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Environmental Impact and Sustainable Solutions: A Case Study of 'Onto Deposit' Mining in Dompu Regency

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ABSTRACT

'Onto Deposit' mining activities in Dompu Regency, West Nusa Tenggara, have significant impacts on the surrounding environment, especially in the form of land degradation, water pollution, and disturbances to biodiversity. This study aims to identify the main environmental impacts of these mining activities and formulate solutions based on the principles of sustainable development. The method used is a qualitative study through field observations, interviews with local residents, and a review of environmental policy literature. The results of the study indicate that in addition to groundwater and river pollution, forest damage and social conflict are also major issues. The solutions offered include the application of reclamation technology, the use of environmentally friendly mining systems, and community involvement in monitoring and supervision of the mine. This study recommends the establishment of a multi-stakeholder forum to bridge the interests of companies, governments, and communities in order to maintain a balance between resource exploration and environmental sustainability.

Keyword: *environmental impact, mining, onto deposit, dompu district, reclamation, sustainable development.*

ABSTRAK

Kegiatan pertambangan deposit onto di Kabupaten Dompu, Nusa Tenggara Barat, membawa dampak signifikan terhadap lingkungan sekitar, terutama dalam bentuk degradasi lahan, pencemaran air, dan gangguan terhadap keanekaragaman hayati. Studi ini bertujuan untuk mengidentifikasi dampak lingkungan utama dari aktivitas pertambangan tersebut serta merumuskan solusi berbasis prinsip pembangunan berkelanjutan. Metode yang digunakan adalah studi kualitatif melalui observasi lapangan, wawancara dengan warga lokal, serta kajian literatur kebijakan lingkungan. Hasil penelitian menunjukkan bahwa selain pencemaran air tanah dan sungai, kerusakan hutan dan konflik sosial juga menjadi isu utama. Solusi yang ditawarkan antara lain penerapan teknologi reklamasi, penggunaan sistem tambang ramah lingkungan, serta pelibatan masyarakat dalam pemantauan dan pengawasan tambang. Studi ini merekomendasikan pembentukan forum multi-pihak untuk menjembatani kepentingan antara perusahaan, pemerintah, dan masyarakat guna menjaga keseimbangan antara eksplorasi sumber daya dan kelestarian lingkungan.

Kata Kunci: *dampak lingkungan, pertambangan, deposit onto, kabupaten dompu, reklamasi, pembangunan berkelanjutan.*

Introduction

Dompu Regency, West Nusa Tenggara, is an area rich in mineral resources, especially 'Onto Deposit' that have high economic potential. However, the exploitation of these resources is not free from serious environmental consequences. In recent years, increased mining activities have given rise to various ecological

problems, including deforestation, land degradation, and water pollution. This study aims to evaluate these impacts and formulate relevant mitigation and adaptation strategies for the environmental sustainability of the Dompu area.

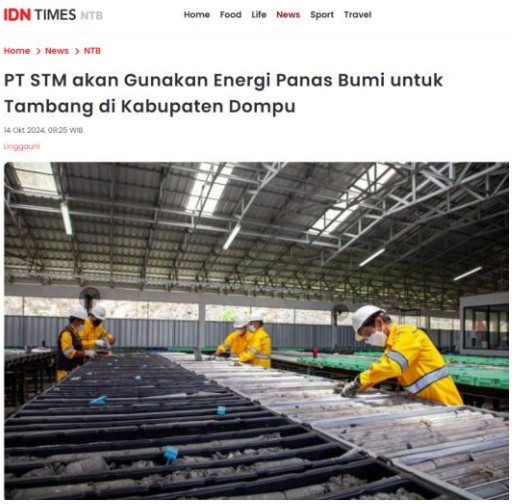

Figure 1.1 References to phenomena from the mass media regarding mining activities

Mining activities play a crucial role in economic development, particularly in regions rich in mineral resources such as West Nusa Tenggara, Indonesia. In Dompu Regency, the 'Onto Deposit' discovered and explored by PT Sumbawa Timur Mining (STM)—is estimated to contain over 2 billion tons of copper and gold ore (IDN Times, 2024). While this discovery promises significant economic benefits, large-scale mining operations often trigger complex environmental and social consequences. According to the Indonesian Forum for the Environment (WALHI, 2022), poorly managed mining projects have contributed to water pollution, land degradation, and social conflict in several provinces, including NTB.

