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# Study of management and development of *Observatorium Astronomi ITERA Lampung* (OAIL) area: Part II

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**Abstract.** At 20<sup>th</sup> November 2016, Institut Teknologi Sumatera (ITERA) and Institut Teknologi Bandung (ITB) also Government of Lampung Province have launched the ITERA Astronomical Observatory or known with *Observatorium Astronomi ITERA Lampung* (OAIL). The coordinate of the observatory is 05° 27' 71" S and 105° 09' 39" E and the altitude is 1030 above sea level. OAIL area will be the center of education in science and ecotourism in Lampung Province which may attract tourists. Therefore, management and development of the observatory should be directed so that the main function of the observatory is not disturbed. In this research we did assessment and evaluation of OAIL area to be a specific area by distributing questionnaire to some related agencies, expertise people (academy), and surrounding population. The results show that from total 83 respondents, 64 respondents choose that OAIL area is appropriate as a specific area and 19 respondents say that OAIL area is not appropriate as a specific area. From 19 respondents who do not agree, there are 8 respondents (almost 50%) from Regional Disaster Management Agency of Lampung Province.

## 1. Introduction

Bosscha Observatory is the only observatory in Indonesia since 1923 which is used for research and public outreach. The location of Bosscha Observatory is also very strategic. It is one of the observatories located near equator in the southern hemisphere. There are only few observatories located in the southern hemisphere, such as South Africa Astronomical Observatory (SAAO) in South Africa, European Southern Observatory (ESO) in Chile, and Australian Astronomical Observatory (AAO) in Australia. Since its commissioning in 1928, Bosscha Observatory has been playing main role in producing scientific data. In other aspect, Bosscha Observatory stands as one of the oldest observatories in the world with almost a century old. Rural development activities around Bosscha Observatory currently is not strictly controlled. Many developers are constructing new buildings around the Observatory that cause disruption of observational activities. To get good observation data and to keep younger generation learn space science properly, we need another observatory in addition to the existing Bosscha Observatory.

The ITERA Astronomical Observatory – Earth and Space Education Center in Sumatera (IAO-ESSECS) or known as *Observatorium Astronomi ITERA Lampung* (OAIL), launched by Institut Teknologi Sumatera (ITERA), Institut Teknologi Bandung (ITB), and Lampung Provincial Government on November, 20<sup>th</sup> 2016 is located at Mount Betung, Wan Abdul Rachman Forest Park, Lampung



Province. The development of OAIL is not only aimed at space science center but also to accommodate ecotourism aspects for public outreach which can attract interest from local and international visitors. As Bosscha observatory is protected cultural heritage by Law Number 2 Year 1992 (<https://bosscha.itb.ac.id/id/index.php/tentang-bosscha/>) [1], it is not impossible for OAIL to be the second generation observatory after Bosscha Observatory. Cultural heritage building should be protected from internal and external potential disturbances such as rapid and uncontrolled development that could possibly give impact to non-optimal performance of the observatory.

Wan Abdul Rachman Forest Park is also one of protected forests in Indonesia. It is a conservation forest area (Minister of Forestry Decree Number 408 Year 1993 [2]) and this area is quite apprehensive. Now, it is estimated that only 35% area is still forested, while the other is deformed into mixed gardens, farms, and settlements or gutters [3]. Wan Abdul Rachman Forest Park area is a common asset regulated by the government with the aim of conserving biodiversity and environmental services. Wan Abdul Rachman Forest Park has many collections, such as natural and non-natural plants, animals, native or non-native species which could be used for research, education, cultivation support, culture, tourism, and recreation.

One way to protect and to maintain the observatory is by making development of observatory area as specific area [4]. Management and supervised development for the OAIL area are needed to control undesirable development. Each criterion in specific area should be assessed so that a decision is made which can then be used as a protected and maintained building, i.e. kind of building maintenance, and appropriate management for the construction of OAIL area. Previous paper from this research was based on four kind of respondents (Ministry of Forestry, Ministry of Environmental, Ministry of Public Works and Housing, and Regional Disaster Management Agency, Lampung Province) with a total of 50 respondents. From 50 respondents, 35 respondents agree that OAIL can be as a specific area while 15 respondents do not agree. In this research we add other respondents from academic and researcher communities. They are from Urban and Regional Planning Study Program, Geomatics Engineering Study Program, Institut Teknologi Sumatera, and Department of Forestry, Universitas Lampung.

