".[63] The "Safety, Health and Rehabilitation Fund" will be used to rehabilitate the environment from mine fires and explosions, chemicals spillages, water contamination and tailing and waste dump breaches amongst other health, safety and rehabilitation concerns.[64] Schedule 2 of the Bill also has clear and prescriptive standards on how riverbed mining should be done in efforts to protect the environment from irreparable damage.[65] All the new mine closure provisions that are found in the new legislative framework Bill assist in contributing to the realisation of the SDGs.

## 2.7 Conclusion

The objective of this chapter was to discuss the concept of integrated mine closure, its beneficial elements in regards to the SDGs and ultimately why mine closure should be prioritised. The salient characteristics that define mine closure have been outlined. The chapter has also discussed integrated mine closure's crucial interplay with the SDGs and how the mine industry can benefit from such an interplay.

The literature reviews illustrate that integrating mine closure initiatives into the life of the asset (LoA) is crucial in making a difference as it empowers the community through creating shared value and assists in advancing the SDG agenda. The clear and crucial positives of integrated mine closure as discussed in this chapter warrant for mine closure to be prioritised even to the extent of mine closure being included in legal frameworks. Furthermore, it has been illustrated that incorporating integrated mine closure as early as possible is imperative.

The next chapter will explore how integrated mine closure and post-closure can contribute to the social group of the SDGs.

[62] Nyabereka, F & Moyo, M. (2020) *Making the Rules.* Africa Legal.
[63] Mines and Minerals Amendment Bill - H.B. 19, 2015 sec 41.
[64] *Ibid*.
[65] Mines and Minerals Amendment Bill - H.B. 19, 2015 sched 2.

## CHAPTER 3:

## THE CONTRIBUTION OF MINE CLOSURE IN REALISING THE SOCIAL GROUP OF THE SDGS

### 3.1. Introduction

The objective of chapter 3 is to examine how integrated mine closure and post-closure contribute to the social group of the SDGs. Therefore, the following sections will discuss how mine closure contributes in realising the SDGs that are found in the social group. The SDGs that will be discussed under the social group are SDG 1- no poverty, SDG 2- zero hunger, SDG 3- good health and well being, SDG 4- quality education, SDG 5- gender equality, SDG 10- reduced inequalities, SDG 16- peace, justice and strong institutions and SDG 17- partnerships for the goals. The chapter will conclude in Section 3.10 by summarising the chapter findings and addressing the question of whether mine closure contributes to the social group of the SDGs and should be prioritised.

### 3.2. The contribution of mine closure in realising SDG 1- no poverty

When it comes to integrated mine closure and post-closure's ability to aid in "ending poverty in all its forms everywhere"[66], it then becomes critical not only that a mine has closure and sustainability in mind by hiring locally when it comes to employment but that the mine assists employees and residents in alternative employment and skills once extraction and mineral processes cease.[67]

"Detailed reskilling and training" programmes are important in eradicating poverty as it can be a way of building economic resilience against mining being the sole source of income.[68] As explicated in ICMM's Closure Maturity Framework, the goal and aim in closure is for local procurement and local employment strategies as well as training development programmes to be designed in such a way that they support the diversification of the economy beyond extractive sector dependent industries.[69]

In order to forestall and eradicate poverty, integrated mine closure has to give its residents assurance of alternative employment, or at a minimum, the skills that are required to work in other industries after mine closure.[70] This is an important way to sustainably end poverty as it improves the functional literacy of the mine labourers whilst ensuring that they will be marketable in the job

[66] Retrieved from United Nations website (accessed on 28 December 2021).
[67] Hilson, G. & Murck, B. (2000). "Sustainable development in the mining industry: clarifying the corporate perspective." Vol. 26. *Resources Policy* 230.
[68] Closure Maturity Framework (2020) 22.
[69] See *id* at 14.
[70] Hilson, G. & Murck, B. (2000) 230.

market.[71] The goal here essentially becomes ensuring that the post-mine land use supports each other with the social and economic transition.[72]

A case in point is the Picadilly mine in Sussex which found itself closing due to a crash in the world potassium prices in the year 2016.[73] This case illustrates how to create strong and resilient communities by transforming finite resources into more sustainable human capital.[74] The mining company did this by significantly improving the skills of the local workforce and ultimately benefitting Sussex.[75] The mining company developed mechanical and electrical skills applicable in other industries, like welding, renewable industry, surveying, land rehabilitation and mechanics.[76]

The mine company created a work time table by which the mine workers worked for four days and then took four days off, allowing them to engage in other economic activities such as mechanical and agricultural activities.[77] This inevitably helped diversify their skillset and diversify the economy which resulted in the mine workers being hired by other businesses in the region after closure.[78] An example that venerates this, is how a local bakery and distribution business has benefitted by employing 80 people with an excellent work ethic which has resulted in its growth by 50 per cent since the closure of the mine.[79]

Another example of economic diversification and the eradication of poverty through sustainable means is the Wieliczka Salt Mine in Poland which has managed to maintain 440 jobs from the mine and created a further 200 jobs for the needs of tourism.[80] Wieliczka Salt Mine has repurposed itself as a "tourist route" and is now a historic monument as well as a UNESCO (The United Nations Educational, Scientific and Cultural Organization) World Heritage Site.[81] This case shows an appreciation of socio-economic aspects which aim to sustain the growth of mining regions through post-closure initiatives.

### 3.3. The contribution of mine closure in realising SDG 2- zero hunger

Mine closure and post-closure initiatives can accord with the register of ending hunger, achieving

[71] *Ibid*.
[72] Closure Maturity Framework (2020) 14.
[73] Syahrir, R., Wall, F. & Diallo, P. (2021) 5.
[74] *Ibid*.
[75] See *id* at 7.
[76] *Ibid*.
[77] See *id* at 5.
[78] *Ibid*.
[79] *Ibid*.
[80] Wirth, P., Mali, B.C & Fische, W. (Eds.). (2012) 139. *Post-Mining Regions in Central Europe Problems, Potentials, Possibilities*. Oekom.
[81] *Ibid*.

food security and improved nutrition, and promoting sustainable agriculture[82] by supporting the development of local entrepreneurship in agribusiness and by developing programmes that encourage value chain activities in farming activities that already exist.[83] Another way in which mine closure and post closure initiatives can contribute to SDG 2 is by strengthening the linkages between smaller farmers and the larger farmers, strengthening linkages to more market-oriented farming operations to grow staple foods and ensuring that they are able to sell their surpluses on the local, national and regional markets.[84]

Mine closure and post-closure initiatives can further contribute to SDG 2 by improving the overall business climate of an area such as improving the crippling effects of market fragmentation, proper investments in hard and soft infrastructure, innovative technologies, farming models that are more business friendly, warehousing and storage capacity.[85] All this can assist in increasing sustainable food production whilst fostering resilient agricultural practices within a region.

An exemplification of such initiatives is Barrick Gold's project in Cuncashca Peru which trained the community by integrating modern farming, livestock and dairy practices with the fundamentals of business development.[86] A new water management infrastructure was installed to help cultivate grasslands for cattle grazing and to improve irrigation which resulted in a significant increase in the crop production.[87] The cattle herd was strengthened by way of genetic improvement as local dairy cows were cross-bred with Brown Swiss bulls and this has resulted in 250 cattle being genetically improved and further resulting in the significant increase in milk production.[88] Furthermore to create a more conducive environment for animal breeding Corrals were installed for the livestock. A new dairy plant owned by families in the village was also built in order to manufacture milk and dairy products such as milk, cheese, butter, ice creams and yogurt.[89] The result of this project has created new markets in a variety of areas and the average monthly household income has leaped from $46 in 2002 to $166 in 2008.[90] Production increased so much that 4,200 litres of milk was produced per month in 2008, and between 2005 and 2007 the cheese production increased 400%.[91] These initiatives form part of post-closure initiatives as the water management infrastructure will be present beyond the life of the mine and will continue to bolster and encourage a more sustainable

[82] Retrieved from United Nations website (accessed on 29 December 2021).
[83] Ramdoo, I. (2013). "Fixing Broken Links: Linking extractive sectors to productive value chains." *European Centre for Development Policy Management* 10.
[84] See *id* at 12.
[85] *Ibid*.
[86] See *id* at 11.
[87] *Ibid*.
[88] *Ibid*.
[89] *Ibid*.
[90] See *id* at 12.
[91] *Ibid*.

way of living. Furthermore, the community has been equipped with modern farming practices and skills which can be transferred to future generations.

Another representative case is that of Newmont Ghana Gold's ahafo agribusiness growth initiative (aagi); where they partnered with the NGO African Connections Ghana in a project that helped improve the productivity and product quality of agricultural activities whilst adding economic value independent of mining activities.[92] Farmers were introduced to new crops and a variety of crops with high market potential.[93] Farmers were trained on industrial procurement standards and export requirements for the production of five crops that have high productivity potentials and ready markets, specifically, soybean, ginger, chilli pepper, maize, and plantain.[94] The project was successful in creating a network among suppliers of markets and farmers resulting in almost 200 farmer groups being formed in eight communities and the total participation of farmers standing at 2, 647.[95] This project is a post-closure initiative which has helped contribute to the sustainability of communities post the life of a mine. This project has done that by training farmers not just in farming specific crops but in operating farming value chains and generating sustainable economic value that will continue long after the mine is no longer in operation.

