JOURNAL OF DEGRADED AND MINING LANDS MANAGEMENT
ISSN: 2339-076X (p); 2502-2458 (e), Volume 4, Number 2 (January 2017): 739-747
DOI:10.15243/jdmlm.2017.042.739

Research Article

Public participation in the utilization and rehabilitation of coastal natural resources (case study of coastal erosion in West Kalimantan)

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Abstract: Emerging development on the coastal region can result in coastal erosion and mangrove ecosystems damage. This disastercould eliminate settlements, agricultural land and public infrastructure. However, for mitigation of those events happened, the government has been constructing the Breakwaters andmangrove reforestation. We used survey method using quota sampling technique in 90 households. The study used a region-based approach. Measurement of socio-economic characteristics, knowledge, perception, and public participation were Chi square test and F test One-Way ANOVA. The results showed that most of samples were middle-lower socio-economy conditions (88.7%). The lower socio-economic caused of 1) the loss of residential and agricultural land due to beach erosion; 2) types of agricultural commodities; 3) work as farmers have the certainty get higher income than as fishermen; and 4) the ability of adaptation in the new location. The high public perception was not accompanied by high levels of public participation to rehabilitate coastal ecosystems.

Keywords*: community participation, perceptions, rehabilitation, socio-economic, utilization*

Introduction

Coastal erosion of West Kalimantan has occurred since the last four decades and nearly reaches 60 km of coastline. This erosion is equivalent to a rate of about 20 meters per year (Akbar et al. 2008). Coastal erosion is a change in the coastal plain which cause shoreline recede (Bird 2008; Alongi 2008). In addition to natural factors, the dominant factor that will exacerbate coastal erosion today is human behavior which accelerates environmental changes (Marfai and King, 2008; Marfai et al., 2008; Parvin et al., 2008; Day et al., 2008; Kulkarni et al., 2010; Marshall et al., 2011; Ward et al., 2011).

Human behaviour has resulted in coastal sediment imbalance is mainly due to: sand mining (Bird, 2008), coastal embankment (Ongkosongo, 2010), as well as the construction of dams that reduce sediment and disrupt the flow of water in estuary and coastal (Palanques and Guillen, 1998). Damage to the coast is also a result of mangrove ecosystems destruction. The role of mangrove forests as a protecting cap due to their root system and the trunk can reduce the strong currents and wave energy (Mazda et al., 2006). In addition, the role of mangrove is to supporting coastal fisheries and offshore ecosystems (Rönnbäck, 1999). Therefore, the destruction of mangrove forests has now resulted in the decline in public socio-economic level. Coastal damage reduction efforts havebeen done by the government by constructing Breakwaters and reforest the mangrove, which are both costly (Akbar et al., 2011).

The problems - the ethnic diversity of the community, also affected the cultural diversity of coastal communities of West Kalimantan. Ethnic communities with a population of predominantly settled in the coastal West Kalimantan are Malay and Bugis, which followed by Chinese, Banjar, Jawa, and Dayak races. Cultural diversity enriched socio-cultural characteristics of the community in various aspects: jobs, knowledge, perceptions, and strategies for coastal resource use. The expansion of settlements, the manufacture of road infrastructures, expansion of agricultural land - intensive shrimp ponds, and

dam construction have acknowledged the damage done to mangrove ecosystems (Ewel et al., 1998; Rönnback, 1999; Sathirathai and Barbier, 2001; Thampanya et al., 2006). Even intensive shrimp farms may impact to 50% damages of the forest area of mangroves (Rönnback, 1999; Primavera and Esteban, 2008). This study aimed to analyze the behavior of the community in the form of participation adaptively cope with coastal damage in respond to rehabilitation efforts.

Methods

Primary data consisted of four components, i.e. 1) socio-economic characteristics of households, 2) public knowledge; 3) the public perception; and 4) community participation coastal rehabilitation activities and conservation of natural resources. Integrated analysis studies the public responses as participation of coastal communities to prevent and to mitigate damage to the coastal environment.

