

## The Participation of Coastal Communities in The Conservation of Mangrove Areas in Tongke-Tongke and Biringkanaya in Indonesia

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### Abstract

Since the days of independence, the government has tried to make policies to maintain the existence of mangrove ecosystems. Several mangrove research have been carried out before, but research on the influence of community psychological factors in the conservation and rehabilitation of mangrove forests is still limited. This study aimed to determine whether psychological factors that can influence people's willingness to maintain mangrove ecosystems, as well as social and economic aspects. In this research mixed-method approach was used. The results showed that the majority of respondents were willing to carry out rehabilitation and showed a correlation with gender, education level, benefits and risks that could be caused without the existence of a mangrove ecosystem, but there was no correlation with the length of time the community settled in the area. The recommendation from an approach that involves the community was joint management between the community, government, NGOs, stakeholders and academics.

**Key words:** Conservation, Mangrove, Coastal Community, Indonesia

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### Introduction

The Indonesian archipelago is located between the Continent of Australia and the Continent of Asia, it has 17,508 large islands and small islands, with an area of 5,193,250 km<sup>2</sup> covering a land of around 1,919,440 km<sup>2</sup> and the sea area around 3,273,810 km<sup>2</sup>. Indonesia has a coastal length of 95,181 km and is inhabited by around 140 million inhabitants. Indonesian coastal areas have productive ecosystems and have high biodiversity in the form of coral reef ecosystems, seagrass ecosystems, estuary ecosystems and mangrove ecosystems. Mangrove ecosystems in Indonesia are around 3.5 million ha or 25% of the area of mangrove forests in the world. Mangrove forests have economic functions and ecological functions. Geographically, the Indonesian Archipelago is at 5°54'2.34 "U-95°13'25.83" T in the city of Sabang, up to 9°7'28.19 "S-141 ° 1'6.03" T in the city of Marauke, stretching along 5,335 km, with a population of 264 million in 2017.

Despite the implementation of conservation policies since the 1980's, the government still poorly manages the mangrove protected area due to limited stakeholder participation, ineffective conservation programs and failure to increase awareness among the local community. Mangrove conservation has become an international issue (Sandilyan & Kathiresan, 2012;(Abdullah, Said, & Omar, 2014)(Hutchison, Manica, Swetnam, Balmford, & Spalding, 2014). Co-managementconservation has been used in resource mangrove management (Abdullah et al., 2014), especially in management in the sustainability of the protected area, restoring ecosystem and reducing poverty in rural areas(Suryahadi, Suryadarma, & Sumarto, 2009;Joppa & Pfaff, 2011; Abdullah et al., 2014).

There are several of scientific research papers limited to on mangrove biological and ecological aspects(Din, Saenger, Priso, Dibong, & Blasco, 2008). Nevertheless an issue pertaining social (Abdullah et al., 2014)and psychological factors on community that earn a living mangrove(Powell & Osbeck, 2010) and guidance on ways to successfully integrate community's psychological factors into restoration planning is limited(Kil, Stein, Holland, & Anderson, 2012;Abdullah et al., 2014). Collaboration between planning and environmental psychology at the level of policy making (Abdullah et al., 2014). in the study of psychological factors among the willingness of local residents to participate and attitude in managing mangrove rehabilitation which is one of the problems recommended in Indonesia (Oh, Friess, & Brown, 2017). Many studies have focused on the status of mangrove forests and little about community involvement (Powell &Osbeck, 2010)

The importance of conservation in integrating the psychological factors of local people in carrying out mangrove rehabilitation. The purpose of this study was to evaluate psychological factors in relation to socio-economic demographic characteristics of the formation of coastal community-based conservation from a local household survey

### **Literature Review**

The term co-management was used in conservation that relatesto coastal community and resource management, community social, ecological approaches, protected areas, and co-management(Aheto et al., 2016). Niedzialkowski, Paavola, & Jedrzejewska, (2012)explain that co-management is implementation conservation strategies involving communities in the decision making and being actively involved as partners in mangrove area management.