A further example is the Catemu agricultural project of Chile implemented by the Anglo American Chagres Copper Smelter which was aimed at supporting skills and self-sustaining techniques for goat and bee honey producers in the region of Catemu.[96] The mine company provided assistance to small goat producers through a breeding plan. Initiatives included crossbreeding with the goal of improving the genetic quality of the production of milk and meat. The company also improved the productive practices of the herdsmen and the quality of the cheese. 300 people were trained in two years and in 2005, the company assisted in the marketing of farm products by launching the Lomas brand.[97] The initiatives by the company also included bee keeping and the company assisted in cutting diseases in bees by 30%.[98] These skills and self-sustaining techniques taught by the mine company form part of post-closure initiatives as they are sustainable skills that are future-orientated and contribute towards human and social capital.

### 3.4. The contribution of mine closure in realising SDG 3- good health and well being

The OECD's (Organisation for Economic Co-operation and Development) well-being framework

[92] See *id* at 11.
[93] *Ibid*.
[94] *Ibid*.
[95] *Ibid*.
[96] See *id* at 12.
[97] *Ibid*.
[98] *Ibid*.

indicates emerging international consensus that health status is one of the outcomes which contribute to people's well-being.[99] Health is essential for life and for achieving other well-being dimensions due to the fact that it defines people's ability to work and generate an income as well as to participate in social life, education and civil activities.[100]

Responsible mines implement Social and Environmental Management Systems to manage negative impacts on community health and well-being. These responsible mines, through integrated mine closure are able to contribute to a no nett loss in community health and well-being. There are also instances in which effective mine closure planning enables community members to realise enhanced levels of well-being beyond the life of a mine through various ways.[101] Mine closure and post-closure initiatives can help fund and improve health services and infrastructure and this can contribute to the health and well-being of a community over a long period of time.[102] Integrated Closure initiatives can bolster community health activities by combating communicable diseases and reducing the mortality of non-communicable diseases which also impacts the health of communities in the long term.[103] Integrated closure can help ensure adequate medicines and emergency services as well as work with clinic committees in strengthening the dialogue on health care.[104]

An example in point is De Beers disease management programme which addressed a need of society through its created shared value approach and contributed to sustainability through integrating a disease management programme in its operations. De Beers did this through a voluntary HIV/AIDS study in 2001 which indicated that 35 percent of Debswana employees had tested positive for HIV with the actual infection rate possibly being much higher.[105] This was the first comprehensive disease management programme in southern Africa and it offered free anti-retroviral treatment to the employees of the company and their spouses.[106] De Beers managed to positively utilise the intersection between the needs of society and the needs of the company as it collaborated with NGOs, health care providers and community organizations.[107] The programme can be regarded as a form of social closure as the programme managed to curb long-term, adverse social impacts within

[99] Enhancing well- being in mining regions: key issues and lessons for developing indicators (2019). The Organization for Economic Cooperation and Development 6.
[100] See *id* at 18.
[101] Morrison-Saunders, A., McHenry, M. P.., Rita Sequeira, A., Gorey, P., Mtegha, H & Doepe, D. (2016). "Integrating mine closure planning with environmental impact assessment: challenges and opportunities drawn from African and Australian practice." *Impact Assessment and Project Appraisal* 3.
[102] EQUINET (TARSC), SATUCC, Benchmarks Foundation, SADC CNGO. 2018. "Advancing public health rights, claims and standards in mining, Report of a Side Session at the Alternative Mining Indaba." 10 September 2021.
[103] *Ibid*.
[104] *Ibid*.
[105] Fraser, J. (2019) 789.
[106] Retrieved from De Beers Group website (accessed 15 December 2021).
[107] Fraser, J. (2019) 790.

the communities and continues to be a great aid in the region post-closure.[108]

In Ghana, AngloGold Ashanti assisted in the combatting of the lethal disease- malaria by way of malaria control programme in 2005.[109] AngloGold Ashanti's integrated control programme managed to reduce the rate of worker absentees by 50 per cent over two years and to decrease the infection rates by 72 per cent.[110] In 2014, after nine years, the hospital was treating less than 100 cases of malaria in a month. This case illustrates how a company can contribute to the improved health of the region as AngloGold Ashanti established the Obuasi Malaria Control Centre and laboratory facilities which can be regarded as a form of social closure as the programme continues to be a great aid in the region.[111] The long-term positive social impacts can be seen through the mine's address of operational issues as the mine managed to build the capacity of health workers and establish skills that would serve the community beyond the life of the mine.

### 3.5. The contribution of mine closure in realising SDG 4- quality education

Integrated mine closure and post-closure initiatives have played a strong role of ensuring inclusive and quality education in the recent past. Mine companies can contribute to quality education and ultimately sustainable development by assisting people with vocational programmes and higher education opportunities such as scholarships as well as building schools and other forms of educational infrastructures. Educational and skills development programmes can offer broader and more equal access to local communities by systematically transforming finite mineral resources and accelerating human capital.

A good example of how integrated mine closure and post-closure initiatives can contribute to quality education can be seen in South32 Hotazel Manganese Mines' Social labour plan (SLP) when they handed over the newly-built Rearata Primary School to the Northern Cape Department of Basic Education in Vergenoeg Village.[112] The school comprises of 14 newly-built classrooms with a total capacity of 500 learners, a learning centre dedicated to Grade R, a fully-equipped computer centre, a library, an administration block, ablution facilities and a nutrition block that provide meals for the learners.[113]

South32 Hotazel Manganese Mines in the Northern Cape also support other education projects such

[108] *Ibid*.
[109] *Ibid*.
[110] *Ibid*.
[111] AGA Malaria and PublicPrivate Partnerships in Ghana's Health Sector to Obtain Value from Extractives Projects. (2016). African Natural Resources Centre.
[112] Bizcommunity News. 2022. "South32 hands over newly-built school to the Department of Basic Education". 15 March 2022. Bizcommunity.
[113] *Ibid*.

as a robotics programme which is currently rolled out through 12 schools and also facilitates a Science and Maths programme offering extra lessons to high school learners that are within the district.[114] Such initiatives are imperative as they ensure sustainability beyond the mine by improving the quality of the lives of host communities through education.

Another instance of mine closure and post-closure initiatives contribution towards quality education can be seen in the case of MMG Lane Xang Minerals Limited Sepon Mine's (LXML) assistance to high school graduates in Vilabouly district by way of a two-year Business Administration Traineeship and as a result, 41 trainees have managed to complete the programme since it began in 2006.[115] On October 2014, eight graduates were granted Diplomas in Business and Management from Savannakhet Technical and Vocational College.[116] Empowering individuals through skills training and other forms of education is one of the ways in which a mine can make a sustainable contribution within and close to the communities that they operate.

MMG (LXML) has further made a positive educational difference in the district by giving the students an opportunity to study further at universities by handing fourteen scholarships to the best graduating students and have assisted twenty students from fourteen villages with educational packages.[117] Closure initiatives that occur through the vehicle of education can empower individuals to get out of poverty and have a better future.

### 3.6. The contribution of mine closure in realising SDG 5- gender equality

Integrated mine closure and post-closure initiatives can contribute to the sustainable development goal of gender equality by accelerating the progress of those that are furthest behind and in this case that being women and girls. Mine companies can take on various initiatives that empower women and girls whilst conversely combatting discrimination and violence whether in the workplace or in social settings. Mine companies can assist through post-closure initiatives by systematically empowering women into decision-making positions in their local spheres.

The Rio declaration also valorises the impulse of empowering women as a form of sustainable development and ultimately contributes to realising SDG 5 through principle 24.[118] Principle 24 which is in line with SDG 5 advocates for girls to be given equal rights to education, employment and careers to be opened up to women, for women to be allowed to fully participate in social, cultural

[114] *Ibid*.
[115] Retrieved from MMG website (accessed 15 December 2021).
[116] *Ibid*.
[117] Retrieved from LXML website (accessed 15 December 2021).
[118] The Rio Declaration on Environment and Development (1992). United Nations.

and public life and to erase all negative stereotypes and prejudices towards women.[119]

A case from Cerro San Pedro in Mexico has seen New Gold's mine implementing an Integrated Closure Program designed on the basis of a Social Impact Assessment (SIA) which contributes to gender equality. The company has to a large extent focused on the much needed and fragile economic environment through economic diversification by empowering the vulnerable which mainly includes the women of Cerro San Pedro. New Gold's Cerro San Pedro mine went about doing this by collaborating with five organisations and providing about 429 skills-training hours in eight local communities.[120] These programs involved 384 people in total and 90% of the people were local women.[121]

Another example is Thiess' woman in senior management policy; in 2013, Thiess implemented a Woman in Mining company policy by which it sustained and accelerated the flow of woman into senior management positions and other non-traditional roles and made sure to create and uphold an atmosphere that regards highly the potential of women at all kinds of levels.[122] The Woman in Mining company policy also involves programmes for parental leave and consistent gender pay equity reviews.[123]

Another instance is Goldcorp's Professorship in Women in Engineering where Goldcorp has gone about levelling the gender disparities and accelerating the progress of those that are behind in terms of gender equality through the mining and engineering fields at University level. Goldcorp has done this by donating C$500,000 in 2014 to the University of British Columbia on International Women's Day with the aim of setting up the Goldcorp Professorship in Women in Engineering.[124] The programme includes increasing the female proportion from 20% to 50% in the engineering faculty within the next five years and the programme also aims to promote women in engineering through recruitment strategies and marketing women in engineering to parents and high school students.[125]

### 3.7. The contribution of mine closure in realising SDG 10- reduced inequalities

Labonne has argued that mining can foster sustainable development if the rent that is accrued is used to reinvest into sustainable economic initiatives.[126] Integrated mine closure and post-closure is

[119] *Ibid*.
[120] Everingham, J., Svobodova, K., Mackenzie, S., Witt, K. (2020). "Participatory processes, mine closure and social transitions." *Centre for Social Responsibility in Mining* 13.
[121] *Ibid*.
[122] Mapping Mining to the Sustainable Development Goals: An Atlas (2016) 31.
[123] *Ibid*.
[124] *Ibid*.
[125] See *id* at 32.
[126] Hilson, G. & Murck, B. (2000) 230.

one brilliant way in which mine companies can assist in such reinvesting initiatives and assist in reducing economic inequality within the local communities in which they operate. Integrated mine closure and post-closure is a propitious stage to assist the locals of an area as they are the ones that are most impacted by mining operations.

