

# The Participation of Oyster Mushroom Farmers in Agro Ecovillage to Support Sustainable Development

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**Abstract.** The benefit of Oyster Mushroom Farmers Participation in agro ecovillage is an ingredient in the preparation of innovation, research and development, public service, and input for a long term development plan on an ongoing basis in Indonesia. The purpose of the research is to determine the determinants factor of the oyster mushroom farmers' participation in the concept of agro-eco-village. The method of the study is using Multi-Dimensional Analysis Scaling (MDS) with the use of Rap Mushroom software and prospective Analysis. The results of the MDS analysis are the sustainability index and leverage factors, while the prospective analysis illustrates the distribution of important factors and their impacts. These two methods use expert assessments and the association of oyster mushrooms farmers in data retrieval. Final results showed the index of sustainability of 45.9% (not sustainable) and a factor of leverage is the use of the type and the amount of energy effectively and efficiently with the Root Mean Square of 14.14. The prospective analysis shows that the system is stable because it shows the variable driving force or a deciding set of variables bound strongly.

**Keywords:** *oyster mushroom, farmer participation, agro ecovillage, MDS, prospective*

## INTRODUCTION

Baglog waste oyster mushrooms have not been utilized to the fullest. Baglog waste oyster mushroom contains a composition of 80% sawdust, 10% rice bran, 1.8% gypsum, and 0.4% Total Solid. Mushroom culture-medium contained 2.69% nitrogen, 41.07% carbon, and 0.99% phosphoric acid. While respectively nitrogen and carbon content in rice bran were 3.08% and 47.34%, in mushroom *Pleurotus energy* were 3.41% and 34.63%. Biobrick uses the resin of cat's eye and tapioca flour as adhesive to produce bio briquette that fulfills the Indonesian National Standard requirement which is 47355759 cal/g [1], [2]. The damage that occurred at the village was dominated by the lack of public awareness and the local government to preserve nature. One effort to approach

environmental damage problem in the village is through the participation of oyster mushroom farmers in the utilization of baglog waste into renewable energy alternative to support Ecovillage development.

Ecovillage concept is a village which is created to build environmental culture. The development of ecovillage is implemented at the village level with the consideration that village is an autonomous region that has a strategic role in maintaining natural resources, environment, historical relics, economic development of the community, and socio-cultural. The eco-village concept is based on the principles of sustainable development and the findings of ecology as the underlying discipline. However, an ecovillage cannot exist without the support of the local government and the community. A village is expected to recognize and implement a settlement's environmental management by maintaining environmentally friendly behavior in daily activities. There are five characteristics of ecovillage components, including (1) Ecovillage derived from community participation initiatives, (2) The value of social life ecovillage comes from its community, (3) The ecovillage community is looking at regaining the size control over their resources within the community, (4) The Ecovillage community has a strong sense of shared values, which they often characterized in spiritual matters, and (5) Ecovillage serves as the location of research and as demonstration farming [3]-[6].

Referring to the concept of Ecovillage, this study restricts its scope to the activity of oyster mushroom farmers in the implementation of agro Ecovillage through the utilization of baglog waste into Biobriket. The purpose of the research is to determine the determinants factor of the oyster mushroom farmer's participation in the concept of agro-eco-village.

## METHOD

This research is conducted by the method of desk study and direct observation in Payung Putih Babakan Cisaat located in Sukabumi district. This study took place in the year 2019. The data collection process, both primary and secondary data, is conducted for four months from February to May 2019. The data types that are collected include primary data and secondary

data. Primary data is data obtained directly in the field, in the form of interviews from Oyster mushroom farmers and related agencies. Secondary data is data obtained from reading sources or documents related to the oyster mushroom farmers. The data analysis method is tailored to research objectives. These methods include Multidimensional Scaling (MDS), Montecarlo, leverage analysis with the use of the Rap-Mushroom software and prospective analysis.

**Analysis Multidimensional Scaling (MDS)**

MDS analysis is one of the double-variable techniques that can be used to determine the position of a different object based on its resemblance, as well as to know the interdependent relationships or mutual dependence between variables and data. This relationship is not known through the reduction or variables grouping, rather by comparing the variables in each object using the perceptual map. MDS is also a technique that can help researchers to identify key dimensions and leverage attributes [7]-[12]. MDS relates to the creation of maps to illustrate the position of an object with other objects based on the similarities of the objects. The MDS method helps identify double dimension scaling known as a perceptual map, which is a method that is to describe or map a perceived relative impression of several objects related to perception.

In MDS, the attribute/factor/component or size to be measured can be mapped within the distance of Euclidian where the perceived object has the same characteristics as the closest Euclidian distance. Conversely, objects with different characteristics are called dissimilarities so that the difference between them can be measured within the perceived perception distance in the perception index, such as the Sustainability Index. Distance determination techniques are based on Euclidian Distance with the following formula:

$$d_{1,2} = \sqrt{(X_1 - X_2)^2 + (Y_1 - Y_2)^2 + (Z_1 - Z_2)^2 + \dots}$$

Description:  
 $d_{1,2}$  = Euclidian distance  
 $X, Y, Z$  = Attribute  
 $1, 2$  = Observation

