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# SOCIAL IMPACT ANALYSIS AND REPLACEMENT COST OF POST SAND MINING DAMAGE PT.X NANJUNG RIVER VILLAGE, MATAN HILIR SUB-DISTRICT

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**Abstract (English)**

Mining operations always involve a number of environmental interactions. Sand mining operations degrade the surrounding environment, causing significant physical damage to the landscape and possibly making the area more vulnerable to air pollution, flooding and landslides. A national private company called PT X has conducted exploration and feasibility studies. In calculating losses due to pollution, the analysis method is the replacement cost method. The disease cost analysis approach is used in data analysis to calculate economic losses due to post-mining pollution. From the results of the analysis that has been carried out, it is known that the location of the mining business activity has an estimated quartz sand reserve of 7,708,637 tons with a mining plan of 300,000 m3 / year and this calculation shows that each resident is entitled to receive a replacement cost of Rp.1,542,807 / month. The result of the calculation of the total environmental damage recovery value is Rp.1,482,521,465. The results of the post-mining damage analysis show that the application of mining can have a negative impact on the environment and society.

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Sand Mining, replacement cost method, cost of illness, and benefit cost ratio (BCR)

## 1. INTRODUCTION

Indonesia has a wealth of natural resources, which has led to extensive resource exploitation for mining and other uses. Mining is one activity that makes use of natural resources (Rusmawan & Muzammil, 2020). The Indonesian mining system's employment of open-pit mining practices has altered the country's terrain and resulted in the loss of native species and flora in environmental areas (Rusmawan & Muzammil, 2020). One of the natural minerals utilized in this mining is quartz sand. Sand mining belongs to category C since it produces a distinct product from coal, andesite, and other minerals (Falatehan, 2023). Excavators, bulldozers, and sand processing equipment are among the tools used in sand excavation operations (Waniatri et al., 2022). Quartz sand is the most common material found in the crust of the earth (Ramadhan et al., 2018). Quartz sand is the result of weathering rocks that include the primary mineral silica (SiO2). Following this weathering, byproducts are carried to coastal regions by wind or water and end up on beaches, rivers, lakes, and occasionally shallow oceans. According to Umurrudin et al. (2018), quartz sand is a crucial raw resource for a variety of industrial sectors, including cement, glass, and construction materials.

The ecosystem is always impacted by the sequence of mining operations (Syaifulloh, 2021). According to Didiek (2020), sand mining operations cause physical harm to the ecosystem, increasing its susceptibility to flooding, landslides, and air pollution. Furthermore, water quality is contaminated and deteriorated by waste from equipment used in sand mining activities (Hulukati & Isa, 2020). Additionally, seawater seeps straight onto agricultural land on many farmers' fields along the coast as a result of erosion brought on by coastal changes. Most mining activities are not licensed as businesses. While some of these incidents have

been handled properly in court, many have not yet involved stringent legal action. To regulate the legal elements of sand mining, legislation has been developed (Sri et al., 2019). There hasn't been any legal action because government efforts haven't been carried out as well as they should have.

Although the mining sector makes a significant contribution to the nation, there are drawbacks as well as benefits. "Mining is part of mining business activities to produce minerals and/or coal and their associated minerals," according to Regulation No. 26/2018 of the Minister of Energy and Mineral Resources. This implies that mining is the process of acquiring minerals, coal, and other materials for use in a variety of applications, including mining (Nurcahyo, 2020). Indicates that sand is one of the primary minerals with a high production and extensive distribution. If the survey, manufacturing, and marketing processes are carried out as well as possible, this group of minerals will be the most productive and lucrative. Sand mining can be done with conventional or mechanized techniques. According to Minister of Energy and Mineral Resources Regulation No. 26/2018, mining is a portion of the mining business in order to produce minerals, coal, and similar minerals.