In definition conservation, held by communities and for communities, with active partners in mangrove area management(Lundquist, Morrisey, Gladstone-Gallagher, & Swales, 2014;Abdullah et al., 2014). The fundamental principles for co-management are sustainable management where local communities can manage and extract benefits from natural resources at the local level (Chong, 2006;Jusoff & Bin Hj Taha, 2009), to improve local communities and pro attitude(Halder, Sharma, & Alam, 2012). Co-management places community involvement at the centre of conservation program which is generally a collaborative management framework between four major groups that responsibility to manage natural resources in mangrove area(Schusler, Decker, & Pfeffer, 2003; Aheto et al., 2016)

It is just, management natural resources that involving local communities, time for communities to establish, governance, renew, and management sustainable natural resource capacity(Khadka & Nepal, 2010;Baral & Stern, 2011),

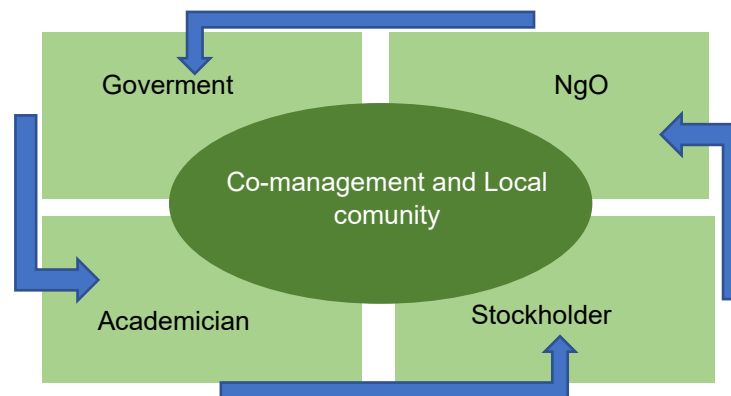


Fig 1. Inter-sector collaboration in joint management (Vachon & Klassen, 2008; Vangen, Hayes, & Cornforth, 2015)

#### The Conceptual framework of co-management establishment

Cardoso, Lopes, & Poels, (2014), there are three common theoretical frameworks in the assessments of the success or failure of the Co-management approach which are psychological factors institutional factors, and ecological factors (Abdullah et al., 2014). Table. 1 shows the compilation of co-management framework (Plummer & Armitage, 2007).

The psychological factor to environmental concern, start on the late 20th (Elliott, 2012; Elliott, 2015). Psychological factors involved positive or negative attitudes of local constituencies towards conservation programs (Mutanga, Vengesayi, Muboko, & Gandiwa, 2015). This include social identification (Blume, Brock, Durlauf, & Ioannides, 2011), beliefs (Eccles & Wigfield, 2002), attitudes (Ajzen, 2005), values and norms (Merli, 2006), perceptions (Özler, 2013), knowledge (Newell & Marabelli, 2014), conservation purposes and benefits perceived (Walton, Samonte-Tan, Primavera, Edwards-Jones, & Le Vay, 2006), willingness to participate (Parent, Plangger, & Bal, 2011), motivations, involvements, decision-making, the nature of human appraisals of and responses to risk, threatened resources, (Walton et al., 2006) environmental degradation and related psychosocial impacts. In the mangrove research that state, social, economic and cultural benefits (Beitl, 2011; M. Brander et al., 2012) as the important factors of community participation in tourism development in a protected area (Beitl, 2011; Umilia & Asbar, 2016). Studies on psychological factors are normally supported by the community's socio-demographic characteristics (Gjonca & Calderwood, 2004).