The 'Onto Deposit' in Dompu Regency is the amount of copper-gold ore deposits discovered by PT Sumbawa Timur Mining (STM) in the Hu'u Project area, which includes Hu'u, Dompu, and Bima Districts, NTB. This deposit is a copper and gold ore reserve located below the earth's surface and was discovered around 2013. STM classifies it as an important mineral discovery and has the potential to be developed into a world-class underground mine.

PT Sumbawa Timur Mining (STM), a company that has held the 7th generation Contract of Work (KK) since 1998, has been exploring in this area since 2010. The exploration results show that the 'Onto Deposit' has a mineral resource potential of approximately 2 billion tons, including 1.1 billion tons of indicated resources and around 0.9 billion tons of inferred resources. The mineral content includes 0.96% copper (Cu) and 0.58 g/t old (Au) for indicated resources.

This discovery has attracted the attention of various parties, including the central and regional governments, because of its great economic potential. However, large-scale exploitation of mineral resources also raises concerns about

possible environmental impacts, such as water and soil pollution, ecosystem damage, and social conflicts with local communities.

Several previous studies have highlighted the potential and challenges of mining activities in Dompu. For example, a study by Haris Miftakhul Fajar from the Indonesian Geologists Association (IAGI) stated that although the potential for mineral reserves in the 'Onto Deposit' is very large, the proof is still in the exploration process and has not been fully proven. This shows the need for a cautious approach in developing mines in the area.

In addition, a report from the Geological Agency of the Ministry of Energy and Mineral Resources (ESDM) revealed that the Hu'u area also has geothermal potential reaching 200 Megawatts (MW), which can be utilized to support sustainable mining activities. The use of renewable energy can be a solution to reduce the environmental impact of mining activities. Based on the aforementioned background and growing environmental concerns surrounding mining activities, this study aims to analyze the environmental impacts of the 'Onto Deposit' mining in Dompu Regency and to formulate solutions grounded in the principles of sustainable development. The findings of this study are expected to support policymaking that balances mineral resource exploitation with environmental conservation.

Research Methodology

This study employed a qualitative approach, utilizing field observations, in-depth interviews, and document analysis. Observations were conducted three times across mining-affected areas in Dompu Regency. A total of 10 informants were interviewed, including local residents, traditional leaders, government officials, company representatives, and environmental academics. Informants were selected using purposive sampling based on their relevance and experience with mining activities. The research was carried out from June to August 2024. Data were analyzed thematically to identify environmental impacts and sustainable solution opportunities. This This study employed a qualitative case study approach to analyze the environmental impact and sustainability challenges of the 'Onto Deposit' mining project in Dompu Regency, NTB. The methodology consists of several stages:

Literature Review: Relevant documents such as AMDAL reports, environmental policies, and previous studies were reviewed to build a contextual understanding of the mining impacts.

Field Observation: Site visits were conducted in Hu'u Subdistrict to observe physical environmental changes, such as land use alterations and water conditions.
In-depth Interviews: Semi-structured interviews were conducted with: Local residents (5 people), Community leaders (2 people), Local government officials (2

people), Representatives of PT STM (1 person). Informants were selected using purposive sampling based on their relevance to the research topic.
Data Documentation and Thematic Analysis: All field notes and interview transcripts were categorized and coded using a thematic approach to identify recurring environmental and social issues.
Validation and Triangulation: Triangulation was applied by comparing findings from interviews, observation, and secondary data sources to ensure credibility.

