Feasibility analysis of lake ex-andesite stone mining as geo-tourism area at Tegalega Village, Cigudeg, Bogor

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ABSTRACT

The existence of large wallow which is an ex-mining of andesite stone that is not manage properly became the focus of this study. The objective of this study was to analyse the potential of geo-tourism object at the land of ex-andesite stone mining (Setu Jayamix), as well as to find out the feasibility value of geo-tourism object at the lake of ex-andesite stone mining (Setu Jayamix). Mix methods, which is a combination of qualitative and quantitative methods with the research design of sequential exploratory was used in this study. Sequential exploratory design is a research model where the qualitative data is collected and analyzed, then followed by the collection and analysis of quantitative data, which aims to strengthen the results of the study. The results showed that the potentials of geo-tourism in ex-andesite stone mining area i.e. lake waters, the uniqueness of andesitic stone outcrops, and the view of landscape that overgrown by various plantation crops. Based on the results of the feasibility analyses of geo-tourism, then obtained a feasible value for the geological criteria of physical components (score = 26.334), sustainable for the economic components (score = 20.114), sustainable for the conservation components (score = 10.971), and educative (score = 8.518). Meanwhile, for the accessibility component is declared to be less feasible (score = 61.446).

ABSTRAK

Keberadaan kubangan besar yang merupakan area bekas penambangan batu andesit yang tidak terkelola secara maksimal menjadi fokus penelitian ini. Penelitian ini bertujuan untuk mengkaji potensi obyek geowisata pada lahan di kawasan bekas tambang batu andesit (Setu Jayamix), serta mengetahui nilai kelayakan obyek geowisata di kawasan danau bekas tambang batu andesit tersebut (Setu Jayamix). Metode kombinasi (mix methods), yaitu gabungan antara metode kualitatif dan kuantitatif dengan model penelitian sequential exploratory design digunakan dalam penelitian ini. Sequential exploratory design merupakan model penelitian dimana data kualitatif dikumpulkan dan dianalisis, kemudian diikuti dengan pengumpulan dan analisis terhadap data kuantitatif, yang tujuannya untuk memperkuat hasil penelitian. Hasil penelitian menunjukan bahwa potensi-potensi geowisata yang terdapat di kawasan lahan bekas tambang batu andesit (Setu Jayamix) adalah perairan setu, keunikan singkapan batu andesit, serta pemandangan lanskap kawasan yang ditumbuhi berbagai tanaman perkebunan. Berdasarkan hasil analisis kelayakan geowisata, maka diperoleh nilai layak untuk kriteria geologis komponen fisik (skor = 26,334), berkelanjutan untuk komponen ekonomi (skor = 20,114), berkelanjutan untuk komponen konservasi (skor = 10,971), serta edukatif (dengan skor = 8,518). Sedangkan untuk komponen aksesibilitas dinyatakan kurang layak (skor = 61,446).

Keywords: Geo-tourism, ex-mining, feasibility analysis, Bogor

INTRODUCTION

The potentials of mining and energy materials in Bogor Regency are quite diverse. Based on the types of minerals or production they produce can be distinguished such as, a) Excavation materials "C", which is based on mining permit issued by the local government of Bogor Regency consists of limestone, clay, andesite, sand, gravel, feldspar, and backfilled, with a total production around 18.5 million tones in 2002, and b) Excavated materials "B" which consists of gold and silver with total production of around 29 kg in 2002.

By looking at the potential of excavation materials "C" in Bogor Regency which is quite large, the mining system using the most open method

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becomes the system that is mostly carried out by mining operators. As it is known, the last process of mining activities using the open method is in the form of gaping holes and damage to the surrounding ecosystem.

One of the large mining pits is located in Nanggaherang area, Tegalega Village, District of Cigudeg, Bogor Regency. This large hole is an ex-andesite stone mining conducted by PT. Jaya Readymix, which has been exploited since 2012, and since the condition of the big hole has been left, it has been filled with rain water and springs below and has formed like a little lake. Therefore, the surrounding communities call that little lake as Setu Jayamix (taken from the company of PT. Jaya Readymix) or Setu Tambang.

