

Literature Study: Review of the Negative Impacts of Mining Activities in Various Countries on the Environment, Society, and Local Economies, and Mitigation Strategies

Angela Glorya Marito Samosir¹, Sobar Sutisna², Lukman Yudho Prakoso³

^{1,2,3} Department of Disaster Management, Faculty of National Security, Universitas Pertahanan, Jakarta, Indonesia.
Email: angelagloria06@gmail.com¹, cdbriidu@gmail.com², lukman.prakoso@idu.ac.id³

ARTICLE HISTORY

Received: May 11, 2025

Revised: July 12, 2025

Accepted: July 12, 2025

DOI

<https://doi.org/10.52970/grdis.v5i3.1299>

ABSTRACT

Mining activities, on the one hand, contribute significantly to national development. However, these activities negatively impact the environment, society, and economy, particularly for local communities. This literature review aims to examine the negative impacts of mining activities in various countries on the environment, society, and economy, as well as the mitigation strategies employed to reduce these negative impacts. The method used in this study is a literature review, analyzing international journal articles published between 2020 and 2024, with a total of 24 journals analyzed, consisting of 7 journals from 2020, 4 journals from 2021, 4 journals from 2022, 4 journals from 2023, and 5 journals from 2024 discussing the negative impacts of mining activities and mitigation strategies implemented to reduce these impacts. The results of the study indicate that the environmental impacts of mining include soil degradation, water pollution, and ecosystem damage. The social impacts include forced migration and social tension, while the economic impacts include economic instability and unequal distribution of economic benefits. The mitigation strategies identified are that to reduce the negative impacts of mining, it is necessary to conduct environmental impact assessments, rehabilitate mining areas, adopt environmentally friendly technologies, and implement more comprehensive policies that involve local communities in decision-making.

Keywords: Mining Activities, Environment, Society, Economy, Mitigation Strategies.

I. Introduction

Mining activities have long been recognized as a key economic sector contributing significantly to infrastructure development, industrialization, and global technological advancement. Resources extracted from mining are essential components in various industrial sectors, ranging from manufacturing to energy. Essentially, mining management aims to improve the community's welfare and prosperity, thereby granting the state the right to regulate mining activities. While mining activities offer economic benefits, they can also negatively impact the environment. Therefore, these adverse effects must be controlled by implementing structured and well-planned management to prevent excessive environmental damage (Ahadis, 2023)

Governance is considered good if it can fulfill the principles of management to the fullest extent (Dewa et al., 2023), Namely, (a) public participation means that every individual has the right to participate in



decision-making directly or through institutional representatives. This participation must be based on freedom of expression and active contribution, (b) transparency, which refers to the provision of valid information so that government activities and institutions can be monitored by interested parties and effective information management is available, (c) attention to stakeholders, whereby every institution strives to provide the best services to interested parties, (d) commitment to the principles of sustainable mining, which is essential for the mining sector to continue to develop and survive. However, despite its economic contributions, mining activities also negatively impact the environment and society, especially in areas with inadequate resource management. (Naibbi & Chindo, 2020). One of the most critical environmental impacts of mining activities is water, air, and soil pollution caused by mining waste containing heavy metals such as arsenic and mercury. This contamination causes ongoing ecosystem disruption and endangers the health of communities living near mining sites (Ganesan et al., 2024).

Research conducted by Gunawan (2023) Conflicts in the mining sector in Indonesia are related to various issues, such as compensation, community rights, occupational safety, and environmental impacts. Additionally, community participation in decision-making processes is emphasized as a step to reduce conflicts. To prevent violations in the mining industry, stricter and more effective law enforcement is necessary. Mining conflicts are complex issues requiring a comprehensive approach involving the roles of the government, industry, and local communities. Therefore, addressing these issues must prioritize community participation and effective law enforcement. In addition to environmental aspects, mining also impacts social aspects. Communities living near mining areas often face exposure to air and water pollution that affects their health, such as increased respiratory diseases and other health problems (Obasi et al., 2021). Furthermore, mining expansion often triggers land conflicts, evictions, and loss of access to natural resources, exacerbating social inequality, especially for local communities (Omotehinse & Ako, 2019).

The unequal distribution of economic benefits from the mining sector further exacerbates social impacts. Mining companies and external parties mostly enjoy the profits from this sector, while local communities have to bear the burden of environmental degradation and loss of economic welfare. The lack of strict regulations and the low environmental responsibility of mining companies further exacerbate this situation (Naibbi & Chindo, 2020). Based on these issues, it is important to understand the comprehensive impacts of mining from environmental, social, and economic perspectives to improve mining companies' accountability and strengthen the protection of local communities' rights and environmental sustainability. This study aims to obtain a comprehensive overview of the negative impacts of mining activities in various countries on the environment, society, and economy, as well as mitigation strategies to reduce these negative impacts. Thus, this study not only presents the results of the analysis of the negative impacts that have occurred but can also serve as a basis for considering mitigation strategies and sustainable alternative policies.

II. Literature Review

The articles used in the literature review are from reliable sources, thereby enhancing the quality and credibility of this study. In addition, the articles are relevant to the topic being studied, thereby contributing directly to the understanding of the topic discussed. The articles used are also recent, having been published within the last 10 years, so that the theories and opinions used are still relevant to the topic. Based on this, the literature review used can support this study.

2.1. Definition of Mining

Mining is one of the most advanced aspects of industry today. According to Government Regulation of the Republic of Indonesia Number 25 of 2023 on Mining Areas, mining refers to all or part of the activities conducted in the context of research, management, and exploitation of minerals or coal, including general surveys, exploration, feasibility studies, construction, mining, processing and refining, transportation and sales, as well as post-mining activities. Mining operations are activities aimed at optimizing the utilization of

natural resources derived from mines. Mining natural resources includes various chemical elements, minerals, ores, and rocks, including precious stones from natural deposition processes. Mining operations encompass various stages, from general investigation, exploration, feasibility studies, construction, mining, processing and refining, transportation, sales, and post-mining maintenance (Wowor, 2017). According to Risal et al. (2013), Mining can be defined as an activity aimed at obtaining metals and minerals by damaging nature, such as destroying mountains, forests, rivers, and seas, and disrupting the lives of surrounding communities. This activity is often considered one of the most environmentally and socially destructive, where only a small group of wealthy individuals benefit. This definition includes elements such as environmental damage, deception, myths, and benefits enjoyed by only a few.