## 2. Method

### 2.1. Observatory Criteria

An Astronomical Observatory should be built with some criteria, especially its location. The location should be at high altitude, yet have sufficient infrastructure supports such as road, electricity, clean water. Good climate and weather are needed for astronomical observation. According to [5] criteria, building an observatory should consider some criteria as follows:

- a. Location  
Observatory location must be in a rural area far away from lighting and traffic. Located at high altitude above the surrounding area and avoiding city center. Ideal location for observatory can be reached in 2 – 3 hours by car from city center.
- b. Infrastructure  
Observatory should have road, electricity, clean water, and telephone line. The road to reach observatory must be good enough to support any vehicle.
- c. Weather condition  
The most important and basic aspect to build observatory is its night sky. The night sky must be free from cloud to enable proper observation of astronomy objects. Strong winds can disturb observation because it will introduce atmospheric turbulence that can make telescope vibrating. Strong winds also make negative effect for star observation.
- d. Seeing factor  
Seeing is the key factor to decide whether the location is good or not for building observatory and do observation. Astronomical seeing refers to the amount of apparent blurring and twinkling of astronomical objects like stars due to turbulent mixing of air on the atmosphere of the Earth. The seeing condition describe how much Earth's atmosphere disturbs the image of the astronomical objects seen with telescope. A location with bad seeing will produce poor image

such as blur and resolution degradation, while a location with good seeing will produce higher resolution image.

## 2.2. Specific Area

Observatorium Astronomi ITERA Lampung (OAIL) area must be assigned as a specific area to support Wan Abdul Rachman Forest Park program. The definition specific area is a strategic area in which spatial planning is prioritized [6]. Examples are large-scale economic development areas, protection of national culture, nature conservation, and nature reservation. According to [7], a region that can be as specific area if it can fulfill some criteria, as follows

- Region that have a scale of production activities and/or potential natural resources, artificial resources, large human resources and influence the development of economic, demographic, political, defense and security aspects, and the development of the surrounding region.
- Region with scale of production activities and/or the potential of natural resources, artificial resources, and large human resources as well as their business and/or activities, have a significant and important impact on similar activities and other activities in region, surrounding area and the country's territory.
- Area that have a big driving factor for improving the socio-economic welfare of the community both in the region and surrounding area.
- Area that have relation with activities carried out in other regions bordering both nationally and regionally.
- Area that have a strategic position and their business and/or activities have a significant and important impact on national and regional political and defense conditions.

## 2.3. Method

Questionnaires distribution to respondents was used as primary tool. Primary data were obtained directly from respondent of related government services and academicians or researchers. The respondents from related government services comprise of Ministry of Forestry, Ministry of Environmental Lampung Province, Ministry of Public Works and Housing, and Regional Disaster Management Agency, Lampung Province. On the other hand, academicians or researchers are from Urban and Regional Planning Study Program, and Geomatics Engineering Study Program, Institut Teknologi Sumatera, and Department of Forestry, Universitas Lampung. The steps of analysis on each questionnaire are the following,

- Assessment of each criterion from specific area will be rated between 1 to 5 with the provisions inappropriate, less appropriate, quite appropriate, appropriate and very appropriate.
- The final value from each respondent in each criterion is obtained by multiplying the value of each criterion with simple weighting (Y). If assessment value each criterion is 4 or 5, the value will be multiplied by 5, if assessment value each criterion is 3, the value will be multiplied by 3, and if assessment value each criterion is 1 or 2, the value will be multiplied by 1.
- Classification to be achieved from this research are two classes (appropriate and inappropriate as specific area). Hence, it is necessary to determine class interval by reducing the highest final value with the lowest final value in each respondent then divided by number of class.

$$\text{Class Interval} = \frac{\text{Highest Value} - \text{Lowest Value}}{\text{Number of Class}} \quad (1)$$

- Final result (appropriate and inappropriate) can be obtained by reducing the highest value in each respondent with class interval.

$$\text{Highest Value} - \text{Class Interval} = X \quad (2)$$

If the final value of each criterion (Y) is bigger or equal to X, it says that OAIL area appropriate to be specific area, but if Y is smaller than X, it says that OAIL area is inappropriate to be specific area.