Result and Discussion

3.1 The study show several problem main findings regarding the main problems

a. Water and Soil Pollution

'Onto Deposit' mining activities in Dompu Regency, especially in the Hu'u District and its surroundings, have resulted in pollution of surface water sources such as rivers and small streams that were previously used by the community for bathing, washing, and irrigation. The water color that changes to cloudy and has a pungent odor is an indication of the presence of heavy metals and hazardous chemicals from mining waste. Waste from washing ore that is disposed of without going through the tailing pond system (waste storage) causes seepage into the soil, which ultimately reduces the quality of groundwater. Several residents' wells show changes in color and taste, and cause health problems such as itching and digestive problems.

Water sampling by local residents and environmental activists shows high levels of metals such as manganese (Mn), lead (Pb), and iron (Fe) in river water. This condition shows the weak supervision of mining waste management, which should be supervised by environmental authorities and regional technical agencies. The solution that can be applied is the implementation of a technology-based waste processing system, such as the chemical precipitation method or tailing dry stacking. In addition, there needs to be a periodic water quality monitoring system carried out jointly by the community, companies, and the environmental service, so that water quality remains within the established standard quality threshold.

b. Ecosystem Damage

Mining in the 'Onto Deposit' area is generally carried out using an open pit system or open pit mining, which requires large-scale land clearing. This has a direct impact on the loss of natural vegetation, including protected forests and shrubs that play an important role in maintaining the local ecosystem. Loss of vegetation disrupts biodiversity in the area. Endemic species such as the maleo bird and several types of rare butterflies that used to be easy to find are now starting to disappear. This habitat change also has an impact on the disruption of the food chain and the migration of wildlife to residential areas.

Ecosystem damage also has an impact on soil stability. Without vegetation buffers, erosion increases sharply, especially during the rainy season. Small landslides and road damage are common, endangering communities and disrupting local transportation access. To overcome this, mining companies are

required to reclaim post-mining land by replanting local vegetation. In addition, it is necessary to develop conservation programs for rare animals and plants through collaboration with local environmental institutions and academics.

c. Social Conflict

Mining activities not only have a physical impact on the environment, but also cause social conflict between mining companies, local communities, and the government. Many residents feel they are not involved in the decision-making process, especially regarding land acquisition and profit sharing. The emergence of differences of interest between landowners, local workers, and investors often triggers tension. Some residents reported acts of intimidation when refusing to sell land or when protesting the environmental impacts of mining.

The lack of open and transparent communication mechanisms is the root of this conflict. In fact, according to the principle of Free, Prior and Informed Consent (FPIC), indigenous and local communities have the right to give consent to projects that impact them. A possible solution is to form a multi-party communication forum consisting of representatives of the community, indigenous leaders, companies, and local governments. This forum functions as a space for dialogue, negotiation, and supervision of mining activities so that social and economic justice can be realized proportionally.

D. Lack of Supervision

One of the important findings of this study is the weak supervision of the implementation of the AMDAL (Environmental Impact Analysis) document. Many recommendations that should have been implemented by the company were ignored due to the lack of strict supervision from the relevant agencies. The lack of field supervisors and limited operational budget from the Regional Environmental Service are the main obstacles. In many cases, companies only make formal reports, but implementation in the field is far from what is stated in the planning document.

In addition, the community also does not have sufficient access to information and evaluation results of mining activities. In fact, openness of information is a basic principle in democratic and responsible environmental management. To overcome this, local governments need to increase institutional capacity through digital-based supervision training (for example the use of drones or water quality sensors). A web-based transparency system is also needed, where the public can directly see environmental management reports from mining companies.

In the AMDAL document for 'Onto Deposit' (PT STM, 2022), water quality parameters in the surrounding area were stated to be within safe thresholds. However, no follow-up monitoring data was presented, particularly for heavy metal content in groundwater. Several residents reported experiencing skin irritation and digestive issues after using well water, as conveyed in interviews with local community members. While clinical data was not collected, these narratives indicate a perceived link between mining activity and water quality.

