

Analysis of the Social, Economic, and Ecological Impact of Mining Activities of PT. Gag Nickel on Society and Coral Reef Ecosystem in Gag Island, Raja Ampat District

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ABSTRACT

This study analyses the social, economic, and ecological impact of PT. Gag Nickel mining activities on the society and coral reef ecosystem in Gag Island, Raja Ampat district. The data was obtained through in-depth interviews, observations, and questionnaires distributed to employees of PT. Gag Nickel and the surrounding community. The results of the research show that the presence of P.T. Gag Nickel has improved the income and well-being of the local population, with the majority of the population working as employees of the company. However, mining activities also cause damage to coral reef ecosystems, including soil erosion, sedimentation, and marine water pollution. In conclusion, in order to better sustainability, increased commitment of companies in managing environmental impacts and public involvement in decision-making related to mining activities is required. This research provides important insights for mining companies and other stakeholders in managing the impact of mining activities sustainably.

INTRODUCTION

Gag Island, located in the West Waigeo District of the Islands, Raja Ampat District (Hastanti & Triantoro, 2012), is an island with a wealth of abundant natural resources, both in land and in water. Gag Island has an area of 6,500 hectares which is astronomically located at the coordinates 2°25' LU-4°25'LS and 130°55' BB-132°55'BT. Gag Island is surrounded by Gebe Island to the north, Pele Island toward the east, and the Halmahera Sea to the south and west. (Insan et al., 2020). Its strategic position and natural wealth make Gag Island a potential location for economic and industrial development.

PT. Gag Nickel, a mining company operating on Gag Island, has a borrowing permit for 60.325 hectares of forest area. (Arofat, 2019). The presence of the mining industry in a region often results in a significant shift in the structures of the local community's livelihoods. (Agil, 2019; Listyani & Hariyanto, 2018; Nurlaila & Soetarto, 2017; Zitri, 2024). Many of the inhabitants who used to rely on traditional sectors such as agriculture and fishing are now switching to employees of mining companies. This phenomenon also occurs in various mining locations in Indonesia, such as in Morowali (Demmallino et al., 2018). In addition, the potential mineral resource of nickel-laterite deposits in accordance with the geological conditions of the area is a major attraction for mining activities.

Although mining activity on Gag Island has had a positive impact in terms of improving incomes and public welfare, it also has a variety of environmental impacts that need to be taken into account. One of the main focus is the impact on the coral reef ecosystem. These ecosystems play a vital role as habitats for a variety of marine species, which are not only ecologically valuable but also economically (Ramadhan et al., 2017). Various studies indicate that mining activities can have negative environmental impacts (Putri et al., 2022), such as soil erosion, sedimentation, and pollution of sea water. Mine debris has threatened the sustainability of coral reefs around the mine's operational area. The study aims to study the social, economic, and ecological impact of PT. Gag Nickel mining activities on the coral reef ecosystem and Gag Island society.

LITERATURE REVIEW

The presence of mines in an area has the potential to change the ecosystem, socio-economic and environmental order (Fitriyanti, 2016). Theories of social and ecological change address the interactions between changes in ecosystems and human social systems. Human activities, such as mining, influence natural ecosystems which in turn influence the socio-economic structure of society (Berkes et al., 2015; Walker et al., 2004). Mining activities cause changes in coral reef ecosystems through soil erosion, sedimentation and marine pollution. These changes have a direct impact on the livelihoods of local communities, especially fishermen. Apart from that, social changes occurred when many residents shifted from traditional sectors such as agriculture and fishing to become mining workers. This theory also emphasizes the importance of social-ecological resilience, namely the ability of ecosystems and communities to recover from negative impacts (Berkes et al., 2015). The social

impact of the emergence of social conflict between communities is due to disruption of community activities (Purwanto, 2015), as well as the low number of local workers working in the mines (Raden, 2010). Even though mining brings prosperity to society, on the one hand, the distribution of welfare is still unequal (Nurlaila & Soetarto, 2017). Environmental aspects as well as mining activities have an impact on ecological damage (Anggariani et al., 2020).

Sustainable development by prioritizing the economy, social and environment provides long-term benefits for the sustainability of natural resources, community welfare and economic growth (Barbier, 1987). Wise management will have a positive impact on the next generation.