According to Hendratno (2002) and Kubalikova (2013), there are several earth phenomena that can be used as a basis for geo-tourism promotion activities, such as:

a. Active earth processes, including volcanic eruptions and their products, earthquake-prone, rock movements that are still active so as to produce fields fault, a manifestation of geothermal and prone to landslides.

b. Natural beauty that is formed due to the geodynamic processes of the past, such as mountains, rivers, beaches, karst, plateaus and coral reefs.

c. Cultural aspects of the past that are influenced by geodynamic developments, such as the formation of ancient sites due to natural disasters that occur.

d. Geological resource exploitation activities, such as the exploitation of valuable hydrocarbons and mineral mines (gold, copper, silver, etc.) in both large and small scale.

e. Geological resource exploitation activities which cause problems to the surrounding environmental conditions.

According to Wood (2002) and (Arafat and Flamin, 2012) the nature tourism should have some principles such as nature base, ecologically sustainable, environmentally educative, useful for the local community, and tourist.

From those problems describe above, then an optimal management effort is extremely needed so that the existence of ex-andesite stone mining can be functioned further. For this reason, a study needs to be conducted to assess the available potentials in the area of ex-andesite stone mining to determine their eligibility as an Geo-tourism Tourism Destination (DTW).

The objective of this study was to analyse the potential of geo-tourism object at the land of ex-andesite stone mining (Setu Jayamix), as well as to find out the feasibility value of geo-tourism object at the lake of ex-andesite stone mining (Lake Jayamix).

METHODS

This study was conducted in April-May 2019 in the area of ex-andesite stone mining that is known as Setu Jayamix. It is located in Tegalega Village, Cigudeg District, Bogor Regency, West Java.

All variables that was analyzed in this study refer to the guidelines for operationalizing variables from geo-tourism of Dowling and Newsome (2006), in the form of five characteristics so that the development and geo-tourism management can take place continuously for a long period of time, with components that will be recorded and assessed namely geological, sustainable, educative, community participatory and tourist satisfaction.

Three types of methodology were used during the data collection. Firstly, data collection conducted by observation, interview and questionnaire delivery. Secondly, literature review was done through studying literatures, reports, scientific works, journals and research articles that related to this research. Thirdly, field documentation method to obtain data directly from the research site.

The data were analyzed using three methods. First, using descriptive qualitative analysis, which is an analysis method that aims to describe and explain the potential of geo-tourism objects in the area of ex-andesite stone mining. Second, using the Geo-tourism Feasibility Assessment method with the evaluation criteria according to the Director General of the Regional Nature Tourism Object Attraction and Attraction (ADO-ODTWA) (Departemen Kehutanan, 2003; Arafat and Flamin, 2012). Third, was creating and verifying conclusion which could answer the problems that formulated since the beginning.

RESULTS AND DISCUSSION

Geo-tourism potential

Geological variable

Sub variable: Physical

If we enter Setu Jayamix area, we will be welcomed with a stretch of lake which is always filled with water that sourced from springs at the bottom of the lake and rainwater. The water runoff of the mining when it is fully charged will flow graphically through the community channel to the Ciater River located in Binong Hamlet at Tegalega Village. The total area area of the lake is almost 1.5 ha with a depth of water estimated around 27 meters with greenish waters, giving rise to a very beautiful panorama and has its own charm.

The greenish color of the water is so beautiful and it is also supported by the quality of lake water which is not polluted, in accordance with the results of the lake water quality test conducted on April 10, 2019 that for all surface water quality test parameters meet the environmental quality standard (BML) based on Government Regulation No. 82/2001 concerning management of water quality and water pollution control. This is also strengthened by the evidence that the large number and various species of fish that live in large waters, so that this place is used as a fishing area by surrounding communities.

The beauty of the existing lake water combined with views of andesite stone outcrops on the walls of lake, which is a gray andesite stone mining process. It is a type of igneous stone of the middle category as a result of melting magma diorite formation.

