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Priority Scale for the Public Policy on the Reclamation of Post Nickel Mine in the Regency of East Luwu, South Sulawesi

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Abstract Reclamation on the post nickel mining area in East Luwu needs to be conducted with concern to the environment sustainability and local economic growth. It can be implemented with appropriate public policy by the regional government offices. The study aimed to determine the priority scale of policies that support the reclamation in the post nickel mining area in Sorowako, District of Nuha, Regency of East Luwu. The study was conducted in the reclamation area of post nickel mining East Luwu Regency, South Sulawesi. Data were collected from questionnaire from related stakeholders, e.g. the community, the mining company, regional government office, department of forestry, and NGO. The assessment of analytic hierarchy process (AHP) used pairwise comparison to determine the priority scale. The supporting data used documents of the socio-economic and socio-ecologic externality on the reclamation taken from regional offices, the mining company, community, department of forestry and environment NGO. Through this study, we suggest three strategic priorities for the policy on the post nickel mining reclamation area, as follows. First is the operational management (0.792), while the second level policy is the empowerment and participation of the community (0.655) on the reclamation of post nickel mining area. Finally, the last level policy is the regulation and institutional management towards the post nickel mining reclamation with scale of 0.453.

Keywords Analytic Hierarchy Process, Nickel mine reclamation, Priority formulation

1. Introduction

The Ministry of Forestry has being regulated that mining companies should conduct land reclamation after the mining activities is finished in the forest area [1]. The reclamation means to re-condition the forest to be functioned as before the mining activities, to its original purposes.

PT Vale Indonesia, Tbk is a mining company which produce nickel. It is located in East Luwu Regency, South Sulawesi. PT Vale Indonesia Tbk has conducted the forest rehabilitation on the area post mining activities. Initially, the revegetation did not consider the appropriate characteristic and management of the area, plants adaptability, as well as the planting method. It is due to the poor knowledge of the policy makers on ecology restoration. However, the implementation of appropriate agroforestry practices has been used to rehabilitate the land area of post mining activities since 1991 [2].

The reclamation of post nickel mining in East Luwu is public concern. The activities need proper approach thus the function and roles are long term sustainable. The success of reclamation on the post mining area depends on the policy system implement by the government, the public policy should be in coherence with the standard of mining environment, management awareness, company's ability and community participation, thus the reclamation will be success. The appropriate public policy is expected to give solution for the community that interact with the post nickel mining area which is mostly turns into agriculture land area. Thus it can reduce the social conflict between communities with PT Vale Indonesia Tbk as the cause of environment degradation due to the mining activities.

In the determination of development policy especially related to the reclamation area in East Luwu, each policy maker such as the officials of related Environment Unit or the member of community often face the problem's complexity thus bring out many considerations and alternatives i the decision making. The alternative policy frequently in a series, thus it is difficult to determine the

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priority of the policy. Thus we used Analityc Hierarchy Process (AHP) to help us in measuring the priority of policy that should be decided by multi criteria consideration with maintained consistency. The aim of this study is to determine the scale of priority on the policies that support the post nickel mining reclamation in Sorowako, Nuha District, East Luwu Regency. The output of the study is expected to help the policy making for maintaining the sustainability of the environment in the reclamation area.

2. Analytic Hierarchy Model

The method of Analytic Hierarchy Process (AHP) is a decision making method that used heararchy as its main tools. With this hierarchy, a complex and unstructured problem is diparted, grouped, and arranged into hierarchy form [3]. Primary data of the AHP is the people perception that considered as expert. The criteria of expert does not mean genius, smart or has doctoral or professor degree, but means someone that has more understanding on the related problems. Besides that, AHP is a flexible model which gives ideas and defines problem with each assumption, and get expected solution from it. The process also allowed us to test the sensitivity of the results towards the changes on information. It is also designed to accommodate human natures rather than force them to thinks contrsatly to their conscience. AHP is the exact process to overcome the complex political and socio-economy problems [4].

AHP is a theory about measurement used to find the ratio scale from the comparison of discreet or continuous pairing. The comparisons are obtained from actual measurement or a basic scale that reflect the strength of feeling and relative preferences. AHP has a special concern on the irrelevance of consistency, measurement of dependence in and between the structure element groups. AHP is mostly found in the decision making of many criteria, planning, prediction and resources allocation. Thus AHP is also called as multipurpose method despite its controversial [5]. AHP can be considered as a model of multiobjective-multicriteria-multifactor decisions [6].