METHODOLOGY

The research was carried out in Gag Island, West Waigeo District of the Islands, Raja Ampat District, in the work area of Gag Nickel. This location was chosen because it is an area directly affected by mining activity and has a coral reef ecosystem that needs to be studied. The research uses two types of data: primary data obtained directly from respondents (P.T. Gag Nickel employees and the surrounding community) on socio-economic conditions, culture, perceptions, and attitudes towards the impact of mining, as well as the state of coral reef ecosystems; and secondary data from village profiles, village statistics, and official reports related to the study area.

Data collection is carried out through in-depth interviews, live observations, and the dissemination of questionnaires. Observations were made to see directly the state of the coral reef ecosystem and the daily activities of the community as well as employees. The questionnaire was distributed to the selected respondents using purposive sampling techniques to obtain quantitative data.

The number of samples is determined using the Slovin formula to ensure adequate representation. Data analysis uses two approaches: qualitative descriptive analysis for data from interviews and observations, and mix method analysis (qualitative and quantitative) to process quantitative data such as household conditions, income, expenditure, and Likert scales to measure attitudes and perceptions.

The research tools used include an interview guide for in-depth interviews, an observation form to record the results of live field observations, and a questionnaire containing structured questions to obtain quantitative data from respondents. Through this research method, it is expected to gain a deep and comprehensive understanding of the social, economic, and ecological impact of PT. Gag Nickel mining activities on the coral reef ecosystem and Gag Island society.

RESEARCH RESULT AND DISCUSSION

Based on primary data collected through questionnaires where, information obtained includes age, gender, marital status, last education, primary employment status, working time, long stay in Gag Island, living in one roof, income, and expenditure presented in Table 1.

Table 1 Respondent Description

No	Description	Frequenc y	%
1	Age		
	17-25 Years	2	4
	26-35 Years	11	22
	36-45 Years	15	30
	46-55 Years	15	30
	56-65 Years	2	4
	> 65 Years	5	10
2	Gender Type		
	Male	40	80
	Female	10	20
3	Status of Bride		
	Not Bride	2	4
	Bride	45	90
	Divorce dead/living	3	6
4	Last Education		
	Primary School	15	30
	Junior High School	16	32
	Senior High School	12	24
	Diploma	2	4
	Bachelor's Degree	5	10
5	Main Occupation Status		
	Fisherman	5	10
	Civil Servant/Military/Police	3	6
	Trader	5	10
	Farmer	3	6
	Private Employee	32	64
	Others	2	4
6	Work Experience		
	≤ 5 Years	35	70
	5-10 Years	2	4
	11-15 Years	3	6
	> 15 Years	10	20
7	Duration of Residence in This Area		
	< 1 Year	2	4
	1-10 Years	7	14
	11-20 Years	4	8
	21-30 Years	10	20
	>30 Years	27	54
8	Living under one roof		
	1 to 4 People	28	56
	5 to 8 People	19	38

	More Than 9 People	3	6
9	Income		
	< Rp. 1.500.000	2	4
	Rp.1.500.000-Rp.2.500.000	1	2
	Rp.2.500.000-Rp.3.500.000	2	4
	> Rp. 3.500.000	45	90
10	Expenditure		
	< Rp. 1.500.000	7	14
	Rp.1.500.000-Rp.2.500.000	1	2
	Rp.2.500.000-Rp.3.500.000	2	4
	> Rp. 3.500.000	45	90
	Total Respondents	50	100

Family Welfare Indicators The identification of respondents based on income and expenditure profiles has not yet been used as a benchmark to see the level of well-being of the population. Characteristics of the predominant respondents are 36-45 years old and 46-56 years old. The number of respondents was 15 (30%) each, both of them if summed up to a majority of 30 (60%). From the perspective of health, the age category falls into the late adulthood and early old age (Depkes, 2009). From the economic perspective, this age category goes into the productive category of 15-64 years, which is the age of being able to work and produce goods/services (BPS, 2022).

The gender of the respondents was dominated by 40 or 80% of the men and 10 or 20% of the women. This comparison is relevant because the men are more predominantly working in PT. Gag Nickel.

Respondent profiles based on marital status were grouped into three categories of marriage: unmarried, married, and divorced/living. The majority of respondents were married 45 or 90%, divorced-living 3 or 6%, and not married 2 or 4%. Working time \leq 5 Years of 35 people (70%). This working time is earned on average by the community that occupies as a worker P.T. Gag Nickel. The working time $>$ 30 years was earned by the society that is generally occupied as a fisherman / farmer or merchant.