Landscape within the study area is in good condition. It is known that the soil type is Andosol which has fertile properties that can be cultivated for mixed gardens.

Species of fauna found during field observation such as butterfly (*Delias fruhstorferi*), dragonfly (*Aesha* sp.), some small birds, some reptile, and leaf-monkey.

Sub variable: Accessibility

The variability of road condition to the Setu Jayamix area was observed from the provincial capital of West Java Province (Bandung) to the location of the activity consisted of several conditions, as follows:

1. From the provincial capital (Bandung) using the Purbaleunyi toll road to the Yasmin Bogor toll exit, passed the Jagorawi toll road and the BORR toll. Distance traveled ± 190.1 km with excellent road conditions, generally flat.
2. From Yasmin, Bogor, driving through a non-toll road (in the city) heading to Ciseeng intersection. Distance traveled ± 19.1 km with a road condition that is in sufficient condition, with little or no holes but uneven road surfaces.
3. From Ciseeng crossroad using the district road to the study site in Tegalega Village, Cigudeg District, it is ± 19.7 km away with the condition of the road being in bad condition, with many holes in it.

The damage of the road approaching the research site is caused by the traverse of large vehicles such as large trucks carrying heavy loads in the form of sand and stone material. Therefore, the road conditions are quite alarming, especially in the rainy season. The road conditions are very muddy and slippery in rainy season and is full of dust in dry season.

The trip to the Jayamix area can be reached by ± 4 hours 39 minutes from the capital city of West Java Province (Bandung), with total distance of ± 228.90 km. The route used was through the Purbaleunyi toll road to enter Jakarta, then using the Jagorawi toll road to enter the Bogor area, continued by using the BORR toll road to get to the Yasmin junction and continue with the normal road to the Semplak intersection or the Parung market towards the Rumpin District. From the Parung market location, go straight to the three intersection of Rumpin. After crossing three intersections, turn right toward BDK-Bogor, Rumpin. Just follow the road straight and if you find a signpost written of PT. Lotus SG Lestari and just follow it. After passing through various types and conditions of the road as well as several settlements of residents and several mining areas, we will arrive at the destination.

If using public transportation, we will only reach the center of Cigudeg District, and to continue the journey we can use motorcycle taxi or rent a car.

The type of road for the width of the lane without the median barrier that will be traversed to the location observed from the Ciseeng junction is a concrete road with a road width of >11 meters. However, although this road is quite wide, but because the area that we pass is in the sand and stone mining area of several mining companies that every day use this road as a haul road for large vehicles of

their mining business, the road conditions are always congested with huge vehicles so you have to be more careful.

Sustainability variable

Sub variable: Accessibility

From the results of interviews with several staff of Tegalega Village, Cigudeg District, it was conveyed that the types of jobs or the biggest livelihoods of the Tegalega villagers is farmers and became daily laborers out of the mining business, while the livelihoods of other types of work were very few such as trading, self-employment and motorbike taxi driver. What is of concern is the number of village people who do not have permanent work or unemployed is very large. It can be seen from the demographic data of Tegalega village in 2018 for the type of work or livelihood that from the working age community (15 to 64 years) as many as 4,138 people where there are 1,072 people (26%) who do not have permanent jobs or who do not work (unemployed).

In the Bogor Regency Regional Indicator Target Book 2014 - 2018, that monthly income earned by the people of West Bogor including Tegalega Village was Rp. 14,850,000 per year or Rp. 1,237,500 per month.

The Tegalega Village apparatus quite welcomed to the information that there is a tourism potential that can be developed from natural conditions in the form of lake of ex-mining activities that have been abandoned by the company, namely Setu Jayamix, which will later be able to open new jobs and will also increase community income, including working as tour officers, ticket guards, security personnel, janitors, food vendors, souvenirs, photographers, motorbike taxi, tour guides and other workers that will be needed for the operation of a tourist area, and it can increase village cash income from ticket prices paid by the end of tourist area.

Sub variable: Conservation

From observations in the field there are at least eight components in the natural ecosystem that can be maintained with this geo-tourism development plan, namely water, terrestrial plants, aquatic plants, terrestrial fauna, aquatic fauna, soil, air temperature and stones (landscape).