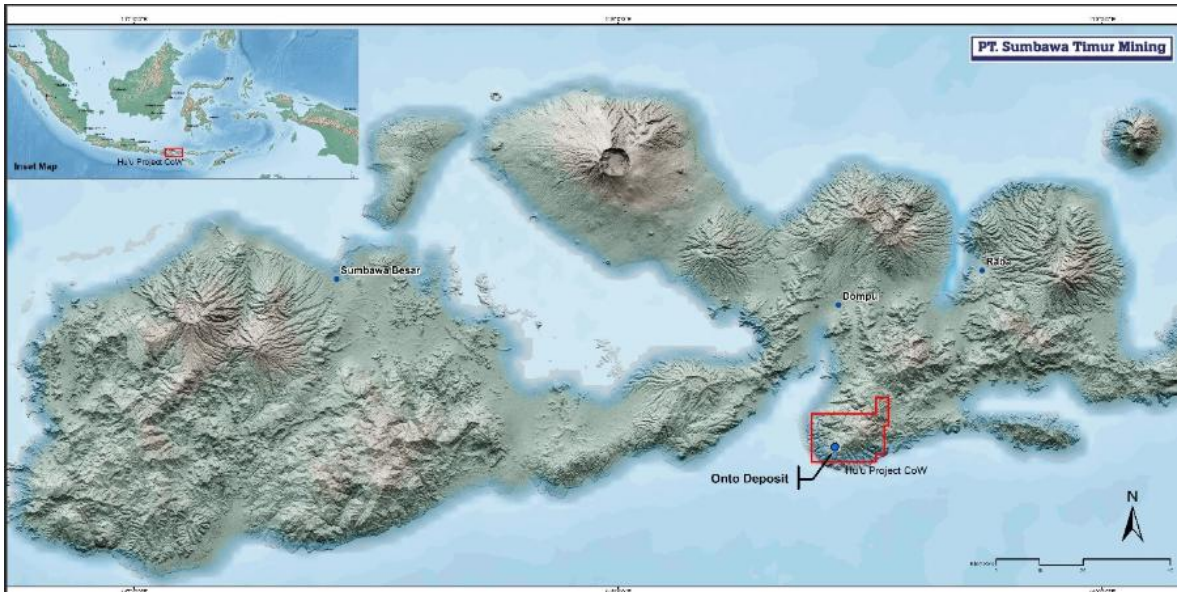

Figure 3.2 'Onto Deposit' mine location map

Tabel 3.1 Comparison of Water Quality Indicators

Parameter	Unit	PerMenLH No. 5/2014	Site	Status
pH	-	6.5-8.5	5.8	Below standart
Total Dissolved Solids	mg/L	1000	800	Below standart
Arsenic	mg/L	0.01	0.02	Exceeds limit
Mercury	mg/L	0.001	0.002	Exceeds limit
Iron	mg/L	0.3	0.1	Below standart
Turbidity	NTU	5	3	Below standart

3.2 Recommendation Solutions

a. Land Reclamation

Strengthening environmental regulations is a very important initial step in controlling the negative impacts of mining. The local government needs to tighten mining exploration and exploitation permits by requiring strict, transparent, and public participation-based Environmental Impact Analysis (AMDAL). The AMDAL preparation process must involve local communities, academics, and environmentalists so that the results are more objective and can be scientifically accounted for. Law enforcement also needs to be strengthened by ensuring that mining companies are responsible for the environmental damage that occurs. The government must have a periodic monitoring and evaluation system for company compliance in implementing the principles of good mining practice. Administrative, criminal, and civil sanctions must be applied strictly to

environmental violations to create a deterrent effect. In addition, environmental regulations that apply at the national level must be adapted to the local conditions of Dompu Regency.