Profile of respondents based on long stay predominantly long stay $>$ 30 years 27 people (54%). This stay is the same as the age of the respondent. The majority of respondents who live $>$ 30 years old are born and grown up in Gag Island. Living in the same roof means family members both children and parents who live together are considered members of the household. The profile of respondents based on living in a single roof was dominated by 1 s.d. 4 people of 28 (56%). The domination of the household members on 1 s.d. of 4 people is due to some members of the new household pioneers and some also their children are adults/families and are not dependent.

According to the survey, 64% of respondents work as private employees. This domination of private employees is due to PT. Gag Nickel prioritizing communities that reside near the company's environment to be employees. In addition, the community also works as traders that partner with P. Gag Nickel

or open a business in front of the house, with a majority monthly income above Rs. 3,500,000. It shows that the existence of mining companies has made a significant contribution to the increase in the income of local communities (Pambudi et al., 2023; Rochmaningrum, 2012; Suciadi et al., 2020; Wahyudin, 2020).

The survey of respondent expenditure obtained that the majority of respondents spending > Rs. 3,500,000 as much as 45 people (90%). The high rate of expenditure is proportional to the income earned by the respondents. A lot of expenditure is spent on financing motor vehicle purchases that are done on average in terms of credit, household consumption needs, and non-consumption housing needs. A level of well-being is a consistency in balanced and sustainable needs without any interference. We need other indicators outside of revenue and expenditure. The indicator used today is the BKKBN indicator. This indicator divides the criteria of family well-being into five stages, namely families:

- a. Pre-welfare family, a family that has not been able to meet one of the six (six) indicators of family welfare 1 (KS 1) or the indicator of "basic needs" (basic need).
- b. Family welfare 1, (KS 1), a family capable of meeting the six (6) indicator stage KS 1, but not meeting any of the eight (8) indicator family well-being 2 or indicator psychological needs (psychological needs) of the family. Stage indicator KS 1 is:
 1. Generally, family members eat twice a day or more;
 2. Family members have different clothes for home, work/school or travel;
 3. Houses occupied by family members have good roofs, floors, and walls;
 4. If a sick member is taken to a health facility;
 5. If a fertile couple wants to go to contraception facilities;
 6. All 7-15 year olds in school.
- c. Family Welfare 2 (KS 2), a family that is able to meet 6 (six) indicators of stage KS I and 8 (eight) indicator KS II, but does not meet any of the 5 (five) Indicators of Stage KS III (KS III), or the development needs indicator of the family.
 1. In general, family members perform worship according to their respective worships and beliefs;
 2. At least 1x a week all family members eat meat;
 3. All family members acquire at least 1 set of new clothes in a year;
 4. The floor area of the house is at least 8 m² for each householder;
 5. The last three months of the family is in a healthy condition so that they can perform their duties and functions;
 6. There is one or more family members who work to earn income;
 7. All the family members aged 10-60 can read Latin;
 8. Fertile age couples with more than two children use contraceptives.
- d. Family welfare 3 (KS 3), a family that is able to meet 6 (six) KS I stage indicators, 8 (eight) KS II indicators and 5 (five) KS III indicators but does

not meet either of the 2 (two) Family Welfare III Plus (KS III Plus) indicators or family self-esteem indicators. Indicator stage KS 3 is:

1. Family efforts to improve religious knowledge;
 2. Part of family income is saved in the form of money / goods;
 3. Family eating together at least once a week is used to communicate;
 4. Family participation in community activities at home;
 5. Families obtain information from newspapers / magazines / radio / TV / internet.
- e. A well-off family of 3+ (KS 3+), a family capable of meeting a total of 6 (six) KS I phase indicators, 8 (eight) KS II indicator, 5 (five) KS III indicator and 2 (two) KSIII Plus Phase indicator.
1. The family regularly and voluntarily contributes material to social activities;
 2. There are members who are active as managers of social gatherings/institutions/community institutions.