From the final result, it can be decided whether OAIL area can be chosen as a specific area or not according to each respondent. If there are three or more criteria shows appropriate, the OAIL area can be chosen as specific areas. While, if there are less than three, the OAIL area cannot be assigned as specific area.

### 3. Result

The first paper of this research had 4 respondents from related government services (Ministry of Forestry, Ministry of Environmental, Ministry of Public Works and Housing, and Regional Disaster Management Agency, Lampung Province) that has been presented in the International Conference on Science, Infrastructure Technology, and Regional Development (ICoSITeR) 2018, 19<sup>th</sup> – 20<sup>th</sup> October. In this paper we added academicians or researchers (Urban and Regional Planning Study Program, and Geomatics Engineering Study Program, Institut Teknologi Sumatera, and Department of Forestry, Universitas Lampung). The total respondents who fill the questionnaire were 83 respondents. The number of respondent distribution can be seen in Table 1.

**Table 1.** Distribution of Respondents

No	Institution	Number of Respondents
1	Ministry of Forestry, Lampung Province	15
2	Ministry of Environmental, Lampung Province	11
3	Ministry of Public Works and Housing, Lampung Province	12
4	Regional Disaster Management Agency, Lampung Province	12
5	Urban and Regional Planning Study Program, Institut Teknologi Sumatera	10
6	Geomatics Engineering Study Program, Institut Teknologi Sumatera	5
7	Department of Forestry, Universitas Lampung	18
<b>Total</b>		<b>83</b>

The questionnaire data are processed based on method that has been explained in the previous section. The result can be seen at Table 2. Looking the result from Table 2, by adding academics or researchers as respondents, the result does not differ significantly. From a total of 83 respondent, more than 50% respondents agree that OAIL can be a specific area. In detail, there are 63 respondents (77%) agree that OAIL area appropriate to be assigned as a specific area, and 19 respondents (23%) do not agree that OAIL area is appropriate to be a specific area. This means that management and development OAIL area can be more controlled and directed so the main function from observatory is not disturbed. Similar to results presented in previous work, 23% respondents who do not agree if OAIL is appropriate as specific area, around 42% respondents (8 respondents) are from Regional Disaster Management Agency Lampung Province. This could be understood, since OAIL area is located at Mount Betung, with high elevation angle. Disasters such as erosion and earthquake will have big effect to this area.

**Table 2.** The Result of Suitability OAIL Area as Specific Area.

No	Institution	Appropriate	Not Appropriate
1	Ministry of Forestry, Lampung Province	13	2
2	Ministry of Environmental, Lampung Province	9	2
3	Ministry of Public Works and Housing, Lampung Province	9	3
4	Regional Disaster Management Agency, Lampung Province	4	8
5	Urban and Regional Planning Study Program, Institut Teknologi Sumatera	9	1
6	Geomatics Engineering Study Program, Institut Teknologi Sumatera	5	0
7	Department of Forestry, Universitas Lampung	15	3
<b>Total</b>		<b>64</b>	<b>19</b>

#### 4. Conclusion

ITERA Astronomical Observatory - Earth and Space Education Center in Sumatera (IAO-ESSECS) or known as Observatorium Astronomi ITERA Lampung (OAIL) will be developed by Institut Teknologi Sumatera (ITERA), Institut Teknologi Bandung (ITB), and Government of Lampung Province. OAIL area will be established as a centre of science internationally. Moreover, ecotourism will also be developed as effective means for public outreach in science field that can attract local and international visitors. This research used questionnaire to respondents, aimed to know whether OAIL area can be assigned as specific area to control its development and maintenance. The respondents are from Ministry of Forestry, Ministry of Environmental, Ministry of Public Works and Housing and Regional Disaster Management Agency, Lampung Province, Urban and Regional Planning Study Program, Geomatics Engineering Study Program, Department of Forestry, Universitas Lampung. From a total of 83 respondents, 77% respondents agree that OAIL area is appropriate as specific area, and 23% respondents do not agree. This means that management and development OAIL area can be more controlled and directed, so the main function from observatory is not disturbed. From 23% respondents who do not agree, there are 42% respondents come from Regional Disaster Management Agency Lampung Province. They argue that OAIL area is located on high elevation with high potential disaster.

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