#### Co-management and mangrove rehabilitation

One of the programs in co-management approach is mangrove rehabilitation that is defined as the act of partially or fix an ecosystem's structural or functional characteristics been reduced to have more social, economic or ecological value than existed the disturbed or degraded state (Datta, Chattopadhyay, & Guha, 2012). Impact of the tsunami disaster increased (Saikia et al., 2013; Triyanti & Chu, 2018) interest community of mangrove rehabilitation in Indonesia to improve coastal protection the tsunami disaster. The co-management concept was mostly utilized in coast countries with specific terms such as co-management Mangrove (CM) (Datta, Chattopadhyay, & Guha, 2012). Indonesia achieved the most success in the implementation of mangrove rehabilitation programs through co-management (Giri, Pengra, Zhu, Singh, & Tieszen, 2007) in some countries such as like several countries in Southeast Asia (Ince Yenilmez, 2015) achieved a moderate level of success while South Africa reported low level of success.. In Indonesia, coastal communities started the program voluntarily and this effort was strengthened by appropriate technology transfers from NGOs, academics and stockholder (Abdullah et al., 2014). In Indonesian, coastal communities started the program voluntarily and these efforts were further strengthened by the transfer of appropriate technologies from NGOs, academician, and stockholder (Abdullah et al., 2014). The government initiative came later after it succeeded. The government initiatives came later after succeeding.

Research conducted by Hashim, Kamali, Tamin, and Zakaria (2010) highlighted issues on Community-based Conservation in Managing Mangrove Rehabilitation in Perak and Selangor. then by Annisa Triyanti, Yvonne Walz, Muhammad Aris Marfai, Fabrice Renaud, Riyanti Djalante

highlighted issues on Ecosystem-Based Disaster Risk Reduction in Indonesia: Unfolding Challenges and Opportunities (2017), and then by Datta, Debajit, Chattopadhyay, R. N. Guha, P. (2012) highlighted issues on Community based mangrove management: A review on status and sustainability. They state that although mangrove rehabilitation efforts may be site may be changed due to erosion and consequently the hydrologic regime could be altered. Indonesia adopted new regulations and guidelines in the development of mangrove areas such as the Forest Harvesting Guidelines in Mangrove Forest and the Special National Task Force on Planting of Mangrove and Other Suitable Species in Coastal Areas, in order to maintain a 200 meter green belt from the beach.