Table 2. Indicators of Family Welfare

No	Indicator	Number of Households		Qty	Percentage		Qty %
		Yes	No		Yes	No	
1	Generally, family members eat twice a day or more.	50	0	50	100	0	100
2	Family members have different clothes for home, work/school or travel	50	0	50	100	0	100
3	The house of the household had a good roof, and a good floor, and walls.	50	0	50	100	0	100
4	When a sick member is taken to a health facility	50	0	50	100	0	100
5	When a fertile couple wants to have C.B. go to a contraceptive facility	50	0	50	100	0	100
6	All 7-15 year olds in school.	50	0	50	100	0	100
7	Generally speaking, family members perform worship according to their respective beliefs.	50	0	50	100	0	100
8	At least once a week, the whole family eats meat.	50	0	50	100	0	100
9	The whole family has at least one set of new clothes in a year.	50	0	50	100	0	100
10	The floor area of the house is at least 8 m2 for each householder	50	0	50	100	0	100
11	For the last three months the family is in good health so that they can carry out their duties and functions.	49	1	50	98	2	100
12	There is one or more members of the family who work for income	47	3	50	94	6	100
13	All family members aged 10 to 60 can read Latin.	50	0	50	100	0	100
14	Fertile age couples with two or more	50	0	50	100	0	100

children using contraceptives							
15	Family efforts to improve religious knowledge	50	0	50	100	0	100
16	Part of the family's income is saved in the form of money.	43	7	50	86	14	100
17	The family's habit of eating together at least once a week is used to communicate.	49	1	50	98	2	100
18	The family is involved in community activities in the residence	49	1	50	98	2	100
19	The family gets information from newspapers/magazines/radio/tv/internet	43	7	50	86	14	100
20	Families regularly and voluntarily make material contributions to social activities	6	44	50	12	88	100
21	There are members who are active as managers of social gatherings/institutions/community institutions	8	44	52	15,38	84,62	100

The results of the list of indicators are recapitulated in order to obtain the diversity of the level of well-being of the population based on level of welfare. The results are summarized in Table 3.

Table 3. Distribution of welfare levels based on family welfare stages

No	Level of Welfare	Qty	Percentage
1	Pre-Prosperous Family		
2	Pre-Prosperous Family I	1	2
3	Pre-Prosperous Family II	4	8
4	Pre-Prosperous Family III	39	78
5	Pre-Prosperous Family III +	6	12
		50	100

Table 3 shows that the population of Gag Island who reside around PT. Gag the majority are in the category of well-off families 3 of 39 persons (78%). The domination of this level of well-being is not independent of the existence of a nickel gauge which has an impact on improving the economy wheel of the community. The majority of the population is working in nickels gauge and the change in income is not constantly heading towards a fixed income. Some people who can not meet level 3 or level 3+ gauge due to some indicator factors that can not be met even though the monthly income is categorized as high. This is because the indicators count not only economic welfare, but also social welfare.

Public Perception of the Company

The data analysis of respondent responses aims to find out how respondents respond to the statement of each indicator item present in the

questionnaire submitted. Indicator items must have a scale with the aim of generating accurate qualitative data. (Sugiyono, 2015:92).

The public perception of the company consists of 17 statements to be answered by respondents. The answer to this perception uses a likert scale with four answer options. Four answer options are made to avoid a neutral answer. The results of the analysis of the answer description are presented in table 4.

Table 4. Community Perception of the Company

Statement	Frequency (%)				Average
	Strongly Disagree	disagree	Agree	Strongly Agree	
	-1	-2	-3	-4	
1. Companies socialize to the public about the possible environmental impact on the company's activities	10	26	32	32	2,86
2. The company has done environmental impact management well.	2	16	62	20	3
3. The impact of corporate operations on the decline in public health	2	48	40	10	2,58
4. Companies are committed to improving clean water facilities and facilities			26	74	3,74
5. Companies are committed to improving environmental hygiene facilities and facilities			36	64	3,64
6. The company's activities have an impact on environmental pollution	10		66	24	3,04
7. The presence of the company interferes with the tranquility of the community.			36	64	2,32
8. The company is fully committed to improving community education..	6	36	56	2	2,54
9. The company is fully committed to improving community health.		2	60	38	3,36
10. The company is fully committed to sports and youth programmes		10	78	12	3,02
11. Companies are fully committed to entrepreneurship, job creation, and economic means of improving the well-being of the community.		8	44	48	3,4
12. Companies are fully committed to pollution control, greening, clean water supply, nature conservation, and environmental health	16	24	42	18	2,62
13. The company is fully committed to cultural and spiritual programs		22	68	10	2,88
14. Public communication with the company is going well.	4	16	54	26	3,02

15. The existence of a company increases the income of the public.	16	84	3,84
Average			3,06

Statement 1 is submitted to the company to socialize to the public about the possible environmental impact on the company's activities. The majority of respondents tend to choose scores 3 and 4 of 32% on the likert scale, respectively. The average indicator indicates 2.86, which means that respondents can be concluded that they agree with the statements made. According to respondents, socialization of the possible environmental impact carried out by companies has not been limited to society as a whole.

