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Economic Valuation of the Post Nickel Mine Reclamation in East Luwu Regency, South Sulawesi

Hirfan[1,*], Soemarno[2], Endah Setyowati[3], Andi Tamsil[4]

[1]Doctoral Program of Environmental Studies, University of Brawijaya, Malang, Indonesia
[2]Faculty of Agriculture, University of Brawijaya, Malang, Indonesia
[3]Faculty of Administration Sciences, University of Brawijaya, Malang, Indonesia
[4]Faculty of Fisheries and Marine Sciences, Makassar Moslem University of Indonesia, Makassar, Indonesia

Abstract Reclamation of post nickel mining area in East Luwu needs to be conducted with concern for environmental sustainability and local economic growth. This study was aimed at determining the economic valuation of the reclamation of the post nickel mining area in East Luwu with the approach of willingness to pay (WTP). The research was conducted in the concession land area of post nickel mining in East Luwu Regency, South Sulawesi. Primary data were collected by dialog, workshop and FGD with the related stakeholders, e.g. the community, the mining company, regional government office, department of forestry, and NGO. The assessment of WTP used open-end questionnaire. The secondary data were the socio-economic and socio-ecologic of the externality on the reclamation taken from regional offices, the mining company, community, department of forestry and environment NGO. The results show that the value of WTP from the community as the beneficiaries of the reclamation is Rp. 226,077 for the following benefit: increase the environment quality of the post mining area for 27.56%, increase the local community income for 22.76%, decrease the ecosystem degradation of the area for 8.65%, expand the dynamic economic activities for 7.05%, and increase the demand of seasonal and annual plants production for 4.49%. 1. The reclamation of the post mining area should support the economic growth for the regional development, such as the reclamation of the post nickel mining in East Luwu Regency.

Keywords Economic valuation, Externality, Nickel mining, Reclamation, WTP

1. Introduction

Mining industry with open pit method has been known to cause following impact of environmental damage. This method of mining cause the surface run off disturbed the soil stability and damaged the land ecosystem. After the Climate Change Summit in Bali at the end of 2007, Ministries of environment, forestry, and energy and human resources together with the actors of mining sector agreed to implement environment-friendly mining or *green mining* [1]. Green mining requires the mining companies to conduct their activities by concerning the environmental aspects. In the implementation of green mining, the mining companies should rehabilitate the area of the post mining site, waste management, acid water management, monitoring of soil and water condition in the area and other environment conservation efforts.

The Ministry of Forestry regulate that companies should implement land reclamation after the mining activities over on the forest area [2]. The reclamation is mean to restore the condition of the forest thus it can be functioned as before, according to its original purposes.

One of the mineral resources in Indonesia is nickel. The potential of nickel ore is world-known. The world market for nickel remained strong in the 90s, where the demand for nickel increase, especially for Europe and Asia countries which estimated for 370 million tons. Nowadays, the mining of nickel, the processing and the purification of nickel was conducted by a total of 45 companies distributed in 28 countries. PT Vale Indonesia, Tbk is one of mining companies that produce the nickel in East Luwu Regency, South Sulawesi. This company reached 75,989 Metricton (IMT) nickel in 2010.

PT Vale Indonesia Tbk has conducted the forest rehabilitation on the area that got the impact from the mining activities. In the initial period, the revegetation was conducted without concerning the appropriate characteristic and management of the area, plants adaptability, and planting method. It is due to the lack of knowledge of the planner and the executor of the revegetation activity in the means of ecology restoration. However, the implementation of appropriate silviculture has been used to rehabilitate the land area of post mining activities since 1991 [3].

* Corresponding author:
dodforindonesia@gmail.com (Hirfan)
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Externality from the activities of nickel mining is the degradation of environment quality and the reclamation of post mining activities. The success of reclamation of the post mining area depends on the policy system that implemented by the government, management awareness, company's ability and community participation. The regulation should be in coherence with the standard of mining environment, thus the reclamation will be success.

The reclamation area of post nickel mining in East Luwu acts as public goods. Thus, it needs an approach so that the function and roles are sustainable for long term. Sustainability is the efforts to provide the best output for human and environment for the recent and future, with undetermined time. The sustainability related to the continuity of the aspects of social, economy, institution and environment community as well as non human environment. Sustainability is also form the civilization and human activity, where each individual can meet their needs and decant their potential for current and future days.

Sustainability aspect towards the advantage of reclamation area on the post- nickel mining in East Luwu gives hopes for surrounding community for the area development, prosperity and well being life. Therefore the continuity of the reclamation area needs approach that requires the beneficiaries of the reclamation to participate and initiatively willing to pay the advantages that they have been received.