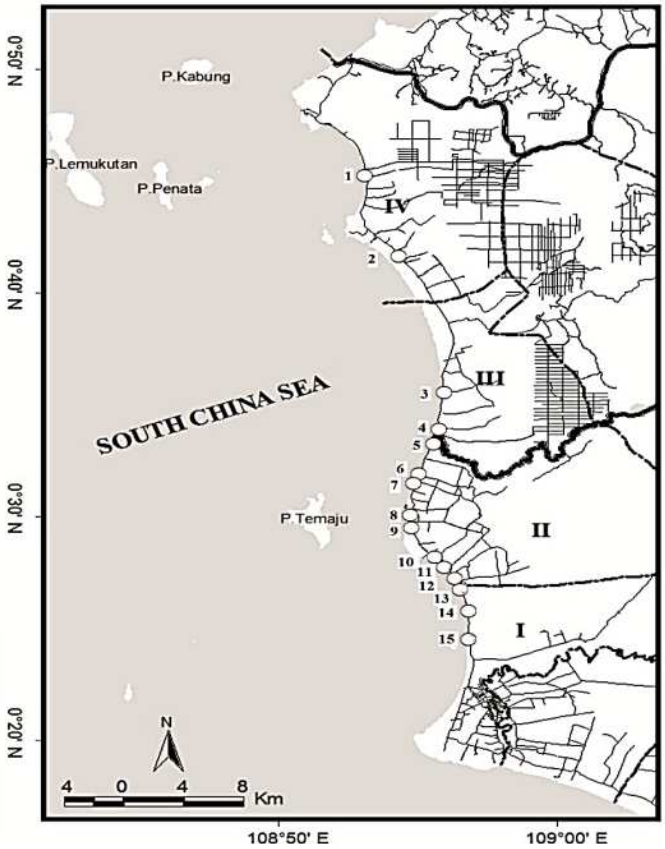

Figure 1. Study location in the coast of West Kalimantan in north equator. #villages: 1. Karimunting (the Karimunting Bay); 2. Sungai Keran; 3. Sungai Jaga A; 4. Sungai Duri; 5. Sungai Duri I; 6. Sungai Duri II; 7. Sungai Bundung Laut; 8. Sungai Kunyit Laut; 9. Sungai Limau (the Sungai Duri Bay); 10. Sungai Dungun; 11. Mendalok; 12. Semudun; 13. Malikian; 14. Sengkubang; and Penibung (the Penibung Bay).# District: I. Mempawah Hilir, II. Sungai Kunyit, III. Sungai Raya and IV. Sungai Raya Kepulauan

Indicators of community participation rehabilitate these beaches adopting adaptation strategies by Ritohardoyo et al. (2014) based on the amount of diversity in the community participation strategy adapts to damage the coastal environment.

Statistically, relationships between components: socio-economic, knowledge, perception, and participation of coastal communities; were using cross tabulation analysis (crosstab) with test Chi Square ($\chi 2$).The use of the $\chi 2$ to determine the relationship between components by the proportion of each group, where the data were nominal (category) and large sample size. The strength of relationship of a variable based on: 1) $\chi 2$ count is greater than $\chi 2$ table; or 2) the value of a smaller proportion than the level of error tolerance (α) then there is a relationship between components. The magnitude of the relationship between the components can be calculated based on the value of the coefficient of contingency (C), which is then compared with the magnitude of the coefficient of contingency: contingency coefficient maximum (Cmax). The error rate (α) in this study was 5%. Analysis of

the difference between the location of the components was done using the test statistic F One Way ANOVA; i.e. different test value-average composite index at 95% confidence level. Statistical data processing aided using software SPSS (Statistical Package for the Social Sciences).

Results and Discussion

General conditions – administratively, the study locations located in two coastal regency in West Kalimantan: Bengkayang and Mempawah. The linkage between the administration and biophysical location of the 15 villages that have eroded coast area varies in each Bay location of the study (Figure 1). The land use based on the district show that there has been a decrease in the rainfed area within a period of 2009 - 2014 with the average up to 40% in Sungai Kunyit, Sungai Raya and Sungai Raya Kepulauan. The decline in paddy field is an indication of coastal erosion and conversion of rice fields into shrimp aquaculture. Even the shrimp aquaculture increased its range of up 400-1300% in the same period in Sungai Raya and Sungai Raya Kepulauan District. State forest area 2000-6000 hectare in the District of it for same period has become oil palm plantations.