The best way to reduce inequalities through closure initiatives is to implement social investment and capacity-building programmes that target marginalised and disempowered people with the goal of empowering them to be able to live independent of the mine. This point is well articulated by the Centre for Social Responsibility in Mining (CSRM) when it says:

*"Mining companies routinely invest in communities and have increasingly moved from random sponsorships and donations to more strategic investment. A key consideration in determining whether investments are strategic or not is the extent to which they create dependency or have the potential to eventually provide benefits independent of the mining company."*[127]

Mine companies should tailor their closure initiatives in a context-sensitive manner with the goal of empowering the under-represented and the vulnerable in such a way that they are not dependent on the mine. Context is important when reducing inequalities as different communities may have different problems and different vulnerable groups in a community such as indigenous people whose rights may need to be recognised and uplifted. In order to adequately reduce inequalities, mine companies should go about doing closure through a community-orientated lens based on collaborative dialogues focussing on local and regional priorities; this means that the starting point should not be the politics of permitting but the community and what it needs.[128]

A case in example is Teck's Sullivan mine in Kimberley where Teck contributed to reducing inequality in the city of Kimberley by including indigenous people and the local community in co-creating strategies for the post-closure land use which ultimately became a tourism and recreation destination.[129] Inequalities were reduced through repurposing from mining to a tourism-based economy and the economic impact of the pending closure was mitigated thanks to Teck's training opportunities and career transition plans which involved reducing inequalities amongst the locals.[130]

Another reason that helped the Picadilly mine in the Sussex region cope with sudden mine closure and maintain sustainable development was the mine's integrated closure strategy of maximising its local contributions to the community by buying more than 52% of its services and supplies locally

[127] Everingham, J., Svobodova, K., Mackenzie, S., Witt, K. (2020) 14.
[128] Owen, J, R. & Kemp, D. (2013). "Social licence and mining: A critical perspective." Vol. 38. *Resources Policy* 34.
[129] Integrated Mine Closure: good practice guide (2019) 22.
[130] *Ibid*.

such as truck and auto parts, basic machinery, equipment and contract labour.[131] These linkages managed to reduce inequalities by triggering other economic and social activities such as the hospital, the local agricultural sector and the schools that served 25 000 people within the region and therefore managed to mitigate the impacts of mine closure.[132]

## 3.8. The contribution of mine closure in realising SDG 16- peace, justice and strong institutions

Integrated mine closure and post-closure initiatives can contribute to Peace, Justice and Strong Institutions by actually delivering adequate mine closure in a way that aligns with community visions and addresses their needs. As has been the case before, failure to do adequate closure can precipitate a furore among the communities and can lead to unpeaceful environments filled with dissatisfaction and a possibility of spiralling into violence. Conversely, adequate closure through integrated and post-closure initiatives can make an environment more peaceful, more willing to adhere to the rule of law and can encourage stronger institutions within an environment than was previously the case. Therefore, integrated closure and post-closure initiatives can create peace through innovative social and economic development that makes inclusive societies for sustainable development.

In line with the OECD, Blum defines peacebuilding as:

> [Peacebuilding] includes activities designed to prevent conflict through addressing structural and proximate causes of violence, promoting sustainable peace, delegitimizing violence as a dispute resolution strategy, building capacity within society to peacefully manage disputes, and reducing vulnerability to triggers that may spark violence.[133]

Authors have extended this definition to include mitigation of both violent and non-violent conflict.[134] For peace to occur during integrated mine closure and post-closure initiatives; communities have to be the focus of the initiatives. If this is not the case then the relationship between mining companies and communities can lead to unrest in a region and compounded negative outcomes such as loss of life, relational rupture, damaged property, reputational damage, lost income, injury, legal complications, lost development opportunities for both parties and environmental damage.[135]

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[131] Syahrir, R., Wall, F. & Diallo, P. (2021) 5.
[132] *Ibid*.
[133] United States of America (2011). Improving Peacebuilding Evaluation: A Whole-of-Field Approach. United States Institute of Peace 2.
[134] Bellamy, A., Williams, P & Griffin, S. (2006). *Understanding Peacekeeping*. Polity.
[135] Bond, C, J. (2014). "Positive peace and sustainability in the mining context: beyond the triple bottom line."

Nonetheless, integrated mine closure and post-closure initiatives can contribute in making an environment more peaceful than it was before by doing adequate consultations with communities,[136] being transparent to the communities in all undertakings, through participatory water monitoring[137] as well as through mine development agreements[138] as progress and development within communities often brings about contentment.

An example of community consultation can be seen in the case of Pasminco's Broken Hill Mine, where closure has been addressed in a systematic manner by which proper communication and consultation has taken place with the community whilst the mine still had another five years to go.[139] The mine has approached community engagement and consultation in such a way that it has been "a life-of-mine principle", being transparent and honest with its dealings with the community and this has resulted in mining at Broken Hill proceeding without serious interruptions for almost 120 years.[140] When consultation and communication are integrated into operations with the end goal of closure in mind, this often results in little to no issues and paves way for sustainable peace within that community. It is also important to provide adequate notice of closure as much as possible as that also increases the chances of peaceful transitions.

### 3.9. The contribution of mine closure in realising SDG 17- partnerships for the goals

Integrated mine closure and post-closure is an archetypal stage to realise co-production and cooperation in collaborative endeavours as a way of achieving SDG 17. The process of "co-production" is an important approach for social closure as it can be an opportunity for companies to partner with stakeholders such as civil society, local government departments and communities when making decisions on projects.[141] Co-production that involves the community results in increased community satisfaction, a greater sense of local ownership, increased innovation and increased efficiency which all leads to more resilient and cohesive communities, however, in order for this to actualise, coproduction must be integrated in mining processes well in advance of actual closure.[142]

Collaborative partnerships are important as they may be the only way to solve complex social issues

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[136] See *id* at 168.

[137] Participatory water monitoring: a guide for preventing and managing conflict (2008). Compliance Advisor/Ombudsman.

[138] Gibson, G & O'Faircheallaigh, C. (2010) 48. I*BA Community Toolkit: Negotiation and Implementation of Impact and Benefit Agreements*. Walter & Duncan Gordon Foundation.

[139] Laurence, D. (2006). "Optimisation of the mine closure process." Vol. 14. *Journal of Cleaner Production* 296.

[140] *Ibid*.

[141] Edwards, J. & Maritz, A. (2019) 311.

[142] *Ibid*.

that are at the root of market failures;[143] especially in the extractive industry. ICMM principles which serve as an elucidation of leading practice endorse partnership and inclusive consultation with local communities as articulated in ICMM Principle 9.1 by requiring member companies to:

*"Implement inclusive approaches with local communities to identify their development priorities and support activities that contribute to their lasting social and economic wellbeing, in partnership with government, civil society and development agencies, as appropriate."*[144]

The case of Newmont-Mt McClure gold project epitomises the significance of cooperative partnerships in regard to successful mine closure as the Newmont-Mt McClure management team went on to be recognised with the Golden Gecko Award for Environmental Excellence in 2004 as they effectively engaged and consulted with relevant stakeholders.[145] Mt McClure consulted with a number of broad categories of stakeholders to exemplify their appreciation of cooperative partnerships; these stakeholders included:[146]

- Indigenous people;[147]
- Regulators;[148]
- post-closure land users;[149]
- industry peers;[150]
- universities;[151]
- consultants;[152]
- contractor selection and management;[153]
- operational level personnel;[154]
- owners of the corporate entity;[155]

[143] Fraser, J. (2019) 789.
[144] Mining Principles Performance Expectations (2022). International Council on Mining and Metals 10.
[145] Australia (2006). Mine Closure and Completion. Department of Industry, Tourism and Resources. The Commonwealth of Australia 44.
[146] *Ibid*.
[147] *Ibid*.
[148] *Ibid*.
[149] *Ibid*.
[150] *Ibid*.
[151] *Ibid*.
[152] *Ibid*.
[153] *Ibid*.
[154] *Ibid*.
[155] *Ibid*.