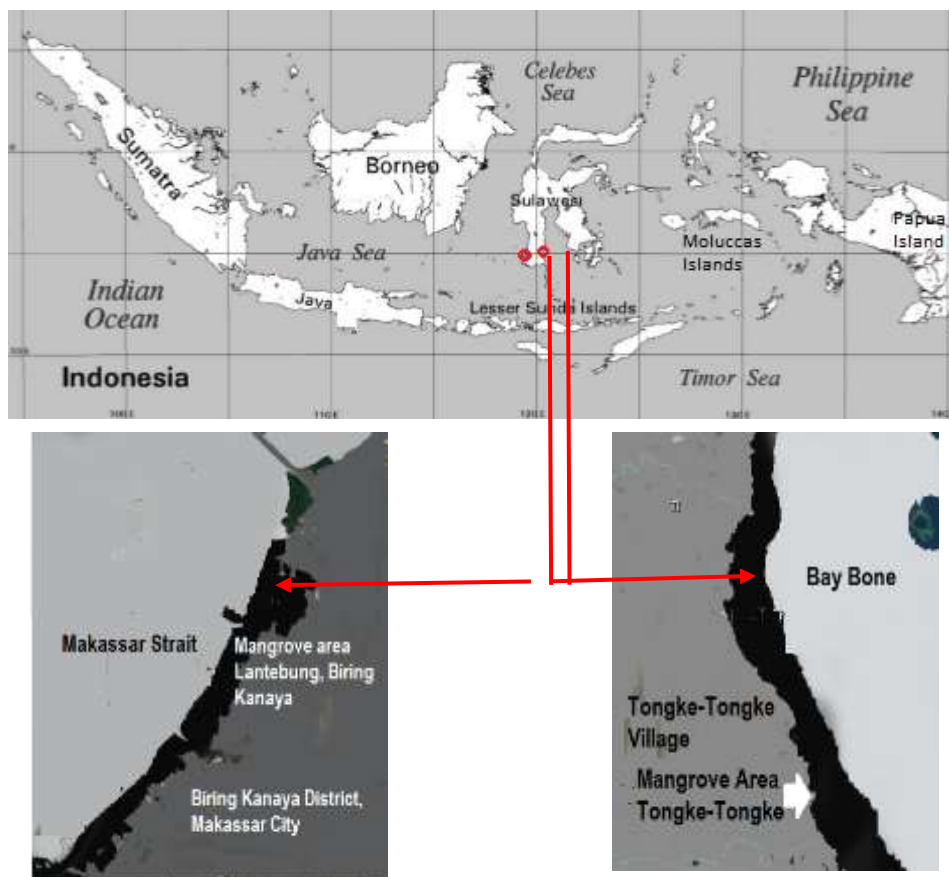
### Materials and Methods

This study combines sequential methods with quantitative and qualitative methods (Spillman, 2014). In the quantitative data collection, 143 households were surveyed. The head of the family is given the top priority to answer the questionnaire but if it does not exist, household members aged 17 years and over are eligible to fill in questionnaires. The samples were selected by quota sampling, which are at the Tongke-tongke and Biringkanaya households. In the qualitative data collection, it involves sixteen key-informant interviews from different groups. They are community, local NGO, head of village, contractor appointed by government, and government officer for mangrove replanting. The selection of informants is through the purposive and snowball sampling method (Cohen & Arieli, 2011; Sibona & Walczak, 2012).

The first variable in the study is psychological factors are the perception, attitude, pro-environment knowledge, and willingness to participate (Abdullah et al., 2014; Wiener, Manset, & Lemus, 2016). Validity and reliability tests have been conducted to measure internal consistency in the development of questionnaires. Because mangrove conservation and rehabilitation programs through a joint management approach are relatively new in Indonesia, willingness to participate is important to measure (Walters et al., 2008). This study uses the *New Ecological Paradigm* Theory Scale (NEP) developed by Dunlap; Anderson, is the most important theory in measuring pro-environment behavior and attitudes that affect human responses to ecological degradation and pollution (Ferrer-i-Carbonell & Gowdy, 2007). This paper reports the results of quantitative data analysis and findings (Sobh & Perry, 2006).

### Study Area

The research was carried out in the Tongke-Tongke Mangrove Area of Sinjai District (TT), and the Biringkanaya Mangrove Area, Makassar city (BK), the two regions were study areas in South Sulawesi Province as shown in Figure. 2. TT is about 210 km from Makassar city and BK is 15 km from Makassar city. TT is a coastal village in Sinjai District, South Sulawesi Province and is located at latitude 5 ° 11'38.52 "S and longitude 120 ° 18'3.83" E. BK is a coastal village in Biringkanaya District, Makassar city located at latitude 5 ° 4'43.18 "S and longitude 119 ° 27'55.44" E. TT has a mangrove area of 173 ha, while BK is a mangrove area of 12 ha which is designated as a Permanent Forest Reserve that is protected and managed sustainably by the community and the government. Mangrove management mainly focuses on the tourism sector, conservation for research purposes and in protecting the fishing industry. Aquaculture activities for crab production in mangroves are based on highly regulated systems, with a 25-year rotation cycle for each sub-coupe in each compartment.



**Fig 2.** Study area, map of Indonesia archipelago, Lamalanrea sub-district, and Tongke-Tongke village.

## Results and Discussion

There were 143 respondents interviewed in two study areas where the distribution for TT was 98 respondents (68.5%) and BK as many as 45 respondents (31.5%). Local community respondents represent 109 respondents (76.13%), while migrants are 34 respondents (23.87%). Age ranges from 24 to 65 years in which the larger age group is 24-33 year, 7 respondents (4.9%), 34-43 years, 29 respondents (20.3%), 44-53 year, 56 respondents (39.2%) and 54-63 year, 51 respondents (35.6%). Overall respondents are locals who have lived in the study area for 9-25 years. The education level of respondents in Senior High School 13 people (9.10%), Junior high school 23 people (16.08%), Primary school 91 (63.63%), and uneducated 16 people (11.19%). Willingness to participate are the main factor in knowing psychological factors among local community participation in mangrove forests rehabilitation when carried out using a co-management approach.