Adaptation coastal communities cope with damage to the beach – Adaptive behaviour of coastal communities toward coastal erosion and rehabilitation of mangrove ecosystems are reviewed on three aspects of participation, such as 1) public campaign about the importance of mangrove ecosystems, 2) utilization of environmental services of mangrove ecosystems, and 3) the rehabilitation of the beach by breakwaters, planting mangrove, and conservation of mangrove ecosystems. Study of community participation in preserving and rehabilitation of coastal ecosystems, especially mangrove ecosystems more emphasis on spatial distribution and its relation to socio-economic, knowledge, and perceptions of individual societies.

Socio-economic conditions of society

Socio-economic conditions greatly affect the adaptive behavior of society, in addition to ecological factors (Ritohardoyo et al., 2014). Household income per capita annually throughout the study locations around IDR 20-27 million/year. This income was above the regional minimum wage of West Kalimantan Province in 2013, i.e. 12.7 million / year. Socio-economic of coastal community in general throughout the study locations around 88.7%, it is in the lower middle category (Table 1). Based on χ2test, the location of the study have associated with socio-economic levels of society with a probability value of 0.001 ($p < 0.05$) at 95% Confidence Interval. The magnitude of relationship of a location on the socio-economic conditions was quite strong, as indicated by the contingency coefficient (C) 0.412 approaching Cmax: 0.8. Socio-economic conditions are also reflected in one of the parameters of human development index (HDI) in the study area were below average - provincial and national averages. Reviewed by their spatial distribution (Table 1), Karimunting Bay socio-economic of communities differ significantly with the Sungai Duri and Penibung (F test = 8.468; the probability 0,000). Karimunting Bay communities around 86.7% have a middle upper socio-economic. Instead, the socio-economic of people between the Sungai Duri Bay 86.7%) with the Penibung Bay (93.4%) did not differ significantly and it is in middle category.

Table1. Socio-economics distribution of Population in Bay of: Karimunting, Sungai Duri, and Penibung

Socio-economics level (Score)	**Karimunting (Km)**		**Sungai Duri (SD)**		**Penibung (Pe)**		**Total**	
	Σ	%	Σ	%	Σ	%	Σ	%
High (> 32)	6	20,0	4	13.3	2	6.7	12	13.3
Moderate (27 – 32)	20	66.7	8	26.7	20	66.7	48	53.4
Low (< 27)	4	13.3	18	60.0	8	26.7	30	33.3
Σ	30	100.0	30	100.0	30	100.0	90	100.0
Chi Square	18.4; p : 0.001; Contingency Coeficience: 0.412							
Score rate	30.07		26.37		27.63		F = 8.468;	
Significance α: 0.05	(≠ SD;≠ Pe)		(≠ Km)		(≠ Km)		p = 0.000	

Differences in socio-economic conditions in the Karimunting Bay with the others caused by coastal erosion. Coastal erosion has proven to eliminate settlements and agricultural land in the Sungai Duri Bay and Penibung (Akbar et al., 2008). The effects of coastal erosion caused by the extent of agricultural land ownership society Sungai Duri Bay and Penibung Bay less than 0.5

hectare/ household, while in Karimunting Bay of more than 0.5 hectare/ household. In addition, agricultural land of Karimunting communities located on land the upstream away from their settlement at this time, so it is not easily intruded by seawater and eroded. Prior to 1992, most of the Karimunting Bay people living far from the coast. However, since the ethnic conflict Dayak and Madurese, Karimunting people migrate to coastal areas.

This displacement only as a residence, but plantation remains on the ground.Adaptation of most Penibung Baypeople was migrating to a safer place. Most of the communities in this relocation had coconut plantations towards the land in which planted with banana plants. The dependence of most people Karimunting Bay in the agricultural sector: rubber and coconut, is one cause of socio-economic conditions of the Karimunting Bay still higher than the Sungai Duri Bay community and Penibung. This is because coconuts and rubber have the certainty and sustainability of results and though the price tends to decline depends on the market, than most people Sungai Duri Bay (56.7%) and the Penibung Bay (44.3%) whose main job and side job as a fisherman.

Public awareness of the damage beaches and mangrove ecosystems.