- members of the wider closure project dealing with human resources, safety, care and maintenance management.[156]

Sibelco sand-mining on Stradbroke Island, Australia, is another example in which partnerships and adequate consultation were done throughout the closure process. The consultations included the indigenous Quandamooka and resulted in opportunities to participate in online surveys, public meetings, written submissions and open-ended commentary.[157] The collaborative strategies involved traditional owners, business operators, State and local governments on the island, residents and environmental and conservation groups, mine workers, the mining company and the tourism and fishing industries in a partnership strategy that lead to an economic transition.[158]

Partnerships have proven to be important in aiding the handing over process. CSRM questions the "in perpetuity" term usually associated with post-mining obligations as a lack of ability to define end points as the term fails to address companies that are no longer active in an area, no longer have a presence in the relevant jurisdiction, or have ceased to exist completely.[159] Newmont- lead-zinc Woodcutters Mine illustrates the importance of partnerships in avoiding such horrible predicaments; as the partnerships by Woodcutters mine lead to agreements with the traditional owners of the land by which the actions taken (decommissioning, rehabilitation and monitoring activities) supported proper handing over.[160] Newmont's lead-zinc Woodcutters Mine was able to realise SDG 17 through the pursuance of adequate mine closure.

## 3.10. Conclusion

The objective of this chapter was to determine how integrated mine closure and post-closure can contribute to the social group of the SDGs. As explored through the chapter, this chapter has indicated that integrated mine closure and post-closure initiatives when done properly can largely contribute to the social group of the SDGs. As explicated by the chapter; in order to realise the social group of the SDGs, a company has to focus and give proper attention to the well-being of people; there are more effective results as far as sustainability is concerned if the starting point of integrated mine closure is people and not the politics of permitting.

This chapter also highlighted that integrated closure is an iterative process that requires early engagements with communities in order to contribute to the SDGs and achieve best outcomes. The chapter has also indicated that created shared value approaches are imperative and can serve to

[156] *Ibid*.
[157] Everingham, J., Svobodova, K., Mackenzie, S., Witt, K. (2020) 11.
[158] *Ibid*.
[159] See *id* at 14.
[160] *Ibid*.

realise key concepts such as co-production, cooperation and partnerships.

The next chapter explores how integrated mine closure and post-closure can contribute to the economic group of the SDGs.

## CHAPTER 4:

## THE CONTRIBUTION OF MINE CLOSURE IN REALISING THE ECONOMIC GROUP OF THE SDGS

### 4.1. Introduction

The objective of chapter 4 is to examine how integrated mine closure and post-closure contribute to the economic group of the SDGs. Consequently, the following sections will discuss how mine closure contributes in realising the SDGs that are found in the economic group. The SDGs that will be discussed under the economic group are SDG 7- affordable and clean energy, SDG 8- decent work and economic growth, SDG 9- industry, innovation and infrastructure, SDG 11- sustainable cities and communities and SDG 12- responsible consumption and production. The chapter will conclude in Section 4.7 by summarising the chapter findings and addressing the question of whether mine closure contributes to the economic group of the SDGs and should be prioritised.

### 4.2. The contribution of mine closure in realising SDG 7- affordable and clean energy

As a point of departure, mine closure and post-closure initiatives can play a very meaningful role in the realisation of SDG 7 by utilising closure initiatives as clean-up activities which ultimately assist in realising affordable and clean energy in areas that could have easily become wastelands.[161] Furthermore, post-closure initiatives can be utilised for clean energy technologies to support a transition to a low-carbon future as minerals such as lithium and copper can be harnessed in the production of wind turbines, solar panels, electricity networks and electric cars.[162] As the transition to clean energy accelerates; mine companies can play their part when possible by utilising the previously mined areas as an opportunity to facilitate renewable energy initiatives.

Nolwazi Sokhulu underscores this point by noting that:

> *"What is attractive about abandoned mines is often their proximity to electricity infrastructure such as substations and transmission lines, as well as road and transport infrastructure. The existence of infrastructure can lower renewable energy project costs."*[163]

As explicated above, without of course the need for the mine to be abandoned; is the valuable point that a mine's proximity to various infrastructure can be an opportunity to leverage on the already

[161] Sokhulu, N. 2016. "Bringing life to old mines through clean energy." 08 November 2016. *DNA Economics.*
[162] Nakanwaji, S. (2021) *Mine Closure and Justice implications*. Indian Journal of Projects, infrastructure and Energy Law (IJPIEL).
[163] Sokhulu (2016).

built infrastructure and to further build renewable energy infrastructures.

From being referred to as the "missing" MDG; energy has been increasingly reckoned as underpinning economic and social development and as a necessary means to end poverty and to decouple its adverse impacts.[164] Mine closure and post-closure initiatives can play a crucial role in embracing sustainable and affordable energy which is one of the central themes of the SDG 2030 agenda as envisioned in the preamble which calls for "universal access to affordable, reliable and sustainable energy".[165]

A representative case is that of a German coal mine in Leipzig which managed to utilise its post-closure initiative on an open-cast operation and realised SDG 7 by taking advantage of the exposed and expansive area when it decided to deploy solar energy in the area.[166] The German coal mine of Leipzig built a solar power plant with 5 megawatts (MW) of installed capacity which was one of the largest at the time and this solar plant is able to supply power to 1800 households.[167]

Another example of an integrated mine closure and post-closure initiative that managed to contribute to SDG 7 is the case of a mine clean-up operation by Chevron Questa Mine in New Mexico which constructed a 1MW concentrated photovoltaic facility on a mining tailings dam.[168] This solar field engendered by Chevron Questa Mine comprises 173 solar trackers of about 18 feet by 21 feet in size and covers about 20 acres and is enough to power about 300 New Mexico homes.[169]

Casselman wind power project in Pennsylvania is another example of a post-closure initiative that has contributed to SDG 7 through renewable energy. This Large-scale wind energy project was deployed on a former mine site with eight of the project's 23 wind turbines sitting on top of a rehabilitated surface mine.[170] The wind power project has a capacity of 34.5 MW and is able to power up to 8000 homes and supports the local economy by way of lease payments to landowners and has managed to create local employment.[171]

## 4.3. The contribution of mine closure in realising SDG 8- decent work and economic growth

[164] Nerini, F, F., Tomei, J., To, L, S., Bisaga, I., Parikh, P., Black, M., Borrion, A., Spataru, C., Broto, V, C., Anandarajah, G., Milligan, B & Mulugetta, Y. (2018). "Mapping synergies and trade-offs between energy and the Sustainable Development Goals." Vol. 3. *Nature Energy* 10.
[165] *Ibid*.
[166] Sokhulu (2016).
[167] *Ibid*.
[168] *Ibid*.
[169] *Ibid*.
[170] Retrieved from Way Back Machine website (accessed 10 January 2022).
[171] Sokhulu (2016).

Integrated mine closure and post-closure initiatives can contribute to decent work and economic growth through the clusters and linkages that form around the mining value chain. These linkages and clusters can ultimately serve as a pathway to economic diversification as people further develop and grow various enterprises that can contribute to the economy and to employment. Pertinently, mine closure and post-closure initiatives can actively contribute toward establishing sustainable sectors that are able to stand independently from the operations of the mine.

Mine closure and post-closure initiatives can be used in part as skills development programmes to sustain industry and commerce sectors well after the mines close. Mine closure and post-closure land use can also serve to promote beneficial and sustainable tourism by repurposing the land in such a way that the activities are able to generate income.[172] Mine areas that are repurposed to become tourist attractions can play a vital role in accelerating economic growth and ensuring sustainable income over time.

Once again, mine companies and in this case through integrated mine closure and post-closure initiatives can utilise CSV approaches as a way to develop profitable business strategies that have parallel goals of improving business performances whilst delivering tangible benefits to society.[173] Local procurement and tourist strategies can propel economic diversification and aid in providing much-needed employment to the local communities.

The Llechwed Slate Caverns in Wales is an example of how a mine has been repurposed into a tourist attraction as a way of contributing to economic growth. From extracting half a million tonnes of slate per year by the end of the 19th century to being voted the Go tourist Attraction for the year 2019/2020; Llechwedd's Slate Mountain Adventure provides an experience through the historically significant quarry and provides a ride through an ex-military truck to the highest peaks of the 2,000 acre site.[174]

The tourist attraction facilitates visits to the vast quarries of Maenofferen, Diffwys Casson of the North West Wales Slate Landscape and is also a UNESCO World Heritage Site.[175] Tourists can enjoy taking pictures and creating memories with the encapsulating views of South Snowdonia including Snowdon itself, Moelwyn mountain range, Moel Siabod and the Irish Sea beyond.[176] Tourists can also enjoy being led 500 feet below the ground on Europe's steepest cable railway into the Llechwedd

[172] Integrated Mine Closure: good practice guide (2019) 21.
[173] Fraser (2019) 789.
[174] Retrieved from Llechwedd website (accessed 10 January 2022).
[175] *Ibid*.
[176] *Ibid*.

