IMPACT OF MINE CLOSURE ON THE BARITES MINING COMMUNITIES IN NASARAWA STATE: A QUALITATIVE RESPONES APPROARCH

Salihu Habibu Muhammed-Gani[1], Ibrahim Abdul[2], Ilemona Adofu[3]*

Economics Department, Nasarawa State University Keffi, Nigeria[123]
salihuhabibu@nsuk.edu.ng [1], Ibrahimabdul1624@gmail.com [2], ilemonaadofu@gmail.com [3]

Abstract

This study attempts an evaluation of the impacts of mine closure on the Barites mining communities in Nasarawa state. It uses descriptive and inferential approaches; it employed changes in disposable income, aggregate demand, population, economic activities, and hectare of land degraded as the basis for the evaluation of the social and economic implication of mine closure on the livelihood of the Barites mining communities in the state. Data were generated from primary source and analyzed using Logistic regression technique. The study established that closure of Barites mining activities in the state has slowed down economic activities as well as the livelihood capabilities of the mining communities. The study posits that closure in the mining activities has brought some implications in the area of employment opportunities; decrease disposable income and wealth creation. It however dislocates the social values of the inhabitants leading to high rate of crime, and alarming percentage of teenage pregnancy, HIV AIDS and broken marriages. The study suggests that both the mining companies and the government should mitigate these challenges by providing the mining communities with the essential threshold of life that may re-engineer their livelihood back where it was before the mining activities. Apart from this, the closure of mines should follow a gradual and adaptive processes, as well as legal procedure with adequate consultation with the inhabitants taken into account that the mine is their chief source of livelihood.

1.0 INTRODUCTION

From 1990s till date, mine closure has become one of the most difficult issues facing mining companies, mining communities, and mining countries around the world. For mining companies, safety, environmental and social risks can occur and significant liabilities can arise if closure is not managed properly. For mining communities, mine closure can cause severe distress because of the threat of economic and social collapse of an

entire region (World Bank Group 2002). For governments, abandoned mines can bring large environmental liabilities and clean-up costs unless they set the right closure process. In any case, for both mining communities and government, mine closure usually means a severe reduction in income at best, and a huge cost in terms of social and environmental mitigation. All three parties, mining companies, communities, and governments tend to be heavily involved in mine closure issues. Moreover, each is directly impacted by and concerned about the other parties' respective engagement. Mine closure processes are a prime example of how the new model of trilateral dialogue and cooperation that has been emerging in the mining industry can reduce costs and enhance results for all parties involved (World Bank Group, 2018).

In many cases, the mine is the local economy's primary provider of income, employment, and services. In such a context, mine closure will have significant impacts on the well-being of the community. Such impacts are exacerbated in developing countries, where alternative economic activity may be more limited, and local government and communities often lack the capacity needed to help structure a development process that would provide suitable alternatives. In most cases, the community and the mine have developed an interdependent relationship, whether in terms of employment, services, infrastructure, environmental impact issues, or taxes and royalties (Oliveira, 2016). The level of this integration depends on various factors, including the age and location of the mine, the company's approach to the community and region, government policies, and the structure of the local and regional economy.

In many mining communities and regions, a major portion of government tax revenue comes from mining. If the mine closes, the government will not be able to replace the income; this will impact on the government's ability to serve its constituents and mining communities that may have received direct income from the mine will see a sharp decline in income. It is important for governments and communities to understand and plan for the eventuality of mine closure. Fourie and Brent (2006) believed that these communities need to develop both non-mining activities and other productive assets that will last beyond the life of the mines and generate income for future generations. At the same time, it is typically not possible to replace the economic benefits of the mine completely; major adjustments will likely be required.

Responsible mine closure involves removing plant and equipment and hazardous materials, securing the pits and waste disposal facilities, reclaiming the surface land, and taking all necessary measures to avoid possible future groundwater pollution. Many countries have been burdened with a legacy of unplanned closures, unsafe workings,

hazardous sites, and un-reclaimed land. Many of these sites are in developed countries. Developing countries attracting new investment can learn lessons from these situations to establish safeguards against unplanned closure. In particular, steps need to be taken to ensure that funding is available to rehabilitate the mine on closure. Today, governments often require mining companies to post environmental bonds or contribute to environmental reclamation funds to ensure that sufficient funds are available to close and rehabilitate a mine (Hoadley and Limpitlaw 2008).

Mining communities often have become dependent on the infrastructure and facilities provided through the local mine. In Eastern Europe and the former Soviet Union and in many countries in Africa, Asia, and Latin America, much of the housing and many of the hospitals, schools, and preschools were owned by mines before they were privatized (Gibson, 2006). The more remote an area, the more likely it is that roads and transportation networks, improved telecommunication, and water and sanitation services are provided through a mining operation. When the mine closes, the mining company can no longer maintain these services. Simply "handing over" these services to government rarely works. Governments are not always set up to manage such services, and not all of the services are financially viable in and of themselves.

In recognition of this problem, new approaches to solve some of these concerns are being developed around the world, mostly focused on building capacity within both mining communities and local governments to maintain essential services (World Bank Group, 2002). A notable example is the Misima mine in Papua New Guinea, which was closed in 2004. Placer Dome, which manages the mine, has worked with the local government and communities for more than five years to develop capacity to manage social services after closure. An alternative approach was adopted in Zambia where, after the copper mines were privatized, a large number of social services, including housing, needed to be transferred from the mining company to other management. Here, local contractors have been tapped to provide the services needed in a financially viable manner.

In Nigeria, like other African countries, mine closure is one of the mining industry's toughest sustainable development challenges. At the same time, it provides an opportunity for the industry to demonstrate its commitment to sustainable development by incorporating socio-economic aspects, along with the more physical aspects, into the mine planning process. Even though mining companies may not have sole responsibility for addressing the socio-economic impacts of mine closure, they are key players with significant power, influence and resources. This positions them as important players in the local context, and as potential catalysts for focusing attention and effort on mine closure impacts (Katrine et

al, 2018).

In the barites mining communities in Nasarawa state, Saintmoses (2016) observed that mining operations sometimes become seasonal occurrences depending on the distance of these mines to the nearby city centers and the capacity of the mining companies. These bring to bear certain seasonal social and economic consequence to the mining communities between the times of temporary closure. Mining communities like Keana, Aloshi Kuduku, and some parts of Azara mining communities experienced a complete but sudden closure, in which case proper closure processes have not been followed.