2.2. Mining Procedures

Various mining procedures are used based on the type of mineral being extracted. The four most common surface mining methods are open pit mining, drilling, and rock mining. All these methods involve extracting mineral materials from the surface, while underground mining is carried out through shafts and tunnels; drill and deep-sea mining are also involved. Thus, "the extraction of minerals from the Earth" can be considered an appropriate definition for mining (Ganesan et al., 2024).

2.3. Types of Mining

Mineral and coal mining, as referred to in Government Regulation of the Republic of Indonesia Number 96 of 2021 on the Implementation of Mineral and Coal Mining Business Activities, is classified into 5 (five) categories of mining commodities:

1. Radioactive minerals, including uranium, thorium, and other radioactive minerals;
2. Metallic minerals include aluminum, antimony, arsenic, basanite, bauxite, beryllium, iron ore, bismuth, cadmium, cesium, gold, galena, gallium, germanium, hafnium, indium, iridium, chromium, cobalt, chromite, lithium, rare earth metals, magnesium, manganese, molybdenum, monazite, nickel, niobium, osmium, iron sand, palladium, silver, platinum, rhodium, ruthenium, selenium, zinc, senotim, cinnabar, strontium, tantalum, tellurium, copper, tin, titanium, vanadium, tungsten, and zirconium;
3. Non-metallic minerals include asbestos, barite, sulfur, bentonite, bromine, dolomite, feldspar, fluorite, fluorspar, phosphate, rock salt, gypsum, graphite, halite, ilmenite, calcite, kaolin, cryolite, limestone, quartzite, magnesite, mica, ochre, perlite, pyrophyllite, rhyolite, rutile, talc, alum, wollastonite, yarosite, iodine, zeolite, and zircon;
4. Rocks include agate, andesite, basalt, pumice, limestone, large quarry rock, river rock, chert, diorite, gabbro, garnet, jade, granite, granodiorite, jasper, chalcedony, fossilized wood, sandy gravel, river gravel without sand, chrysoprase, quartz crystal, leucite, marble, obsidian, onyx, opal, sea sand, fill sand, tidal sand, perlite, peridotite, pumice, soil, diatomaceous earth, clay, red soil, absorbent soil, fill soil, toseki, trachyte, tras, slate, and sand that does not contain significant amounts of metallic or non-metallic minerals from an economic mining perspective; and
5. Coal includes asphalt, rock, coal, solid bitumen, and peat.

Mining systems are generally divided into two types: open-pit mining and underground mining. Open-pit mining uses backfilling with excavation, loading, and transportation equipment such as backhoes and dump trucks. The open-pit mining method is where all mining activities occur on the Earth's surface, and the work area is directly exposed to the outside air (Putri et al., 2022).

2.4. Sustainable Development (Sustainable Development Goals / SDGs)

Sustainable Development Goals (SDGs) are global goals officially adopted in 2015 following the end of the Millennium Development Goals (MDGs). This document includes 17 more detailed goals than those outlined in the International Conference on Population and Development (ICPD) and the MDGs. Environmental issues are one of the key topics addressed in this document. Integrating economic development, population, and environmental concepts in the SDGs aims to create sustainability (Adams & Abhayawansa, 2022; Bauer et al., 2023; Hossain et al., 2020).

Sulistiyowati et al., (2022) Explain that sustainability must involve corporate social responsibility (CSR). CSR is a communication process that informs the social and environmental impacts of a company's economic activities on specific communities and society. Sustainable development encompasses a business approach that focuses on financial profit and social and environmental sustainability. Therefore, sustainable development is closely related to social responsibility. CSR, often referred to as corporate social responsibility, is an effort to communicate the social and environmental impacts of a company's economic activities to specific groups and society as a whole (Purnamawati et al., 2023). Sustainable Development was created to shift the paradigm of conventional development toward a better direction. In general, sustainable development can be defined as a development process that meets the needs of the present without compromising the needs of future generations. However, sustainable development is not only focused on environmental issues but also encompasses economic, social, and environmental protection policies. Through this approach, the negative impacts of conventional development, such as environmental damage caused by exploiting natural resources like forests, water, and mining that destroy ecosystems, can be avoided.

2.5. Sustainable Mining

Sustainable development strategy integrates economic, ecological, and social aspects. Based on this concept, there are three main supporting components, namely economic, social, and environmental sustainability. These three components interact and support each other, which applies to the mining sector (Fitriyanti, 2016).

Gopalakrishnan and Ramaswamy (2017) Explain that sustainable mining can be measured by how local communities support mining activities that positively impact their well-being. Meanwhile, Gorman and Dzombak (2018) The concept of sustainable mining operations management emphasizes that sustainable mining does not mean continuing operations at the exact location indefinitely, as the resources available will eventually deplete or become economically unviable to exploit. Various studies on sustainable mining governance show that mining companies positively impact social welfare and economic improvement. Marimuthu et al (2021), as well as environmental impact management (Chairuddin et al., 2023). In countries such as Australia, South Africa, Canada, and Finland, "social license" describes the challenges in building relationships between local communities, organizational behavior, and corporate social responsibility. This term now represents the support provided by the community during mining activities. In some Eastern and Central European countries, mining has played an important role in infrastructure development and poverty reduction (Tsaurai, 2021).

2.6. Impact of Mining

2.6.1 Environmental Impact

The environment is one of the impacts of mining. Long-term mining activities will damage the environment, affecting economic progress in the beginning of mining (Matheis, 2016). Mining can cause environmental conflicts (Hartono, 2023) As well as carbon emissions and community dependence. Mining managed by companies can negatively and positively impact the surrounding community. Mining activities

significantly negatively impact the environment, including water, soil, and air pollution. One of the main impacts is water contamination due to mining waste, which can pollute groundwater and surface water sources. Research in Ghana shows that illegal small-scale mining activities cause severe pollution in rivers used for domestic and agricultural purposes (Mensah et al., 2015). Tailings dams built in mines often contain heavy metals and are very dangerous to water quality and soil in the surrounding area (Worlanyo et al., 2022). Mining can cause various adverse environmental impacts, such as land degradation, landslides, air and water pollution, and damage to tourist facilities. Indirectly, environmental damage also contributes to global warming and climate change (Mambi et al., 2023). Additionally, mining activities cause river pollution, air quality deterioration, and damage to road infrastructure due to trucks carrying loads exceeding their capacity (Habibi, 2022). Other environmental impacts of mining activities include destroying agricultural land, leading to long-term soil degradation that renders the land unusable. Furthermore, mining also causes a decline in soil quality, which can hinder crop production. (Worlanyo et al., 2022). This is also reinforced by the opinion of Hasibuan & Siregar (2023), who state that mining activities impact agricultural production in areas surrounding the mine, and even have a social impact on the community, especially farmers near the mine.