Deep Mine and can also enjoy the experience of an underground lake.[177]

A further example is that of the Mining Center of Faymoreau in France which decided to capitalise on its industrial past by launching a major tourist and cultural project as a way of reviving and developing the town.[178] The rehabilitation and repurposing initiatives have resulted in the setting up of a restaurant by the name “Hôtel des Mines”, and the opening of a museum at a former dormitory for glassmakers known as Site of the Community of Communes “Vendée Sèvre Autise”.[179] A lake has also been developed on the dike and a 6-hectare fishing spot accompanied by the construction of a communal pontoon.[180] Furthermore, a 12 km hiking circuit has also been established and is known as the "path of the mine" in connection with "Vendée Vélo".[181]

## 4.4. The contribution of mine closure in realising SDG 9- industry, innovation and infrastructure

Integrated mine closure and post-closure initiatives can be a propitious opportunity to build resilient infrastructure and promote innovative and sustainable industrialisation. Integrated mine closure and post-closure initiatives can contribute to major infrastructure projects within a community such as road and rail development, and the construction of infrastructure that makes a community more sustainable. As much as possible, a system of infrastructure-shared use or open-access use should be integrated into a community with closure in mind.

An integrated and shared-use regional economic approach in regard to infrastructure can be seen as a social capital investment by a community and can lead to the acceptance of a mining project.[182] Areas where mining exploits have been realised can be opportune places for innovative approaches to building infrastructure that is both physically and culturally resilient; this can as a result create an economic pull towards a certain geographic area.

The adaptation of the Katowice Hard Coal Mine in Poland is an example of innovation and industrialisation through geotechnical aspects and has led to the revitalisation of the post-mining area. This novel approach has assisted in preserving the industrial heritage of Katowice and Upper Silesia for future generations through the adaptation of historic facilities such as the engine room, lift tower and warehouse. This living museum of mining which combines existing infrastructure with the new and skilfully composed infrastructure attracts art connoisseurs and fans of industrial

[177] *Ibid*.
[178] Retrieved from Centre Minier website (accessed 10 January 2022).
[179] *Ibid*.
[180] *Ibid*.
[181] *Ibid*.
[182] Syahrir, R., Wall, F. & Diallo, P. (2021) 6.

tourism whilst protecting the valuable resources of the industrial culture and the identity of the mining city.

The Silesian Museum features the prominent mine shaft hoist tower of the former Katowice Coal Mine which operated for 176 years and hauled over 120 million tonnes of coal until 1999.[183] The steel structure has been adapted into an elevator that serves as a viewing tower; offering a spectacular view of Katowice and other close-lying Silesian suburbs.[184] The museum also features large transparent glass buildings offering a modern counterpoint to the 18th-century historical buildings which also make up the museum's exhibition space.[185]

The main museum is an adaptation of former shafts, tunnels and workshops of the Katowice Coal Mine and is made up of four underground levels with a floor area of nearly 25,000 m², of which 6,000 m² is devoted to exhibition space.[186] The exhibitions comprise of a Gallery of Polish Art made up of a collection of paintings by Polish and Silesian masters from 1800 – 1945 and the next exhibition is the Gallery of Non-professional art also known as 'naive art,' 'outsider art' or 'art brut' which is implicitly tied to Silesian history and identity as it has had a strong presence in Silesia since the industrial revolution.[187] The museum also has what is known as the Laboratory of Theatre Spaces exhibition which documents the history of costumes, lighting, staging in European theatre and scenery.[188] There is also a café in the new infrastructure set up which also further serves to boost the economy of the area.[189]

It is also important to note that a lot of infrastructure can remain valuable to a community once production ceases and a mine company can utilise this as an opportunity for a post-closure initiative by helping a community to self-mobilise and become independent of the company.[190] Iron Ore Company in Labrador, Canada managed to do this by selling a railway at a nominal sum to a company owned by three aboriginal groups and the company that bought the railway now operates a passenger and freight service on the railway line.[191]

## 4.5. The contribution of mine closure in realising SDG 11- sustainable cities and communities

[183] Retrieved from In your pocket website (accessed 10 January 2022).
[184] *Ibid*.
[185] *Ibid*.
[186] *Ibid*.
[187] *Ibid*.
[188] *Ibid*.
[189] *Ibid*.
[190] Everingham, J., Svobodova, K., Mackenzie, S., Witt, K. (2020) 26.
[191] *Ibid*.

It normally takes 10 to 20 years in order to build "sustainable, alternative livelihoods to mining" hence the need to integrate mine closure planning well in advance during the life of the mine.[192] It is important for mine closure initiatives to contribute to sustainable cities and communities through both physical rehabilitation and socioeconomic considerations and that these initiatives ensure the future safety, public health and beneficial use of the site to the affected communities in the long term.[193]

Appropriately so, we now live in times in which large institutional investors and financial institutions have high expectations for responsible mine closure; where track records are important and where institutions such as the Equator Principles Financial Institutions (EPFIs) in accordance with the Equator Principles may withhold financing and advising projects that do not embrace sustainability through adequate mine closure.[194] Pursuant of this fact, mine closure can therefore assist by fostering the continued support of economic investments by investors resulting in a greater probability for the occurrence of investments into sustainable cities and communities.

A case in point is how Vale contributed to the long-term sustainability in Thompson, Manitoba by forming the Thompson Economic Diversification Working Group (TEDWG) which helped witness the evolution of the area into an economically diverse urban centre thanks to Vale's partnership with the city leaders and the indigenous rights holders.[195] These multi-stakeholder dialogues helped identify specific funding in priority 'streams' which led to economic and infrastructure development through procedural and technical capacity building and ultimately resulted in opportunities for sustainable growth.[196]

Another example is how sustainable growth was realised at the former Hydro Aluminium Kurri Kurri Smelter site and the surrounding buffer lands through the Hydro Kurri Kurri Redevelopment Project; the project involved community members and local government in a redevelopment plan which utilised the local government Kurri Kurri District Strategy.[197] A sustainable approach was utilised for the 2000 hectare site which resulted in about 65 per cent of the land being utilised for conservation, 15 per cent for industrial use, 15 per cent for rural land and the final 10 per cent for residential utility.[198] This strategy has proven to be sustainable and long-term orientated; making sure that the community and city at large has a sustainable future which has been well prepared for and well

[192] Edwards & Maritz (2019) 311.
[193] Guidelines for the Implementation of Financial Surety for Mine Closure (2009). The World Bank 2.
[194] A financial industry benchmark for determining, assessing and managing environmental and social risk in projects (2013). Equator Principles 2.
[195] Integrated Mine Closure: good practice guide (2019) 45.
[196] *Ibid*.
[197] Everingham, J., Svobodova, K., Mackenzie, S., Witt, K. (2020) 25.
[198] *Ibid*.

planned.[199]

## 4.6. The contribution of mine closure in realising SDG 12- responsible consumption and production

Closure initiatives can contribute towards responsible consumption and production through better management of production and supply chains whether it be in regard to reducing chemical or food waste or any other form of waste reduction. Good use of resources during integrated mine closure can be ensured through waste reduction mechanisms such as re-use, recycling and separation methods amongst other mechanisms.

There is now an increased pressure for mining companies to extract in a more responsible manner; the unwarranted effects of waste in the past is something we must avoid with due diligence. Safer processes are required within the extractive industries; processes that will produce with less waste and processes where new and sustainable technologies will be incorporated. Responsible consumption and production influence many other spheres of life, and if utilised properly can lead to better economic efficiency, the curbing of emissions, overall improvement of environmental stewardship and the improvement of the well-being of local communities.

The Diavik Diamond Mine operated by Rio Tinto in Canada is an example of responsible consumption and production as evidenced by their thorough waste management plan.[200] Instead of choosing to deposit waste rock on a short haul dumb which would later require the waste to be rehandled to its final location as inert cover material at closure; more responsibly, the material is directly long hauled and as a result, is placed in final form so as to meet the closure criteria.[201] This progressive form of closure reduces net present costs by more than 10 per cent, results in final closure landforms being completed ahead of schedule, and reduces risks of acid rock drainage whilst increasing visual amenity.[202]

The Lower Caroni mining project in Venezuela is another example of responsible consumption and production and this can be seen by the sustainable practices that they have adopted and initiated. The project, for instance, has adopted standards such as ISO 14001 which is a highly respected standard and the project has selected a high-density dredging and pumping system which reduces the cost of wastewater storage and wastewater management.[203]

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[199] *Ibid*.
[200] Integrated Mine Closure: good practice guide (2019) 42.
[201] *Ibid*.
[202] *Ibid*.
[203] Vintró, C., Sanmiquel, L. & Freijo, M (2014). "Environmental sustainability in the mining sector: evidence from Catalan companies." Vol. 84. *Journal of Cleaner Production* 161.

A further example is Peñoles industries' orientation towards responsible and beneficial use of non-renewable natural resources through cleaner production technologies: such as a bag house adapted to clean combustion gases, a wastewater treatment installation and an automatic monitoring network to check air quality.[204] As a testament to their efforts: 100% of the water utilised in industrial processes in Peñoles industries was recycled water in the year 2003.[205]

## 4.7. Conclusion

The objective of this chapter was to explain how integrated mine closure and post-closure can contribute to the economic group of the SDGs. As explored through the chapter, it is clear that integrated mine closure and post-closure initiatives can contribute to the economic group of the SDGs. This chapter highlighted that cleaner and safer processes are essential and should be incorporated into mine closure and post-closure initiatives in order to realise the economic group of the SDGs. The chapter also highlights economic efficiency and how the better management of resources results in more opportunities for everyone as less energy is lost or wasted.