Public's knowledge of the problems affecting the perceptions and attitudes of society in addressing the issue (Ritohardoyo et al., 2014). In general, knowledge and understanding regarding: coastal erosion, breakwaters, the benefits of mangrove ecosystems, destruction of mangrove forests, as well as efforts to rehabilitate the mangrove ecosystems in all locations of the study showed levels of knowledge and understanding is quite high (95.6%). Chi Square test based on the knowledge there was no difference between each locations with probability: 0.054. F test also showed no convincing difference average value at all locations (probability 0.338) at the level of 95%.

Knowledge of coastal erosion - Most respondents (82%) stated that coastal erosion caused by natural processes due to strong waves, especially in the west season. Only 1% of people who claim that coastal erosion occurs due to sand mining and the destruction of mangrove forests. High community knowledge about the causes of coastal erosion due to natural factors, which was about 82%. This shows that people are not thinking about the long term effects that threaten the coastal environment as a result of the development of settlements, plantations and farms. Knowledge is quite high but not followed by a sense of public awareness of environmental sustainability. That ignorance is likely due to they do not feel the impact of damaged coast directly. This is because people tend to feel a loss if the impact directly affects them at the time (Clayton and Myers, 2014),as land conversion into palm plantations and farms provide a faster economic impact for the community, rather than damage the environment.

Only about 24.4% of society that prohibits the use of the land behind the Breakwaters. That is, most people (66.7%) did not make any dispute against public building or land use activities behind the Breakwaters. Public prohibits land use were mainly concerned with the problems of security and public order, and was not related to the physical and biotic environmental sustainability coastal. The consideration was based on their place of recreation that serve alcohol and the prostitute, which raises concerns for the local community. Public argumentation who allow build a new business and residence for the protected land is still a private property which has a formal proof of land ownership. If the land is public property, then the licensing rights to cultivate or building can be done at the village level. No legislation that more technical and specialized regulating the development of the land behind the Breakwaters on the coast, causing this problem.

Knowledge of the benefits of mangroves - Benefits of mangroves for coastal communities of West Kalimantan (Figure 2A) conceived to protect the coast from erosion (43.3%), and strong winds to the settlements (13.3%). In addition, mangrove ecosystem as a habitat for many marine organisms that high economic value (41.1%). This knowledge assumes that mangrove forests are very beneficial as coastal protection, when abrasion and loss of mangrove forests impact have been felt by coastal communities as a result. Only a few people who understand that mangrove forests provide benefits of their wood and leaves.

Mangrove ecosystems to society can certainly be understood as an ecosystem that not only benefits, but also seen to be nonfavorable to them (Figure 2B). Approximately 60% of the respondents interpret the mangrove ecosystems is a dirty place or land. Specifically, 2% respondents stated that mangroves provide no benefit to the economy of households and 10% of respondents considered that rooting in mangrove ecosystems resulted difficult fishermen catch fish. It means, with regard to economic motives, there are 72% of respondents who perceive mangroves useless and detrimental to the economy of coastal communities. By contrast, with regard to aesthetic motives, almost 28% who felt that the mangrove

forests on the coast had obstructed views towards the sea.

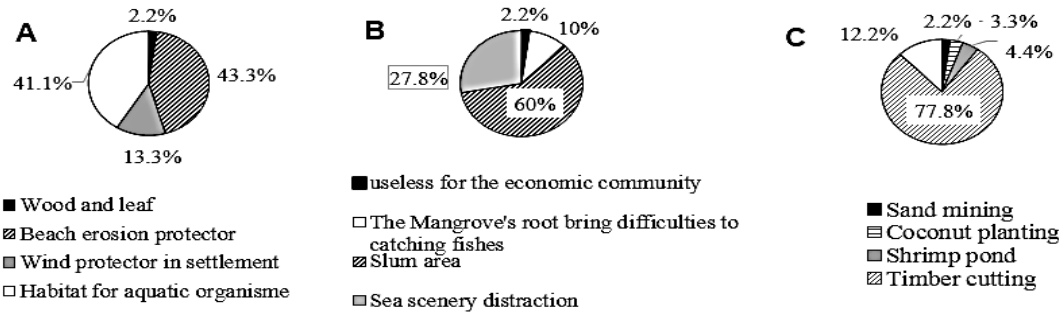

Figure 2. A. Community knowledge about the mangrove's benefit. B. Community knowledge about the mangrove's disadvantages. C. Community knowledge about the cause of mangrove destruction