Saaty mentioned two types of hierarchy, i.e. structural hierarchy and functional hierarchy [4]. The pattern of structural hierarchy is a complex system which arranged into principal hierarchy with downward components based on their structural characteristics. The application of AHP can be divided in to two phases: the phase of hierarchy arrangement and evaluation of the hierarchy [7]. The hierarchy arrangement is commonly known as decomposition including 3 most related and continuous process: (1) identification of level and element, (2) definition of concept (3) formulation of questions.

First process is the identification of levels and elements within the level. The elements are defined and used in the formulation of questions. In the evaluation of hierarchy, there are two phases, i.e. the valuation and the results synthesis. The valuation means the decision maker translates the pair of the elements. The perception or the valuation presented in the scale of 1 to 9. The results will form a matrix of pairwase comparison. The filled matrix will determine the local priority which then synthesizes to create global priority of the below elements. Model of AHP is not strict, but at the end of the model, the inconsistency should be evaluated; to ensure the minimum inconsistency. If the inconsistency was occured at the level of local priority, then the global priority is still consistent or the inconsistency is low.

3. Material and Method

3.1. Data Collection

The policy which determines the priority scale of reclamation policy on post nickel mine reclataion in the Regency of East Luwu Timur was arranged by using the method of Analityc Hierarchy Process (AHP). The application of AHP model is different from other ordinary survey methods. The adoption process on the respondents' opinions in AHP does not require certain minimum number of respondents to represent a perception towards the problem. AHP only requires competent respondents which has comprehensive knowledge towards the studied problem and significantly affects the decision making.

A total of 55 repondents answered the questionnaire. The questionnaire is related to the reclamation policy on post nickel mining in East Luwu Regency. It is divided into three groups. First group is the related institution on the reclamation of the post nickel mining area. Second group is form community, such as key persons (cultural, religion, youth, and NGOs), head or structural officials in the village. The third groups is the policy maker, including the head of Regional and Development office, the head of regional council with the head of the commission, and the head of the Environmental Agency and staff. Based on the data and field condition, we sorted the hierarchy into aspects in determining the priority scale of reclamation policy on the post nickel mining area in East Luwu.

3.2. Analytic Hierarchy Process (AHP)

The author arranged the hierarchy to be evaluated by the respondents. The results are in the form of qualitative data. The qualitative data was analysed further to be quantified. The results from the questionnaire inserted into the matrix of pairwase comparison for every group of corespondents. Synthesis of the respondents was summarized and geometrically rated to assess the global priority for each studied criteria and alternatives. Perception of respondents was calculated with pairwase comparison to know the total score values of each criteria and alternative priorities which assessed in this study.

The formulation of strategy to determine the priority scale on the policy of post nickel mining reclamation is based on the following empirical facts: (1). Fields findings, (2). Empirical data related to the reclamation of post nickel

mining area, community participation, management institutional of the reclamation area, regulation and management of the reclamation, etc, (3). Results of the workshop with the Environmental Agency, Industry and Trading Office, Development Planning Agency of East Luwu, and corporate of the mining companies, (4). Focus Group Discussion of all stakeholder.

The lowest level of hierarchy is Hierarchy Structure IV in the determination of priority scale for the policy of reclamation on the post nickel mining area which valuation is based on the upper levels of the hierarchy. Pairwase comparison determines the most affecting factors in the priority scale determinantion. Furthermore, the priority order of upper level, such as Level I and II was compared.

4. Result

The result of the calculation was interpreted on each hierarchy level. Each number showed priority of several proposed options. Level I described the assumption of the planning purposes on the study as determinant factors which affect the determination of priority scale on the reclamation policy. Final synthesis on the hierarchy structure Level I is shown in following Table 1.

Table 1. Synthesis on the Planning Purpose

No	Planning Purpose	Score	Priority
1	Regulation and institutional of the post mining area reclamation management	0.667	3
3	**Operational management of the post mining area reclamation**	**0.866**	**1**
3	Community participation on the reclamation of post mining area	0.770	2

The results of data analysis which based on the perception of management institution, regional government, community public figure and NGOs showed that the regulation and institutional of the post mining area reclamation management with score 0.667. Second, operational management of the post mining area reclamation scored 0.866, while the third, community participation on the reclamation of post mining area scored 0.667. Final result showed that the operational management of the post mining area reclamation get the first priority. It means that this factor is the most dominant factor for the determination of priority scale for the reclamation policy of the post nickel mining area in East Luwu.