Specific regional regulations regarding mining management, protection of water resources, protected forests, and customary areas will strengthen the position of the local government in managing potential conflicts and environmental degradation. Harmonization between central and regional policies is the key to success in mining supervision. The involvement of independent institutions such as academics and environmental NGOs in supervising mining activities must also be institutionalized. They can be part of an environmental monitoring team tasked with providing data-based recommendations for policy improvements or temporary cessation of mining activities if serious violations are found.

b. Waste Management Technology

Reclamation is the process of restoring post-mining land so that it can function ecologically and economically. Companies are required to prepare a reclamation plan from the early stages of exploration activities, with a budget allocation that is approved and supervised by the government. Reclamation should not be a discourse at the end, but must be an integral part of the entire mining cycle. Rehabilitation efforts can be carried out by replanting local vegetation that is in accordance with the local ecosystem. Restoring natural ecosystems is very important to maintain the sustainability of forest functions, soil quality, and the existence of flora and fauna affected by mining activities. In the context of Dompu which has biodiversity, endemic plant species can be a priority in revegetation efforts.

In addition to ecological aspects, reclamation can also be directed at land use for productive post-mining activities such as agroforestry, livestock, or nature tourism. This approach is known as community-based reclamation. This opens up new jobs for local residents and reduces economic dependence on the extractive industry. It is also necessary to conduct periodic evaluations of the success of reclamation, including through physical parameters (topography, drainage), chemical (pH, nutrients), and biological (biodiversity levels). The government must require mining companies to make transparent reclamation monitoring reports and open access to the data to the public.

c. Community Education and Empowerment

Local communities are the groups most affected by mining activities and therefore must be part of every decision-making process. The principle of Free, Prior, and Informed Consent (FPIC) as recognized by international conventions must be applied in exploration and exploitation activities. This ensures that communities give their consent consciously, without pressure, and with adequate information. Community involvement can begin with a consultation forum routine and inclusive. Every decision-making related to AMDAL, CSR, and management of environmental compensation funds must involve community representatives,

including women and indigenous groups. Their active participation will strengthen the accountability and legitimacy of mining projects.

The government and companies can also form collaborative institutions such as multi-stakeholder forums or village-based mining monitoring committees. These institutions serve as a liaison between companies, the government, and the community to convey complaints, develop CSR programs that are appropriate to local needs, and carry out joint monitoring of environmental impacts. In addition, the community must be given training and capacity building in understanding the technical and legal aspects of mining. This will improve their bargaining position in the negotiation process and prevent exploitation by outside parties. Thus, community involvement is not just a formality, but truly leads to social and ecological justice.

d. Firm Policies and Regulations

One innovative approach to minimizing the environmental impact of mining is to encourage the use of renewable energy in mining areas. The geothermal potential in Dompu Regency, which has been identified by the Ministry of Energy and Mineral Resources at 200 MW, can be utilized to support sustainable mining operations. This clean energy will reduce dependence on fossil fuels that produce high emissions. In addition, companies must implement environmentally friendly mining technologies such as dry tailing disposal, wastewater treatment with bioremediation methods, and digital emission monitoring (smart mining). The use of this technology is important to reduce the risk of water, soil, and air pollution which has been the main problem of conventional mining.