Knowledge mangrove rehabilitation - Only less than 10% of people who know that the destruction of mangrove forests due to land conversion to coconut (3.3%) and shrimp pond (4.4%), and only 2.2% who understand that the removal of sand beach causing damage to forests mangrove (Figure 2C).Rehabilitation of mangrove are generally carried out by planting mangrove at the site rehabilitated. Many planting mangrove using *Rhizophora* spp. which inappropriate species types (Djohan et al., 2015).

Activity planting mangrove understood by most people (60%) are the responsibility of the government, and there should be cooperation between the government - the public (30%). The government is believed to have a budget and regulations to manage the mangrove forest. However, during this time, the government issued a fund for planting mangrove only IDR 370 million (Balai Wilayah Sungai Kalimantan 1, 2011).

Public perception of damage to beaches and mangrove ecosystems

Public perception of the environment is influenced by knowledge (Ritohardoyo et al. 2014), frame of reference, and the mass media information (Clayton and Myers, 2014). In this study, the public perception of: 1) coastal erosion, 2) the benefits of mangrove ecosystems, 3) damage to mangrove ecosystems, and 4) the rehabilitation of beaches and mangrove ecosystems; an overall four parameters that form the basis of society assess the disaster risk of coastal erosion and rehabilitation efforts.

Table 2. Level of perception distribution of population about damage - rehabilitation of coast and mangrove

Perception level (Score)	**Karimunting (Km)**		**Sungai Duri (SD)**		**Penibung (Pe)**		**Total**	
	Σ	%	Σ	%	Σ	%	Σ	%
High (> 90)	3	10.0	12	40.0	16	53.3	31	34.4
Moderate (80 – 90)	18	60.0	11	36.7	10	33.3	39	43.3
Low (< 80)	9	30.0	7	23.3	4	13.4	20	22.3
Σ	30	100.0	30	100.0	30	100.0	90	100.0
Chi Square	13.404; p: 0.009 ; Contingency Coeficience: 0.306							
Score rate	82.00		86.03		88.40		F = 5.895;	
Significance α: 0.05	(≠ Pe)				(≠ Km)		p = 0.004	

Results of different average value test of public perception between locations suggested that the perception society of Karimunting Bay has the lowest value (82.0) than the other locations, but differ significantly only with the public perception Penibung Bay (F_{calc}: 5.895; p: 0.004). That is, the condition of coastal environmental degradation affects public perception at a given location. It also means that the public perception in a location that is broken: Penibung Bay (high perception: 53.3%) and the Sungai Duri Bay (high perception: 40%) higher than the public perception in a location that is not experiencing more severe disaster (Karimunting Bay; only 10% were high

perception). Differences in perceptions between locations may be caused by erosion, destruction of mangrove forests, and rehabilitation efforts are perceived and experienced by the people in the Karimunting Bay different from other Bay communities.

Community participation in rehabilitating damage to beaches and mangrove ecosystems

Community participation in rehabilitating beaches and mangrove ecosystems is a form of adaptation strategies in the coastal communities cope with disasters of coastal erosion and damage to mangrove ecosystems. Adaptive strategy is an act of community or individual dynamic response to environmental issues (Vayda and McCay, 1975). Relationship between locations indicates that public participation in the Karimunting Bay in upper category (46.6%), while participation in other locations mostly in the lower category (60% Sungai DuriBay and 70% PenibungBay). Based on Chi Square test, the level of community participation in the utilization and rehabilitating coast on site assessment (Table 3), showed an effect between locations in the level of community participation with the probability of value: 0.007 ($p < 0.05$). The magnitude of this association is quite strong with contingency coefficient 0.368 approaching the maximum contingency coefficient: 0.8. F Test showed that community participation in different Karimunting Bay with community participation in the Sungai Duri and Penibung Bay. This distinction was based on the value of F: 4.767 and p: 0.011 ($p < 0.05$). That is, that the adaptation strategy in the form of participation rehabilitate the coast through the construction of Breakwaterss and planting mangrove are very different between the people of the Karimunting Bay with Sungai Duri and Penibung Bay.

