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The Negative Externality of Mining Activities in Brown Canyon

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Abstract

The negative impact of mining activites has resulted in environmental damage that reduces environmental functions. One of them is the brown cnyoan mining, whose mining operations have resulted in the loss of of clean water sources and disrupted public health. The research aims to analyse the negative externalities received bt the community and to estimate the economic losses of the community due to mining activites. The data source of this research is primart data with a sample of 50 families using the purposive sampling method. This research uses a mixed-method, which is a combination of qualitative data (indepth interview, descriptive and coding criteria) and quantitative data (resplacement cost and cost od illness). This research shows that the dominant-negative externalities felt by the community are mining nose, decrease water quality and air pollution. The estimated loss from the replacement cost approach is 5,662,500 IDR and the cost of illness approach 3,999,000 IDR, with an average loss per family each month od 192,030 IDR. This negative impact mining disrupts community efficiency because the negative impact is not taken into account by producers in determining mining production.

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INTRODUCTION

The mining sector plays a vital role in the Indonesian economy (Devi & Prayogo, 2013) the mining sector's contribution to the economy can be seen from the value of mining exports which grew from 2017 to 2019 when in 2019 it was valued at 24.9 US$ and in 2020 it was 19.7 US$ (Bureau of Statistics, 2020). In addition, mining exploration and exploitation activities encourage the development of economic activities such as providing jobs, sources of material for the manufacturing sector, construction, agriculture, and the energy industry (Nath & Singh, 2020). The community or the private sector has the right to exploit mining, especially in mineral materials included in mineral C according to Law No. 11 of 1967 Article 3. Although mining activities are needed, they cause environmental damage that is difficult to reverse (Qin et al., 2020). The worst environmental damage that is not controlled and managed properly is usually caused by illegal mining activities (KLHS, 2015).

Environmental degradation due to mining activities causes significant long-term environmental changes (Obeng et al., 2019). Environmental damage due to mining according to Hilson (2003) will destroy vegetation and natural animal habitats, change in landform, land instability, increase in temperature, noise, vibration, dust, land degradation due to inadequate rehabilitation, air emissions due to transportation of mining materials, silting of groundwater, and others. Apart from the physical aspect of the environment, mining activities also have an influence on the food security of the surrounding community due to environmental degradation which decrease agricultural productivity and there is a structural change in the workforce that shifts from farmers to additional workers or small-scale mine owners by (Wegenast & Beck, 2019). Communities living in mining areas are also very at risk from a health perspective, according to (Vendrell-Puigmitja et al., 2020) stated that waste due to mining activities such as small particles of metal and sulfides can be dissolved through soil and rock which then can pollute water resources and aquatic ecology which can enter the human body.

Losses received by the community due to mining create a trade-off with the benefits obtained by the company. These losses often cause externality costs that are not reflected by the market but are accepted by the community as a cost due to perceived losses, so that when the mineral materials increase it will cause increased environmental damage and of course additional hazards due to mining activities to increase, the externality costs increase (Pyndick & Rubinfled, 2015). When a negative externality occurs, the costs calculated by producers to pay for all the factors of production used are too small because they do not take into account the losses to the community, as a result, the goods produced by these producers tend to be too much. Whereas producers still do not bear external costs such as health costs borne by the community due to environmental pollution (Junengsih, 2016).

One of the mining areas is Brown Canyon mining which is a mineral C mining area. Brown canyon has been going on for years which in the long or short term has had a dangerous impact on the surrounding environment such as erosion, decreased quality and quantity of groundwater, decreased soil productivity, disturbance of flores, changes in microclimate, and various socio-economic problems (Wasis, 2020). The Brown Canyon mining area includes 2 administrative areas, namely Rowosari Village, Tembalang District which is included in the administrative area of Semarang City, and Kebon Batur Village, Mranggen District which is included in the administrative area of Demak Regency. The satellite image of the research area is presented in Figure 1.

Mining Brown Canyon has been going on for quite a long time since the 1990s when heavy equipment has been used since 2005 and produces minerals in the form of sand, backfill, and solid rock (Larasati et al., 2016). The name Brown Canyon was inspired by the Grand Canyon or a large canyon in the United States. This is because the impact of mineral C mining activities changes the contours of the mining area into towering cliffs.