In this part of the world, appropriate closure structures with clear mandates, roles and responsibilities were usually not put in place early in the life of mine process. Mine closure committees or advisory panels of key stakeholders which may enhance the achievement of cohesion and ownership were in most cases not formed (Laurence, 2006). A lack of cohesion and cooperation between structures has been identified, which is critical for capacity building, to achieve representative institution-building, partnerships, and effective strategic planning throughout the life of the mine. There has been a need for senior management support which is crucial for these structures to succeed. Just as important is a clear definition of the stakeholders involved: who is "the mine", who is the "community", and who represents government? These issues as important as they are have not been clearly defined throughout the lives of the barites mines in Nasarawa state.

Sallau (2015) state that cooperation, and the clear definition of roles and responsibilities of all stakeholders have been inadequate in the barites mines in the state, and the concept of closure solutions could have been better achieved through anchor projects, rather than a clutch of relatively unsustainable SMME's that only exalt business pressure on both the mine workers and the mining communities in the state. It is difficult too to engender identification among communities with too many small projects.

Apart from this, poor strategic management planning, combined with unrealistic or inadequate closure visions (that lack concrete principles and assumptions), contribute significantly to the failure of mine closure. There is a perceived lack of all-round quality leadership, which contributes to poor relationships. Trust in mining houses is also compromised when they fail to deliver on closure plans. This may be caused either through an inability to negotiate hurdles to closure, or through an ability-performance gap between closure planning and the company's ability to perform the planned interventions or actions (Warhorse & Mitchell, 2006). Trust and the ability for mines to deliver on closure plans is also compromised though inadequate social planning to manage community expectations and integrate communities into closure from the outset.

It is in the light of these and other issues such as changes in disposable income, job looses, and employment opportunities as well as change in aggregate demand that this study seeks to evaluate the impact of mine closure on the livelihood of the mining communities in Nasarawa state. Therefore, questions that agitate the research mind are: 1). What is the impact of barites mine closure on means of livelihood of the people in mining communities in Nasarawa state? 2). How has mine closure affected the lives of the people in mining communities? 3). How can the impact be mitigated or controlled?

Barite is a mineral composed of barium sulphate (BaSO4). It receives its name from the Greek word "barus" which means "heavy." This name is in response to barite's high specific gravity of 4.5, which is exceptional for a non-metallic mineral. The high specific gravity of barite makes it suitable for a wide range of industrial, medical, and manufacturing uses. Barite also serves as the principal ore of barium (Kastne and Miriam, 2002).

Barites has been found at locations in Brazil, Nigeria, Canada, Chile, China, India, Pakistan, Germany, Greece, Guatemala, Iran, Ireland (where it was mined on Benbulben), Liberia, Mexico, Morocco, Peru, Romania (Baia Sprie), Turkey, South Africa (Barberton Mountain Land), Thailand, United Kingdom (Cornwall, Cumbria, Dartmoor/Devon, Derbyshire, Durham, Perthshire, Argyllshire, and Surrey) and in the US from Cheshire, Connecticut, De Kalb, New York, and Fort Wallace, New Mexico. It is mined in Arkansas, Connecticut, Virginia, North Carolina, Georgia, Tennessee, Kentucky, Nevada, and Missouri (World Bank Group, 2018). World barites production for 2017 was 8.65 million tones. The major barites producers (in thousand tonnes, data for 2017) are as follows: China (3,600), India (1,600), Morocco (1,000), Nigeria (700) Mexico (400), United States (330), Iran (280), Turkey (250), Russia (210), Kazakhstan (160), Thailand (130) and Laos (120).

The main users of barites in 2017 were (in million tonnes) US (2.35), China (1.60), (Middle East (1.55), the European Union and Norway (0.60), Russia and CIS (0.5), South America (0.35), Africa (0.25), and Canada (0.20). 70% of barites was destined for oil and gas well drilling mud. 15% for barium chemicals, 14% for filler applications in automotive, construction, and paint industries, and 1% other applications (World Bank Group, 2018).

Most barites produced is used as a weighting agent in drilling mud. This is what 99% of the barite consumed in the United States is used for. These high-density mud are pumped down the drill stem, exit through the cutting bit and return to the surface between the drill stem and the wall of the well (Hanor, 2000). This flow of fluid does two things: 1) it cools the drill bit; And, 2) the high-density barite mud suspends the rock cuttings produced by the drill and carries them up to the surface. Barite is also used as a pigment in

paints and as weighted filler for paper, cloth and rubber.

Barites is the primary ore of barium, which is used to make a wide variety of barium compounds. Some of these are used for x-ray shielding. Barites have the ability to block x-ray and gamma-ray emissions. Barites are used to make high density concrete to block x-ray emissions in hospitals, power plants, and laboratories. Barites compounds are also used in diagnostic medical tests. If a patient drinks a small cup of liquid that contains a barium powder in a milkshake consistency, the liquid will coat the patient's esophagus. An x-ray of the throat taken immediately after the "barium swallow" will image the soft tissue of the esophagus (which is usually transparent to x-rays) because the barium is opaque to x-rays and blocks their passage. A "barium enema" can be used in a similar way to image the shape of the colon (Miller, 2009).

Barites are used in added-value applications which include filler in paint and plastics, sound reduction in engine compartments, coat of automobile finishes for smoothness and corrosion resistance, friction products for automobiles and trucks, radiation-shielding cement, glass ceramics, and medical applications (for example, a barium meal before a contrast CT scan) (Arthur, 2000). Barites is supplied in a variety of forms and the price depends on the amount of processing; filler applications commanding higher prices following intense physical processing by grinding and micronising, and there are further premiums for whiteness and brightness and color. It is also used to produce other barium chemicals, notably barium carbonate which is used for the manufacture of LED glass for television and computer screens (historically in cathode ray tubes); and for dielectrics (Miller, 2009).