Table 3. Level of participation distribution of population about damage - rehabilitation of coast and mangrove

Participation level	**Karimunting (Km)**		**Sungai Duri (SD)**		**Penibung (Pe)**		**Total**	
(Score)	Σ	%	Σ	%	Σ	%	Σ	%
High (> 60)	14	46.6	5	16.7	6	20.0	25	27.8
Moderate (45 – 60)	8	26.7	7	23.3	3	10.0	18	20.0
Low (< 45)	8	26.7	18	60.0	21	70.0	47	52.2
Σ	30	100.0	30	100.0	30	100.0	90	100.0
Chi Square	14.09; p: 0.007; Contingency Coeficience: 0.368							
Score rate	54.27		44.83		44.97		F= 4.767;	
Significance α: 0.05	(≠ SD; ≠ Pe)		(≠ Km)		(≠ Km)		p = 0.011	

The fact that the differences due to their perceived experiences and differences in socio-economic of the community. Experience has happened to the physical conditions in the Sungai Duri and Penibung Bay a lesson learned for the Karimunting Bay community to take preventive action. In addition to the enriching experience of public knowledge Karimunting Bay, population density factors that put pressure on coastal natural resources can be assessed based on the population distribution.

The distribution of the population in the Karimunting Bay about 47 inhabitants / km^2; which means that the density is smaller than the population of the Sungai Duri Bay (258 inhabitants / km^2) and Penibung (197 inhabitants / km^2). This means that residents of the Karimunting Bay has lower pressure to development to its shores biophysical conditions, rather than the others.

The influence of socio-economic conditions of people's participation - Table 4 shows that in middle socio-economic level has the lowest participation rate (45.8%), even in conditions of low socio-economic communities, also followed participation rate (73.4%). Based on Chi Square test, there were significant socio-economic conditions of society to its participation with a probability value: 0.036 ($p < 0.05$). The magnitude of this association was quite strong with contingency coefficient 0.32. That is, the socio-economic status that tends to lower middle has a fairly low level of participation as well.

These symptoms indicate that people who are middle socio-economic status down tend to try to improve their socio-economic status by not participating in rehabilitation activities and the utilization of the beach. Direct economic value in the form of wages received by participants was not equal to or greater than the direct economic value they receive when going out to sea or farming. This means that the public has a job that can provide direct economic benefits outweigh the beach to participate in rehabilitation activities. Of

course, this does not make most people (72.2%) participated in the activity of making Breakwaters and planting mangrove.

Influence of knowledge on community participation - knowledge society, about the destruction of beaches and mangroves and rehabilitation activities on the level of participation in the rehabilitation of the damage does not have a convincing relationship. Most people who were knowledgeable high (54.8%) and moderate (49.1%) were people who have the lowest participation rate. Based on Chi Square test showed no relationship between the level of knowledge related to the participation of the community ($p > 0.05$). It means, there were other factors that influence community participation on high enough knowledge people. These factors may be related to the direct economic value obtained, and the relation to the disclosure of information obtained.

Table 4. Correlation of socio-economics – participation level in coast and mangrove rehabilitation

	Socio-economics level							
	High		**Moderate**		**Low**		**Total**	
Participation level	Σ	%	Σ	%	Σ	%	Σ	%
High	6	50.0	15	31.3	4	13.3	25	27.8
Moderate	3	25.0	11	22.9	4	13.3	18	20.0
Low	3	25.0	22	45.8	22	73.4	47	52.2
Σ	12	100.0	48	100.0	30	100.0	90	100.0
Chi Square	10.254;	p: 0.036; Contingency Coeficience: 0.332						

Factors that lead to low participation of coastal communities with a level high enough knowledge society in rehabilitating coastal environment due to the spread of the information society as incomplete information gained by participants. Based on interviews showed that 47% of respondents knew there was never any campaign; and about 18% of respondents are not aware of any campaign of the rehabilitation of the beach. In contrast, only 36% of respondents who know the details of the lectures with 28% of respondents said that they had there but not often, and 8% of respondents stated that the campaign is often performed. Furthermore, 36% were aware of campaign, it appeared that half had not participated directly by attending the lectures. It revealed that their information activities related to the rehabilitation of the coastal environment are limited to a certain group of people. This means that there were no disclosure of information in the community.