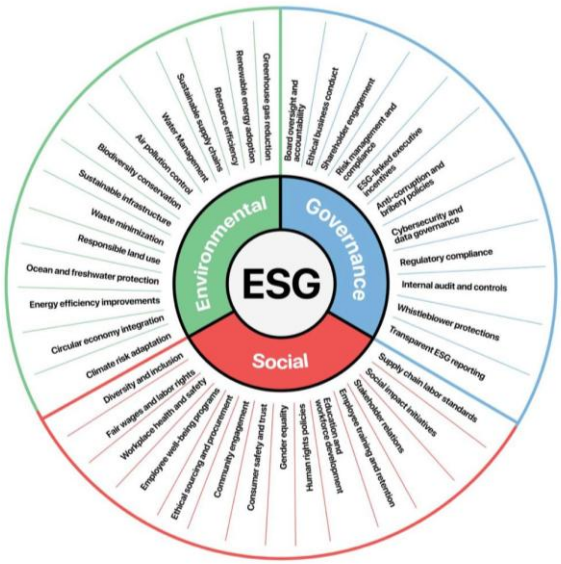

Figure 3.2 The concept of ESG as a 'Onto Deposit' solution

The adoption of this technology can also be aligned with the national Net Zero Emission (NZE) target, where the energy and mining sectors are the main contributors. The government can provide fiscal and non-fiscal incentives to encourage mining companies to implement Environmental, Social, and Governance (ESG) principles in their operations. Thus, the company's profitability does not

conflict with environmental sustainability. Collaboration with local research institutions and universities needs to be encouraged to develop technological innovations that are in accordance with the geological and social conditions in Dompu. The development of local technology will also empower local human resources and accelerate the transformation of Dompu as a center for sustainable green mining in the future.

Figure 3.2 illustrates the main elements in the ESG framework that form the basis for evaluating the sustainability of industrial activities, including the mining sector. In the context of this study, the application of the ESG concept to the 'Onto Deposit' mining activity can be explained as follows:

1. Environmental, Focus on: Protection of water resources (e.g.: impacts on community wells). Waste and pollution management (such as mine waste or tailings). Ecosystem restoration through reclamation (relevant to post-mining advice). Relevance of the study: Initial findings that community wells have changed color and taste can be attributed to weak implementation of water protection and waste management. This indicates the need to strengthen environmental safeguards aspects.
2. Social, Focus on: Community health and safety. Social impacts on local communities. Indigenous peoples' rights and community involvement in decision-making. Relevance of the study: The lack of community participation in decision-making, as well as concerns about health impacts, indicate the need to apply participatory principles and social safeguards.
3. Governance, Focus on: Transparency of environmental and social data. Regulatory compliance. Internal supervision, audit, and accountability. Relevance of the study: Weaknesses in reporting and evaluating AMDAL documents indicate weak governance, especially in transparency and monitoring of environmental impacts.

Conclusion and Suggestions

4.1 Conclusion

The study finds that 'Onto Deposit' mining in Dompu causes notable environmental impacts, which can be mitigated through effective reclamation and environmental management. A collaborative effort involving government, communities, and the private sector is essential to achieve a sustainable mining model. These conclusions support the author's view that sustainable mining requires an interdisciplinary approach, as environmental issues are deeply connected with social, economic, and governance factors. From the author's perspective, designing long-term solutions for sustainable mining requires strong synergy between government, academia, communities, and the private sector. Reclamation and rehabilitation should not be viewed merely as regulatory obligations, but as strategic opportunities to restore ecosystems and foster community-driven economic development. When conducted seriously and through participatory approaches, reclamation has the potential to transform former mining areas into productive landscapes that support food security and biodiversity

conservation.The results of the study also show that reclamation and rehabilitation are not only legal obligations, but also strategic opportunities to restore local ecosystems and open up new community-based economic opportunities. When reclamation is carried out seriously and participatory, ex-mining land can become productive areas that support food security and biodiversity conservation.

Strengthening local institutions and regulations is the main foundation in ensuring that all mining activities run according to the principles of sustainability. Local governments need to be empowered in terms of budget, authority, and technical capacity so as not to become spectators in the exploitation of strategic resources in their areas. The existence of the 'Onto Deposit' in Dompu is indeed a great opportunity for improving the regional economy, but it must be managed carefully. It is important to anticipate potential environmental and social risks through the adoption of green regulations and technology, as unregulated mining may lead to serious and long-lasting damage. This underscores the need for proactive policy and planning.Therefore, mining development must go hand in hand with environmental protection and the rights of local communities.

4.2 Suggestions

1. Local governments need to strengthen the supervision and transparency of AMDAL information.
2. Mining companies are required to allocate a special budget for environmental programs and community empowerment.
3. Further research needs to be conducted periodically to evaluate the effectiveness of the implemented solutions.

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