The ten sub-factors in willingness to participate measured the respondents' readiness to participate in co-management with the five Likert-scale measurements: strongly disagree, disagree, unsure, agree and strongly agree. The overall Cronbach's alpha for all items is 0.897 indicating that all items have satisfactory reliability (acceptable value for Cronbach's alpha is 0.70). Overall, 119 (83.2%), respondents are willingness to participate in mangrove rehabilitation program. Table 1 reports majority of respondents are willing to engage in part-time jobs 91 respondent (63.65%) while 99 respondent (69.2%) agree to participate if they are paid and 30 respondent (21%) agree to volunteer. There were 76 respondents (53.15%) indicating willingness to give donation to run the mangrove rehabilitation activities while 67 respondent (46.85%) disagree. However, only 65 respondent (45.2%) claim to have knowledge and skills in mangrove rehabilitation. Overall, the willingness to participate shows a skew to disagree (mean value < 3.0) by the respondents that disagree to participate as a full-time job (mean=1.98), disagree to participate as a volunteer (mean=2.17) and disagree that they have skills in mangrove rehabilitation

Table 1. WP factor in managing mangrove rehabilitation through co-management approach

No	Item	Strong Disagree n(%)	Disagree n(%)	Unsure n(%)	Agree n(%)	Strongly Agree n(%)	Mode
1	Are you willing to participate in co-management for mangrove rehabilitation in this area?	0 (0%)	0 (0%)	24 (16.78%)	58 (40.56%)	61 (42.66%)	
2	I do willingness to participate as a full-time job	61 (42.66%)	54 (37.76%)	12 (8.39%)	2 (1.4%)	5 (3.5%)	
3	I do willingness to participate as a part-time job	23 (16.1%)	21 (15%)	7 (5.2%)	52 (36.5%)	38 (26.9%)	
4	I do willingness to participate as a volunteer without pay	45 (31.2%)	60 (41.8)	9 (6.1%)	21 (14.7%)	9 (6.2%)	
5	I should have an appropriate pay when participating in this program	16 (11.2%)	22 (15.3%)	6 (4.3%)	39 (41.2%)	40 (28%)	
6	I am willing to donate some fund to the organization to run the mangrove rehabilitation program	18 (12.9%)	39 (27.3%)	10 (6.8%)	52 (36.2%)	24 (16.8%)	
7	Are you willing to share knowledge and skill of mangrove rehabilitation	30 (20.9%)	37 (25.9%)	8 (5.8%)	42 (29.6%)	25 (17.8%)	
8	I have skill in mangrove rehabilitation	33 (23.1%)	37 (25.9%)	8 (5.8%)	43 (30.1%)	22 (15.1%)	
9	I can spend my time for the mangrove rehabilitation program	16 (11.2%)	22 (15.3%)	6 (4.5%)	71 (49.9%)	27 (19.1%)	
10	I future, I am willing to contribute my effort for the program's success	20 (14%)	16 (11.2%)	3 (2.4%)	68 (48.1%)	35 (24.3%)	

While in Table 2, shows the result of willingness to participate had no significant correlation with the length of residency ( $p > 0.05$ ). Perception on benefit perceived, risk perceived and dependency on mangrove resources is another important dependent variable in this study. The perception is ranked from rank 1 to 4 which are most benefits/risk, benefit/risk, less benefit/risk and least benefit/risk. The most benefit perceived is to opportunities such as tourism activity. For the risk perceived, no rehabilitation skill is the most risk factor if co-management was implemented (mean=1.89), not enough money for funding in programs (mean = 2.37) and payment for them might not be worth it (mean = 2.66). Mangrove resources are very important for the local community's livelihood (64%) because the marine lives provide additional income and the mangrove serve as a barrier from storms and strong wind. Regarding knowledge, more than half (55%) of the respondents know or heard about the Conservation Act and 103 (71%) respondents know about the types of prohibited activities in mangrove forest accordance with the Conservation Act.

They also understand that trespassing and cutting of mangrove trees in the permanent forest reserves without the permission of the Forestry Department is strictly prohibited. Whole respondents agree that mangrove conservation is very important and should be managed using a sustainable approach for the next 30 years to safeguard the needs of future generations. Thus it is very important to provide education and awareness of environmental conservation (78. %), to have the cooperation of the government, NGOs and stakeholders 5%) and getting women to actively participate in mangrove conservation programs (43%).