Influence the perception of people's participation - Perception of the majority of people (77.7%) in the category is quite high (Table 2) but the participation of the majority of people (72.2%) is quite low (Table 5). Analysis of Table 5 shows the public perception of the category high (77.4%) and moderate (48.7%) are the one with low participation. Chi-squared test showed there was a relationship between the perception to the community participation in the probability value: 0.000 ($p < 0.05$). The magnitude of this association was quite strong with contingency coefficient 0.43 at the 95% confidence interval.

Table 5. Correlation of perception – participation level in coast and mangrove rehabilitation

Participation level	**Perception level**							
	High		**Moderate**		**Low**		**Total**	
	%	Σ	%	Σ	%	Σ	%	%
High	1	3.2	14	35.9	10	50.0	25	27.8
Moderate	6	19.4	6	15.4	6	30.0	18	20.0
Low	24	77.4	19	48.7	4	20.0	47	52.2
Σ	31	100,0	39	100,0	20	100,0	90	100,0
Chi Square	20.467; p : 0,000;		Contingency Coeficience: 0.430					

Factors that lead to low community participation because of the limited information obtained by a group of people. It can be in coastal communities have a distance (gap) between communities, and it is also possible lack of awareness of most people to the activity. It seems low public awareness because they consider that the improvement of the coastal environment is the responsibility of the

government completely. The participation rate for the rehabilitation of the beach both in construction Breakwaters or for planting mangrove constrained due to the direct economic value received by participants. As the linkage socio-economic of people's participation, the direct economic value of the consideration received by the participants greatly influence their decision to participate.

Conclusion

The study revealed that the link between socio-economic, knowledge, and the public perception of environmental rehabilitation community participation would not always walk in harmony. There are several factors that influence the unconformity that direct economic benefit gained by the community as well as the perception that people assume responsibility for protecting the environment is the obligation of the government. Preservation of the coastal environment can be success if the public has the feeling of a sense of belongingto their environment. This feeling can be realized in community participation utilize and manage the coastal environment without exceeding the carrying capacity of the environment. Protecting the environment can also be affected socio-economic conditions, knowledge, and perceptions. By law, differences in the perception of a rule in each location lead to differences in implementation in the field.

References

Akbar, A. A., Sartohadi, J., Djohan, T.S. dan Ritohardoyo, S. 2011. Fungsi Mangrove Sebagai Pelindung Pantai (Studi Kasus: Tingkat Kesuksesan Penanaman Mangrove di Kawasan Bangunan Pengaman Pantai Kalimantan Barat). Makalah pada *Pertemuan Ilmiah Tahunan* ke XXVIII HATHI tanggal 28 – 30 Oktober 2011di Ambon, Indonesia.

Akbar, A.A., Djohan, T.S. dan Sartohadi, J.. 2008. Ekosistem Mangrove dan Abrasi di Pesisir Kalimantan Barat. *Forum Geografi* 22 (1): 60 – 71.

Alongi, D.M. 2008. Mangrove forests: resilience, protection from tsunamis, and responses to global climate change. *Estuarine, Coastal and Shelf Science* 76 :1-13.

Balai Wilayah Sungai Kalimantan I. 2011. *Profil Pantai Kalimantan Barat*: Pembangunan Pengamanan Pantai Kalbar Akibat Erosi (Perubahan Garis Pantai Akibat Gelombang Pasang). Satuan Kerja Pelaksanaan Jaringan Sumber Air Kalimantan I Provinsi Kalimantan Barat.

Bird, E. 2008. *Coastal Geomorphology: an introduction*, 2nd Edition. John Wiley & Sons, Ltd, Chicester.

Clayton, S. dan Myers,G.2014. *Psikologi Konservasi*. Pustaka Pelajar, Yogyakarta

Day, J.W., Christian, R.R., Boesch, D.M., Yáñez-Arancibia, A., Morris, J., Twilley, R.R.,Naylor, L., Schaffner, L. and Stevenson, C. 2008. Consequences of Climate Change on the Ecogeomorphology of Coastal Wetlands. *Estuaries and Coasts* 31:477–491.