Educative variable

Within the Setu Jayamix area there are a number of attractions that can be included in interesting and educative interpretation media and can increase tourist awareness about environmental conservation educatively, including at least four attractions that can be included in interesting and educative interpretation media as follows:

1. Beautifully colored waters and uncontaminated quality that contain elements of a lake aquatic ecosystem education.
2. Outcrops of andesite from mining processes that are unique and interesting that contain elements of geological education.
3. Introduction of a variety of terrestrial and aquatic plants that thrive in locations that contain educational elements of terrestrial and aquatic ecosystems.
4. Introduction of various aquatic and terrestrial animals that can live and thrive in lake waters which contain elements of lake waters ecosystem education.

All components can be used as an interesting interpretation media and educational material for tourists who will visit later.

Analyses results show that Setu Jayamix area is very potential and feasible to be developed and made a tourist destination. This is concluded in accordance with the criteria the eligibility determined in each class states that almost all classes are declared worthy of each criteria value, namely, geological variable for physical components with a score of 26.334, geological variable for accessibility components with a score of 61.446 (Table 1), sustainable variable for economic components with a score of 20.114, sustainable variable for the conservation components with a score of 10.971 (Table 2), and educative with a value of 8.518 (Table 3). The level of eligibility for each class varies based on the interval of each class.

From the Tabel 1. it can also be seen that conservation criterion achieving the maximum score score of 10.971, compared to the other criterion. This indicates that at least eight components in the natural ecosystem contained in the geo-tourism development plan area, namely water, terrestrial plants, aquatic plants, terrestrial fauna, aquatic fauna, soil, air temperature and stones (landscape), this will be maintained through conservation-based tourism activities and management. Furthermore, for the economic, physical and educational geological components it is also close to the maximum score,

indicating that the high number of unemployment and low income levels can also be used as opportunities for the development of geo-tourism potential in the region by involving the Tegalega Village communities in maximum area management, so that the number of unemployment can be reduced and the level of community income can be increased.

For physical components of geology variable that will show the beauty of the waters of lake, the uniqueness of ex-mining andesite stones and the landscape conditions that are grown with a variety of plants that thrive because they are on Andosol soil type that are well cultivated for plantation areas if managed properly will make this geo-tourism area will very interesting for tourists to visit.

Geo-tourism Assessment

Table 1. Assessment results of the geological variable in ex-andesite stone mining of Setu Jayamix area.

No.	Element	Sub element	Weight	Value	Total score*
Geological: Physical components					
1	Condition of water	Water quality	0.2926	40	11.704
2	Uniqueness of andesite	Uniqueness	0.2926	20	5.852
3	Landscape (flora)	Existence of plants	0.2926	30	8.778
			Total score:	**90**	**26.334**
Geological: Accessibility components					
1	Road condition	Level of road damage:			
		Distance 190.1 km of the total distance of 228.90 km	0.2926	40	11.704
		Distance 19.1 km of total distance 228.90 km	0.2926	60	17.556
		Distance 19.7 km from total distance 228.90 km	0.2926	40	11.704
2	Distance from the city	Distance from the provincial capital	0.2926	15	4.389
3	Type of road	Width lane road without median divider	0.2926	40	11.704
4	Travel time	long trip	0.2926	15	4.389
			Total score:	**210**	**61.446**

Table 2. Assessment results of the sustainable variable in ex-andesite stone mining of Setu Jayamix area.

No.	Element	Sub element	Weight	Value	Total score*
Sustainability: Economic components					
1	Livelihoods/occupation	There will be alternative livelihoods/occupation and reduced unemployment	0.3657	30	10.971
2	Level of income	Perception that there will an increase of community income	0.3657	25	9.1425
			Total score:	**55**	**20.114**
Sustainability: Conservation components					
3	Natural ecosystems that can be maintained or managed through conservation-based tourism	Presence of natural ecosystem that can be maintained or managed through conservation-based tourism	0.3657	30	10.971
			Total score:	**30**	**10.971**

Table 3. Assessment results of the educative variable in ex-andesite stone mining of Setu Jayamix area.