An impact is any change in the environment brought about by human action (Sri et al., 2019). Individual, group, and societal actions that shield groups from social and cultural influences that alter behavior are what lead to social effect. Development is one of several variables that can affect society. Cause and effect are related to development assumptions. There will always be issues with development, both positive and negative. The economics, ecology, education, and environment are among the many sectors that development always prioritizes. Society is impacted by social issues that emerge in it.

The big trucks that move sand every day harm the road and the surrounding area of Batu Kuda Hamlet. Mining operations have caused the main highway to become dusty and muddy, which further pollutes the air. These vehicles frequently transport heavy cargo, putting other motorists in danger. On the old land, the water that has been mined for sand eventually becomes stagnant and forms tiny lakes. This mining activity has resulted in the conversion of many homeowners' gardens and properties into mining sites. Additionally, the roads that connect villages have become steep and slick due to sand mining, particularly during the wet season.

The Investment and Integrated Services Office is one of the offices that approved the issuance of business licenses for non-metal mining for specific kinds of quartz sand rock commodities to PT. X, a national private firm, with letter number 5 December 2022. A mining business license for specific non-metal mineral kinds, namely quartz sand (IUP), has been granted for the 601.16 Ha area in issue, which is located in South Matan Hilir District, Ketapang Regency, West Kalimantan Province. The Government of the Republic of Indonesia awarded a new mining business license (IUP for the exploration stage of certain types of non-metal minerals) that covers 601.16 hectares (Risk Based Business License). Sungai Nanjung Village, South Matan Hilir District, Ketapang Regency, West Kalimantan Province is the area's administrative location.

At this level, feasibility studies and exploratory activities have been carried out. The area of the mining business activity has an estimated quartz sand reserve of 7,708,637 tons, with a mining plan of 300,000 m3/year and a mine life plan of 10 years, according to the analysis of the exploration data. Prior to starting mining operations, mine planning must be finished in order to assess the mine's viability based on the results of technical study and the viability of the business plan. The following factors become elements of mining technical studies and mining investment feasibility: sand selling price, sand production target, capital

expenditure, production cost, price and cost increase rate, and discount rate. By calculating the value of these parameters, the viability of mining investment may be examined using the Discounted Cash Flow Rate of Return analysis.

## 2. THEORITICAL REVIEW

Development policies pertaining to the management of natural resources and the environment heavily rely on economic assessment. The deterioration of natural resources and the environment presents economic issues because of the declining ability of these resources to create products and services, particularly those that are irreversible and cannot be returned to their original state.

### *Replacement Cost*

Cost of replacement or extra provisions Replacement cost, sometimes referred to as future cost, is the price paid when an asset or service needs to be replaced. Capital budgeting, which covers the planning, addition, replacement, or removal of any fixed assets, benefits from the concept of replacement cost. It is also helpful for standardizing spending and budgets. The amount of replacement costs, including water replenishment costs, is calculated using the replacement cost calculation method. The replacement cost of environmental damage brought on by PT X's post-mining operations can be estimated with the use of this computation (Frits Purtomo et al., 2020).

### *Cost Illness*

The oldest assessment method in the health care industry is the cost of disease technique, which evaluates the financial impact of a condition on society by accounting for all health care resources used (Pramasari et al., 2022). This method was used to determine the cost of health services for illnesses brought on by variations in the quality of the surrounding air. The sum of the direct and indirect expenses was computed. The expenditures of medications, upkeep, and other charges are all regarded as direct expenses. In the meantime, the value of time missed from work because of illness is calculated by indirect costs (Munawwarah et al., 2021).

### *Benefit Cost Ratio*

The Benefit Cost Ratio approach is another comparison tool that follows the same principles for benefit and cost ratios as IRR. This strategy was chosen as a result of comparing the total present value of benefits less costs (Fanani, 2021). By comparing the entire costs and benefits of mining operations to the total expenses, the Benefit Cost Ratio (BCR) evaluates the economic feasibility of mining operations. The overall advantages of mining outweigh all expenses if the BCR value is greater than 1. A score of 3 (three) denotes this, whereas a value of 1 (one) means that the overall expenses spent outweigh the total advantages of mining (Astuti & Sungkowo, 2016).