Djohan, T.S., Laksono, P.M., Anantasari, E., Utama, A.N. dan Suhesthiningsih, K. 2015. Kondisi hutan bakau tebangan masyarakat dan industri pulp di Batu Ampar, Kalimantan Barat. *Kawistara* 5 (2): 99 – 122.

Ewel, K.C., Twilley, R.R. and Ong J.E. 1998. Different kinds of mangrove forests provide different goods and services. *Global Ecology and Biogeography Letters* 7 (1): 83 – 94.

Kulkarni, V.A., Jagtap, T.G., Mhalsekar, N.M. and Naik, A.N. 2010. Biological and environmental characteristics of mangrove habitats from Manori creek, West Coast, India. *Environmental Monitoring Assessment* 168:587–596.

Marfai, M.A. and King, L. 2008. Tidal inundation mapping under enhanced land subsidence in Semarang, Central Java Indonesia. *Natural Hazards* 44:93–109.

Marfai, M.A., King, L., Singh, L.P., Mardiatno, D., Sartohadi, J., Hadmoko, D.S. and Dewi, A. 2008. Natural hazards in Central Java Province, Indonesia: an overview. *Environmental Geology* 56:335–351.

Marshall, A., Robinson, L. and Owens, M.A. 2011. Coastal construction trends in response to coastal erosion: an opportunity for adaptation. *Journal Coastal Conservation* 15:61–72.

Mazda, Y., Magi, M., Ikeda, Y., Kurokawa,T. and Asano, T. 2006. Wave reduction in a mangrove forest dominated by *Sonneratia* sp. *Wetlands Ecology and Management* 14: 365 – 378.

Ongkosongo, O.S.R. 2010. *Kuala, Muara Sungai dan Delta*. Lembaga ilmu Pengetahuan Indonesia, Jakarta.

Palanques, A. and Guillen, J. 1998. Coastal changes in The Ebro Delta: Natural and Human Factors. *Journal of Coastal Conservasion* 4 (1): 17 – 26.

Parvin, G.A., Takahashi,F.and Shaw, R. 2008. Coastal hazards and community-coping methods in Bangladesh. *Journal Coastal Conservation* 12:181–193.

Primavera, J.H. and Esteban, J.M.A. 2008. A review of mangrove rehabilitation in the Philippines: successes, failures and future prospects.*Wetlands Ecology Management* 16: 345–358.

Ritohardoyo, S., Cahyadi, F.D. dan Nugrahaeni, L. 2014. Strategi adaptasi masyarakat terhadap banjir rob di permukiman pesisir Kota Pekalongan dalam *Aspek Sosial Banjir Genangan (ROB) di Kawasan Pesisir*, editor Rirohardoyo, S., Sudrajat, dan A. Kurniawan. Gadjah Mada University Press, Yogyakarta, hal. 43 – 102.

Rönnback, P. 1999. The ecological basis for economic value of seafood production supported by mangrove ecosystems. *Ecological Economics* 29 (2): 235 – 252.

Sathirathai, S., and Barbier, E.B. 2001. Valuing mangrove conservation in Southern Thailand. *Contemporary Economic Policy* 19 (2): 109–122.

Thampanya, U., Vermaat, J.E, Sinsakul, S. and Panapitukkul, N. 2006. Coastal erosion and mangrove progradation of Southern Thailand. *Estuarine, Coastal and Shelf Science* 68 (1-2): 75 – 85.

Vayda, A.P. and McCay, B.J. 1975. New Direction in Ecology and Ecological Anthropology. *Annual Review of Anthropology*, 4: 293 – 306.

Walters, B.B., Roonnbaack, P., Kovacs, J.M., Crona, B., Hussain, S.A., Badola, R., Primavera, J.H., Barbier, E.B. and Dahdouh-Guebas, F. 2008. Ethnobiology, socio-economics and management of mangrove forests: A review. *Aquatic Botany* 89: 220–236.

Ward, P. J., Marfai, M.A., Yulianto, F., Hizbaron, D.R. and Aerts, J.C.J.H. 2011. Coastal inundation and damage exposure estimation: a case study for Jakarta. *Natural Hazards* 56:899–916.

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