As concept to supports the sustainability towards the utilization of the post nickel mining reclamation area in East Luwu, we conduct the study with willingness to pay (WTP) approach. WTP concept has the assumption that individual preferences towards a good or service is perceptible on their willingness to pay for the good or the service [6, 7]. Therefore, the aim of this study is to analyse the WTP of community that get the benefits from the reclamation of the post nickel mining area in East Luwu, South Sulawesi. Thus, the output of the study was expected to help the consideration for the policy making for the sustainability of the environment in the reclamation area.

2. Material and Method

2.1. Study Area

The research was conducted in the mining site of PT Vale Indonesia, Tbk located in the area of Sorowako, Nuha District, East Luwu regency, South Sulawesi. Geographically, the concession site of PT Vale Indonesia, Tbk is at 120045' – 123030' East and 6030'-5030' South. The area was divided into three categories as follows: Soroako Project Area (SPA), for 10,010.22 ha, Soroako Outer Area (SOA) for 108,377.25 ha, and Sulawesi Coastal Deposit (SCD) for 100,141.54 ha.

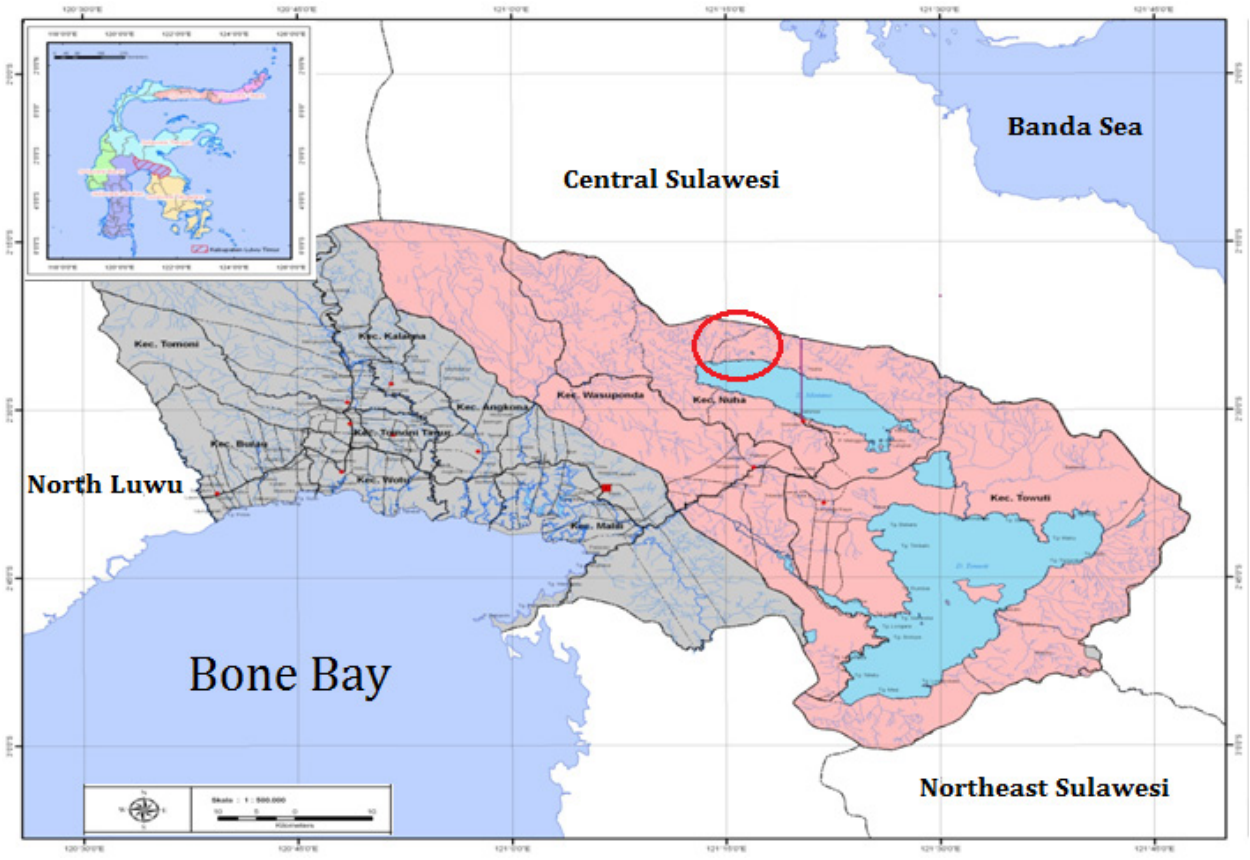

Figure 1. Study Site: East Luwu Regency. **Description:** O = Mining Area

The mining system that conducted by PT. Vale Indonesia, Tbk is Open Cut Mining by levelling mining start from the surface. The surface soil is temporarily removed and placed in particular area to be reuse to cover the mining pit after the mining activities finished (Backfill). The forest area that used for the nickel mining is tropical lowland forest. Several recorded local vegetation in the area are Belulang, Cina-Cina, Cemara (*Casuarina equisetifolia*), Damar (*Podocarpus* spp), Nosu (*Ficus ribes* Reinw. Ex Blume), Lodah (*Ficus* sp), and Panopi (*Eugenia* sp).