2.6.2 Social Impact

Indonesia's Mining activities have positive and negative impacts on society and the country. The positive impacts include creating jobs and mining production that meets domestic and international market demand. Thus, mining exports can increase the country's income and economic growth. According to Maulidiyah et al., (2021) The positive impacts of mining on the socio-economy of the community are increased income and job opportunities. The negative impact on the social structure of communities around mining companies may include bad behavior that tends to lead to law violations, consumptive lifestyles, and employees who can influence the community's purchasing power, resulting in disharmony in local community relations. In Ramlah et al., (2019) Studies show that mining can cause conflicts between communities and companies and health impacts. Other impacts include displacement, marginalization, and oppression of local communities (Ellis et al., 2017). Mining often results in the displacement of local communities, forcing them to move to areas with depleted natural resources and toxic environments. This displacement significantly affects indigenous communities, who rely on their ancestral lands for survival. The lack of adequate rehabilitation programs leads to health problems, inadequate living conditions, and limited access to clean water (Dontala et al., 2015).

2.6.3 Economic Impact

The negative economic impacts of mining are also significant. High dependence on the mining sector makes the local economy vulnerable to changes in global commodity prices. A decline in gold prices can significantly impact the income of the community and local government, creating economic instability. The distribution of benefits from mining activities is often uneven (Selawati & Rafika, 2024). Mining generally boosts the local economy, increasing the population's income and expanding business opportunities in other sectors. However, social unrest can be caused by income inequality, unequal distribution of profits from resource extraction, corruption resulting from careless management of natural resources, and other factors. Conflicts between companies, illegal miners, and anti-mining activists may arise. The loss of traditional livelihoods for local communities and the government's failure to reinvest mining revenues can lead to increased poverty (Kholiya, 2020). According to Tsurai, (2021), citing research by Yang and Ho, (2019) The economic impact of mining can be seen in the improvement of the economy of communities around mining sites, reflected in the emergence of new types of jobs, increased income, improved housing quality, ownership of transportation, access to water sources, and a decrease in unemployment rates.

2.7. Hypothesis

1. Simultaneous research hypothesis

All mining activities significantly negatively impact the community's environmental, social, and economic quality.

2. Partial research hypothesis

a. There are negative impacts on environmental quality

Not properly managed mining activities will significantly negatively impact environmental quality, including soil degradation, water pollution, and loss of biodiversity.

b. There are negative impacts on the social aspects of the community

Mining activities will increase social tensions, trigger forced migration, and exacerbate social inequalities among the affected local communities.

c. There are negative impacts on the economic aspects of the community

Mining activities will provide short-term economic benefits, but will create economic instability and unequal distribution of benefits for the local community in the long term.

In this study, previous research contributions are significant because literature provides a strong foundation for understanding broader issues, including comparisons between countries and mitigation approaches that have been implemented, thereby providing a more comprehensive picture for the development of better policies or sustainable solutions in the future.

III. Research Method

The research method in this literature study focuses on a systematic and comprehensive review of various scientific sources that discuss the impact of mining activities in various countries on local communities' environmental, social, and economic aspects. This study adopts a literature review approach aimed at compiling, identifying, and analyzing relevant findings from previous research to gain a comprehensive understanding of the dynamics of these impacts and to examine various mitigation strategies that have been implemented.

3.1 Literature Source

The data used in this study is secondary data. Secondary data is obtained indirectly from various literature sources, such as books, papers, research journals on mining, and other academic sources. More specifically, the data was obtained from previous research conducted by other researchers. Literature searches were conducted using the Scopus and Google Scholar databases. The keywords used in the search include "impact of mining activities" and "community."

3.2 Literature Selection Criteria

1. Relevance: The literature is related to the research topic, namely, the impact of mining activities on the environment, society, and economy of the community
2. Publication: The literature must be recent, with a maximum of 5 years old, published between 2020 and 2024
3. Availability: The literature is available in full text and written in English

Based on the search results using the specified keywords, 382 articles were found. Based on the screening results, 24 articles were selected according to the specified criteria. The 358 articles that were not

selected were excluded for several reasons, such as not being original research, irrelevant to the review's focus, unclear design/methodology, and protocol studies.

3.3 Data Analysis

The analytical approach used in this study is thematic analysis, which aims to identify patterns or find themes from data collected by researchers. This method is highly effective for research focused on qualitative data, as it allows researchers to delve deeply into the data, identify relationships between existing patterns within a phenomenon, and explain the extent to which the phenomenon occurs from the researcher's perspective (Heriyanto, 2018).

3.4 Synthesis and Development of Theory

After reviewing relevant articles, the results of the literature study were synthesized by integrating the similarities and differences of each article, then drawing collective conclusions through a synthesis matrix to develop a theoretical framework regarding the negative impacts of mining activities and mitigation strategies. A synthesis matrix is a table or diagram that helps researchers group and classify the results of analyses from various articles and combine different elements to reach conclusions that reflect the overall articles. This framework is expected to contribute to developing theories or models to reduce the negative impacts of mining activities (Murniarti et al., 2018).

3.5 Practical Implications

Literature reviews play an important role as the basis for all types of research. Literature reviews can serve as a basis for developing knowledge, recommending guidelines for policy and practice, and providing evidence about an influence, so that if done well, they have the potential to generate new ideas and directions for a particular field. (Snyder, 2019).

3.6 Reflexivity and Reliability

In literature studies, reflexivity and trustworthiness are complementary and constitute important elements in ensuring the quality and integrity of research results. Reflexivity refers to the active and conscious acknowledgement of one's beliefs, biases, and assessment systems before, during, and after the actual research process. Therefore, reflexivity has greater potential to guide the research process. (Lazard & McAvoy, 2020). Trust is built through transparency, thoroughness, and consistency in data collection and analysis to ensure that the findings are credible and reliable. (Damiasih, 2025).