No.	Element	Sub element	Weight	Value	Total score*
1	Educative	Educative media interpretation	0.3407	25	8.5175
			Total score:		**8.5175**

For the educative component that will present interesting and educative interpretative media in the form of beautiful colored waters and uncontaminated quality that contains elements of education in the lake ecosystems, outcrops of andesite from the mining process that are unique and interesting that contain elements of geological education, introduction of various terrestrial plants and water that thrives in locations that contain elements of terrestrial and aquatic ecosystem education and the introduction of a variety of aquatic animals and terrestrial animals that can live and thrive in lake waters that contain elements of lake aquatic ecosystems if properly managed will make this geo-tourism area very interesting for tourists to visit while increasing tourist awareness about environmental conservation.

However, for the geological variable of accessibility which gets a fairly low score below the maximum score of 61.444, this indicates that judging from the condition of the road (level of damage to the road), distance from the provincial capital, type of road (width of the lane road without median boundaries), as well as travel time are in unfavorable conditions to be developed into an geo-tourism area, but with the planning of improvement and good accessibility management and supported by other good geo-tourism components, this geo-tourism area will still be attractive to tourists to visit.

Geo-tourism feasibility analysis

Table 4. Assessment results of object and geo-tourism attractiveness of ex-andesite stone mining of Setu Jayamix area.

Variable	Max. Score	Min. Score	Interval *	** Feasibility criteria	Total score ***	Remarks
Geological:						
Physical	29.260	7.135	7.315	Feasible: 21.945 - 29.260 Feasible enough: 14.63 – 21.945 Less feasible: 7.315 - 14.63	26.334	Feasible
Accessibility	87.780	24.871	20.970	Feasible: 66.81 – 87.780 Feasible enough: 45.84 - 66.81 Less feasible: 24.871 to 45.84	61.444	Feasible enough
Sustainability:						
Economy	21.924	9.143	4.260	Feasible: 17,664 to 21,924 Feasible enough: 13.404 - 17.664 Less feasible: 9.143 - 13.404	20.114	Less feasible
Conservation	10.971	3.657	2.438	Feasible: 8.533 s / d 10.971 Feasible enough: 6.095 - 8.533 Less feasible: 3.657 - 6.095	10.971	Feasible
Educative	10.221	3.407	2.271	Feasible: 7.950 - 10.221 Feasible enough: 5.68 – 7.950 Less feasible: 3.407 to 5.68	8.518	Eligible

CONCLUSION

1. Setu Jayamix, a Lake ex-andesite stone mining has the potentials of geo-tourism object (Table 4). Those potentials include as follows:
   - The beauty of greenish unpolluted lake waters, the uniqueness of ex-mining andesite stones outcrops, and the landscape surrounding which grown by variety of fertile plants.
   - At least eight natural ecosystem components that contained around the lake such as water, terrestrial and aquatic plants, terrestrial and aquatic fauna, soil, air temperature and stones (landscape), which can be maintained through conservation-based tourism activities.
   - The high number of unemployment and the low level of income of the people around the lake can be used as opportunities for the development of the potential for geo-tourism in this region by involving the community in the management of geo-tourism.
   - Interesting and educative interpretation media in the form of beautiful colored unpolluted lake water that contains element of education of lake's ecosystem, andesite stone outcrops that are unique and interesting of mining processes that contain element of geological education, introduction of various plants and fauna which contains elements of terrestrial and aquatic ecosystems education.
2. Currently, there are not many surrounding communities can be involved in the existence of Setu Jayamix, as the area formally is not open for the public. The area is still managed by PT. Jaya Readymix, but they are not carried out any activities on the land.
3. Based on feasibility assessment, Setu Jayamix area is feasible to be developed for geo-tourism that considered from geology variable for physical component, sustainability variable for economic component, sustainability for conservation component, and educative component. Meanwhile, accessibility component is stated to be less feasible.

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