FACTOR FORMATION ANALYSIS OF COASTAL COMMUNITY PREFERENCE IN MAINTAINING MANGROVE FORESTS AT LEMAH KEMBAR, EAST JAVA, INDONESIA

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ABSTRACT

The sustainability of mangrove forests benefits the organisms in the surrounding area, because mangrove forests have three main functions, namely physical, biological and economic functions. The purpose of this study is to analyze the most important factors in coastal communities in maintaining the sustainability of mangrove forest ecosystems. Research on the preferences of coastal communities in preserving mangrove forests uses correlational research factor analysis. Lemah Kembar community uses mangrove forests either directly, where they hunt oysters and crabs, or indirectly as a wave retardant and sea water intrusion. Calculation of factor analysis resulted in four main factors formed in preserving mangrove forests including local agreements (eigenvalue = 3.339), regulation and government protection (eigenvalue = 1.904), mangrove forest location (eigenvalue = 1.205), and livelihood (eigenvalue = 1.122). Local agreements are the most important consideration in realizing the sustainability of mangrove forests, because people are more obedient to the rules determined and agreed upon together.

KEY WORDS

Mangrove forest, coastal community, forest sustainability, factor analysis.

Indonesia is one of the tropical countries possessing a diversity of types and structures of mangrove vegetation. Saparianto (2007) stated that mangrove is forest vegetation that grows between tidal lines. Nevertheless, it is capable to grow on coral shores, dead coral land on which a thin layer of sand is overgrown or covered with mud or muddy beaches.

Mangrove forests have three main functions for the preservation of resources, namely physical, biological and economic functions. Mangrove forests physical function maintains and stabilizes coastlines as well as river banks, protects against waves and currents, accelerates the formation of new land. Mangrove forest biological functions serve as a place of care, a place to find food, a breeding ground for various types of crustaceans, fish, birds, monitor lizards, snakes, epiphytic and parasitic plants, and a nutrient producer. Mangrove forest economic function serves as a recreation site, farmland, and generates foreign exchange using industrial raw material products (Saparianto, 2007). In addition, mangroves growing at the end of large rivers act as the final reservoir for industrial waste from urban areas and upstream villages. The mangrove forest area is capable to accumulate heavy metals contained in the growing ecosystem or mangrove forests in the pond environment which act as Cu pollution biofilter (Kariada and Andin, 2014).

Most of these environmental problems are caused by community behavior (Akhtar and Helly, 2014). Illegal logging and conversion of mangrove forests are the main factors in mangrove forest degradation (Muryani et al., 2011). In this case, the community merely assesses mangrove forests in terms of economic benefits, regardless of the physical and biological benefits (Suzana et al., 2011). Nevertheless, the community has begun to grow awareness in preserving mangrove forests. According to Harahab and Graziano (2011), community participation in managing mangrove forests is influenced by management, knowledge, and attitudes factors.

Lemah Kembar Village, Sumberasih Subdistrict, Probolinggo Regency possess mangrove forest ecosystem. The community has an awareness to preserve the mangrove forest ecosystem. Community awareness on the sustainability of mangrove forests is exhibited by establishing groups. Most of the group members are the fish farmer or

POKDAKAN (Fish Cultivator Group which was established on May 26, 2010, under the name POKDAKAN Mina Mas). POKDAKAN "Mina Mas" in 2011 founded POKDAKAN Sumber Vanamey. The purpose of establishing POKDAKAN Sumber Vanamey is cooperating with Japan to implement the Silfishery system. POKDAKAN Mina Mas and Sumber Vanamey empower the community on fish and shrimp cultivation, as well as management and utilization of mangrove forests. Each group member has an obligation to participate in planting and maintaining forest sustainability. The community is aware of the importance of the existence of mangrove forests for the sustainability of aquaculture business, the majority of which are POKDAKAN Mina Mas traditional pond members.

Fish farmers "Mina Mas" have planted 1,072,555 trees from 1985 to 2012 with a mangrove forest area of 43.7 hectares. Some seeds for planting mangrove forests were received from ISME-Japan (5,750 stems of mangrove seedlings). In addition, there were 28,000 mangrove seeds provided by the Provincial Government. The 2013 development plan for an area of 11.6 hectares with 150,000 mangrove seedlings was planted on the west coast of the Bibis River estuary and riversides. Based on the description of the background, this study aims to analyze the most important factors determining the preferences of coastal communities in maintaining the sustainability of mangrove forest ecosystems. This preference research produced the most important factor in the Lemah Kembar community in maintaining the sustainability of the mangrove forest ecosystem.