IV. Results and Discussion

A literature review of 24 articles published between 2020 and 2024 shows that mining activities hurt the environment and local communities. These impacts are categorized into several main aspects, namely environmental, social, and economic impacts, as well as mitigation strategies to reduce the negative impacts of mining, as detailed in Table 1 below.

Table 1. Literature Review Result

No	Author (Year)	Research Title	Impact		
			Environment	Social	Economy
1	Ganesan et al., (2024)	The Impact of Geology on Environmental Management in Mining Operations	✓		
2	Tella & Danjibo, (2024)	The Environmental Impact of Mining Activities in the Local Community: A Structural Equation Modelling Approach	✓	✓	
3	Susanto et al. (2024).	The Impact of Acid Mine Drainage on the Environment and Society	✓	✓	✓
4	Samanlangi, (2024)	Environmental Justice and Resource Extraction: Analyzing the Social Dynamics of Mining Projects	✓	✓	
5	Silva & Rocha (2024)	The Impacts of Mining on Society, Economy, and Its Relationship with Geodiversity	✓	✓	✓
6	Rahayu et al., (2023)	Environmental and Social Injustice: Impact and Sustainability of Small-Scale Tin Mining Under Indonesia's New Mineral and Coal Regulation	✓	✓	✓
7	Kirsanov et al., (2023)	Environmental and monopolistic issues in industrial minerals mining	✓		✓
8	Dehghani et al., (2023)	A Mimic Model Approach for Impact Assessment of Mining Activities on Sustainable Development Indicators	✓	✓	✓
9	Tambol et al. (2023).	Impacts of Mining on the Environment in West African Sahel: A Review	✓	✓	✓
10	Kong & Xiong, (2022)	Hazards Caused by Mining Activities and Corresponding Treatment Technologies	✓		
11	Haddaway et al. (2022)	Evidence of the impacts of metal mining and the effectiveness of mining mitigation measures on social-ecological systems in Arctic and boreal regions	✓	✓	✓
12	Magidi & Hlungwani, (2022)	Development or Destruction? Impacts of Mining on the Environment and Rural Livelihoods at Connemara Mine, Zimbabwe	✓	✓	✓
13	Tampushi et al. (2022)	Assessing Social and Environmental Impacts of Artisanal and Small-Scale Gold Mining Practices in Lolgorian, Kenya	✓	✓	✓
14	Aleksandrova & Timofeeva (2021)	Impact of mining of common minerals on the environment and public health	✓		
15	Marimuthu et al. (2021)	Assessment of Key Socio-Economic and Environmental Challenges in the Mining Industry: Implications for resource policies in emerging economies	✓	✓	✓
16	Leuenberger et al., (2021)	Health Impacts of Industrial Mining on Surrounding Communities: Local Perspectives from Three Sub-Saharan African Countries	✓	✓	✓

No	Author (Year)	Research Title	Impact		
			Environment	Social	Economy
17	Mwakesi et al., (2021)	Impact of mining on the environment: A case study of Taita Taveta County, Kenya	✓	✓	
18	Kholiya (2020)	Assessing the Environmental and Social Impact of Large-Scale Mining Operations in India: An Empirical Investigation	✓	✓	✓
19	Khobragade (2020)	Impact of Mining Activity on the Environment: An Overview	✓	✓	
20	Mwakesi et al., (2020)	Mining Impacts on Society: A Case Study of Taita Taveta County, Kenya		✓	
21	Sobczyk et al., (2020)	Exploitation of Mineral Resources for Sustainable Development on the Example of Poland	✓		
22	Agboola et al. (2020)	A Review on the Impact of Mining Operation: Monitoring, Assessment, and Management	✓		
23	Kazindu et al. (2020)	Environmental Impacts Analysis of Mining on the Surrounding Communities: A Case Study of Rutongo Mines Ltd in Rulindo District, Northern Province of Rwanda	✓	✓	
24	Gomez & Cebada, (2020)	A Socio-Environmental History of a Copper Mining Company: Rio-Tinto Company Limited (1874–1930)	✓	✓	

Based on the analysis of existing articles, it can be concluded that the impact of mining activities on the environment, society, and economy is often discussed simultaneously, demonstrating the complexity of the issues involved. Five articles specifically discuss the impact on the environment, and one article focuses on the social impact. Meanwhile, six articles discuss environmental and social impacts simultaneously. Additionally, 1 article addresses environmental and economic impacts, and 13 comprehensively cover environmental, social, and economic impacts. This reflects that mining issues have broad and diverse impacts, affecting both environmental and social and economic aspects, and are often interrelated, particularly for local communities.

4.1 Environmental Impact

Mining activities cause widespread soil degradation, altering the natural vegetation of the land, which is difficult to restore, and reducing soil fertility (Ganesan et al., 2024; Tella & Danjibo, 2024; Sobczyk et al., 2020). Additionally, mining triggers erosion, loss of land productivity, and environmental imbalances that hinder agriculture and worsen ecosystems (Silva & Rocha, 2024; Rahayu et al., 2023; Kirsanov et al., 2023). At the Connemara Gold Mine in Zimbabwe, mining has caused severe soil erosion, rendering the land unproductive (Magidi & Hlungwani, 2022).

Mining has a significant negative impact on ecosystems and environmental sustainability. The loss of natural vegetation and water pollution caused by mining threaten biodiversity and damage biota habitats, disrupting ecosystem balance (Kong & Xiong, 2022; Aleksandrova & Timofeeva, 2021; Mwakesi et al., 2021). Additionally, mining can alter climate conditions, exacerbating environmental sustainability challenges by disrupting temperature patterns, humidity, and overall ecosystem stability (Marimuthu et al., 2021). Mining waste reduces soil fertility, disrupts agriculture, and produces Acid Mine Drainage (AMD), which worsens water quality by releasing toxic heavy metals, lowering water pH, and damaging natural habitats (Susanto et al., 2024; Samanlangi, 2024). Additionally, the use of mercury in small-scale gold mining further degrades water and soil quality, damaging aquatic ecosystems (Tampushi et al., 2022). In Rwanda, mining waste

contaminates rivers and reduces access to clean water for nearby communities (Kazindu et al., 2020). Mining activities also have adverse effects on the health of surrounding communities, such as increasing the risk of respiratory and skin diseases, and reducing quality of life (Leuenberger et al., 2021; Mwakesi et al., 2021; Kholiya, 2020; Khobragade, 2020). Gomez & Cebada (2020) highlight that mining activities can cause severe air pollution, as seen in Spain, leading to severe respiratory issues among nearby residents.