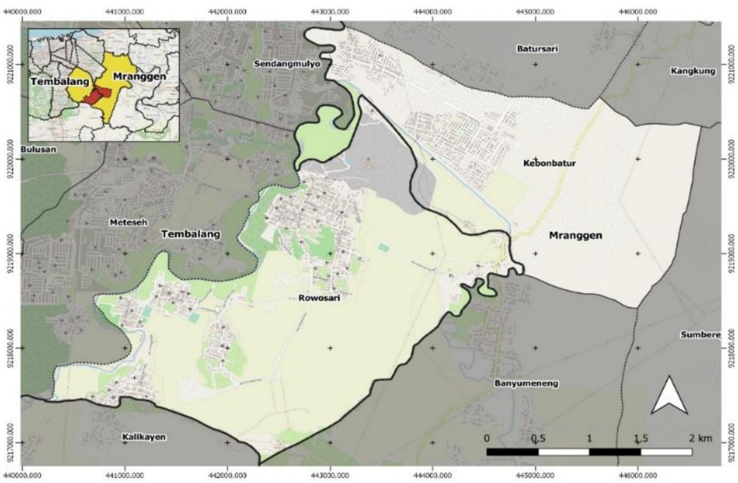

Figure 1 Satellite Image of C Brown Canyon Mining Area
Source: Personal Design, 2020

From Figure 1, it can be seen that in addition to changes in contour, mining activities for mineral C also cause loss of vegetation which can disrupt the hydrological cycle. As a result, floods occur in the rainy season and drought in the dry season. This is due to the loss of the function of vegetation as a barrier and storage of rainwater.

Although the former mining activities present a fascinating land change. However, it has resulted in moderate and severe environmental damage as well as causing damage to infrastructure, causing health problems, and having an impact on abiotic components (loss of fertile soil layer, reduced availability of groundwater, landslides, and air pollution) and loss of biotic components (Maulana et al., 2018). Even. The illegal status in brown canyon mining is the absence of monitoring of mining activities so that there is no effort to control environmental damage that harms the surrounding community.

The negative externalities caused by brown canyon mining have an impact on the loss of environmental functions and have an impact on pollution that affects the community's health. So this research will estimate negative externalities using replacement cost and cost of illness. The loss of environmental functions such as decreasing groundwater quality causes people to have to spend a certain amount of money to provide clean water. Hakim & Nur (2020) in their research used replacement costs to replace the provision of clean water due to water polluted by waste. The replacement costs will generate a value of benefits to estimate the cost of replacing environmental quality degradation with other alternative goods and services (Nurfatriani, 2006). According to Park & Park (2004), replacement costs are costs to recreate functionality but in a form or appearance that may differ from the original. Furthermore, according to Tahzeeda et al., (2018), replacement costs are based on costs that people are willing to pay to avoid damage or loss of services or fees paid for replacement services that provide the same functions and benefits.

Replacement can be determined according to the condition of the loss of environmental function, as in the research of Sidiq & Maruf (2018) due to the decrease in air quality due to the smell of garbage accompanied by a large number of insects causing replacement costs, namely mosquito medicine, fly glue, and air freshener as a component of economic losses due to living around the Final Disposal Site. Due to the loss of environmental function, namely the availability of clean water, the replacement cost is used to replace the supply of clean water. In addition to the emergence of replacement costs, the decline in environmental quality such as air pollution causes health problems for communities living around mining areas. Cost of illness estimates the estimated cost of replacing health care with treatment. Cost of illness estimates the cost that must be provided to recover from illness (Nugraha et al., 2019). The use of the cost of illness approach in this research is used to estimate negative externalities borne by the community to treat illness suffered due to pollution (Sidiq & Maruf, 2018). Replacement cost or cost of illness includes monetary valuation which accommodates cost that cannot be calculated from economic activity. This cost arises due to market failures due to unknown ownership rights in which the real value of an item is one of the public goods (eg environmental functions) whose value is not reflected by its market price (Orlowski & Wicker, 2019). According to Aravossis & Karydis (2004 these costs are included in the revealed preference approach which reflects actual preferences or individual costs for estimating the use of values. Croci et al., (2021) stated that this method is easy and time-saving compared to the contingent valuation method. In contrast to other researches that use the contingent valuation method, this method can reveal the value directly through market value which in this context is used as an estimate of economic loss.