What has also been highlighted in this chapter is that innovation and technology play a large role in contributing to the economic group of the SDGS as they are central concepts in the repurposing of areas. Innovation and technology can boost the economy, create cleaner energy infrastructures and find innovative infrastructure shared-use models or innovative technology for waste reduction.
The next chapter explores how integrated mine closure and post-closure can contribute to the environmental group of the SDGs.

[204] *Ibid*.
[205] *Ibid*.

# CHAPTER 5:

# THE CONTRIBUTION OF MINE CLOSURE IN REALISING THE ENVIRONMENTAL GROUP OF THE SDGS

## 5.1. Introduction

The objective of chapter 5 is to examine how integrated mine closure and post-closure contribute to the environmental group of the SDGs. Subsequently, the following sections will discuss how mine closure contributes in realising the SDGs that are found in the environmental group. The SDGs that will be discussed under the environmental group are SDG 6- clean water and sanitation, SDG 13- climate action, SDG 14- life below water and SDG 15- life on land. The chapter will conclude in Section 5.6 by summarising the chapter findings and addressing the question of whether mine closure contributes to the environmental group of the SDGs and should be prioritised.

## 5.2. The contribution of mine closure in realising SDG 6- clean water and sanitation

Integrated mine closure and post-closure initiatives can contribute to clean water and sanitation by way of building clean water and sanitation infrastructure and setting up programmes which will continue to operate and aid lives post-closure. The United Nations highlights that "For each dollar invested in water and sanitation, on average there is a return of eight dollars in costs averted and productivity gained."[206] It is therefore pertinent for mine companies and governments to approach integrated mine closure and post-closure in a way that prioritises water and its sustainable management for the benefit of the community. Integrated mine closure and post-closure initiatives can help establish safe and more affordable drinking water for communities. One way to ensure sustainable development is if mine companies integrate community well-being into the life of a mine and one key driver of sustainability is clean water and sanitation.

With Closure in mind, integrated mine closure initiatives can contribute to clean water and sanitation by way of hydrogeological and geochemical works which can contribute to the water quality, flow and or quantity, resulting in more sustainable communities.[207] It is, therefore, possible for integrated mine closure and post-closure initiatives to contribute to and improve access to sanitation, wastewater treatment and more affordable drinking water amongst other water needs.

A case in point can be seen in Arequipa, Peru, where Cerro Verde managed to avoid a potentially catastrophic social and business dilemma by correctly not competing for the already scarce water

[206] Exploring the business case for corporate action on sanitation (2014). United Nations Global Compact 21.
[207] Closure Maturity Framework (2020) 30.

source. Through consultations with government representatives, regional officials, civil society groups and water authorities, Cerro Verde became au fait with the nuances of the situation and decided to invest in a water treatment plant.[208] The wastewater treatment plant which was integrated during the operations of the mine continues to be a sustainable post-closure initiative and has brought sustainable development to Arequipa's municipal water treatment which used to treat only less than 10 per cent of its municipal sewage but now treats 95 per cent of its municipal sewage.[209]

The sewage treatment plant has managed to reduce faecal coliform counts which had exceeded the World Health Organisation (WHO) standards at five spots along the river for safe agricultural irrigation and water consumption by livestock.[210] This has resulted in the reduction of incidents of water illness and has improved agricultural outcomes as attested by water authorities who confirm that the higher biological oxygen demand (BOD) per litre has improved drastically.[211] Previously, the untreated water would be discharged directly to the river that serves as the principal water source for the area but due to the intervention by Cerro Verde, an opportunity that met both a social and a business need was identified.[212] The mine has navigated through a critical social and sustainability issue in the community by using created shared value by firstly obtaining a guaranteed volume of water for their own operations from the treated water which does not bring the mine in competition with the farmers who use the fresh water supply and have assisted the farming industry with more clean water for their utility through the water treatment.[213]

Another instance is that of Canadian company, Erdene Resource Development Corporation which created a post-closure solution and advanced the sustainable development agenda in Mongolia by offering to assist Shinejinst community which is 90km away from the Bayan Kundi exploration camp.[214] Erdene engaged with stakeholders and became aware of the town's need to improve its access to potable water as prior to 2017; potable water was trucked into Shinejinst from the regional capital which is about 270 km away.[215] Whilst commissioning hydrogeological work to source a water supply in Bayan Khundi, Erdene offered to expand the investigation area to include Shinejinst and embraced CSV resulting in the discovery of a potable water source 3 km away.[216] Erdene personnel then worked together with the municipal officials to drill the new water well which now

[208] Fraser, J. (2019) 790.
[209] *Ibid*.
[210] Fraser, J. (2021) 6.
[211] See *id* at 8.
[212] See *id* at 6.
[213] See *id* at 7.
[214] Fraser, J. (2019) 790.
[215] *Ibid*.
[216] *Ibid*.

provides drinking water to the local residents in a more reliable and cost-effective manner when compared to the trucking method.[217]

### 5.3. The contribution of mine closure in realising SDG 13- climate action

The ICMM recognises mine closure's ability to contribute towards climate change as envisaged in Principle 6 which encourages the continual improvement in environmental performance issues, such as climate change.[218] In order for mine companies to contribute environmentally to sustainable development, they must adopt more preventative and proactive stances when it comes to environmental management and mitigation techniques.[219] Adequate climate risk assessments must be undertaken during the project design so as to properly inform mine closure and the long-term planning of a mine operation.

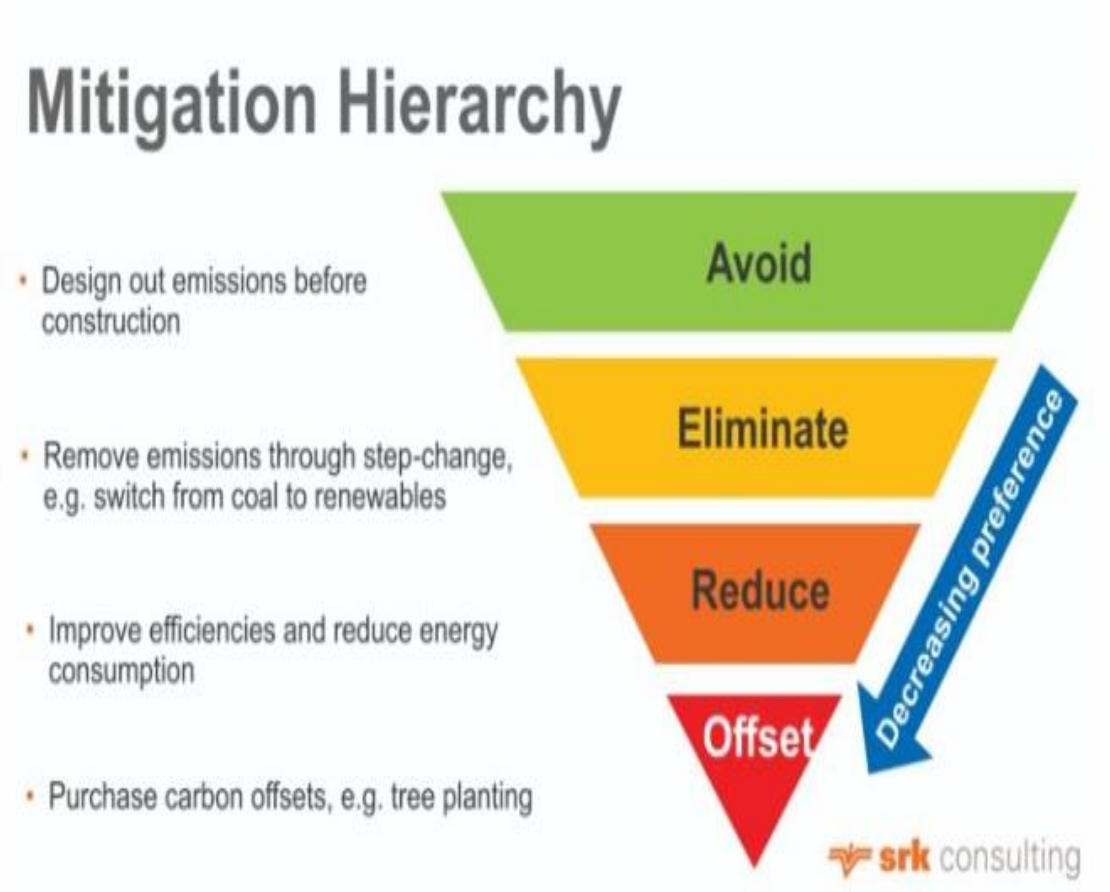


**FIG 5: Mitigation hierarchy**

In order to be proactive against climate change mine companies can adopt programmes that align

[217] *Ibid*.
[218] Mining Principles Performance Expectations (2022) 9.
[219] Fig. 5. Retrieved from ESI Africa website (accessed 29 December 2021).

with the Kyoto Protocol in significantly reducing greenhouse gas emissions, such as incorporating natural gas at manufacturing facilities and reducing the use of N2O.[220] Mine companies must strive to align to the Paris agreement within the United Nations Framework Convention on Climate Change (UNFCCC) by "holding the increase in the global average temperature to well below 2° C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5° C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change".[221] Seeing that many communities are dependent upon fossil fuel extraction; it is therefore imperative for mine companies to strategise with communities and support the communities to diversify their economies in a viable and just manner.