The nickel mining area of Sorowako consisted of two blocks, i.e. East and West Block. West block contained hard rocks that directly proportionl to the content of the nickel. Otherwise, the East block has less hard rock which also means less nickel content. The average elevation in Sorowako is 9 to 30% with altitude about 600 m above sea level. The area was dominated by laterite soil. Laterite (oxisol) is weathering soil and low clay content, less than 16 me/100 g. contain iron oxides or Al oxide [4].

Most resident of East Luwu lives form agricultural sector. Agriculture absorbs 70.37% of total 62,289 labor [5]. Soil and weather in East Luwu is very suitable for agriculture and plantation. The most production is paddy, followed by crops, fruits and corns. Palm oil also one of commodity in East Luwu. The palm oil plantation owned by the community, governments and private companies.

2.2. Data Collection

The research was correlation descriptive study which try to describe the facts correctly and the correlation of related phenomenon that has been studied. The economic valuation of the environment was embodied in the value of community's willingness to accept (WTA) the negative externality from the degraded environment quality due to the nickel mining PT Vale Indonesia.

Primary data were collected with dialog on the general condition of the reclamation area, issues and specific problems of negative externality on the socio-economy of community and environment issues which caused by the mining activities [8]. We also explored the community perception towards the policy from the government to overcome the problems. Primary data were also collected by workshop and focus group discussion (FGD). The workshop and FGD was aimed to get the inputs of recommendation from the community leader, community, academician, the head and staff of the PT Vale Indonesia, Tbk, Office of Regional Development East Luwu, Department of Forestry and environment NGO. The workshop provide information related to the mining system that implemented by PT. Vale Indonesia, Tbk (Open Cut Mining). It also informs us the dynamic evaluation on the revegetation program on the post nickel mining land area, and the function of stakeholders in the restoration process. The FGD also discuss the environment quality, inflicted externality, and the implemented public policy as the base for the reclamation of the post nickel mining area. The FGD clarify the information on the data base and deepen the assessment on the problems from the different opinions. For the willing to pay (WTP) assessment, we used questionnaire with open-ended question. The questionnaire was used to determine the compensation fund that will be paid by the community for the advantages that they get from the reclamation of the area. The respondents are selected purposively, chosen due to getting the benefits from the reclamation area. Total were 140 respondents to represent the area.

Secondary data were the economy environment related to the changes on the environment quality due to the mining activities. The data also includes the impacts of the implemented mining system, the socio-economic changes and socio-ecologic changes related to negative externality of the nickel mining. We also use the supporting data related to the formulation of the public policies towards the operational nickel mining. The secondary data were obtained from the regional offices in East Luwu, department of forestry, the mining company, and environment activist (NGO).

2.3. Willingness to Pay Analysis

The analysis of WTP used the quantitative descriptive approach. The method was focused on determining the value of willingness to pay (WTP) of the community from the benefit that they get from the reclamation, e.g. the improved environment quality [9]. If the respondent does not have the right on the goods or services produced from the natural resources, then the relevant measurement is the maximum WTP on the goods or services. Otherwise, if the respondent has the right, then the relevant measurement used the minimum willingness to accept (WTA) if it's gone or damaged.

3. Result and Discussion

3.1. Willingness to Pay (WTP)

The advantages for the community from the reclamation are as follows. 1. Increase the environment quality of the post mining area for 27.56%, 2. Increase the local community income for 22.76%, 3. Decrease the ecosystem degradation of the area for 8.65%, 4. Expand the dynamic economic activities for 7.05%, and 5. Increase the demand of seasonal and annual plants production for 4.49%.

On the area of reclamation, the beneficiaries' community in East Luwu has average income below Rp 1,862,675.47. Mostly the reclamation area was used for the seasonal and annual plantation. Thus, it can be said that the reclamation area encourage the local economic development for the community. The value of WTP from the community for getting the benefits from the reclamation area of post nickel mining in East Luwu is Rp. 226,077. The value was the median of all respondents (Fig. 2).