The destruction of nature and the loss of environmental functions have caused the brown canyon mining to be closed in 2015 but in fact, the mine is still operating now. So that the negative impact is accepted by the community without any compensation by the mining party to the community for the loss of environmental functions and the illness suffered by the community.

Even though land changes have provided attractive tourism potential, illegal mining operations have harmed the state resulting in environmental damage, loss of environmental functions, and even impact on public health without accountability. Through the replacement cost and cost of illness estimation approach, it will provide insight into economic losses due to negative externalities of brown canyon mining activities. However, it is different from previous research regarding environmental degradation due to negative externalities of production activities which only estimate the impact of economic losses without knowing the impact of other impacts that may be felt by the community as well as the community's response to these negative impacts such as research by Junengsih (2016); Hakim & Nur (2020) which only analyzes the impact of waste from the economic loss side of the affected community. Sidiq & Ma'aruf (2018) in their research also analyzes the impact of economic losses on landfill waste that is too piled up, while Tahzeeda et al (2018) only estimate the environmental function from the economic side. So in addition to estimating community economic losses due to mining, it is also completed with in-depth research to the community regarding the negative impacts felt due to mining activities.Based on these problems, this research aims to analyze the negative impacts and estimate the economic losses of the community around the Brown Canyon mining area

RESEARCH METHODS

This research was conducted around the Brown Canyon mining area which is a mineral C mining area. Data was collected in 2 villages affected by the Brown Canyon mining, namely Rowosari Village and Kebon Batur Village. Rowosari Village is located in Tembalang District, Semarang City, while Kebon Batur Village is located in Mranggen District, Demak Regency. This study consisted of two types of samples, namely respondents and key informants.

The number of respondents obtained in this research consisted of 50 households selected using the purposive sampling method where sampling was based on the fulfillment of the criteria determined by the researcher (Sekaran & Bougie, 2017). The criteria required by researchers are productive age (15-64 years) who are affected by negative externalities from Brown Canyon mining. The respondents who were affected by the pollution were taken from two villages located in the mining area, namely Rowosari Village, Tembalang District, Semarang City, and Kebon Batur Village, Mranggen District, Demak Regency. Then an accidental collection is carried out from the house to house until the number of respondents has represented households that have been negatively affected by mining activities. As many as 74% of respondents came from Rowosari Village and the remaining 26% of respondents came from Kebon Batur Village. This is because most of the mining areas are located in Rowosari Village.

Key informants in this research were taken using the accidental sampling technique which was taken until the saturated data, meaning that it was complete enough and came to a homogeneous point. Key informants were interviewed using the local language, namely "Boso Kromo" but transcribed in Indonesian. Key informants in this study numbered 5 people are representatives of the respondents met.

Data collection was done using a Pre-Survey of research locations and direct interviews with respondents. The pre-survey was conducted by observing the mining activities of mineral C in Brown Canyon and the impact of these mining activities on the community. Furthermore, the author uses structured interviews with 50 families affected by the Brown Canyon mining activities to obtain more detailed data.

The analytical method used in this research is the mixed-method which is a mixed-method or a combination of qualitative and quantitative (Creswell, 2014). Qualitative data were analyzed using qualitative descriptions and coding criteria were analyzed using Atlas ti software, namely, the code emerged from the explanation of the data or also referred to as the theme that emerged from the results of in-depth interviews (Santos, 2015). While quantitative data were analyzed using the replacement cost method of clean water, cost of illness.

Replacement costs are included in revealed preference approaches that reveal their true preferences through behavior(Orlowski & Wicker, 2019). This method describes people's behavior by incurring additional costs to reduce environmental degradation (Paramnesi & Riza, 2020). The information needed as a basis for determining the replacement cost includes replacement water sources, the amount of replacement water consumption, and the costs incurred to obtain water.

$$\text{RRBP} = \frac{\sum_i^n BPi}{n} \quad \text{..(1)}$$

Where RBBP is average replacement cost (IDR/year), Bpi id replacement cost of respondent i (IDR/year), n is number of responden (KK) and i is respondent n-i (1,2,3,4,...n)

The cost of illness is used to estimate the economic loss of the community from the pollution caused which in turn causes adverse effects on health. Cost of illness is done by estimating economic losses using health costs (Seno et al., 2018). The health cost researched is health costs incurred as a result of polluted air. Determination of cost illness is based on the type of illness, duration of illness, medical expenses, transportation costs for treatment, and lost income due to illness (Mishra, 2015).