4.2 Social Impact

Mining activities often cause forced displacement of people due to environmental damage, which triggers social tensions and conflicts between communities, companies, and governments (Samanlangi, 2024; Dehghani et al., 2023; Mwakesi et al., 2021). Water and soil pollution exacerbate these conditions, forcing communities to relocate for cleaner natural resources (Leuenberger et al., 2021; Mwakesi et al., 2020; Kazindu et al., 2020). This displacement also impacts cultural identity and increases social tensions between local communities and newcomers (Kholiya, 2020; Khobragade, 2020). Although mining creates jobs, large companies and government officials enjoy most of the benefits, while local communities often remain trapped in poverty (Silva & Rocha, 2024; Magidi & Hlungwani, 2022). Land acquisition without fair compensation is also a cause of social injustice that exacerbates poverty and degrades the quality of life (Rahayu et al., 2023; Marimuthu et al., 2021; (Haddaway et al., 2022; Gomez & Cebada, 2020). Additionally, the illegal mining sector exacerbates inequality by increasing child labor practices, workplace accidents, and the exploitation of natural resources without considering environmental sustainability (Tambol et al., 2023; Tampushi et al., 2022). This inequality in access to economic and social benefits often exacerbates social tensions and worsens existing inequalities, particularly in communities heavily dependent on mining work (Samanlangi, 2024; Tella & Danjibo, 2024; Susanto et al., 2024; Tambol et al., 2023).

4.3 Economic Impact

Illegal mining practices and unsustainable extraction of natural resources exacerbate social inequality and harm local communities, while companies and the state enjoy most of the economic benefits (Magidi & Hlungwani, 2022; Marimuthu et al., 2021; Tampushi et al., 2022; Leuenberger et al., 2021). The inability to develop other economic sectors further exacerbates this dependence, hindering the development of other sectors and leading to significant economic losses, both in the short and long term (Dehghani et al., 2023; Tambol et al., 2023).

4.4 Mitigation Strategies to Reduce the Negative Impact of Mining Activities

A literature review of 26 articles found that 23 articles provided recommendations for strategies to mitigate the negative impacts of mining activities on the environment, society, and economy. One important initial step is to conduct an environmental impact assessment to identify potential damage to soil, water, air, and biodiversity (Ganesan et al., 2024). This analysis is crucial to provide a clearer picture of the extent of the impact of mining activities on the surrounding ecosystem, which can serve as a basis for more appropriate mitigation measures. On the other hand, the restoration of mining areas through land restoration and rehabilitation, as well as the implementation of protection zones around mining facilities, can prevent further damage to the soil and ecosystems (Sobczyk et al., 2020; Mwakesi et al., 2021). One widely used technique is phytoremediation, which involves using plants to clean contaminated soil (Haddaway et al., 2022; Agboola et al., 2020). The greening and tree planting initiatives implemented by the mining company China National Petroleum Corporation (CNPC) can be a reference for restoring areas degraded by mining activities (Tambol et al., 2023). This initiative can serve as a model for sustainable restoration efforts.

For mine waste management technology, adopting environmentally friendly technologies that reduce pollutant emissions and improve water use efficiency is also significant (Aleksandrova & Timofeeva, 2021;

Khobragade, 2020). Physical technologies, such as using activated carbon adsorbents and diatomite to remove harmful substances from mining waste and contaminated water, can also improve water quality. (Kong & Xiong, 2022). Using natural and environmentally friendly materials provides an effective solution for cleaning water without damaging the broader ecosystem. Additionally, chemical technologies using lime and limestone can neutralize soil acidity and reduce the potential for living organisms to absorb heavy metals. Furthermore, active treatment systems with lime to increase water pH and passive systems that utilize plants to absorb heavy metals from acidic mine water should also be considered (Susanto et al., 2024; Kholiya, 2020). Furthermore, transitioning from open-pit mining to underground mining is proposed as a more environmentally friendly method that does not cause severe soil and water damage. (Kirsanov et al., 2023). This transition can reduce direct impacts on the surrounding natural conditions, reduce dust and air pollution, and avoid significant damage to existing ecosystems.

Furthermore, strengthening environmental governance and stakeholder collaboration is essential to ensure sustainable and equitable resource management (Silva & Rocha, 2024; Dehghani et al., 2023). Strict government regulation and oversight of mining activities in mineral-rich areas are also crucial (Tella & Danjibo, 2024; Marimuthu et al., 2021). Rigorous oversight can prevent overexploitation and ensure mining practices do not harm the environment or threaten community well-being. Policy reforms that involve local communities in decision-making processes are also important to support sustainability and social justice in the mining sector, so that their needs can be adequately accommodated (Samanlangi, 2024; Magidi & Hlungwani, 2022; Mwakesi et al., 2020). One way to achieve this is by improving impact assessments that incorporate the perspectives of affected communities before and during project implementation. (Leuenberger et al., 2021; Kazindu et al., 2020).

V. Conclusion

The negative impacts of mining activities are felt not only in environmental aspects but also in social and economic aspects. Land degradation, water and air pollution, and ecosystem damage directly impact environmental sustainability and the quality of life of surrounding communities. In social terms, mining often causes forced migration, social tensions, and inequality in the distribution of economic benefits. Dependence on this sector also exacerbates local economic instability and hinders economic diversification. Therefore, adopting effective mitigation strategies, including applying environmentally friendly technologies, land restoration, and policies that support social justice and sustainability, is important. Involving local communities in the decision-making process is an important step to ensure that their needs are met and that negative impacts are minimized. Based on the findings of this study, it is hoped that the government will be more proactive and responsive in managing mining by formulating policies, establishing strict regulations, and working with community leaders and local communities to conduct strict supervision of companies carrying out mining activities. Further research is also recommended to explore in depth the specific impacts of each type of mining on the environment, society, and the local economy. Comparative studies between different types of mining are also needed to formulate more adaptive and sustainable policies.