METHODS OF RESEARCH

The research location was in Lemah Kembar Village, Sumberasih District, Probolinggo Regency. Research on the preferences of coastal communities in maintaining the sustainability of mangrove forests used a type of correlational research. Correlational research is a type of research that observes the relationship between one or several variables with one or several other variables (Yusuf, 2014). Respondents were used as samples for research on the analysis of community factors safeguarding the coastal environment using a purposive sampling technique. According to (Sugiyono, 2009), purposive sampling is a technique of determining samples with certain considerations. The object of research is people who carry out activities in the mangrove forest area of Lemah Kembar Village. These are crab and shellfish gatherer, cultivator, and activities that affect the presence of mangroves.

Respondents in this preference analysis study were 40 people. Determination of the number of respondents according to Suliyanto (2005), the number of samples at least four times the number of variables. Data collection techniques utilized were: interviews, observation, and documentation. The measurement scale used a score of 1 to 4 or four answer choices to avoid respondents' tendency to eliminate neutral choices in the questionnaire (Arikunto, 2006). The choice contained in the questionnaire are Strongly Agree (SS) with a value of 4, Agree (S) with a value of 3, Disagree (TS) with a value of 2, and Strongly Disagree (STS) with a value of 1.

Table 1 – KMO Accuracy Table

KMO Size	Recommendation
0.9	Very good
0.8	Good
0.7	Medium
0.6	Adequate
0.5	Bad
<0.5	Rejected

Source: Suliyanto, 2005.

Stages in analyzing factors (Suliyanto, 2005), include problem formulation and factor analysis. The variables studied based on the results of preliminary research are mangrove forest benefits (P1), livelihoods (P2), prohibitions and legal sanctions (P3), prohibitions and

religious sanctions (P4), local agreements (P5), awareness and knowledge (P6), socialization and training (P7), experience of environmental change (P8), rehabilitation time (P9) and location (P10). The process of factor analysis is based on the correlation matrix between one variable with another variable, to obtain a factor analysis that all variables must correlate. Model accuracy assessment used Kaiser-Mayer-Olkin (KMO).

Determination of the number of factors needed to represent the variables to be analyzed is based on the amount of eigenvalue and the percentage of the total variance. Factors that have an eigenvalue equal to or greater than 1 (one) are maintained in the factor analysis model, while others are excluded from the model. The results of extraction in the factor matrix identify the relationship between factors and individual variables. Nevertheless, these factors variables are correlated. Therefore these variables were difficult to interpret. Through the rotation of matrix factors, these are converted into simpler matrices to ensure easier interpretation. Factor rotation used the varimax procedure. Factor interpretation was conducted by classifying variables possessing a minimum loading factor of 0.4. Should the variable possess resulting loading factor less than 0.4 then it is removed from the model. The final stage of factor analysis is to determine the accuracy in choosing the Principal Component Analysis (PCA) factor analysis techniques. It is conducted to determine the residual number (difference) between correlations observed with the produced correlation. The smaller the percentage, the more precise the technique is.

RESULTS AND DISCUSSION

Lemah Kembar Village Community Characteristics. The majority of the people of Lemah Kembar Village, Sumberasih Subdistrict, Probolinggo Regency, Indonesia, are Madurese. The means of communication uses the Madurese language. The chosen respondents were directly related to the utilization and management of mangrove forests, namely oyster and crab gatherer, farmer groups around mangroves and surrounding communities.

Based on respondents' gender, there were 28 men and 12 women utilizing the mangrove forest. The composition of female respondents is lower because women in the Lemah Kembar Village area use mangrove forests merely to improve the family economy. The respondent age range was 25 years to 60 years. Field result exhibited those respondents who used mangrove forests at productive age. 39 respondents are within the age range of 25-55 years. Respondents level of education ranges from not taking education to high school graduates. The level of education was 8 uneducated, 18 elementary school graduate, 7 middle school graduate, and 7 high school graduates. Mangrove forests provide direct and indirect benefits to the community. Based on field study, 16 respondents' uses oysters, 4 utilize rebon shrimp, 10 uses crabs, and 15 utilize water around the mangrove.