Historically, barites was used for the production of barium hydroxide for sugar refining, and as a white pigment for textiles, paper, and paint. Although barites contains the toxic heavy metal barium, it is not toxic because barium sulphate is extremely insoluble in water (Katrine et al, 2018). The increasing demands for drilling grade barites is now progressing astronomically due to the increasing world population and its insatiable need for energy as exemplified by the effort of the emerging world power in china and growing economics like India, as well as the continuing crisis in the oil-rich gulf region (World Bank Group, 2002).

In Nigeria, many occurrences of barites are known. But the existing geological survey department report of 1959 on the occurrences of this mineral is preliminary. Barites deposits are found in the Ogoja area, Gombe and the Benue basin, that is Nasarawa Benue axis. In Nasarawa State, barites are located in Azara, Ribi, Tunga, Aloshi, Wuse, Hure,

Keana and Gimdin-keke. Since the survey, commercial mining has began in these areas with exclusive prospecting licences granted to many mining companies within and outside the state. By this survey of 1959, the areas mentioned above have an average estimated reserve of 71,000 tones. However, recent survey by the geology department of Nasarawa State University discovered an estimated deposit of more than a hundred thousand tonnes in each of the areas (Sallau, 2018).

The place of Nasarawa State in the centre of the Benue basin with the entire feature that characterized the geology of Nigeria makes the area rich in solid mineral deposits and a nest for mining prospecting companies. Barites mining activities has been on the increase since the discovery by the geological survey of 1959. Nigerian Barites enjoys great attention and utilization in the oil and gas exploration activities, the reason why it is mined profusely in this study area, since its important occurrence was first reported by Tete in 1959 (Geological survey of Nigeria (1968). The drilling of oil and gas, in the Niger Delta and other parts of the country consumes about 60% of barites produced in Nigeria (Ishaya et al 2018).

Before its discovery in Nasarawa state and other parts of the country, major servicing and oil companies in the oil and gas industry in the Niger Delta import barites for their industrial operations. The Nasarawa barites is thus invaluable, especially that it has the right mineralogical and geochemical properties needed for drilling operations. The high specific gravity of (4.45) is commonly referred to as the high grade can be tailored to fit any mud type. It reduces the problem of "Barite sag," (loss of weighting property). It is also used as weight filler in paper industry. The white colour of barites in these mining communities, and its high specific gravity (S.G.) account for its better use in the paper industry, **(Saintmoses, 2016).**

It can also be used in rubber processing industry. It is invaluable in coagulating rubber even in the absence of sulphur which helps in vulcanizing rubber. It is used in the glass manufacturing industry and building asbestos roofs and quality wall paper. As asbestos is increasingly becoming fashionable among Nigeria builders, this opens a new window for those companies to look inward for barites. The high specific gravity quality and strategic location makes the Azara barites a better alternative. It is also used in chemical industries for agro-allied applications. For example, it is used in the making of animal feeds, fertilizers, and so on Only recently, it also found application in the pharmaceutical companies for drugs has made the search for barites like the search for the mythical Treasure Island **(Saintmoses, 2016).**

Since its discovery in the state so many changes occur in the course of barites mining operations which affected the mining communities, mine workers as well as the mining prospectors and even the mode of mining operation itself. In as much as these changes provide employment and better economic condition, it also create or accelerate social, economic and environmental problems, although these problems came not necessarily due to deliberate intents or wanton disregard for these problems, but are by products of genuine efforts at worthwhile goals (of development), however the most striking of these problems is in most case compounded by sudden mine closure **(Saintmoses, 2016).**

Mine closure is the period of time when extracting activities of a mine have ceased, and final decommissioning and mine reclamation are being completed. It is generally associated with reduced employment levels, which can have a significant negative impact on local economies. It is also the period when the majority of mine reclamation is completed, making the land safe and useful again (Comargo, 2014).

In South Africa, which is a major mining country, closure planning has not yet been formalized (Ndaba, 2010). This has led to a range of unintended consequences that have the potential to become sovereign risk if not adequately managed. According to Norgate and Rankin (2000), closure planning, is relatively a newcomer to mine planning, which continues throughout the life of a mine, starting with conceptual closure plans prior to production, periodic updates throughout the life of the mine, and a final decommissioning plan. This is captured more coherently in the Australian Model to mine closure. At most mines, progressive reclamation over the life of the mine is used to reduce the reclamation burden at closure.

Bennett and Blamey (2001) posit that, Closure planning has two distinct components. On-site planning is mostly about environmental rehabilitation and returning the landform to a reasonable condition where vegetative recovery is enhanced. Off-mine closure is about loss of livelihood, which is a more complex issue. An element of this is generating an offset against the high clost of environmental remediation, which in certain cases can exceed the value of the mineral that was mined in the first place.

Integrated mine closure is a dynamic and iterative process that takes into account environmental, social and economic considerations at an early stage of mine development (World Bank Group, 2002). Fundamental to this process is the need to consider closure as an integral part of the mine operations' core business.

2.2 Theoretical framework

This study adopts the sustainable Livelihood theory as developed by Chambers and

Conway (1992), as its theoretical framework because it emphasises the people's ability to convert their assets or endowment in to positive livelihood outcomes. "A livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living; a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long-term." (Chambers and Conway, (1992).

This livelihoods approach is concerned first and foremost with people. It seeks to gain an accurate and realistic understanding of people's strengths (assets or capital endowments) and how they convert them into positive livelihood outcomes; no single category of assets on its own is sufficient to yield all the many and varied livelihood outcomes that people seek. This is particularly true for poor people whose access to any given category of assets tends to be very limited. As a result they have to seek ways of nurturing and combining the assets they have in an innovative ways to ensure survival. This livelihood framework identifies five core asset categories upon which livelihoods are built. They are: Social Capital, Human Capital, Financial Capital, Natural Capital and Physical Capital.

There is much debate about what exactly is meant by the term 'social capital'. In the context of the sustainable livelihoods frame work it is considered the social resources upon which people draw in pursuit of their livelihood objectives. These are developed through networks and connectedness, membership of more formalized groups and relationships of trust, reciprocity and exchanges that facilitate co-operation, reduce transaction costs and may provide the basis for informal safety nets amongst the poor.

This theory is relevant because it concerned first and foremost with people, and seeks to gain an accurate and realistic understanding of people's strengths (assets or capital endowments) and how they convert them into positive livelihood outcomes. In this case these endowments (land, mineral resources, human resource etc) represent the peoples' capabilities and the key to their sustainable livelihood which is threatened by closure of some of the mines.