RESULTS AND DISCUSSION

The research questionnaire was submitted to 50 respondents who are representatives of each household. The average respondents have lived in the location for 39 years that know the impact of changes in environmental functions due to different mining activities before mining activities. Even 50% of the total respondents have lived between 41 years - 60 years in the area. The average family income is 3,302,500 IDR, although this amount is higher than the UMR of Demak Regency in 2020, which is 2,432,000 IDR, and the UMR of Semarang City in 2020, which is 2,750,000 IDR. However, to fulfill the needs of the family, it is still classified as a low household income, especially since the average household has 4 dependents. While the average education of respondents can still be categorized as having a low education because the average complete education at the junior high school level even though the maximum compulsory education is Senior High School. Respondents who were selected in this research are a community who live very close to the brown canyon mining area which has the most negative externalities from mining activities with a distance between 5 meters - 500 meters, 10% of all respondents live less than 30 meters from the mining location as much as 22% of all respondents live 31 meters to 50 meters from the mining location, while the majority of respondents as much as 66% of respondents live 80 meters - 500 meters from the mining location.

The brown canyon mining activity does not fulfill one of the safety rules for residents who live where the average distance from a resident's house to the mining area is only 127 meters. Whereas the mandate of Law Number 4 of 2009 concerning Mineral and Coal Mining is the minimum limit for the distance from settlements to mining areas, which is 500 meters. Non-compliance with mining activities indicates the existence of illegal mining. Mining started at the beginning of this mining including PETI (Utilization of Mining Materials without a Permit) until 2015 new mining had a permit. Reinforced by the results of an in-depth interview with one of the key informants, as follows:

"Brown canyon ini itu dulu gunung emas mbak, airnya dulu banyak. Kayaknya skitar tahun 1992.an ditambang memakai alat sederhana itu terus lama lama area pertambangan meluas dan menggunakan alat berat. Padahal dulu sempet ditutup mb, karena ga ada ijin. ya sepertinya tahun 2015 katanya sudah memiliki ijin, nah sekarang tidak berani lagi nambang kalau ga punya ijin" (IN)

"This brown canyon used to be Mount Emas, sis, which provided a lot of water. It seems that around 1992, it was mined using simple tools, and for a long time, the mining area expanded and used heavy equipment. Even though in the past it was closed because there was no permission. It seems that in 2015 they said they already had a permit, now they don't dare to mine anymore if they don't have a permit" (EN).

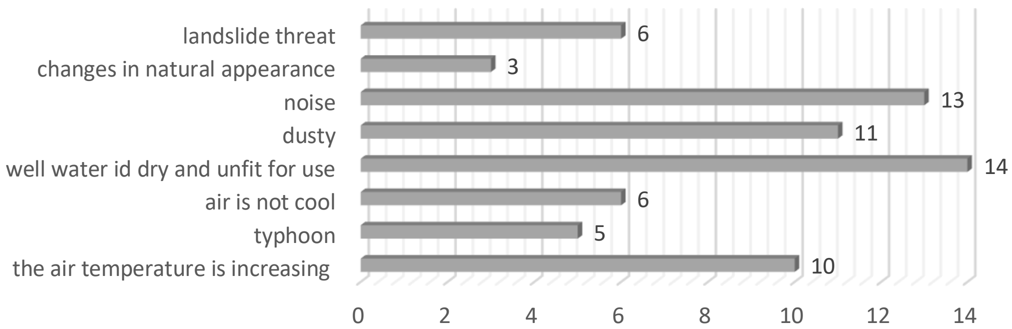

Figure 2. Perceptions of Key Informants on the Negative Impact of Mining (processed Atlas Ti)