The community in this category is the conservationist and agriculture labour or farmer. The benefits are in the form of market expand, and the increasing profit, while the

environment conservationist has the benefits of the contribution of seedlings for revegetation [3, 10], the increasing environmental awareness of the community, and the increase of workshop received by the community.

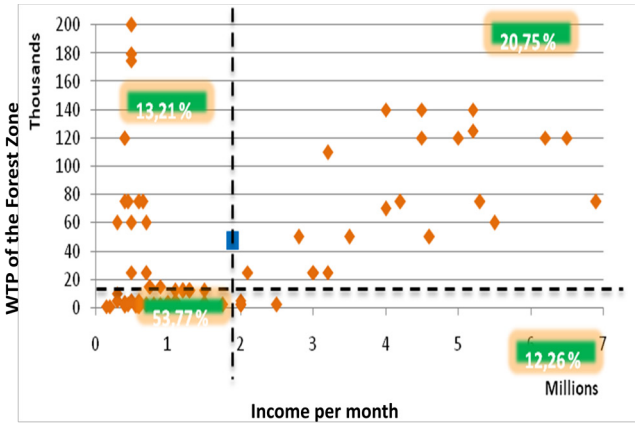

Figure 2. The income distribution of community and the value of WTP in the reclamation area

Community with higher income, above Rp 1,862,675.47 has higher value of WTP, i.e. 20.75%. The community with high income commonly live as big merchant for various plants commodity and distributor of various daily necessities. There is also community with higher income, but has the low WTP, as minority group for 12.26%. In this group, the livelihood is mostly the village structural officers. This group has the job that not directly involved to the environment or seasonal/annual plantation. Thus, even the income is higher; they have lower value of WTP (Fig. 2).

3.2. Externality of the Reclamation

The reclamation results of the post nickel mining area showed an intensification land use. It is followed by the changes on the ecosystem quality of the mining environment which is planned to be increased with the reclamation [11]. The land use intensification for the post nickel mining area can be referred from the indicators of socio-economic [12] and sociology.

Table 1. Socio economic impact of the reclamation area

No	Socio-Economic Impact	Description
1	Land ownership	Increasing of the rights to the land processing for small farmers
2	The area of reclamation	Increasing land area of reclamation
3	Perception of employment in agricultural sector	Increasing interest to work in the agricultural sector
4	Perception of employment in non- agricultural sector	Decreasing interest to work in the non-agricultural sector for the community in the reclamation area
5	Working pattern	Tend to changes into agricultural sector, especially the working time

The impact of socio-economic in the area of post nickel mining can be seen from 5 indicators which explained the intensification on the land use for agriculture: 1. strengthening the infrastructure on the agriculture area, 2. The area of post nickel mining mostly used for the agriculture land area, 3. The increasing employment in the agricultural sector, 4. The decreasing employment in the non-agricultural sectors, 5. The changes of working pattern of community lead to the addition on working time. The socio economic impact of the reclamation area was described in Table 1.

In the reclamation area, the post nickel mining area is also affected by the socio-ecology impact. The reclamation tends to increase the environment quality [13]. The improvement can be seen from the decrease flood or landslide. The socio-ecology impact of the reclamation area explained in the following Table 2.

Table 2. Socio ecology impact of the reclamation area

No	Socio-ecology impact	Description
1	Water resources	The number of water resources increased
2	Access to the water resources	In the dry season, several sites is not difficult to find water
3	Water Quality	In a good condition and meet the health standard
4	Flood	Several location point has no more huge peddle and flood tend to decrease
5	Landslide	The run off were tend to decrease

The reclamation of the post nickel mining area in East Luwu leads to positive externality. The ecosystem quality tends to increase and economic activities have being increased, especially at the agricultural sector. It shows that the role of reclamation on the post nickel mining area of East Luwu as the servicing economic is more predominate than the role as the driven economic. It means that the reclamation is encouraging other economic sector development [14]. In this condition, the local government should concern more on the infrastructure for the public. The policy should be also increase the development of the community.

4. Conclusions

The form of benefits from the reclamation of post nickel mining in East Luwu for the community is as follows: 1. Increase the environment quality of the post mining area for 27.56%, 2. Increase the local community income for 22.76%, 3. Decrease the ecosystem degradation of the area for 8.65%, 4. Expand the dynamic economic activities for 7.05%, and 5. Increase the demand of seasonal and annual plants production for 4.49%. The value of Willingness to Pay from the community as the beneficiaries of the reclamation is Rp. 226,077. The reclamation of the post nickel mining area in East Luwu Regency support the economic growth of the area. However, the benefits are continuously improved by further policy on the implementation of the reclamation.

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