2.3 Empirical Review

Marietjie Ackermann, Doret Botha, Gerrit van der Waldt (2018), in a study on the Potential socio-economic consequences of mine closure of Orkney and Grootvlei mines, attempt to explore how mine workers' dependence on their employment at the mines affects their livelihood. The research was conducted at the Orkney Mine and the Grootvlei Mine

(Springs). The research was conducted within a naturalistic domain, guided by a relativist orientation, a constructivist ontology and an interpretivist epistemology. Data were collected by means of document analysis, semi-structured interviews, focus group discussion and unstructured observation. The study posits that mine closures, in general, have a devastating effect on the surrounding mining communities as well as on the employees.

It however found that Mine closures in the case studies gradually depleted the mining communities' livelihood assets and resulted in the collapse of their coping strategies and livelihood outcomes. It generally affected the communities' nutrition, health, education, food security, water, shelter, levels of community participation and personal safety. The study also posits that if not managed efficiently and effectively, mine closures may pose significant challenges to the mining industry, government, the environment, national and local economic prosperity and communities in the peripheral areas of mines. This truly amplifies that mine closure, whether temporary or permanent, is an issue that needs to be addressed with responsibility towards all stakeholders, including the mining community and the labour force.

Camargo (2019), in a study of Socio-economic impacts of mine closure: a case study using satellite imagery. The study presented some highlights of the socio-economic problems faced by the area. Using remote sensing techniques the authors have assessed the socio-economic factors of the area and recommended various remedial measures to overcome the adverse impacts of mine closure. The study was conducted in India the Raniganj Coalfields of Coal India Limited and it posits that the mining area may be facing severe social and ground stability problems as a result of numerous old, abandoned mines. And that already subsidence has occurred in a number of places, such as the Salanpur, Baraboni and Jamuria areas of the Raniganj coal fields.

Van-Heerden (2016), in a study of Sustainable mining communities post mine closure: Critical reflection on roles and responsibilities of stakeholders towards local economic development in the City of Matlosana, attempt to explores the role that mining companies and other role-players should play in the development of local economies in order to reduce the negative social impacts of future closures. The City of Matlosana (Klerksdorp Gold Fields) is used as a case study. Various perspectives, including legal, economic, political, environmental, and social perspectives on the challenges the city face were obtained through the use of multiple methods, including surveys, interviews and observations, as well as content analysis of documents, meeting notes and feedback. Using the constant comparative method to analyze the data obtained, themes such as a lack in

trust, poor communication and collaboration, poor institutional capacity, political interference and a lack in integrated planning emerged. The study shows that what presently is being done will not be enough to make a meaningful impact on the economy post mine-closure. Five themes emerged illustrating the current status. Legislation such as the Mineral and Petroleum Resource Development Act is vague, causing different interpretations by different agents.

Secondly the Department of Mineral Resources is not capacitated to discharge its legal responsibilities. Thirdly the municipality's Integrated Development Plan is poorly constructed with limited participation from key stakeholders and provides no guidance. Fourthly the political and technical leadership and skills to secure a future beyond mining in local government and private business is lacking. Lastly the city's infrastructure is old and will hamper the prospects of future development. In this broken environment the response from mining has been varied. In the absence of a regional closure plan, each mine contributes as it sees fit and the contribution thereof will probably not contribute to secure a life post mining. The study makes recommendations about improving the legislative framework and planning arrangements, and hopes to contribute to the knowledge base for all local actors to learn from.

Aragon, Rudy and Toewsz (2015), in their study of mining closure, gender and employment reallocations, examine the heterogeneous effect of mining shocks on local employment, by gender. Using the closure of coal mines in UK starting in mid 1980s, the study found evidences of substitution of male for female workers in the manufacturing sector; Mine closures increase number of male manufacturing workers but decrease, in absolute and relative terms, number of female manufacturing workers. The study document showed similar, though smaller, effect in the service. This substitution effect has been overlooked in the debate of local impacts of extractive industries, but it is likely to occur in the context of other male dominated industries. The study also finds that mine closures led to persistent reductions in population size and participation rates.

Stacey, Naude, Hermanus, and Frankel (2019), on their part attempt to generate a locally relevant guideline for the socio-economic aspects of mine closure for South African closure practitioners, decision makers and stakeholders. In their study of the socio-economic aspects of mine closure and sustainable development, they commissioned two studies, the first of which examined the closure dynamics of 36 mines in Mpumalanga and KwaZulu-Natal in 2006 using cotenant analysis. A follow-up study (July 2007) focusing on Mpumalanga confirmed some of the results of the first study. It also contained broad guidelines for mine closure covering social and labour planning, job creation, the use of

mine infrastructure, developmental incentives, and environmental rehabilitation. Both projects cited problematic social aspects of closure such as confusion in the management of social (as opposed to environmental, engineering, or other physical) risks; inappropriate training for self-employment; the failure of job creation schemes; the illegal occupation of houses; and vandalism of infrastructure and facilities. They undertake a third study to generate a locally relevant guideline for closure, taking into account local and global developments in the field, including existing closure toolkits. The studies found that Mine closure in the context of developing countries differs from that which occurs in developed countries, in that alternative socio-economic and environmental options are limited in the former. Yet building the foundations for sustainable local economic development is a pressing concern in developing countries requiring creativity, cooperation and leadership.

Dube, (2017), in a study of Socio Economic Impact Study of Mining and Mining Polices on the Livelihoods of Local Population in the Vindhyan Region of Uttar Prades NITI Aayog, New Delhi, surveyed the major mining areas in the Vindhyan Region of Uttar Pradesh, to study the effect of Government Mining Policy on mining in the region and mining activities on the socio-economics of the local people and their dependency on mining for their livelihood sustainability. The effect of mining activities on the vegetation of the region and soil characteristics was also studied. The perceptions of the local people regarding the reclamation of these mining areas after mining closure and their preferential choices for post mining land use were viewed The Socio-economic study was extended to include mining areas of Allahabad, Mirzapur and Sonabhadra districts of Vindhyan region, in the nearby mining areas in order to study the existing resources of the area, social-economic structure of the community, employment patterns, income generation activities, dependency on forests, mining, impacts of mining, impact of mining closure on livelihood, preference of land use of mined out areas and species preferred for restoration by the local people along with information on other related environmental and socioeconomic aspects etc. The study has been performed in mining areas by using Participatory Rural Appraisal (PRA) tools and by Questionnaire based Surveys. Most of the local populace were illiterate and had poor awareness regarding the mining rules and policies, their rights and regulations and forestry programmes for development. Major population was wage-labourers and agriculture as a source of occupation had lost its significance because of land acquisition mainly for mining.