References

- Adams, C. A., & Abhayawansa, S. (2022). Connecting The COVID-19 Pandemic, Environmental, Social and Governance (ESG) Investing and Calls for 'Harmonisation' of Sustainability Reporting. *Critical Perspectives on Accounting*, 82, 1–13. <https://doi.org/10.1016/j.cpa.2021.102309>
- Agboola, O., Babatunde, D. E., Isaac Fayomi, O. S., Sadiku, E. R., Popoola, P., Moropeng, L., Yahaya, A., & Mamudu, O. A. (2020). A Review on The Impact of Mining Operation: Monitoring, Assessment and Management. *Results in Engineering*, 8, 1–23. <https://doi.org/10.1016/j.rineng.2020.100181>
- Ahadis, H. (2023). Model Tata Kelola Pertambangan Berkelanjutan di Provinsi Lampung. Disertasi: Universitas Lampung.

- Aleksandrova, A. Y., & Timofeeva, S. S. (2021). Impact of Mining of Common Minerals on The Environment and Public Health. *IOP Conference Series: Earth and Environmental Science*, 848(1), 1–9. <https://doi.org/10.1088/1755-1315/848/1/012136>
- Bauer, P., Traxler, A. A., & Greiling, D. (2023). Management Control by Municipal Utilities for Value Creation to Achieve The Sustainable Development Goals. *Utilities Policy*, 84, 1–8. <https://doi.org/10.1016/j.jup.2023.101641>
- Chairuddin, M. A., Mahyudin, I., Fatah, L., & Aziz, Y. (2023). Dampak Perusahaan Batubara Terhadap Lingkungan dan Ekonomi Lokal Masyarakat Sekitar Kecamatan Padang Batung dan Kecamatan Sungai Raya Kabupaten Hulu Sungai Selatan, Kalimantan Selatan. *EnviroScientee*, 19(2), 130–139.
- Damiasih, D. (2025). Psychological Factors Influencing Tourist Decision Making. *Golden Ratio of Social Science and Education*, 5(1), 59–72. <https://doi.org/10.52970/grsse.v5i1.433>
- Dehghani, H., Bascompta, M., Khajevandi, A. A., & Farnia, K. A. (2023). A Mimic Model Approach for Impact Assessment of Mining Activities on Sustainable Development Indicators. *Sustainability*, 15(3), 1–15. <https://ideas.repec.org/a/gam/jsusta/v15y2023i3p2688-d1055110.html>
- Dewa, M. J., Sinapoy, M. S., Haris, O. K., Tatawu, G., Sensu, L., & Arifin. (2023). Kebijakan Hukum Pengelolaan Pertambangan Berbasis Kesejahteraan Masyarakat Government Legal Policy Against Mining in Forest Areas. *Halu Oleo Legal Research*, 5(1), 157–170. <https://journal.univpancasila.ac.id/index.php/selisik/article/view/631>.
- Dontala, S. P., Reddy, T. B., & Vadde, R. (2015). Environmental Aspects and Impacts: Its Mitigation Measures of Corporate Coal Mining. *Procedia Earth and Planetary Science*, 11, 2–7. <https://doi.org/10.1016/j.proeps.2015.06.002>
- Ellis, J. I., Ellis, J. I., Clark, M. R., Lamarche, G., Rouse, H. L., & Lamarche, G. (2017). Environmental Management Frameworks for Offshore Mining: The New Zealand Approach. *Marine Policy*, 84, 178–192. <https://doi.org/10.1016/j.marpol.2017.07.004>
- Fitriyanti, R. (2016). Pertambangan Batubara: Dampak Lingkungan, Sosial dan Ekonomi. *JURNAL REDOKS*, 1(1), 34–40.
- Ganesan, A., Sethuraman, P., & Balamurugan, S. (2024). The Impact of Geology on Environmental Management in Mining Operations. *Archives for Technical Sciences*, 31(2), 86–93. <https://doi.org/10.70102/afts.2024.1631.086>
- Gomez, G. J. J., & Cebada, J. D. P. (2020). A Socio-Environmental History of a Copper Mining Company: Rio-Tinto Company Limited (1874–1930). *Sustainability*, 12(11), 1–8. <https://doi.org/10.3390/su12114521>
- Gopalakrishnan, V., & Ramaswamy, C. (2017). Patient Opinion Mining to Analyze Drug Satisfaction Using Supervised Learning. *Journal of Applied Research and Technology*, 15(4), 311–319. <https://doi.org/10.1016/j.jart.2017.02.005>
- Gorman, M. R., & Dzombak, D. A. (2018). A Review of Sustainable Mining and Resource Management: Transitioning From The Life Cycle of The Mine to The Life Cycle of The Mineral. *Resources, Conservation and Recycling*, 137, 281–291. <https://doi.org/10.1016/j.resconrec.2018.06.001>
- Gunawan, L. S. (2023). Konflik Pertambangan di Indonesia: Studi Kasus Tambang Emas Martabe dan Upaya Meningkatkan Partisipasi Masyarakat dan Penegakan Hukum dalam Industri Pertambangan. *Jurnal Pendidikan Tambusai*, 7(1), 2062–2074.
- Habibi, A. (2022). Pencemaran Lingkungan Akibat Tambang Batu Bara di Desa Serongga Kabupaten Kotabaru. *Pusat Publikasi S-1 Pendidikan IPS FKIP ULM*, 1, 1–9.
- Haddaway, N. R., Cooke, S. J., Lesser, P., Macura, B., Nilsson, A. E., Taylor, J. J., & Raito, K. (2019). Evidence of The Impacts of Metal Mining and The Effectiveness of Mining Mitigation Measures on Social-Ecological Systems in Arctic and Boreal Regions: A Systematic Map Protocol. *Environmental Evidence*, 8(1), 1–11. <https://doi.org/10.1186/S13750-019-0152-8/TABLES/4>
- Haddaway, N. R., Smith, A., Taylor, J. J., Andrews, C., Cooke, S. J., Nilsson, A. E., & Lesser, P. (2022). Evidence of The Impacts of Metal Mining and The Effectiveness of Mining Mitigation Measures on Social–