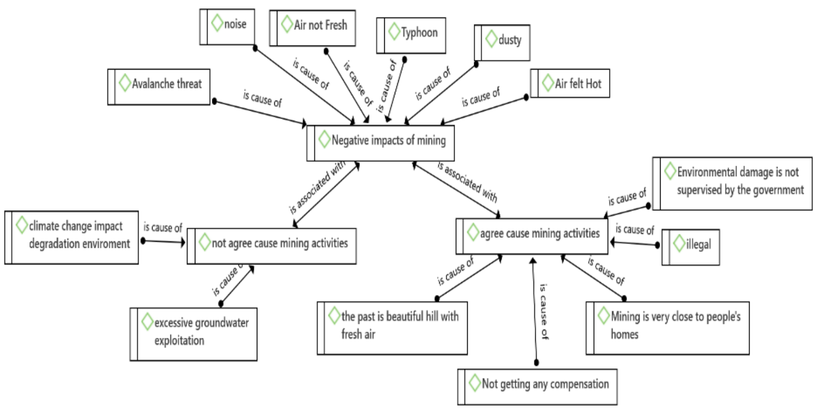

Figure 3. The ATLAS.ti Analysis Result
Source: Primary Data, 2020

The changes in natural conditions before mining and after mining are generally felt by the community because the average community has lived in the area for 39 years (before mining activities). Whereas in the past the Brown Canyon Mining was formerly a hill called Mount Emas which was certainly a beautiful and cool area. Of course, it was filled with green vegetation and abundant groundwater sources as well as the presence of several animals that lived on the hill. However, as mining activities progress, the land surface changes have changed, followed by environmental degradation which is dangerous for the community living around the mining area. Figure 1 shows qualitative data that has been concluded in the form of codes or criteria which are then quantified using Atlas.ti software based on the number of times the emphasis or disclosure of each code has been determined.

If the results in Figure 1 are concluded, two dangers threaten community's lives, namely environmental damages and public health hazards (Stephens & Ahern, 2001). This is caused by dust particles resulting from reduced air quality in mining areas, and changes in natural appearance due to vegetation clearance (Doku & Appiah-kubi, 2014); (Garada, 2015) noise, reduced water quality, and the threat of natural disasters including landslides and typhoons (Adedeji et al., 2014). Based on the perception of the key informant then three dominant impacts were taken, then the three negative impacts were presented in a questionnaire to be answered by all respondents.

Table 2. Negative Externalities Perceived by Society

	Impact		**No impact**	
	n	**%**	**n**	**%**
Loss of Groundwater Source	23	46	27	54
Noise	45	90	5	10
Air pollution	38	76	12	24

Source: Primary Data, 2020 (processed)

Table 2 presents a recapitulation of respondents' answers regarding the three dominant-negative impacts felt by the community based on independent interviews with key informants. The three negative impacts are the loss of groundwater sources, noise, and air pollution. The highest negative externality felt by respondents was noise caused by the mining dum machine, which was 90%. This operating heavy equipment causes the community to be disturbed when resting and sometimes when carrying out activities in the house (Edwards et al., 2011). The dredging of minerals and the transportation of minerals caused the decreased air quality to be felt by the respondents by 76%. This decrease in quality is due to the increased temperature and dust that interferes with the community's activities when they are in their respective residences. Reinforced by the key informant statement which stated that:

"Mmm ya uda biasa mbak seperti ini, debu debu, jadi rumah itu kalua di sapu cuman 2 kali sehari ga bersih. Ini disapu berkali kali juga terus aja debuny pada masuk jadi ya gini panas, pengap, berdebu, bising juga. Ganggu awalnya tapi udah biasa sekarang" (IN)

"It is usual, it's dust, so if you sweep the house only 2 times a day, it won't be clean. It was been swept many times and the dust kept coming in, it felt hot, stuffy, dusty, noisy too. Annoying at first but I just enjoy it now" (EN)

This negative externality can cause public health problems as stated by Ahmad et al., (2014) in their research that the increased temperature, the air is not fresh (stuffy), due to the dust particles produced will cause eye irritation, itching, coughing, and other ailments. The community who lives near the mining areas are not comfortable with transportation traffic carrying mining products, a lot of dust particles are blown away by air and cause air pollution (S.

K. Mishra, 2015). Furthermore, negative externalities that resulted in a decrease in the availability of groundwater and decreased groundwater quality, were not clear, and not clean due to mining activities were only felt by 46% of respondents. Respondents who do not choose the loss of groundwater sources because they assume that the availability of groundwater is currently difficult not because of the loss of green vegetation in the mining area but the availability of groundwater is currently difficult. This result is reinforced by the statement of the key informant who stated that:

"O air pdam mbak, itu ya karena memang sekarang air sulit. Jadi sepertinya ga ada sangkutannya mb memang bukannya memang sekarang dmn dmn sulit ya mb air tanah. Jadi ya harus pompa atau ga ya beli air galon, air nya itu keruh ga jernih, dan bahkan ada yg uda dibor gitu sampai dalam banget baru mau keluar" (IN)