Table 2. Correlation between WTP with gender, race, education and length of residency

No	Item	Strong Disagree n(%)	Disagree n(%)	Agree n(%)	Strongly Agree n(%)	Person chi-square
1	Gender					
	- Male	11 (7.7%)	8 (5.60%)	41(28.68%)	53 (37.06%)	
	- Female	3 (2.10%)	2 (1.40%)	10 (7%)	15 (10.49%)	
	- Total	14 (9.79%)	10 (7%)	51(35.67%)	68 (47.56%)	
2	Age					
	- 24 - 34 year	0	0	3 (2.10%)	4 (2.80%)	
	- 35 - 44 year	0	0	15 (10.49%)	14 (9.79%)	
	- 45 - 54 year	0	0	21 (14.68%)	35 (24.48%)	
	- 55 - 66 year	0	0	16 (11.19%)	35 (24.48%)	
3	- Education level					
	- No schooling	0	2 (1.4%)	5 (3.5%)	9 (6.29%)	
	- Primary School	0	4 (2.8%)	51 (35.6%)	36 (25.17%)	
	- Junior high school	0	2 (1.4%)	11 (7.69%)	10 (6.99%)	
	- Senior High School	0	0	4 (2.8%)	9 (6.29%)	
	- University	0	0	0	0	
4	Leng of residency					
	- < 5 year	16 (11.19%)	18 (12.59%)	0	0	
	- 5 - 9 year	0	0	5 (3.5%)	9 (6.29%)	
	- 10 - 14 year	0	0	18 (12.59%)	30 (20.98%)	
	- 15 - 20 year	0	0	29 (20.28%)	18 (12.59%)	
	- > 20 year	0	0			

New Ecological Paradigm (NEP) Scale for pro-environmental attitude

The pro-environmental attitude is another important factor in determining local community response to the environment and mangrove conservation. Respondents strongly agreed on item 15 ecocrisis (77.8%), item 7 anti-anthropocentrism (59.0%) and item 1 limit to growth (55.9%). However, most respondents strongly disagree with item 12 anti-anthropocentrism (56.2%) and item 2 anthropocentrism (50.0%). Additionally, more than 12.0% of the respondents were unsure about NEP scale items especially items 10 and 11 because of the difficulty in understanding the terms ‘ecological crisis’ and ‘the earth is like a spaceship’. Item 1 required rewording without changing the meaning in NEP scale in order to be easily understood by the layman. The original statement of “we are approaching the limit of the number of people the Earth can support” was changed to “Earth is getting crowded with a growing population”. The overall Cronbach’s value is 0.634 which is lower than the cut-off points of 0.70.

Table 3. Mean percentage distribution and reliability statistics for 15 NEP Scale

No	Nep Item	Mean	SD	Item-total correlation	Alpha if item deleted	Skewness
1	Eart in getting crowded with a growing population	4.49	0.69	0.401	0.607	-1.813
2	Humans have the right to modify the natural environment to suit their needs.	1.68	0.9	0.483	0.59	1.819
3	When humans interfere with nature it often produced disastrous consequences	4.55	2.633	-0.073	0.759	16.536
4	Human ingenuity will ensure that we do not make the Earth unlivable	2.05	1.185	0.396	0.594	1.165
5	Human as severely abusing the environment	4.26	0.833	0.395	0.603	-1.486
6	The earth has plenty of natural resources if we just learn how to develop then	2.9	1.373	0.46	0.579	0.201
7	Plants and animals have as much right as human to exist	4.45	0.856	0.313	0.612	-2.227