## 3. RESEARCH METHODS

### Location Overview

Sungai Nanjung Village, Matan Hilir District, Ketapang Regency, West Kalimantan Province is where PT X's license is administratively located. The mining site can be reached in a number of ways. It takes about 35 minutes to fly from Supadio Airport in Kubu Raya to Rahadi Oesman Airport in Ketapang by an ATR aircraft from Pontianak. Then, take a four-wheeled vehicle to the WIUP location after arriving at Rahadi Oesman Airport Ketapang.

This journey takes about 1.5 hours and covers about 50 km. Here is a picture of the mining location map.

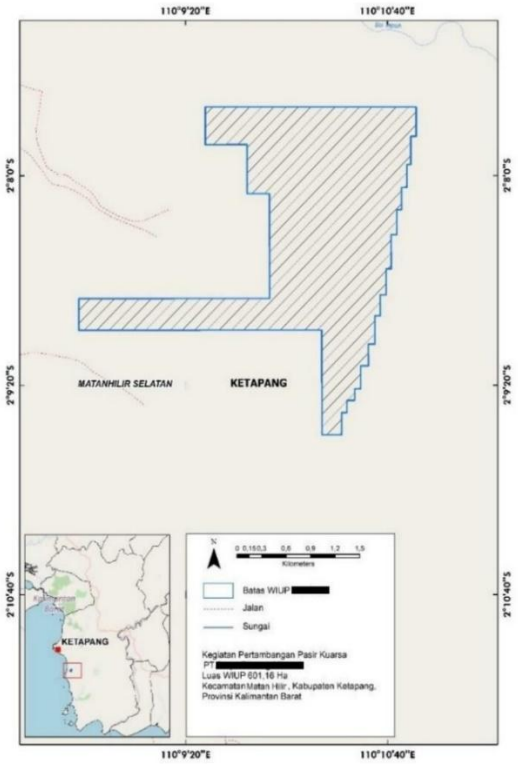


Figure 1. Sand Mine Planning Location

**Secondary Data Analysis Parameters**

Mining in the industry is also known as the design of activities that include mine planning. To determine the economic feasibility of designing this quartz sand mine using several mandatory parameters that must be considered, namely as follows:

1. Environmental conditions around topography
2. Geometry of the mining slope
3. Mining method appliedAnalisis Data

Data analysis is used to determine the economic losses resulting from quartz sand mining operations, such as air pollution that impacts nearby populations. Utilize an analytical method, particularly the replacement cost method, to determine pollution losses in the manner described below. In 2020, Frits P. et al.

BP = P x QD .....(1)

Unknown:

BP = Total Cost replaced (Rp/year)

P = Unit Price (Rp/L; mb/year)

QD = Total demand (Rp/L; mb/year)

Through data analysis, we may use the cost of illness analysis approach to assess the magnitude of pollution impacts on nearby communities and the financial losses resulting from post-mining contamination (Jo, 2014):

C = P + MC .....(2)

Unknown :

C = Cost of illness

P = Income that comes out

MC = Cost of health expenditure (medicine)

to weigh the benefits and drawbacks of using the benefit cost ratio (BCR) method to evaluate the possible advantages of the post-mining plan that will be put into place. The formula below was used (Vajpayee et al., 2019):

B/C Ratio = Revenue Total cost (Fixed + Variable)

Finally, the economic valuation formula is used to calculate the cost of post-mining land reclamation using the following formula.

TEV = UV + NUV .....(3)

## 4. RESULT AND DISCUSSION

### Social Environmental Impact of Mining

According to Durkheim, people interactions with their surroundings and society produce social repercussions. He said that for society to coexist peacefully, everyone must follow the norms and values of the community. Social effects are the result of interactions between different social elements in the local environment. A social influence can also be attributed to the outcome of a policy or action implemented by a well-known individual, organization, or social institution. People's lives might be impacted by both positive and bad societal effects. Therefore, in order to prevent these influences from harming a large number of individuals, supervision and control activities are required. The company can work with existing institutions in the Sungai Nanjung Village area to employ the Sungai Nanjung Village community in activities according to their respective abilities and expertise. It is expected that the company will be transparent with the community or will visit the community directly to inform the local community about the activities that will be carried out through more intensive socialization. Additionally, since the community still depends on the environment, mining operations shouldn't harm it.