Rio Tinto's "Mine of the Future" operation in Western Australia illustrates how automation can mitigate the impacts of a mining operation on climate while developing green value chains which form part of post-closure initiatives for the future and the diversification of local economic sectors.[222] The technological advances of the "Mine of the Future" include an autonomous vehicle haulage system that uses supervisory control system and a remote controller to move ore around the mine site, an automated drilling system that can simultaneously utilise multiple drill rigs; and a long-distance Autohaul system.[223] This automation technology creates efficiencies and reduces the degree of climatological impact by curbing the amount of truck idle time and carbon-intensive fuel consumption.

Another case is that of Ambuja, in rural India, which managed to identify biomass-centred green supply chains and leverage on the biomass opportunity in its fuel mixture to reduce GHG (Greenhouse gases) emissions and save on energy expenditures through alternative fuel at its Rabriyawas plant.[224] The company's CSR arm known as the Ambuja Cement Foundation (ACF) attained greater value creation by engaging local farmers to join the new biomass market and managed to co-locate much of the plant's biomass supply whilst fostering significant local procurement with suppliers from the surrounding farmland.[225] A farmer-producer organization (FPO) has been established and more than 500 farming families have taken advantage of this structure and sold biomass to the plant including cotton stalk, sugarcane waste and other crop residues.[226] The establishment of the successful biomass value chain has created biomass-centred green supply

[220] Vintró, C., Sanmiquel, L. & Freijo, M (2014) 60.
[221] Paris Agreement (2015). United Nations Framework Convention on Climate Change.
[222] Climate-Sensitive Mining: Case Studies. Background Paper for Building Resilience: A Green Growth Framework for Mobilizing Mining Investment (2019). The World Bank 19.
[223] *Ibid*.
[224] See *id* at 28.
[225] *Ibid*.
[226] *Ibid*.

chains which will continue to be valuable after the mine has closed.

### 5.4. The contribution of mine closure in realising SDG 14- life below water

Mine companies have to make sure not to cause marine and nutrient pollution by responsibly closing mines. Marine sustainability is important for life below water and for sustaining the socio-economic benefits that come with promoting healthy oceans. It is important to find innovative ways of mitigating and preventing detrimental impacts on marine environments.

Life under water must be integrated into impact assessments with a significant focus on the quality of mine closure in relation to the marine environments. Marine disposal of tailings must be done in a responsible manner with as little harm being done to the oceans and the life that exists under water. Mine companies must be careful not to cause harm to the seas and sea life through acid mine drainage.

Mine companies can adopt precautionary principles in efforts to protect marine life. Mine companies must also ensure that they minimise or prevent marine habitat disturbance through their mine operations and closure. Mine companies must understand the long and short-term impacts of their operations so as to prevent any negative impacts on life that exists below water.

First Quantum Minerals' subsea tailings disposal in Turkey is a case in example as this underground copper-zinc mine discharges half of the mine tailings into the anoxic zone at the bottom of the nearby Black Sea in accordance with Turkish regulations.[227] A thorough third-party scientific monitoring programme has been put in place to ensure that the tailings do not negatively impact life in the sea and so far, the long-term monitoring has shown no change in water quality emanating from the tailings discharge.[228] This area produces around half of the sea fish in Turkey and a quarter of the shellfish.[229] Acid is not produced in the water as the tailings cannot oxidize due to the lack of oxygen found at this depth.[230]

### 5.5. The contribution of mine closure in realising SDG 15- life on land

It is important for land to be restored, protected and utilised in a sustainable manner during mine operations. One should always have closure in mind when operating on any particular land and should make sure to integrate closure initiatives during the life of a mine so as to avoid adverse impacts. There are many sustainability issues that can emanate from negatively impacting the environment because negative environmental impacts can limit land use options and ultimately

[227] Mapping Mining to the Sustainable Development Goals: An Atlas (2016) 58.
[228] *Ibid*.
[229] *Ibid*.
[230] *Ibid*.

result in a lack of realistic economic diversification options.[231] This was one of the problems faced by Singkep, in Indonesia where local communities were not able to diversify into the agricultural and fisheries sectors due to the land being contaminated by corrosive water from the abandoned former mining sites.[232]

Integrated mine closure and post-closure initiatives are therefore crucial for stabilising a site physically and chemically and ensuring that the environment is sustainably restored to be able to support local biota and create habitats for wildlife. Mine companies must make sure to prioritise ongoing topsoil retention, dust management and biodiversity during the life cycle of a mine as integrated mine closure has proven to be a working approach in ensuring the integrity of biophysical systems. The ICMM emphasizes through principle 7 that mine companies must "contribute to the conservation of biodiversity and integrated approaches to land-use planning"[233] as land is the foundation of development and human well-being and, in some cases, may be irreplaceable.[234]

An exemplification of how mine closure can contribute to SDG 15 is how a Gold mine was turned into botanical garden in Southeast Minahasa, Indonesia.[235] PT Newmont Minahasa Raya (PTNMR) planted hundreds of thousands of trees on a former mine site in Southeast Minahasa and delivered 443 hectares of revegetated land to the Government of Indonesia which is now a thriving forest of mahogany, nyatoh, sengon and teak trees.[236] This reforestation strategy was incorporated into PTNMR's closure plan and Sustainable Development Program very early in the mine's lifecycle and the forest now serves partly as a botanical garden in collaboration with the Ministry of Forestry.[237] The botanical garden and the reclaimed forest are capable of creating positive environmental conditions and economic benefits for local inhabitants.[238] This integrated mine closure and post-closure initiative further contributes to SDG 15 by ensuring the habitats of hundreds of species of birds, plants, insects and other animals.[239] The reclaimed forest now serves as a model for carbon absorption as the first of its kind in Indonesia and due to the rich biodiversity, the forest and the garden are expected to serve as a laboratory and outdoor classroom for education and environmental research.[240] This case clearly illustrates how responsible mining and closure can

[231] Syahrir, R., Wall, F. & Diallo, P. (2021) 5.
[232] *Ibid*.
[233] Mining Principles Performance Expectations (2022) 7.
[234] Nerini, F, F., Tomei, J., To, L, S., Bisaga, I., Parikh, P., Black, M., Borrion, A., Spataru, C., Broto, V, C., Anandarajah, G., Milligan, B & Mulugetta, Y. (2018) 13.
[235] Integrated Mine Closure: good practice guide (2019) 23.
[236] *Ibid*.
[237] *Ibid*.
[238] *Ibid*.
[239] *Ibid*.
[240] *Ibid*.

actualise into long-term benefits to local communities.[241]

Another case in example is how a well-planned and executed mine closure strategy was witnessed at Westside open-cut coal mine in New South Wales by Oceanic Coal Australia Limited, Glencore.[242]The progressive rehabilitation programme apportioned the area and rehabilitated each area according to its specified completion criteria.[243] One area included a void which has now been retained as a permanent lake.[244] The goal of the mine has always been relinquishment and has managed to do so after optimising ecological outcomes by returning the land to high-quality native vegetation and the area is home to a wide range of fauna and flora.[245] Nine threatened species have recently been found on the rehabilitated site and such species include the masked owl, grey-headed flying fox, greater broad-nosed bat, powerful owl, little bent-wing bat, squirrel glider and large-eared pied bat.[246]

A further example is how Vedanta successfully adopted a biodiversity policy and management standard that is in line with the guidelines of the International Finance Corporation (IFC) and other international standards.[247] Their commitment to sustainable development is evidenced by their collection of 360, 000 seeds and over 80, 000 plants which it moved to specialised facilities of the Karoo Desert National Botanical Garden with the goal of replanting the endemic species once the surface had been restored.[248]

## 5.6. Conclusion

The objective of this chapter was to examine how integrated mine closure and post-closure can contribute to the environmental group of the SDGs. As the evidence shows, integrated mine closure and post-closure initiatives can significantly contribute to the environmental group of sustainable development goals. This chapter has illustrated that the environment is key towards sustainable communities and responsible closure actualises into long-term benefits to local communities.

This chapter has also highlighted that a preventative and a proactive stance is important when it comes to environmental management and mitigation techniques. The chapter has illustrated that efficiency in systems as part of integrated closure can reduce environmental impacts including impacts on the climate.

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[241] *Ibid*.
[242] See *id* at 58.
[243] *Ibid*.
[244] *Ibid*.
[245] *Ibid*.
[246] *Ibid*.
[247] Bizcommunity News. 2021. "Best practice mine closure achieved." 27 August 2021. Bizcommunity.
[248] *Ibid*.

Furthermore, it has been crucially pointed out, that long-term planning is essential in order for integrated and progressive closure systems to adequately deal with environmental concerns. Lastly, the chapter has also highlighted the importance of collaborations in witnessing CSV which positively impacts the environment.

The next, penultimate chapter evaluates the research against the research questions and objectives formulated in the first chapter and provides a summary of the findings.

# CHAPTER 6:

# EVALUATION AND SUMMARY

## 6.1. Introduction

Having established the contribution of integrated mine closure and post-closure in realising the SDGs in the preceding chapters, the objective of this chapter is to evaluate whether the findings in the preceding chapters warrant for adequate mine closure to take place. The following sections will evaluate mine closure's contribution towards each group of the SDGs before concluding in section 6.5 whether mine closure should be prioritised.