8	The balance of nature is strong enough to cope with the impacts of modern industrial national.	1.88	1.073	0.514	0.579	1.381
9	Despite our special abilities, human is still subject to the laws of nature	4.38	0.808	0.345	0.609	-1.832
10	The so-called "ecological crisis" facing humankind has been gretlyexaggrated.	2.53	1.164	0.215	0.623	0.532
11	The earth is like is a spaceship with very limited room and resources	4.03	0.837	0.152	0.63	-1.073
12	Human was meant to rule over the rest of nature.	1.69	1.015	0.325	0.608	1.683
13	The balances of nature are very delicate and easily upset.	4.35	0.786	0.255	0.619	-1.87
14	Humans will eventually learn enough about how nature work to be able to control it.	2.53	1.286	0.376	0.595	0.66
15	If things continue on their present course, we will	4.76	0.5	0.08	0.63	-3.098

Note: N = 143; Cronbach's;  $\alpha = .634$ ; minimum = 3.104; maksimum = 4.761

As shown in Table 4, the item 3 (When humans interfere with nature it often produces disastrous consequences) shows no correlation with the overall score from the scale because the value of corrected item-total correlation is less than 0.3. Overall, this result shows that the respondents have a positive attitude towards pro-ecological worldview when the majority agree with the odd-numbered items and disagree with the even-numbered items. The difficulty to understand the statement is the main factor for the low mean score. For even-numbered items under Dominan Social Paradigm (DSP) worldview which is related to the individualism and self-interest attitude, shows that the majority of the respondents disagree with the statements.

Damage and encroachment of mangrove forests are common throughout the territory of Indonesia. The co-management approach has been implemented for a long time and is increasingly in demand for mangrove rehabilitation after several Tsunami disasters. As a result, psychological factors are determined in this study as important factors that still need to be studied. Collecting information about WP respondents is a major factor in determining the level of community readiness for co-management in mangrove rehabilitation initiatives. This study shows that local communities in the study area are willing to participate as part-time jobs and they want to be paid. WP has a significant positive correlation with gender, age and education level.

The results of this study have found that men and women are slightly different in WP. Despite the small number of female samples, the majority of them expressed their interest in participating in co-management programs as facilitators at rehabilitation sites. Migrant respondents were not interested in participating because of lack of skills, knowledge and were busy with their work compared to the indigenous population. Respondents who were more educated tended to be WP than respondents who were less educated because the first to have more awareness of environmental issues, especially for sustainability in the future. Therefore, the lack of skills in rehabilitation requires special training on how to identify good and mature propagules and monitoring skills at the replanting site are two main skills that must be taught. This can be done by having a replanting contractor, the leader of a local rehabilitation organization or an experienced forestry technical staff.

In addition, the duration of the residency factor did not correlate positively in the formation of co-management for the study area. Limitations in this correlation may be due to the heterogeneity of respondents and the limited number of samples collected. Further research might determine the reason why these variables are omitted. The respondents had a positive attitude towards the pro-ecological worldview when the majority did not agree with statements under the DSP. The overall value of Cronbach in this study is 0.634. This is because some respondents are unfamiliar with statements and they do not agree that their attitudes are harmful to the environment. This result is similar to the study conducted by Wu (2012) which explores the NEP Scale in China (Cronbach's  $\alpha = 0.65$ ). Differences in the socio-cultural environment in interpreting statements about scale between developed and Western countries are the main factors that contribute to low



reliability and abnormalities. The positive perception from the local community in the study area the formation of co-management is a good channel that can be used by leaders of mangrove rehabilitation and conservation to strengthen collaboration with villagers and village associations. After the local community recognizes the benefits and importance of mangroves for the future, the feasibility of a rehabilitation program can be done through co-management with technical guidance.

### Conclusion

For future management, the implementations of approach through adaptive co-management between the local community, government agency and NGOs is recommended to develop better conservation management towards mangrove sustainability in Indonesia. The organization in mangrove conservation programmer should first strengthen their capacities especially local institutions such as conservation leaders, elected leaders, tourism entrepreneurs, women and occupational groups. The public awareness and research efforts should be made at village, district and sub-district by sharing the power and responsibility from the policy makers. The concerted effort of academicians, NGO, stakeholders and corporate bodies are greatly needed. Thus, this study recommends further research on local governing and community institutions capacity including the financial capability to support co-management establishment. This future study is recommended to be conducted by the focus group discussion method among stakeholder.

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