2.4 Gaps in the Literature

From the foregoing therefore, the following gaps which this study intends to fill

have been identified. (1) Most studies did not give adequate attention to the stakeholder on whose shoulder the entire burden of closure rest. Bearing in mind the stakeholders' interest and choice for future development of the mining communities, this research study is a stakeholder centered research (2) the study also employed the Choice Modeling Technique and it is used here to assess preferences of both current and prospective community members about the desirable attributes of the community's interests.

3.0 Methodology

This study employed survey research design in the assessment of the impact of mine closure in the barites mining communities in Nasarawa State. This design enabled this study to generate data from wide range of respondents on the impact of mine closure on the barites mining communities in Nasarawa State. The study undertook an intensive survey using a great deal of questionnaires and mining companies' documents.

The study is basically an intensive fieldwork conducted in the barites mining communities; therefore, this study adopts a qualitative approach in Oder to engender a good perspective to the study. The qualitative approach is participant-observer based study which engage gathering of data directly from the respondents. This qualitative approach is not guarded by pre-arranged grouping of investigation, as it provides room to discover the characteristics and basis of the respondent viewpoint through better and thorough investigation (Patton, 2002).

3.2. Model Specification

In other to verify the strength of livelihood characteristics on lives of the mining communities in Nasarawa State, a Logit model is employed as it was used by many scholars, such as Rudriguez & Smith (1994); Adjei (2008); and Achia, Wangombe & Khadioli (2010). Adopting the work of Achia, Wangombe & Khadioli (2010), this study specifies the following Logit regression equation

$$\text{logit}(p) = \left(\frac{p}{1-p}\right) = \delta_0 + \delta_1 CIN + \delta_2 CEA + \delta_3 PMT + \delta_4 \text{ALD} \quad \text{.....(3.1)}$$

Where, p is probability that an individual was poor as a result of the closure, using INC as a proxy (i.e. INC = 1 if individual is poor, and 0, otherwise).

INC = income level (<30,000 = poor, >30,000 = not poor) at time t.

CIN = change in income (as a result of closure of mines)

CEA = change in Economic Activities (slow down in economic activities)

PMT = population movement out of the communities.

ALD = arable land degradation

While $\delta 0$ is the constant parameter, and δ_1, δ_2, δ_3, δ_4, are the parameter estimates of the explanatory variables.

The a priory expectation of the model is that $\delta_1, \delta_2, \delta_3, \delta_4, < 0$

4.0 Data Presentation and Analysis

4.1 Data Presentation

Four hundred questionnaires were administered, out of which three hundred and twenty-three were returned.

4.1. Data Analysis and Discussion of Result

4.2.1 Descriptive analysis: socio-Economic and demographic profile of the respondents.

The socio-economic characteristics considered in this study include; age, marital status, number of wives or husband, number of dependants, educational qualification, and occupation.

1. Age Bracket

In table 4.1 below, out of the 323 members of the mining communities that were randomly selected for this study, 290 (89.8%) people are within the age bracket of 25-30, 31-35, 36-40, and 41 and above. this implies that the study utilize more of adults in these communities, who are in most cases heads of households and are at least responsible for the well being of their families.

Table 4.1: Age of respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-24 1	33	10.2	10.2	10.2
	25-30 2	98	30.3	30.3	40.6
	31-35 3	72	22.3	22.3	62.8
	36-40 4	82	25.4	25.4	88.2
	>41 5	38	11.8	11.8	100.0
	Total	323	100.0	100.0	

Source: Author's Computation from SPSS 25.0 2021.

2. Marital Status

The marital status of respondents is revealed in table 4.2 below using frequencies and percentages. From investigation most of the respondents 162(50.5%) are married, 134(41.5%) are single, while 27(8.3%) are either divorced or widowed. This implies that most of the respondents have responsibilities of great concern, and hence, information obtained from them may deem to be credible.

Table 4.2: marital Status of respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00 sigle	134	40.7	41.5	41.5
	2.00 marr	162	49.2	50.2	91.6
	3.00 divor	14	4.3	4.3	96.0
	4.00 wido	8	2.4	2.5	98.5
	5.00 othe	5	1.5	1.5	100.0
	Total	323	98.2	100.0	
Missing	System	6	1.8		
Total		329	100.0		

Source: Author's Computation from SPSS 25.0 2021.

3. Number of Dependants

Table 4.3 below shows that only 64 (19.8%) of the respondents have no dependants, however, most of the respondents (80.2%) have in their households dependants ranging from 2-7 people. The implication is that most of the respondents, apart from being responsible people, they may be worse hit by the slowdown in Economic activities in the communities as a result of these closure of mines.

Table 4.3: Number of Dependants

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1. none	64	19.8	19.8	19.8
	2. 1-2	100	31.0	31.0	50.8
	3. 3-4	112	34.7	34.7	85.4
	4. 5-6	26	8.0	8.0	93.5
	5. 7+	20	6.2	6.2	99.7
		1	.3	.3	100.0
	Total	323	100.0	100.0	

Source: Author's Computation from SPSS 25.0 2021

4. Educational Qualification

The Educational qualification of the respondents is revealed in able 4.4 below. It showed that majority of these miners and artisans 234(72.4%) attends tertiary education. This may not be unconnected with the unemployment situation in the country. A few proportions of them attend primary and secondary education, while others attends non formal education.

Table 4.4: Educational Qualification

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1. Prlmar	10	3.0	3.1	3.1
	2.Second	43	13.1	13.3	16.4
	3.Tertiary	234	71.1	72.4	88.9
	4.nonfom	16	4.9	5.0	93.8

	5.others	20	6.1	6.2	100.0
	Total	323	98.2	100.0	
Missing	System	6	1.8		
Total		329	100.0		

Source: Author's Computation from SPSS 25.0 2021

5. Occupation of respondents

Majority of the respondents 65.8% are either famers or Artisans and Miners, while, 36.2% of the respondents are business men who provides subsidiary services in the mining communities. The implication is that th research respondents are compose of people who may be worse hit by these mines closure and may give credible information.