In order to ensure the successful execution of PT X's quartz sand mining activity plan, this policy must be followed. There could be social conflict in the community as a result of the varying opinions and attitudes of the populace on PT X's plan for quartz sand mining; some people support it, while others oppose it. According to this definition, conflict arises when different parties have divergent viewpoints about the same thing, in this case, PT X's proposal to mine quartz sand. Other societal effects of sand mining include the following:

### Environmental Damage

Degradation of the environment is one effect of sand mining that people are worried about. Groundwater levels may drop as a result of mining activities. Due to decreased groundwater flow, sand extraction operations may result in decreased groundwater availability and losses. Changes in land use also have an impact on groundwater quality and

quantity. Residents that live close to sand mines lament the deteriorating quality of the groundwater in their areas, characterizing it as more acidic, murkier, and sandier since the mines started. Although there is now more water available in greater quantities, the quality is unfit for human consumption.

**Health Problems**

Health problems The majority of the sand mining locations in Sungai Nanjung Village are next to residential areas. Sand-loaded trucks are a typical sight in the neighborhood. Other drivers are frequently irritated when trucks hauling sand exceed their load capacity and are not covered with tarpaulins. Due to dust on the road from sand being pushed by the wind, visibility is quite poor during the day. The dust can cause breathing issues for Sungai Nanjung Village residents in addition to vision impairment. Inhaling dust particles over time can lead to serious respiratory health issues, raising the risk of respiratory issues for both employees and the local community. In the future, this will lead to a lot of issues.

**Economic Impact**

Building roads, ports, and other infrastructure facilitates the production and delivery of mining goods and services for public consumption, which benefits all economic activity. This demonstrates that the local community definitely uses the existence of sand mining as a source of revenue to pay for their necessities. Sand mining may provide jobs for local populations. Creating jobs can boost local income and combat poverty. The existence of the sand mine in Sungai Nanjung Village provides financial advantages to the neighborhood. A sand mine should ideally ask for approval from the authorities and evaluate the possible environmental effects of the mining operation in light of the aforementioned effects of mining. Because their sand mines could close at any time, workers will undoubtedly be at a disadvantage.

**Replacement Cost Calculation**

The cost calculation's findings can compensate for environmental harm brought on by PT X quartz sand post-mining operations in Sungai Nanjung Village. Every home in Sungai Nanjung Village requires a gallon of water for everyday purposes. It is anticipated that they can use five gallons in a month, although this will vary depending on the number of family members living in each home. A one-gallon refill costs about Rp 10,000 per gallon. It is known that if Rp 50,000 is spent over the course of a month, Rp 600,000 will have been spent in a year. In 2023, Ketapang Regency's minimum wage is Rp 3,085,615. The computations that follow are shown:

P = Rp.3.085.615/month
QD = Rp.50.000 /month
P x QD = Rp.3.085.615 x Rp.50.000
Bp = Rp.1.542.807,00

As a result of this calculation, it is known that each resident is entitled to receive a compensation fee of Rp.1,542,807/month.

**Cost Illnes**

while calculating the effects of mining-related pollution. Assume that residents spend more than IDR 120,000 a month on regular medical consultations. The cost of disease technique is used to determine the cost of community health reimbursement. Three health

consultations each month are anticipated in Sungai Nanjung Village. Thus, it is evident that the locals spend Rp 120,000 every month. Within a year, it was discovered that Rp 1,440,000 was spent annually on medical consultations. The cost of illness computation is shown in the following.