Statement 2 submitted The company has performed environmental impact management well. The majority of respondents tend to choose a score of 3 of 62% on the likert scale. The average indicator indicates a number of 3 which means that the respondents can conclude that they agree with the statement. According to the respondents during the summer and south winds from the mine area carried dust that caused air pollution along the roads and houses of the public thus disrupting public health. However, the company has been mitigating environmental management by irrigating roads with water. Besides, there has been a group of kokomes doing erosion prevention and garbage management. The company has also provided assistance to garbage carriers for the management of garbages in settlement environments.

Statement 3 The impact of the company's operations on the decline in public health. The majority of respondents tended to choose a score of 48% on the likert scale. The average indicator indicated a figure of 2.58 which means that the respondents agreed with the statements made. According to respondents, the impact of the company's operations has influenced the decline in health. Dust from the mine in the rainy season and southern winds can cause respiratory infections. Air pollution from dust also causes cough and flu in the villages. The existence of mines can have a negative impact on the health of workers and communities around the mines. P.T. Gag Nickel prioritizes health for workers and the general public by providing health care clinics in the area of the Company for free. In addition, Gag Nickel also through the Public Promotion Programme (PPM) in the field of health to build Puskesmas Pembantu (Pustu) to serve the people of Gag Island in 2022.

Statement 4 The Company is committed to improving clean water facilities and facilities. The majority of respondents tended to choose a score of 4 of 74% on the likert scale. The average indicator showed 3.74 which means that the respondents were quite in agreement with the statements made. The source of clean water for the people of Gag Island comes from mountain springs, which are supported by P.T. Gag in accordance with its commitment to improving the means and supply of cleanwater through pipanisation from water sources (boring fountains) to residential settlements.

Statement 5 The company is committed to improving environmental hygiene measures and practices. The majority of respondents tend to choose a score of 4 of 64% on the likert scale. The average indicator indicates 3.64, which

means that the respondents agree strongly with the statements made. PT. Gag's commitment to improving environmental hygiene facilities and facilities is implemented through the acquisition of garbage carriers that regularly enter community settlements to transport garbages.

Statement 6 The company's activities have an impact on environmental pollution. The majority of respondents tend to choose a score of 3 of 66% on the likert scale. The average indicator indicates 3.04, which means that the respondents can conclude that they agree with the statements made. The respondents stated that the environmental-damaging activities of the company, including barge boats that dump anchors can drag corals on the anchor disposal area more than 20 meters causing the coral to be damaged; mining trucks with a carrying capacity of 20 tons enter the settlement area, dust during the rainy season enters the settlements of the population, soil erosion due to mine drilling. This environmental pollution is perceived by the community as the water becomes crumbling, the coral is destroyed and the vibration of the impacted barge ships as well as the deposits of mud/sedimentation. The environmental pollution in the waters affects fishermen's activity. Fishermen who used to catch fish in waters around the villages are now fishing areas further away with a distance of about 2 hours. The company's commitment to environmental pollution has been made through complaints by indigenous groups, youth groups Kokomes for erosion prevention and garbage treatment.

Statement 7 The presence of the company interferes with the tranquility of the public. The majority of respondents tended to choose a score of 4 of 64% on the likert scale. The average indicator indicates 2.32 which means that it can be concluded that respondents do not agree with the statements made.

Statement 8 The company is fully committed to improving public education. The majority of respondents tend to choose a score of 3 of 56% on the likert scale. The average indicator shows 2.54, which means that the respondents agree with the statements submitted. Some respondents feel that there is no commitment of the company because of the limited scholarships granted to the public. Statement 9 The company is fully committed to providing improvement of public health. The majority of respondents tend to choose a score of 3 of 60% on the likert scale. The average indicator indicates 3.36 which means that the respondents agree with the statements submitted. The commitment to improving public health is realized through the existence of aid to the development of a helper puskesmas through PPM programmes and mass medicine for the community. In addition, the community can perform free treatment in the public health clinic of P.T. Gag. The company also improves the facilities of the clinic to be able to serve the general public.

Statement 10 The company is fully committed to sports and youth programmes. The majority of respondents tend to choose a score of 3 of 78% on the likert scale. The average indicator indicates 3.02 which means that it can be concluded that respondents agree with the statements submitted. The company's commitment was realized with the development of a football field to channel the young talent of Gag Village.