Table 4.5: Occupation of respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.farmer	58	17.6	18.0	18.0
	2.business	117	35.6	36.2	54.2
	3.miner	54	16.4	16.7	70.9
	4.artisan	12	3.6	3.7	74.6
	5.others	82	24.9	25.4	100.0
	Total	323	98.2	100.0	
Missing	System	6	1.8		
Total		329	100.0		

Source: Author's Computation from SPSS 25.0 2021

4.2.2: Descriptive analysis: state and Dimension of Livelihood affected by closure of mines

i. Change in Income of respondents

Table 4.6 below indicates that majority of the respondents 235(71.4%) experienced downward change in income as a result of closure of mines, while 87(26.4%) of them were not affected by the closure.

Table 4.6: Change in Income of respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	87	26.4	26.4	26.4
	1.00	235	71.4	71.4	97.9
	2.00	2	.6	.6	98.5
	3.00	1	.3	.3	98.8
	4.00	1	.3	.3	99.1
	5.00	2	.6	.6	99.7

Source: Author's Computation from SPSS 25.0 2021

ii. Monthly Income of respondents

The income of the respondents as revealed in table 4.7 below explains that 190(57%) of the respondents have a monthly income brought down to less than N30,000 as a result of closure of mines in these communities. This explains that many cannot afford certain services needed for their wellbeing. This makes them and members of their families vulnerable as well as the entire community. Hence most of them fall below the minimum wage. The finding here corroborates with the study conducted by Adjei (2014).

Table 4.7: monthly Income of respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.0 No	133	40.4	41.0	41.0
	1. yes	190	57.8	58.6	99.7
			.3	.3	100.0
	Total	323	98.5	100.0	
Missing	System	5	1.5		
Total		329	100.0		

Source: Author's Computation from SPSS 25.0 2021

Investigation into whether or not there is some improvement in income was revealed in table 4.8 below. It explains that 188(58%) respondents did not notice any improvement in their income long after these mines were closed. This implied that they are in the state poverty even after taking up other jobs.

Table 4.8: improvement in income of respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.0 NO	188	57.1	58.0	58.0
	1.Yes	135	41.0	41.7	99.7
		1	.3	.3	100.0
	Total	324	98.5	100.0	
Missing	System	5	1.5		
Total		329	100.0		

Source: Author's Computation from SPSS 25.0 2021

iii. Change in Economic Activities

The slowdown in economic activities in the Barites mining communities in Nasarawa State is revealed in table 4.9 below. It explains that 268(82.7%) respondents agreed that the closure of mines is responsible for the slowdown in economic activities in their communities, while, 52(16.0%) respondents opined that the closure of mines did not slowdown economic activities in their communities.

Table 4.9: Change in Economic Activities

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.0 NO	52	15.8	16.0	16.0
	1. YES	268	81.5	82.7	98.8
		1	.3	.3	99.1
		1	.3	.3	99.4

		1	.3	.3	99.7
		1	.3	.3	100.0
	Total	324	98.5	100.0	
Missing	System	5	1.5		
Total		329	100.0		

Source: Author's Computation from SPSS 25.0 2021

85.2% of the respondent actually agreed that economic was high when mining activities did not close; this is revealed in table 4.10 below

Table 4.10: Economic Activities before Mines Closure

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	1	.3	.3	.3
	1.Very low	41	12.5	12.7	13.0
	2. Low	49	14.9	15.1	28.1
	3. Average	91	27.7	28.1	56.2
	4. High	97	29.5	29.9	86.1
	5.Very high	45	13.7	13.9	100.0
	Total	324	98.5	100.0	
Missing	System	5	1.5		
Total		329	100.0		

Source: Author's Computation from SPSS 25.0 2021

iV. Change in Population Mobility

Population movement out of the on daily bases for greener pasture is revealed in table 4.11 below. It indicates that 252(78%) agreed that the population of the mining communities decreases greatly as a result of closure of mines

Table 4.11: Change in Population Mobility

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.0 No	68	20.7	21.1	21.1
	1.Yes	252	76.6	78.0	99.1
		1	.3	.3	99.4
		1	.3	.3	99.7
		1	.3	.3	100.0
	Total	323	98.2	100.0	
Missing	System	6	1.8		
Total		329	100.0		

Source: Author's Computation from SPSS 25.0 2021.

227(70.3) actually acknowledged that about 30-50 people enter the mining community on a daily bases before the closure mines. This is revealed in table 4.12 below.

Table 4.12: Population Movement Before closure of mines

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1. 25	96	29.2	29.7	29.7
	2. 30	114	34.7	35.3	65.0
	3. 35	34	10.3	10.5	75.5
	4. 40	46	14.0	14.2	89.8
	5. 50	33	10.0	10.2	100.0

	Total	323	98.2	100.0	
Missing	System	6	1.8		
Total		329	100.0		

Source: Author's Computation from SPSS 25.0 2021.

V. Arable Land Degradation

Investigation into issue of land degradation was revealed in table 4.13 below. It explains that 254(78.6%) respondents agreed that several hectares of arable lands were degraded and left unattended to by the mining companies.

Table 4.13: Arable Land Degradation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.0 No	63	19.1	19.5	19.5
	1. Yes	254	77.2	78.6	98.1
		1	.3	.3	98.5
		3	.9	.9	99.4
		2	.6	.6	100.0
	Total	323	98.2	100.0	
Missing	System	6	1.8		
Total		329	100.0		

Source: Author's Computation from SPSS 25.0 2021.

Majority of the respondents opined that about 100-500 hectares of land were degraded and about 5- 30 Streams were polluted in each of the mining communities in Nasarawa State. This was reviled by table 4.14 and table 4.15 respectfully.

Table 4.14: Hectares of Land Degraded

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	2	.6	.6	.6
	1. 100	68	20.7	21.1	21.7
	2. 250	67	20.4	20.8	42.5
	3. 350	87	26.4	27.0	69.6
	4. 400	72	21.9	22.4	91.9
	5. 500	26	7.9	8.1	100.0
	Total	322	97.9	100.0	
Missing	System	7	2.1		
Total		329	100.0		

Source: Author's Computation from SPSS 25.0 2021.