"O, City Water Service (PDAM) sis, right now is limited. So there is no correlation with it, isn't it true now, everywhere is limited groundwater. So, we must have a water pump or buy gallon water, the water is turbid and not clear, and some even drilled so deep to come out" (EN)

The recapitulation in Table 2 provides insight that the majority of the people who are close to the mining area are not aware that the loss of groundwater sources is caused by the loss of natural vegetation due to mining activities. This result is reinforced by a more in-depth analysis using coding on each conclusion obtained from the interviews that there are two extreme views from the community that there is a community who does not object to the existence of mining because they think that the decline in environmental quality is indeed caused by climate change that has occurred. Whereas according to Doku & Appiah-kubi (2014) decreased water quality and water volume due to erosion of water-receiving sediment effect loss of flora vegetation which in this case is caused by mining activities. However, based on the result in Figure 2, there are respondents who understand the difference before and after mining explained that there was abundant water before mining. This result is supported by the key informant statement which states as follows:

"Iya mba, dulu area pertambangan itu to bukit banyak pohon pohon. Bisa dibilang air tidak sulit. Tapi semenjak ada aktivitas tambah itu, bahkan sekarang sampai seperti itu ya sekarang beli di PDAM itu lo mb disana" (IN)

"Yes, the mining area had lots of trees in the past. We can get water easily. But since there has been mining activity until now, we purchase water at the PDAM"

Based on the results of the qualitative analysis and descriptive statistics that have been presented, to estimate the economic losses obtained by the community due to negative mining externalities, the replacement cost estimation is based on the purchase of clean water as a substitute for groundwater sources that can be obtained without spending money, while the cost of illness is based on community medical expenses due to air pollution.

Replacement cost which is estimated to come from replacing clean water by drilling artesian water wells and or gallons of water is shown in table 4. Replacement cost appears due to mining activities that affect the surface and groundwater quality through contamination with dissolved materials in addition to eliminating groundwater aquifers (Saviour, 2012).

Table 3. Estimated Loss of Clean Water Replacement Costs

Water sources	Frequency		Cost total (IDR)	Mean (IDR)
	n	%		
Artesian + Gallon	30	60	3,876,500.00	129,216.77
Artesian	20	40	1,786,000.00	89,300.00
.00Total	50	100	5,662,500.00	113,250.00

Source: Primary Data, 2020 (processed)

Society in Bengkung and Rowosari villages uses clean water sources by buying gallons of water and artesian water. The losses for each household using gallon water and artesian water are 3,876,500 IDR per month, artesian water users are 1,786,000 IDR per month. The average gallon of water used by respondents is 10 gallons per month per household with various purchase prices consisting of 2,500 IDR per gallon, 3,000 IDR per gallon, 4,000 IDR per gallon. Respondents are accustomed to allocating their expenditures for the fulfillment of clean water even though in fact if mining has never been carried out in the area it is still green vegetation that will fulfill the needs of clean water for the community. This condition causes respondents to have a preference to be willing to pay for replacement costs, meaning that respondents have an attitude that accepts the environmental changes with an average replacement cost of clean water, which is Rp. 113,250 per month.

Pollution of water, air, noise has an impact on health not only for workers but also for residents living in mining areas (Ahmad et al., 2014). The cost of illness appears as an economic loss for residents living around the mining area, including expenses for treatment, transportation costs for treatment, and work loss days. Another cost borne by the community who were left around the Brown Canyon mining area due to the decline in environmental quality is the cost of restoring health.

Table 4. Estimated Losses Due to Medical Expenses for a Month

No	The type of disease	Frequency			
		n	%	cost total (IDR)	Mean (IDR)
1	Cough	18	36	1,105,000.00	61,388.89
2	Flu	6	12	148,000.00	24,666.00
3	Flu + Cough	7	14	548,000.00	78,7285.00
4	Itchy	4	8	84,000.00	21,000.00
5	Cough + Itchy	2	4	102,000.00	51,000.00
6	TBC + Asthma	1	2	1,900,000.00	1,900,000.00
7	Flu + Itchy	2	4	52,000.00	26,0000.00
8	painless	10	20	0	0.00
	Total	50	100	3,939,000.00	Rp 78,780.00