Table 2. Synthesis on the Instruments of the Planning Purpose

No	Instruments of planning	Score	Priority
1	Aspect of regulation, work practice system and financing	0.372	3
2	Aspect of economy, social and ecology	**0.781**	**1**
3	Campaign and socialization, monitoring and maintenance	0.747	2

Final synthesis for the hierarchy structure Level II is the indicators of planning purpose from the determination of priority scale of the reclamation policy for the post mining area. The synthesis hierarchy of Level II presents in Table 2.

Based on the above score rank, the instrument of the planning which consisted of the aspect of economy, social and ecology scored 0.781. These three aspects of planning instrument is the determinant factor for the success of the reclamation policy in the post nickel mining area.

Synthesis on the hierarchy structure Level III is the indicators of the planning purpose for the determination of priority on the reclamation policy of the post nickel mining area. The indicators that used to determine the planning purpose consisted of three groups. Details of the indicators were described in the Table 3. The indicator that needs to be prioritized to support the reclamation policy of the post nickel mining is the second indicator which includes short term and long term orientation, education and research as well as recreation and pleasure of vegetation ecology, and conservation and nursery which scored 0.714. This main indicator is necessary in the formulation of reclamation policy for the post nickel mining area in East Luwu.

Table 3. Synthesis on the Indicators of the Planning Purpose

No	Indicator of planning purpose	Score	Priority
1	- Regional regulation of environment and strategic plan of Environmental Agency - Extend the facilities and infrastructures, and human resources development - Routine financing from regional income and mining corporate	0.466	3
2	- Short term and long term orientation - Education and research, recreation and entertainment - Conservation and nursery	**0.714**	**1**
3	- Increase the environment cadres - Intensify the participation of direct related parties - The insentive and disinsentive, and the establishment of Community Development	0.651	2

The structure of hierarchy Level IV is the design of the policy formulation on the reclamation of post nickel mining area. Synthesis of each level produces the priority order of the reclamation policy. We design three main strategies formula for the reclamation policy of the post nickel mining area (Table 4) based on synthesis from previous explaination.

Table 4. Formulation of the Public Policy Priority Scale

No.	Formulation of strategy	Score	Priority
1	Regulation and institutional of the post mining area reclamation management	0.453	3
2	Operational management of the post mining area reclamation	**0.792**	**1**
3	Empowerment and participation of the community on the post mining area reclamation	0.655	2

5. Discussion

Aspect of economy, social and ecology are substantial instruments from the planning instrument for the determinaton of priority policy of reclamation [8]. These multi- criteria aspects [9], i.e. economy, social and ecology in this case, ensure a good management on the reclamation of post nickel mining area in East Luwu. The aspects of economy, social and ecology related to the facts in the fields that future challenge for the reclamation on the post nickel mining area consisted of four problems: (1) Short term and long term orientation is the values in the determination of priority on the reclamation policy [10]. (2) The increasing for education and research activities as well as the recreation and entertainment correlates to the increasing population of the community. (3) Conservation is necessary to be conducted continuosly [11] with the community involvement due to the low community awareness and knowledge towards the reclamation of the ex-mining area. (4) The vegetation nursery with permanent stand should be implementing for long term [11]. It is expected to affect the value and function of environment, especially the results of reclamation on the ex-mining area. It is the main activity that supports the reclamation policy on the post nickel mining area in East Luwu.

6. Conclusions

Based on the assessment on the priority scale of the policy on the post nickel mining reclamation area, we conclude three strategies as follows. First level policy is the operational management of post nickel mining reclamation (scale of 0.792). Second level policy is the empowerment and participation of the community on the reclamation of post nickel mining area (scale 0.655). The last level policy is the regulation and institutional management on the reclamation of post nickel mining area (scale of 0.453).

The step of strategic policy shall realize the sustainable mining paradigm which emphasized on the consistency of straighten the law practice towards the violation of environment regulation on mining operation. It includes the availability of human resources as inspector, the availability of regulation on the criteria of nickel mining development that should be sustainable economically, socially and environmentally. The regulation on the criteria of local economic growth is also includes in the policy surround the nickel mining area.

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