Table 4.15: Streams polluted

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	1	.3	.3	.3
	1. 5	96	29.2	30.4	30.7
	2. 15	86	26.1	27.2	57.9
	3. 25	78	23.7	24.7	82.6
	4. 25	35	10.6	11.1	93.7
	5. 30	20	6.1	6.3	100.0
	Total	316	96.0	100.0	
Missing	System	13	4.0		
Total		329	100.0		

*Source: Author's Computation f*rom SPSS 25.0 2021.

4.2.3: Logistic Result

Table 4.16: Logistic Regression on Mine Closure and Livelihood

		B	S.E.	Wald	Df	Sig.	Exp(B)
Step 1[a]	CIN0.050	.053	.185	.082	1	.775	1.054
	CEA	-.257	.234	1.202	1	.273	.773
	PMT	.050	.255	.038	1	.846	1.051
	ALD	.004	.190	.000	1	.985	1.004
	Constant	.499	.321	2.421	1	.120	1.648

a. Variable(s) entered on step 1: CIN, CEA, PMT, ALD.

Source: Author's Computation from SPSS 25.0 2021

This study evaluated changes in disposable income, change in aggregate demand, change in population, changes in economic activities, and hectare of land degraded, as a result of closure of mines and these changes influence livelihood, in the mining communities. The Logit result above indicates that the coefficients of Change in Income, Population Movement out of the Mining Communities, and Arable Land Degraded, have conform to a priory expectation, since they are positively sign. The coefficient of Change in Economic Activities has a negative sign as expected. This indicates that these livelihood characteristic have affected the wellbeing of the people of the mining communities in Nasarawa State.

In terms of magnitude, change in economic activities appear to have a profound influence on the livelihood of the mining communities, (δ = -0.235), meaning that if more barites mines closes they are less likely to recover from slowdown in economic activities(less by 24%), hence the probability of recovery from penury is low since mining is the chief source income of the mining communities.. This was followed closely by magnitude of Arable Land Degradation (δ = 0.004), population movement out of the communities, (δ = 0.050), and change in income (δ = 0.53).these took away large portion of livelihood capabilities of the people of these mining communities such that the probability of recovery is weak.

.

All these outcomes pointed out that whereas individuals in these communities whose earnings are below the minimum wage of N30,000 and with large number of dependants are more likely to be poor, while individuals with higher per capita expenditure on education, health and who further years in education are less likely to be underprivileged. Similar conclusion was made by Adjei, (2008).

The model analysis revealed that livelihood of the people of the mining communities is affected by change in income, change in economic activities, population movement and arable land degradation, which were ignited by abrupt closure of mines. This shows that poverty rate of these communities were tilted not in favour of their livelihood capabilities.

Conclusion

From the information generated by this survey, it is clear that mine closure in these mining towns of Aloshi, Azara, Keana, Kuduku and other mining communities has dealt a hard blow on their socio- economic conditions, with far reaching consequences on their well being. The result of the logit regrssion clearly points to the fact that the closure of these barites mines actually slowed down economic and social activities resulting in lower income for the people, lower revenue for the government, and lower population resulting from movement of workers, their families, traders, artisans and partners to other mining areas. This further the separation of families and in some cases, breakdown of family ties etc.

The social and economic impact assessment in tables 4 - 13 clearly analyses how the closure of barites mines in the mining communities in Nasarawa state has impacted on livelihood of the people. Therefore, the work posits that the closure of mines should follow a gradual and adaptive processes, as well as legal procedure with adequate consultation with the inhabitance taken into account that the Land and the mines are their chief sources of livelihood. The mining companies and the government should mitigate these implications by providing the mining communities with the essential threshold of life that may re-engineer their livelihood.

References

Achia, T.N.O, Wangombe, A. & Khadioli, N. (2010). A Logistic regression model, to identify key determinants of poverty using demographic and health survey data. European Journal of Social Sciences, 13(1), 38-45.

Adjei P. O. (2008). The impact of poverty on the health of rural communities in Ghana: a case study of the Amansie West district, Ashanti region. Unpublished Ph.D. Thesis, Department of Geography and Rural Development. Kwame Nkruma University of Science and Technology, Ghana.

Akabzaa, T., & Darimani, A. (2001). Impact of mining sector investment in Ghana: A study of the Tarkwa mining region. Draft report prepared for SAPRI, 70

Anon, S.A., (2017). Introduction to the livelihoods framework, viewed 29 June 2017, from http://www.phuhlisani.com/oid%5Cdownloads%5CCh1.pdf.

Aragon, M., & Juan, P. R. (2012). Mining, Pollution and Agricultural Productivity Evidence from Ghana. Retrieved from https://www.dartmouth.edu/~neudc2012/docs/paper_7.pdf

Aragon, M., Rudy J. &Toewz K. (2015). Mine closure, gender and employment reallocation. UK. british journal of economics.vol 20 No 2.

Baartjes, N.L. & Gounden, K.G.,(2011), 'Causes of mine decline in South Africa', paper presented at the International Mine History Congress, Johannesburg, 15–18 August, viewed 27 May 2016, from http://www.imhc.co.za/assets/pdf/papers/Declining%20Mining%20 in%20SA%20Paper-Neale%20Baartjies.pdf

Banerjee, A. (2013). Status of Women and Gender Discrimination in India. International Journal of