## 6.2. Integrated mine closure and post-closure's contribution to the social group of the SDGs

As highlighted in the study, integrated mine closure and post-closure initiatives are important stages for empowering a workforce with the skills that are required to work in other industries.[249] Mine closure, therefore, strengthens the functional literacy of a community which ultimately works in eradicating poverty and zero hunger.[250] Not doing adequate mine closure means losing out on the opportunity to have resilient and sustainable communities. By not doing mine closure, a country and a particular region can miss out on the benefits that come with repurposing, such as tourism and other post-closure initiatives which are able to inspire societies to become socially healthy. Integrated mine closure is a salient stage in a mine's life cycle and if mine closure is not done properly then important programmes that boost value chain activities and development may altogether be missed. Countries and companies can, therefore, miss the opportunity to collaborate with the agriculture sector and ultimately miss playing an important role of achieving zero hunger.

It is important for mine closure to take place as mine closure has a strong potential to strengthen linkages in society which results in the strengthening of the capacity of other sectors and ultimately helps society to function more harmoniously. Integrated mine closure and post-closure initiatives are therefore imperative and should be adequately done as they can eliminate market fragmentation and create a more functional society. Closure initiatives are also important in the sense that they can create new markets in various areas as already indicated by Barrick Gold's

[249] Syahrir, Wall & Diallo (n 16 above) 7.
[250] Hilson & Murck (n 64 above) 230.

impact in Cuncashca, Peru.[251] It has also been highlighted that integrated mine closure and post-closure initiatives can help strengthen networks among suppliers and therefore create more resilient societies.[252]

Health-related infrastructure can help alleviate well-being issues that societies may be facing and create a healthier workforce by curing and/or minimising the impact of diseases that may have caused havoc to societies in the past. Therefore, integrated mine closure and post-closure initiatives can help reduce the mortality rates and this would not have been the case if closure initiatives had not taken place. Integrated mine closure and post-closure initiatives also have a strong positive influence on the educational front as many pupils have benefitted from scholarship programs and the building of much-needed schools by mine companies.[253] Mine companies through post-closure initiatives can contribute to gender equality through various women empowerment initiatives, whether through education, skills programmes, or other means- what has been made clear is that mine closure initiatives can contribute to the gender equality agenda. Integrated mine closure and post-closure initiatives can reduce inequalities through capacity-building programmes that target disempowered and marginalised people. Integrated mine closure and post-closure initiatives can make an area more peaceful than it was before by way of consultations that unite communities. Not doing integrated mine closure and post-closure initiatives can be detrimental to society as these stages can be fertile ground for collaborations that contribute to more satisfied communities, and a greater sense of local ownership and efficiency. Furthermore, as explicated in the study; collaborations may be the only way to solve complex issues in societies and closure initiatives create such opportunities for collaborations.[254]

## 6.3. Integrated mine closure and post-closure's contribution to the economic group of the SDGs

To a large extent, energy underpins both economic and social development. Without sustainable clean energy, social and economic development may risk coming to halt or worse, the economy may even deteriorate. Post-closure initiatives thus provide an opportunity for crucial clean energy initiatives to be created. These clean energy initiatives can pertinently drive economic development and create thriving societies. These energy initiatives can end up supplying power to places that never had power before. Realising integrated mine closure and post-closure initiatives can go a very long way in creating decent work and economic growth and this is largely due to the linkages and

[251] Ramdoo (n 79 above) 10.
[252] Ramdoo (n 88 above) 10.
[253] Bizcommunity News (n 105 above).
[254] Frazer (n 136 above) 789.

clusters that closure encourages. These clusters have the potential to expand enterprises and strengthen value chains resulting in economic growth and the provision of decent work. Post-closure initiatives have the potential to contribute to economic diversification, negating doing adequate mine closure may result in an area missing out on economic growth. As already venerated by the study, infrastructure is one of the key means of bringing about sustainable development. Post-closure initiatives often contribute to the building of much infrastructure which an area may have lacked in the past. Such infrastructure may help a city or an area to be more functional, creating a better life for people. Not doing adequate closure may result in missing out on such development.

One crucial form of sustainable development that countries and areas can miss out on if they do not do adequate closure initiatives is the ability to create sustainable cities and communities. A lot of economies and cities are under strain due to the lack of economic diversification and beneficiation in an area. As crucially explained, a company and an area may lose out on financial investment from financial institutions and fail to create sustainable cities and communities.[255] As also highlighted, integrated mine closure and post-closure are often the stages where responsible consumption and production can occur. Not doing integrated mine closure and post-closure initiatives means that chances of waste reduction and recycling opportunities may altogether not happen. Not realising adequate closure initiatives can result in health problems due to poor air quality amongst other issues.

## 6.4. Integrated mine closure and post-closure's contribution to the environmental group of the SDGs

Not doing integrated mine closure and post-closure initiatives can be extremely detrimental to the environment and communities may miss out on valuable opportunities to create more healthy and sustainable environments. Clean water and sanitation infrastructure have often been the much-needed difference between healthy societies and non-healthy societies, and this is what integrated mine closure and post-closure initiatives can contribute to society. Through development strategies brought about by integrated mine closure and post-closure initiatives such as increasing the accessibility to potable and clean water, livelihoods may become more bearable, and communities may be able to function more efficiently. As recognised in the study, doing integrated mine closure and post-closure initiatives can often be linked to mitigating the impacts of climate change through the utilisation of biomass and other climate-sensitive energies.[256] The automation of industries may also help reduce carbon-intensive fuel consumption and overall climatological impacts.[257] Not doing

[255] Equator Principles (n 187 above) 2.
[256] The World Bank (n 217 above) 28.
[257] The World Bank (n 215 above) 19.

integrated mine closure and post-closure initiatives may result in fewer opportunities to curb carbon emissions and therefore exacerbate climate change.

In regards to the protection of life under water; if proper closure is not done, seas and marines may be harmed resulting in the loss of sea life. Therefore, closure plays an essential part as a mitigating factor for many potential problems. Integrated mine closure and post-closure are vital in making sure that the land is chemically and physically stable. This is a salient matter as integrated mine closure and post-closure initiatives are often the processes that restore flora and fauna, creating much-needed habitats for life on land. Not doing adequate closure unfortunately means one loses out on such opportunities to contribute to sustainable development.

## 6.5. Conclusion

The objective of this chapter was to evaluate mine closure's contribution towards each group of the SDGs and whether there is an overall necessity for mine closure to be prioritised. As emphasized integrated mine closure and post-closure initiatives are often the stages in which a company makes sure to responsibly conclude its extractive exploits. Not doing this stage can negatively impact many of the sustainable development goals. Not doing adequate mine closure can impact communities and economies; people and the environment. This chapter has emphasized that mine closure can pertinently contribute to the social, economic and environmental group of the SDGs. It has been made evident that mine closure should be prioritised.

# CHAPTER 7:

# CONCLUSION AND RECOMMENDATION

## 7.1. Introduction

As evaluated in this study, the findings warrant for mine closure to take place. As far as the SDGs are concerned, it is undoubtedly better to do adequate mine closure than not to do it. It is important for mine closure to take place as it can prevent a lot of disastrous effects from occurring. Integrated mine closure is warranted as closure can happen anytime.

## 7.2. Summary of the research findings

This study has illustrated that integrated mine closure can minimise the damage, severity and risks associated with sudden mine closure and is important for the livelihoods of people, the earth and other living organisms. This study has also illustrated that mine closure projects can add to the achievement of SDGs; if mine companies and governments that are in charge of designing legal frameworks as well as other relevant stakeholders think very carefully around how this is designed and implemented, it should be achievable.

## 7.3. Addressing the primary research question

The world at large has decided that the SDGs should be prioritised and if they are going to be prioritised then stages such as integrated mine closure and post-closure which have a significant potential to contribute to the SDGs cannot be undermined and undervalued. The contribution of integrated mine closure and post-closure to the SDGs as indicated in this study is substantial and worth prioritising. Companies ought to prioritise adequate mine closure as those companies that fail to do so, may find themselves losing the social license to operate. As indicated in this study, integrated mine closure and post-closure can positively contribute to society in many ways. As the world has focused its attention on achieving the Sustainable Development Goals, by showing the link of mine closure to the SDGs, this study has served to bring about the prioritization of adequate mine closure and its realisation thereof.

## 7.4. Concluding thoughts

Although integrated mine closure and post-closure are to a large extent the last stage of a mining project, they are, nonetheless, very crucial in weighing up the pros and cons of the contribution of mining towards sustainability as a whole. If adequate mine closure is not realised, this will in turn

not just negatively impact the mining company but mining's general ability to bring positive change. If a mining company leaves an area that it came into and the world at large in a worse state than before, this essentially means that the mining exploits will be nothing short of being a veneer and a regrettable activity. Therefore, this study has served to show why integrated mine closure and post-closure are important as they can profoundly contribute to the realisation of the Sustainable Development Goals. With the large benefits and consequences of doing mine closure or not doing mine closure respectively, mine closure ought to be prioritised as the sustainability of the world depends on it. As far as mining is concerned, it has been highlighted in this study that it is not how you start the race but how you finish it.

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