Statement 11 The company is fully committed to entrepreneurship programmes, job creation, and economic means of improving the well-being of the people. The majority of respondents tend to choose a score of 4 of 48% on the likert scale. The average indicator indicates 3.40 which means that the respondents agree with the statements made. The company is fully committed through the implementation of real programs majority of Gag Island residents are employed both in PT. Gag Nickel as well as in contractors Nickel Gag, planting empowerment, and VCO manufacturing. In addition, the community becomes the company's working partner through the distribution of products company needs such as fish, seed vegetables, and development jobs.

Statement 12 The company is fully committed to pollution control programmes, greening, clean water supply, nature conservation, and environmental health. The majority of respondents tend to choose a third score of 48% on the likert scale. The average indicator showed 2.62 which means that the respondents agreed to the statements made. The full commitment in the programme is made through periodic irrigation of the environment to avoid dust, pipanisation from springs to communal settlements, coral transplantation, and erosion reservoir construction. The average indicator indicates 2.62 which means that the respondents can conclude that they agree with the statements made.

Statement 13 The company is committed to cultural and spiritual programs. The majority of respondents tend to choose a score of 68% on the likert scale. The average indicator indicates 2.88 which means that the respondents agree with the statements made.

Statement 14 Public communication with the company is going well. The majority of respondents tend to choose a score of 3 of 54% on the likert scale. The average indicator shows 3.2 which means that the respondents agree with the statements made. Some respondents stated that the company has limited communication, still not spread to the entire public.

Statement 15 The existence of a company increases the income of the public. The majority of respondents tend to choose a score of 4 of 84% on the likert scale. The average indicator indicates 3.84, which means that it can be concluded that respondents fully agree with the statements made. The public communicates before the company operates the public exchanges goods through the barter, when the company is present there is a high turnover of money. The existence of the company increases the economic turmoil with the number of kios / stores / shops that stand in the village of Gag. The public also stated before any company operates the income is still limited from coconut at least 1 month not up to Rs. 1,000,000, the presence of companies gives an impact can have goods and increase consumption.

Respondents' knowledge of the Coral Reef Ecosystem The Gag Island community has a good understanding of the importance of the coral reef ecosystem. A total of 96% of respondents knew that coral reefs were the habitat and livestock of marine life, as well as protecting the coast from waves and storms.

However, mining activities of PT. Gag Nickel have been assessed to have had a negative impact on the coral reef ecosystem. Respondents stated that the dust from the mines and the activity of the barge had caused environmental pollution and coral reef damage. In addition, soil erosion caused by mining activity also leads to sedimentation in surrounding waters detrimental to coral reefs.

The majority of respondents were aware of the prohibition on the use of coral reef-destroying fishing tools such as bombs and cyanides. They also recognized that the usage of destructive fishing devices could result in coral damage and a reduction in economic fish populations such as shrimp and napoleon.

The Company's commitment to the Environment and Society of PT. Gag Nickel has demonstrated its commitment in managing the environmental impact and improving the well-being of the community. The company has socialized on environmental impacts, managed impacts with road irrigation to reduce dust, as well as providing garbage carriers. In addition, P.T. Gag Nickel also provides assistance in the development of Puskesmas Pembantu (Pustu) and provides health clinics for the public free of charge.

Despite this, there are still some criticisms from the community regarding environmental impact management that is considered unmaximum. The public expects companies to be more active in communicating environmental impacts and involving them in efforts to mitigate them.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the research, it can be concluded that the presence of PT. Gag Nickel in Gag Island, Raja Ampat district, has a significant social, economic, and ecological impact on local communities. On the economic side, mining activity has increased the income and well-being of communities, with many people shifting from traditional sectors such as agriculture and fishing to employees of mining companies, providing better economic stability. However, on the ecological side, mine activity causes damage to the coral reef ecosystem through soil erosion, sedimentation, and pollution of marine water that damages habitats and reduces fish populations. Although PT. Gag Nickel has undertaken some mitigation efforts such as road irrigation and the acquisition of garbage carriers, the negative impact on the environment is still felt. Companies have demonstrated commitment to improving public welfare through various empowerment programmes, but the public expects companies to be more active in communicating environmental impacts and involving them in mitigation efforts. In order to better sustainability, increased corporate commitment to managing environmental impact and public involvement in decision-making are essential.

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