- Ecological Systems in Arctic and Boreal Regions: A Systematic Map. *Environmental Evidence*, 11, 1–23. <https://doi.org/10.1186/s13750-022-00282-y>
- Hartono, E. (2023). Analysis of The Impact of Illegal Gold Mining (Peti) on The Socio-Economy of Mine Workers in Gandis Hilir Village, Dedai District, Sintang Regency. *E*, 1(1), 1–5.
- Hasibuan, B. A., & Siregar, R. S. (2023). Dampak Pertambangan Emas Tanpa Izin (PETI) terhadap Produksi Pertanian dan Implementasi Peraturan Daerah. *Jurnal EDUCATIO: Jurnal Pendidikan Indonesia*, 9(1), 368–373. <https://doi.org/10.29210/1202323040>
- Heriyanto. (2018). Thematic Analysis sebagai Metode Menganalisa Data untuk Penelitian Kualitatif. *ANUVA*, 2(3), 317–324.
- Hossain, M., Purohit, N., Sharma, R., Bhattacharya, S., Lisako, E., McKyer, J., & Ma, P. (2020). Suicide of A Farmer Amid COVID-19 in India: Perspectives on Social Determinants of Suicidal Behavior and Prevention Strategies. *Suicide of a Farmer amid COVID-19 in India*, 1–8.
- Kazindu, H., Mupenzi, C., & Maniragaba, A. (2020). Environmental Impacts Analysis of Mining on the Surrounding Communities: A Case Study of Rutongo Mines Ltd in Rulindo District, Northern Province of Rwanda. *Journal of Energy and Natural Resources*, 9(2), 56–69. <https://doi.org/10.11648/j.jenr.20200902.12>
- Khobragade, K. (2020). Impact of Mining Activity on Environment: An Overview. *International Journal of Scientific and Research Publications (IJSRP)*, 10(05), 784–791. <https://doi.org/10.29322/ijsrp.10.05.2020.p10191>
- Kholiya, D. (2020). Assessing the Environmental and Social Impact of Large-Scale Mining Operations in India: An Empirical Investigation. *Turkish Online Journal of Qualitative Inquiry*, 1(2), 658–663. <https://doi.org/10.52783/tojqi.v1i1i2.9986>
- Kirsanov, A. K., Kurchin, G. S., Shkaruba, N. A., Nikolaeva, N. V., Nafikov, R. Z., Kostilev, S. S., & Teshaev, U. R. (2023). Environmental and Monopolistic Issues in Industrial Minerals Mining. *Journal of Degraded and Mining Lands Management*, 10(3), 4567–4573. <https://doi.org/10.15243/jdmlm.2023.103.4567>
- Kong, Y., & Xiong, B. (2022). Hazards Caused by Mining Activities and Corresponding Treatment Technologies. *Highlights in Science, Engineering and Technology*, 11, 122–133.
- Lazard, L., & McAvoy, J. (2020). Doing Reflexivity in Psychological Research: What is The Point? What is The Practice? *Qualitative Research in Psychology*, 17(2), 159–177. <https://doi.org/10.1080/14780887.2017.1400144>
- Leuenberger, A., Winkler, M. S., Cambaco, O., Cossa, H., Kihwele, F., Lyatuu, I., Zabre, H. R., Farnham, A., MacEte, E., & Munguambe, K. (2021). Health Impacts of Industrial Mining on Surrounding Communities: Local Perspectives From Three Sub-Saharan African Countries. *PLOS One*, 16(6), 1–23. <https://doi.org/10.1371/journal.pone.0252433>
- Magidi, M., & Hlungwani, P. M. (2022). Development or destruction? Impacts of mining on the environment and rural livelihoods at Connemara Mine, Zimbabwe. *South African Geographical Journal*, 105(2), 1–22. <https://doi.org/10.1080/03736245.2022.2032294>
- Mambi, A., Pangkorego, O. A., & Sarapun, R. M. S. (2023). Tinjauan Yuridis Dampak Tambang Galian C Illegal Terhadap Kerusakan Lingkungan di Wilayah Kabupaten Toraja Utara 1. *Lex Privatum*, 12(1), 1–12.
- Marimuthu, R., Sankaranarayanan, B., Ali, S. M., Jabbour, A. B. L. de S., & Karupiah, K. (2021). Assessment of Key Socio-Economic and Environmental Challenges in The Mining Industry: Implications for Resource Policies in Emerging Economies. *Sustainable Production and Consumption*, 27, 814–830. <https://doi.org/10.1016/j.spc.2021.02.005>
- Matheis, M. (2016). Local Economic Impacts of Coal Mining in The United States, 1870 to 1970. *Journal of Economic History*, 76(4), 1152–1181. <https://doi.org/10.1017/S002205071600098X>
- Maulidiyah, R., Equanti, D., & Ilmu Pendidikan dan Pengetahuan Sosial, F. (2021). *GeoKhatulistiwa : Jurnal Pendidikan Geografi dan Pariwisata*. *GeoKhatulistiwa : Jurnal Pendidikan Geografi Dan Pariwisata*, 1(1), 1–6.