Factors Forming Coastal Community Preferences in Maintaining the Conservation of Mangrove Forests. The adequacy of samples in the used statistical tests: Kaiser Mayer-Olkin (KMO) and Barlett's Test Sphericity. Data analysis obtained a sampling adequacy measure of 0.617. The adequacy value of the variable sample at the measure of KMO accuracy is adequate, and then the research can be continued and feasible to carry out factor analysis. According to Melati and Basu (2011), should the value of KMO is more than 0.50, the process of factor analysis can be conducted.

Statistic tests for existing variables used Barlett's Test of Sphericity to determine whether there is a correlation or not. Barlett's Test value through a chi-square value of 154.920 with a degree of freedom of 45 and significance <0.05 ensure there is a correlation between variables and feasible to conduct factor analysis.

The initial value was used to determine variable variants before extracting. All initial values produce a value of 1 as before the variable extraction is determined, 100% form the factor or the factor before extraction is equal to the variable as much as 10 factors.

Extraction value is a value that describes the percentage of a variable that can be explained by forming factors (Suliyanto, 2005). The extraction value exhibited in Table 2 produces an average value greater than 0.6. This exhibits that the greater the communalities,

the stronger the relationship with forming factors. The P1 variable produces an extraction value of 0.695, therefore this value indicates 69.5% of the variant of variable P1 can be explained by the forming factors.

Table 2 – Communal Value

	Initial Value	Extraction Value
P1	1.000	0.695
P2	1.000	0.777
P3	1.000	0.753
P4	1.000	0.756
P5	1.000	0.633
P6	1.000	0.649
P7	1.000	0.825
P8	1.000	0.848
P9	1.000	0.863
P10	1.000	0.773

Determination of community preference factors in maintaining the sustainability of mangrove forests through the Total Variance Explained (Table 3). The eigenvalue is a value that indicates the number of variants associated with each factor. Factors that have an eigenvalue of 1 (one) are included in the model, while those with values less than 1 (one) are excluded (Yunitasari and Edwin, 2013). Based on the results of the calculation, 4 factors were formed. These factors were chosen because it produces an eigenvalue equal to or greater than 1 (one).

The first factor produced a value of 3.339; the second factor produced a value of 1.904; the third factor produced a value of 1.205, and the fourth factor produced a value of 1.122. Based on the calculation, it produced a percentage of variance value 33.390; 19.044; 12.051 and 11.222% for example $(3.339 / 10) \times 100\% = 33.390\%$. The total percentage of all four factors is 75.707%. Thus 75.707% of all variables can be explained by 4 factors formed.

Table 3 – Value of Total Diversity

Component	Initial Eigen Value		
	Total	% Diversity	% Cumulative
1	3.339	33.390	33.390
2	1.904	19.044	52.434
3	1.205	12.051	64.485
4	1.122	11.222	75.707
5	0.842	8.424	84.130
6	0.586	5.858	89.989
7	0.404	4.036	94.025
8	0.285	2.849	96.874
9	0.177	1.772	98.646
10	0.135	1.354	100.000

Table 4 – Component Matrix

	Component			
	1	2	3	4
P7	0.740	0.472		
P4	0.726			
P8	0.661			
P10	0.628	0.419		
P1	0.592		0.407	0.412
P6		0.628		
P3		0.595		
P2		0.404	0.693	
P5	0.525			0.587

Table 4 is used to distribute the variables extracted into 4 (four) factors formed by entering the factor loading value (the degree of closeness of a variable to a variable is

formed). The greater the loading factor (greater than 0.4), the more real the variable is included in one of the four factors formed.

Variables possessing a factor loading value of <0.4 are considered to have a weak contribution to the factors formed, therefore they must be excluded from the forming factors (Suliyanto, 2005). Table 4 exhibits that the factor loading value in accordance with the provisions is P1, P2, P3, P4, P5, P6, P7, P8, and P10. P9 does not fulfill the conditions, therefore, it is excluded from the factor. Based on component matrix calculation, the spread of variable factor loading values into the factors formed is not evenly distributed therefore it needs to be rotated.

Factor rotation is a simplification of the factor matrix possessing a difficult to interpret structure (Karyasa et al., 2014). The spread of variants is evenly distributed after rotated using the Varimax method. It is a method used to maximize the number of loading variants on each factor but does not change the value of communality. Factor rotation is a step to maximize the loading factor value of each variable in order to facilitate the determination of the factors.