The distance Euclidian between these two points ( $D_{1,2}$ ) then inside the MDS is projected into the two-dimensional Euclidian distance ( $\hat{D}_{1,2}$ ) based on the regression formula in the following equation:

$$\hat{D}_{1,2} = a + b D_{1,2} + c$$

Description :  
 $a$  = intercept  
 $b$  = slope  
 $c$  = error

In MDS, two points or similar objects are mapped in one point adjacent to each other. The technique used is the ALSCAL algorithm and is easily available on almost every statistical software (SPSS and SAS). Rap-Mushroom In principle makes iterations of the regression process so that the value of the smallest is obtained and attempts to force the intercept on the equation equal to 0 ( $a = 0$ ). Iteration stops if the stress

is  $< 0.25$ . For the attribute as much as  $M$ , the stress can be formulated in the equation as follows:

$$stress = \frac{1}{m} \sum_{i,j,k} \frac{D_{ijk}^2 - d_{ijk}^2}{D_{ijk}^2}$$

Through the rotation method, the position of the sustainability point can be visualized through the horizontal and vertical axes with the value of sustainability indexes rated 0 percent (bad) and 100 percent (good). The output of the Rap-Mushroom analysis is a sustainability index of 0-100 displayed in the ordination and leveraging indicators. Sustainability indices are grouped in 4 categories, namely: 0-25 (bad or unsustainable); 25,01-50 (less sustainable); 50,01-75 (fairly sustainable); 75,01-100 (good or very sustainable).

**Montecarlo Analysis**

To evaluate the effect of errors on the estimation of ordination values, Montecarlo analysis is used by statistical simulation method to evaluate the effect of random error on the estimation process, as well as to evaluate the actual value.

**Leverage Analysis**

Leverage analysis is performed to determine the effect of stability if one of the attributes/factor/components is omitted during ordination. The results of the Influence analysis (Leverage) shows the attributes that have the highest Root Mean Square are the most sensitive to sustainability attributes [7]-[12].

**Prospective Analysis**

According to [13]-[15], the objective analysis lies in four quadrant scheme, namely: (1) quadrant-I is the determinant quadrant, which is the quadrant of driving variables. This quadrant contains attributes that have a strong influence and low inter-attribute dependencies; (2) quadrant-II is the connecting quadrant, which is the quadrant of leverage variables. This quadrant contains attributes that have a strong influence and strong interdependence between attributes; (3) quadrant-III is the quadrant of results, which is the output variables. This quadrant contains attributes that have low influence and strong inter-attribute dependencies; (4) quadrant-IV is the bound quadrant which is the quadrant of the marginal variables. This quadrant contains attributes that have low influence and low interdependence between attributes.

**RESULT**

The Rap-Mushroom analysis shows that the sustainability status value is 45.85%, which is categorized as a less sustainable value. The condition showed that the participation of oyster mushroom farmers suffered the pressure use of gas energy in its management. The results were validated with a 46.64%

Monte Carlo value indicating a very small difference of distinction of 0.79 or less than 1%. These values indicate that the effect of an error, or the impact of a relatively small scoring error. While the stress value of 14.46% and coefficient of determination ( $R^2$ ) has a high enough value of 0.942 which means that the included attributes have a considerable role in explaining the diversity of the participation of oyster mushroom farmers.

The MDS analysis and leverage analysis showed that the attribute/factor/component which has the highest Root Mean Square (RMS) value using the type and amount of energy effectively and efficiently (14.14), it indicates that the attribute/factor/component in the use of the type and amount of energy effectively and efficiently is a key factor that needs to be leveraged (Table 1).

Table 1 Dimensions and attributes of leverage produced by MDS

Attributes	Root Mean Square
Financial Management	7.28
The exchange rate of farming mushrooms	6.12
Competition between oyster mushroom farmers and ordinary farmers and biomass	5.56
The exchange rate of farming mushrooms	5.74
The use of the type and amount of energy effectively and efficiently	14.14
New Renewable energy and Food policies	10.43
Production input component price	5.74
Number and interaction of oyster mushroom farmers	4.46
Availability and technology access	1.95
Methods and ways of utilizing technology	5.32

The ten attributes of leverage are then carried out by assessment of influence levels between attributes, either directly or indirectly. It is done by considering that there is a relationship between each attribute in the participation of oyster mushroom farmers. The relationship between these attributes can be an influence or dependency between attributes. Results of prospective analysis obtained as in Figure 1.

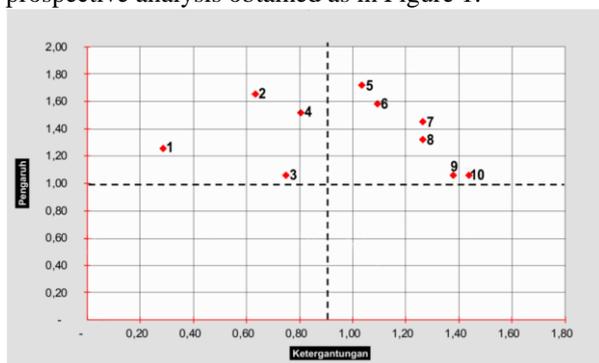


Figure 1: Level of importance of driving factors on the participation of oyster mushroom farmers in Agro-Eco-Village concept

Description of Figure 1:

- 1: Number and interaction of oyster mushroom farmers
- 2: Knowledge and experience of new renewable energy
- 3: Availability and technology access
- 4: The use of the type and amount of energy effectively and efficiently
- 5: The exchange rate of farming mushrooms
- 6: Production input component price
- 7: Competition between oyster mushroom farmers and ordinary farmers and biomass
- 8: New Renewable energy and Food policies
- 9: Financial management
- 10: Methods and ways of utilizing technology

In the question of this study (Figure 1), students were given the rational number in the form of a fraction of two integers. Students were asked to prove an associative property of additional operation for a fraction. Even though it is not a hard problem, some students face difficulty to prove this property.

## CONCLUSION

The results of the study concluded that the determinants factor of the participation of oyster mushroom farmers in the concept of agro-eco-village includes: (i) Number and interaction of oyster mushroom farmers, (ii) Knowledge and experience of new renewable energy, (iii) Availability of technology access, (iv) Financial management.

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