- Mensah, A. K., Mahiri, I. O., Owusu, O., Mireku, O. D., Wireko, I., & Kissi, E. A. (2015). Environmental Impacts of Mining: A Study of Mining Communities in Ghana. *Applied Ecology and Environmental Sciences*, 3(3), 81–94. <https://doi.org/10.12691/aees-3-3-3>
- Murniarti, E., Nainggolan, B., Panjaitan, H., Pandiangan, L. E. A., Widyani, I. D. A., & Dakhi, S. (2018). Writing Matrix and Assessing Literature Review: A Methodological Element of a Scientific Project. *Journal of Asian Development*, 4(2), 133–146. <https://doi.org/10.5296/jad.v4i2.13895>
- Mwakesi, I. W., Wahome, R. G., & Ichang'i, D. W. (2020). Mining Impacts on Society: A Case Study of Taita Taveta County, Kenya. *Journal of Environmental Protection*, 11, 986–997. <https://doi.org/10.4236/jep.2020.1111062>
- Mwakesi, I. W., Wahome, R. G., & Ichang'i, D. W. (2021). Impact of mining on the environment: A Taita Taveta County, Kenya case study. *African Journal of Environmental Science and Technology*, 15(5), 202–213. <https://doi.org/10.5897/ajest2020.2926>
- Naibbi, A. I., & Chindo, M. (2020). Mineral Resource Extractive Activities in Nigeria: Communities Also Matter! *Journal of Geoscience and Environment Protection*, 8, 212–229. <https://doi.org/10.4236/gep.2020.89013>
- Obasi, P. N., Eyankware, M. O., & Akudinobi, B. E. B. (2021). Characterization and Evaluation of The Effects of Mine Discharges on Surface Water Resources for Irrigation: A Case Study of The Enyigba Mining District, Southeast Nigeria. *Applied Water Science*, 11, 1–14. <https://doi.org/10.1007/s13201-021-01400-w>
- Omotehinse, A. O., & Ako, B. D. (2019). The Environmental Implications of The Exploration and Exploitation of Solid Minerals in Nigeria With A Special Focus on Tin in Jos and Coal in Enugu. *Journal of Sustainable Mining*, 18(1), 18–24. <https://doi.org/10.1016/j.jsm.2018.12.001>
- Purnamawati, I. G. A., Yuniarta, G. A., & Jie, F. (2023). Strengthening The Role of Corporate Social Responsibility in The Dimensions of Sustainable Village Economic Development. *Heliyon*, 9(4), 1–12. <https://doi.org/10.1016/j.heliyon.2023.e15115>
- Putri, S. K., Rukmana, E. N., & Saepudin, E. (2022). Narrative Literature Review Penelitian Perpustakaan Digital Sebagai Sumber Pembelajaran saat Covid-19 dalam Database Google Scholar. 12(2), 90–101. <https://e-journal.unair.ac.id/JPERPUS>
- Rahayu, D. P., Faisal, F., Darwance, D., & Ferdian, K. J. (2023). Environmental and Social Injustice: Impact and Sustainability of Small-Scale Tin Mining Under Indonesia's New Mineral and Coal Regulation. *Cepalo*, 7(2), 119–130. <https://doi.org/10.25041/cepalo.v7no2.3137>
- Ramlah, Batiar, & Yusuf, B. (2019). Dampak Keberadaan Tambang Emas Terhadap Kondisi Sosial Ekonomi Masyarakat Petani (Studi di Desa Rau-Rau Kecamatan Rarowatu Kabupaten Bombana). *Neo Societal*, 4(4), 954–961.
- Risal, S., Paranoan, D. B., & Djaja, S. (2013). Analisis Dampak Kebijakan Pertambangan Terhadap Kehidupan Sosial Ekonomi Masyarakat di Kelurahan Makroman. *Jurnal Administrative Reform*, 1(3), 516–530. www.tekmira.esdm.go.id
- Samanlangi, I. (2024). Environmental Justice and Resource Extraction: Analyzing the Social Dynamics of Mining Projects. *Global International Journal of Innovative Research*, 2(3), 700–709. <https://doi.org/10.59613/global.v2i3.123>
- Selawati, S., & Rafika, I. (2024). The Impact of Gold Mining on Community Income in Poboya Village, Mantikulore District, Palu City. *Golden Ratio of Data in Summary*, 4(2), 355–360. <https://doi.org/10.52970/grdis.v4i2.568>
- Silva, V. E. F., & Rocha, J. D. N. (2024). The Impacts of Mining on Society, Economy, and Its Relationship with Geodiversity. *William Morris Davis - Revista de Geomorfologia*, 5(1), 1–16. <https://doi.org/10.48025/issn2675-6900.v5n1.2024.614>
- Snyder, H. (2019). Literature Review As a Research Methodology: An overview and Guidelines. *Journal of Business Research*, 104, 333–339. <https://doi.org/10.1016/j.jbusres.2019.07.039>

- Sobczyk, W., Kowalska, A., & Sobczyk, J. (2020). Exploitation of Mineral Resources for Sustainable Development on the Example of Poland. *Journal of Education, Technology and Computer Science*, 1(31), 49–52. <https://doi.org/10.15584/jetacomps.2020.1.6>
- Sulistyowati, L. N., Effrisanti, Y., Fathuliansyah, N., & Suparta, I. M. (2022). Penerapan CSR di Perusahaan Pertambangan dan Pembangunan Ekonomi Berkelanjutan di Kalimantan Selatan. *Jurnal Ekonomi & Bisnis*, 7, 189–194.
- Susanto, E., Soedjono, E. S., & Titah, H. S. (2024). The Impact of Acid Mine Drainage on the Environment and Society. *IOP Conference Series: Earth and Environmental Science*, 1388(1), 1–10. <https://doi.org/10.1088/1755-1315/1388/1/012018>
- Tambol, T., Vodounou, G. M. B., & Moussa, S. (2023). Impacts of Mining on the Environment in West African Sahel: A Review. *Environmental Protection Research*, 3, 263–277. <https://doi.org/10.37256/epr.3220232723>
- Tampushi, L. L., Onyari, J. M., & Muthama, N. J. (2022). Assessing Social and Environmental Impacts of Artisanal and Small-Scale Gold Mining Practices in Lolgorian, Kenya. *European Journal of Sustainable Development Research*, 6(3), 1–11. <https://doi.org/10.21601/ejosdr/12153>
- Tella, A. A., & Danjibo, N. D. (2024). The Environmental Impact of Mining Activities in the Local Community: A Structural Equation Modelling Approach. *International Journal of Social Work*, 11(1), 44–53. <https://doi.org/10.5296/ijsw.v11i1.21747>
- Tsaurai, K. (2021). Mining, Poverty, and Income Inequality in Central and Eastern European Countries: What do the Data Tell Us? *Comparative Economic Research*, 24(3), 7–25. <https://doi.org/10.18778/1508-2008.24.19>
- Worlanyo, A. S., Alhassan, S. I., & Jiangfeng, L. (2022). The Impacts of Gold Mining on The Welfare of Local Farmers in Asutifi-North District in Ghana: A Quantitative and Multi-Dimensional Approach. *Resources Policy*, 75, 1–2. <https://doi.org/10.1016/j.resourpol.2021.102458>
- Wowor, K. (2017). Penerapan Prinsip Berkelanjutan Sebagai Upaya Pencegahan Kerusakan Lingkungan Hidup Dibidang Pertambangan Ditinjau Dari U-U NOMOR 4 TAHUN 2009. *Agri-SosioEkonomi Unsrat*, 2(13), 343–354.
- Yang, X., & Ho, P. (2019). Is Mining Harmful or Beneficial? A Survey of Local Community Perspectives in China. *Extractive Industries and Society*, 6(2), 584–592. <https://doi.org/10.1016/j.exis.2019.02.006>