Development Research, 3(12), 57–64.
Bennett, J., and Blamey R. (2001) The Choice Modelling Approach to Environmental Valuation, Edward Elgar, Cheltenham, U.K.
Bradbury, J.H. & St-Martin, I. (1983). Winding Down in a Quebec Mining Town: A Case Study of Schefferville. The Canadian Geographer / Le Géographe canadien, 27:128-144.
Burdge R. & Robertson R. (1998). 'Social impact assessment and the public involvement process'. In Burdge R (ed.), A conceptual approach to social impact assessment: revised edition, Social Ecology Press, Middleton, WI, pp.183-192.
Burdge, R. & Vanclay, F. (1995) '*Social Impact Assessment'*, In Vanclay F. & Bronsteineds, D. Environmental and Social Impact Assessment, Wiley, Chichester, UK, pp. 31-65.
Camargo, R., (2014), Holistic mine closure planning: Social, biophysical and financial, Iron Ore Brazil & Anglo American, viewed 29 January 2016, from http://www.mineclosuresolutions.com/wp-content/uploads/2014/05/KEYNOTE-6-Camargo-Ricardo-Holistic- mine- closure-planning-approach-social-biophysical-and-financial.pdf
Clark, A. & Cark J., (2013), An integrated methodology for assessing social and cultural impacts of mining,
Clark, A. and & J. (2015) – "An International Overview of Legal Frameworks for Mine *Closure"*
Coakes S. (1999) Social impact assessment: A policy maker's guide to developing social impact assessment programs, Bureau of Rural Sciences, Agriculture, Fisheries and Forestry Australia, Canberra.
Churchill, W. (2015). It is not enough that we do our best; sometimes we must do what is required. [Online]. Available: http://www.goodreads.com/quotes/15990-it-isnot-enough-that-we-do-our-best-sometimes [11/10/2015].
De Lange, J., (2011), 'Grootvlei left in ruins', Miningmx, 19 June, viewed 15 November2012,from http://www.miningmx.com/opinion.columnists/groo tvlei-lef- in-ruins.htm
Fortuin, H. (2012). Lecture on Environmental Impact Assessments in the Development Planning and Environmental Analysis Module. Stellenbosch, Sustainability Institute, University of Stellenbosch.

Fourie, A. & Brent, A.C. (2006). A Project-Based Mine Closure Model (MCM) for Sustainable Asset Life Cycle Management. Journal of Cleaner Production, 14(12). :1085-1095.
Frost, J. (2018).Introduction to statistics: An Intuitive Guide (E-book) https.//statisticsbyJim.com

Gibson, R. B. (2006). Sustainability Assessment: Basic Components of a Practical Approach. Impact Assessment & Project Appraisal (Beech Tree Publishing), 24(3). :170-182.
Harington, J. McGlashan, N. & Chelkowska, E. (2004). A Century of Migrant Labour in the Gold Mines of South Africa, Journal-South African Institute of Mining and Metallurgy, 104(2). :65-72.
Hoadley, E.M. & Limpitlaw, D., (2008), Preparation for closure: Community engagement and readiness starting with exploration, viewed 26 September 2017,from https://www.researchgate.net/publication/242256553_Preparation_for_Closure_Community_Engagement_and_Readiness_Starting_with_Exploration
Ishaya S., Alhassan M. M. & Ndako N. (2018). Effect of Barite Mining on water quality in Azara, Awe Local Government Area of Nasarawa State, Nigeria. n *https://www.selfgrowth.com › articles.*

Katrine B., Sandra G., Christian J., & Harro S, (2018). Mine Closure: an

Enviromental and Economic Task in Viatnamese Mining Industry. https://www.researchgate.net › publication › 297613592.

Lockie, S. (2014) 'Social Impact Assessment in Review: Setting the Agenda for Twenty-First Century', Impact Assessment and Project Appraisal, Impact Assessment in the 19(4), pp. 277–287.
Lockie, S., Momtaz, S. & Taylor, B. (1999) 'Meaning and the Construction of Infrastructure Development in Australia's Gladstone/Calliope Region', Social Impacts: Water Rural Society, 9(3), pp. 529–542.I
Limpitlaw, D., (2004), Mine closure as a framework for sustainable development, paper presented at the Sustainable Development Practices on Mine Sites Conference, University of the Witwatersrand, Johannesburg, 8–10 March, viewed 23 July 2012, from http://www/csmi.co.za/l/papers/Mine_closure_as_framework_forSD_mar04.pdf
Marietjie A. (2019). Potential social and economic consequence of mine closure of Orkey and Grootvlie mines. www.neweconomics.org/gen/newways_socialaudit.aspx.

McDonald, J. S. (2015). Chi-Square Test of Independence: Handbook of Biological Statistics, www.biostat-handbook.com.

McHugh, M. L. (2013). The Chi-Square Test of Independence NCBI.

Ndaba, M. (2010). Mining and local economic development: A case study of the Rustenburg local municipality. Unpublished thesis. 28/06/2010: University of the Witwatersrand.http://wiredspace.wits.ac.za/handle/10539/8231 [14/03/2015].

Norgate T. E. and Rankin W. J. (2000) "Life Cycle Assessment of Copper and Nickel Production, Published in Proceedings, Minprex 2000, International Conference on Minerals Processing and Extractive Metallurgy, pp133-138. http://www.minerals.csiro. au/sd/CSIRO_Paper_LCA_CuNi.htm
Oliveira, D. (2016), Mine closure, rehabilitation getting more attention from regulators, viewed 02 March 2017, from http://www.miningweekly.com/article/mining- industry-resistant- to-mine-closure-and-rehabilitation-2016-05-27
Ivanova, G. (2015), Assessing social and economic impacts associated with changes in the coal mining industry in the Bowen Basin, Queensland, Australia, centre for Social Sciences Research, Central Queensland University, Rockhampton.
International Council on Mining and Metals (ICMM), (2012). In brief: Mining's contribution to sustainable development - an overview. London: International Council on Mining and Metals (ICMM).

Saintmoses, E. (2016). Barites Mining in Azara Nasarawa State Nigeria
Stacy J. Naude, A. Hammanus, M. & Frank, P. (2019). Socio-economic aspect of mine closure and sustainable development in southern Africa. Journal of southern African Institute of mining and metaliugy. Vol 110 No.2.

Van-Heerden J. J. (2016), Sustainable mining communities post mine closure: Critical reflection on roles and responsibilities of stakeholders towards local economic development in the City of Matlosana. Thesis presented in partial fulfilment of the requirements for the degree of Master of Philosophy in Sustainable Development in the Faculty of Economic and Management Sciences at Stellenbosch University

World Bank. (2002). It's Not Over When It's Over: Mine Closure Around the World.Washington, D.C.: International Finance Corporation.
https://www.sryahwapublications.com › pdf › 1.pdf

World Bank Group. (2018). It's Not Over When It's Over: Mine Closure Around the World.Washington, D.C.: International Finance Corporation.
https://www.sryahwapublications.com