Table 5 – The matrix of Rotation Components

	Component			
	1	2	3	4
P5	0.778			
P1	0.736			
P7	0.699		0.489	
P3		0.851		
P9		0.646		0.533
P10			0.767	
P6			0.740	
P4			0.536	
P2				0.860

The results of rotation with using the Varimax method based on Table 5 produce a more evenly distributed factor loading value into each factor. The distribution produces four factors, including the first factor formed from the rotation results, P5, P1, and P7. The second factor is formed from the results of rotation namely P3 and P9. The third factor is formed from the results of rotation, namely P10, P6, and P4. The fourth factor formed from the rotation results is P2. P8 was excluded from the factor.

Table 6 – Coastal Community Preference Factors

Factor	Eigenvalue	Variable	Loading
Local agreement	3.339	Agreement of local communities not to damage mangrove forests (P5)	0.778
		Mangrove forests provide enormous benefits for the community directly or indirectly (P1)	0.736
		Socialization and training to maintain the sustainability of mangrove forests (P7)	0.699
Government regulation and protection	1.904	Prohibition and legal sanctions to deter damage the environment. especially mangrove forests (P3)	0.851
		Requires a long time to repair/reforest mangrove forests (P9)	0.646
		The location of nearby mangrove forests makes it possible to preserve mangrove forests (P10)	0.767
Location of mangrove forests	1.205	The community possess awareness and knowledge to protect mangrove forests (P6)	0.740
		Religion prohibition and sanction to deter damage the environment. especially mangrove forests (P4)	0.536
	1.122	Mangrove forests provide employment/income for the community (P2)	0.860

The value of factor analysis concluded that there are four main factors considered most important by the community in maintaining the sustainability of mangrove forests. The four new factors will be a factor in maintaining the sustainability of mangrove forests, namely local

agreements, regulations and government protection, the location of mangrove forests and livelihoods (Table 6 and Figure 1).

The appropriate strategy for forestry development must be based on socio-cultural wealth and local wisdom in maintaining, utilizing, and protecting forest functions for future generations (Salosa et al., 2014). Local wisdom is the first factor needed by the community in maintaining the sustainability of mangrove forests. Local agreement generates binding rules on the community to comply with the applicable rules.

The government has made regulations and protected mangrove forests in writing, therefore coastal communities are obliged to preserve mangrove forests. One example of a written rule is the ban on cutting down or damaging mangrove trees along the coast of Probolinggo Regency delivered by BLH Probolinggo Regency based on Law number 32 of 2009 article 67, 69 and 98. Sanctions given to violators are threatened with the shortest imprisonment 3 years and a fine of at least Rp. 3,000,000,000.00 (Three Billion Rupiah).

People influencing the sustainability of mangrove forests are people who live close to mangrove forests or who have direct contact with mangrove forests. The closeness of this location has a relationship that the community at all times can maintain sustainability both directly by maintaining mangrove forests and indirectly when utilizing the economical organisms of mangrove forests.

Figure 1 – Community Factors in Maintaining the Conservation of Mangrove Forests

The direct benefits value is generated from direct use of mangrove forests, namely the potential of wood (building wood and firewood), Nipah leaf craftsmen, fishing, shrimp and crabs (Suzana et al., 2011). The income of coastal communities who depend on mangrove forests or use the value of direct benefits has a responsibility to preserve mangrove forests. If the mangrove forest is damaged, the community will lose their livelihood. According to (Erwiantono et al., 2013), motivation to conserve resources is also caused psychologically. People experience emotional and social ties to the existence of fisheries resources - because their livelihoods depend on the existence of resources.

CONCLUSION AND SUGGESTIONS

Communities that are directly related to the use and management of mangrove forests, namely: oyster and crab gatherer, farmer groups, and surrounding communities. The results of factor analysis resulted in 4 (four) main factors formed in maintaining the sustainability of mangrove forests, namely local agreements, regulations and government protection, the location of mangrove forests, and livelihoods.

The sustainability of mangrove forests benefits the community directly or indirectly. The main consideration in reforestation and mangrove forest conservation to realize the sustainability of mangrove forests is the involvement of the community in the preparation and ratification of local agreements so that the community will comply with the rules that have been determined and agreed upon together. In order to support local agreements, it requires government support by making policies, regulations, and laws that regulate the use and

management of mangrove forests. In addition, the existence of coastal communities closest to mangrove forests is expected to have a sense of awareness and concern for mangrove forests because the community is at all times and can directly monitor mangrove forests. The preservation of mangrove forests may encourage coastal communities being aware of the sustainability of their livelihoods.

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