P = Rp.1.440.000
MC = Rp.120.000
Cost of Illness = 120.000 + 1.440.000 = Rp.1.560.000/citizen/year
It can be seen that the community of Sungai Nanjung Village can compensate for medical expenses amounting to Rp.1,560,000/year.

**Sand Mining Calculation**

There are around 107 employees at the penambangan pasir location who can be used to gauge pendapatan. The average number of truk available at a single location over the course of several years is 41. For one year, 25 x 12 = 300 hari jam kerja/tahun, the total jam kerja efektif hari kalender is 25 hari/bulan jadi. Therefore, the number of truk 41 (DT 26 T) x 300 hari = 12.300 truk/tahun. The price of a perton kuarsa is around Rp 160.000 (Ahlunaza et al., 2022). Additionally, since the dump truck can hold 26 tons, the price of selling the sand is 160,000 x 26 = 4,160,000 - each truck, resulting in mining revenue of 12,300 x 4,160,000 = 51,168,000,000 - per year. Deductions from mining operations, such as repairs for mining equipment and land operating expenses, are not included in the cost of revenue. It is known that the estimated results obtained by mining workers are 478,205,607 per person per year if this revenue is divided evenly among 107 workers.

**BCR Calculation**

This calculation applies to calculate the BCR of dump trucks, and excavators. During the mining period, PT Anonymous leased a dump truck for ten years to be used in the extraction of quartz sand. A 26 T dump truck can be rented for Rp 1,000,000.00 per hour. The average working day in mining is 6.7 hours, meaning that in a month there are 167 effective working hours. This means that if an entrepreneur rents a dump truck for two months, it will pay IDR 334,000,000 for a 26-ton truck with a 9% take rate. While the price of a 26 T mining dump truck is Rp.1,082,000,000. It can be seen that the calculation is as follows as follows.

Total cost-effective (A) = Rp.748.000.000
Rate of return (i) = 9%
Tool usage time (n) = 2 months of tool work usage
Selling value of equipment (f) = Rp. 1,082,000,000
Rental price = Rp. 1,000,000

B/C = (Rp.748,000,000 (P/A, 9%, 2)+ Rp.1082,000,000 (p/f 9%, 2)) 1,000,000
B/C = (Rp.748,000,000. (1.75911)+1,082,000,000 (0.84167)/1,000,000 = 2.018.1
it is known that the result is 2.018.1

**Reclamation Project Replacement Cost Calculation**

As a land management technique, reclamation entails enhancing the land's physical state to stop further harm (Setyowati et al., 2018). A obligatory program called a post-mining land reclamation project is governed by Law No. 4/2009, Article 96, and Perpu No. 78/2010 on post-mining reclamation, Article 2 Paragraph 1. The following is the formula for

environmental economic assessment. Ensuring the valuation of reclamation project outcomes is the goal of the economic assessment of reclamation calculations.

TEV = UV + NUV

According to the sources consulted, a direct mining land reclamation project is expected to cost IDR 1,382,421,465 annually (Cahyana et al., 2021). It has a use value of IDR 100,000 and a non-use value of IDR 100,000 based on its intrinsic worth, which may be computed as follows.

V = 1,482,421,465
NUV = 100,000
TEV = 1,482,421,465 + 100,000 = 1,482,521,465
The results of the calculation of the total economic value are Rp.1,482,521,465

## 5. CONCLUSION

Reimbursement of expenses for locals impacted by the company's post-mining activities. Residents receive IDR 1,542,807 in reimbursement expenses per month and IDR 1,560,000 in health reimbursement costs annually, based on projections of both reimbursement and sickness costs. Despite the potential for environmental harm, especially air and water pollution, the Corporation intends to compensate impacted communities. In addition, the Company is required to pay Rp 1,482,521,465 for the post-mining land reclamation project in the event of environmental damage. A BCR value of >1 was obtained from the analysis of the costs and benefits of post-mining activities, indicating that the project is acceptable and economically feasible to continue. Calculation of workers' income also shows that the project can provide benefits and profits for the company and the community.

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