Source: Primary Data, 2020 (processed)

According to research conducted by Mishra (2010) which stated that households living close to mining areas will be most severely affected, namely the health hazards. Table 3 shows that the total medical costs incurred by respondents varied according to health complaints. The total loss of respondents is 3,939,000 IDR. Respondents went to the puskesmas or purchased drugs at the nearest pharmacy with transportation costs ranging from 5,000.00,- IDR – 10,000.00,- IDR, and some respondents purchased drugs at the stall (without using transportation). Even for serious diseases such as tuberculosis and asthma, only go to the health center and purchased medicine at the nearest pharmacy. Some respondents are not burdened by medical expenses because the Government of Indonesia has provided health insurance including JAMKESMAS and BPJS. The drugs commonly purchased by respondents are eucalyptus, cough medicine, itching ointment. Respondents who only felt minor ailment symptoms such as dizziness due to noise and minor eye irritation chose not to take treatment.

The estimated total economic loss obtained from replacement cost and cost of illness is 9,601,000 IDR in one month, where the average respondent bears a loss of 192,030 IDR. For the community involved in this research, this amount can be categorized as quite large because the average household needs to fulfill the needs of 4 people with an average household income of only 3,302,500 IDR. There are even 30% of respondents who have incomes below 2,000,000 IDR which is lower than the DEMAK District UMR in 2020 which is 2,432,000 IDR. and UMR semarang city in 2020 which is 2,750,000 IDR. The losses borne by the community have created additional expenses for households living near the brown canyon mining that will have an effect on inefficiency in the community This negative externality will not interfere with the achievement of community efficiency if all adverse impacts are included in the calculation of producers in determining mining production (Pyndick & Rubinfled, 2015). The mining party does not take into account the additional costs of externalities in determining the price and quantity of goods produced, so the costs of these externalities are borne by the community. Following the statement, Holtermann (1972) that an externality is the output of one economic actor which becomes the input of another economic actor in this case is "negative" without any compensation received or paid. Furthermore, the resulting externalities have caused the community to have to replace the supply of clean water and restore health because the function of the environment as a public good is based on perfect substitutes where individuals will increase their utility when they can buy substitute goods that are the same as the previous goods to improve their welfare (Freeman, 1979). This is because the quality of the environment as a public good is a luxury item whose supply is available by nature and it is difficult to provide a substitute with the same characteristics (Casey et al., 2008). So the emergence of these externalities causes the community to take averting behavior which is estimated using the actual market price approach, which is using the calculation of replacement cost and cost of illness. Averting behavior is carried out by communities who receive losses due to production activities such as research conducted by Junengsih (2018) Negative externalities due to waste are borne by the community who live close to industrial locations causing people to take averting behavior by determining the cost of replacing clean water and bear the cost of medical treatment due to public health problems due to the decline in environmental functions. This result is also following the research Sidiq & Maruf (2018) the impact of the existence of the Jatibarang TPA causes the community to buy air freshener, mosquito repellent, and fly glue to replace the availability of good air quality as well as spending on treatment costs due to various diseases that arise due to the number of flies and the decrease in air quality. Reinforced by Remoundou & Koundouri (2009) which states that environmental degradation on human health arises as a result of a community's averting behavior to restore their health, resulting in a cost of illness. Furthermore, according to the statement Algbedion et al., (2007) which states that the environmental impact of additional activities raises costs of illness and replacement costs that are not internalized by mining companies causing losses for people living close to mining areas.

CONCLUSION

The negative externalities felt by the community living around the mining area are the decrease in air quality due to dust particles that cause minor ailments, mining noise, and the loss of hydrological potential that can fulfill the needs of groundwater sources. The total economic loss of 9,601,000 IDR consists of the replacement cost of using clean water of 5,662,500 IDR and the cost of illness of 3,939,000 IDR. Replacement cost is the cost of making artesian wells and purchasing gallons, while the majority of the cost of illness arises from a community that has cough due to a lot of dust. However, in the long term, negative externalities that can threaten the safety of the community's lives are disasters caused by human activities and will later cause greater economic losses. The research is one of the research that has passed the Masters towards Doctoral Education Grant scheme for Excellent Bachelors (PMDSU). So the authors would like to thank and appreciate the Institute for Research and Community Service Diponegoro University (LPPM) which has supported the funding for the publication of this article.

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