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Pond Farmers' and Stakeholders' Satisfaction in the Mangrove Planting Program in the Mahakam Delta, Indonesia

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ABSTRACT

In order to encourage rural development and sustainable management of shrimp ponds in the Mahakam Delta area, the government and other organizations have initiated a mangrove planting program in green belts, inside ponds, and abandoned ponds as barren and inactive ponds that are degraded by pond extension through a mangrove planting program since 1999. It is indicated that the program's impact on the community in the Mahakam Delta could be realized when those local people participate more. The research involved 272 pond farmers and 33 stakeholders as the respondents. Analytical techniques for this study were descriptive statistics by applying the scoring on the Likert scale, and employing the chi-square test. The objectives of the study were (1) to measure pond farmers' and stakeholders' satisfaction with the mangrove planting program, (2) to analyze variables that correlate with pond farmers' satisfaction with the mangrove planting program. The results showed that most pond farmers and stakeholders were well satisfied with the mangrove planting program in the Mahakam Delta. Pond farmers' satisfaction was 7.7% in the highest score, 53.8% in the high score, and only 38.5% were at a low score. Also, 7.7%, 38.5%, and 38.5%, 15.4% of stakeholders' satisfaction fell into highest, high, moderate, and low scores, respectively. In the analysis, three variables, which were the farming system adoption (Z_1), education (Z_2), and length of stay in the Mahakam Delta area (Z_3) were associated with pond farmers' satisfaction with the mangrove planting program. Therefore, the local people's satisfaction and characteristics can be considered in developing a strategy for the sustainability-enhancing of mangrove-shrimp farming management. Where, the government needs to realize the policies to mangrove trees planting within ponds, distance setting of green belt area, and improvement of skill and knowledge of local people.

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1. INTRODUCTION

Most ponds in the Mahakam Delta were built from massive mangrove conversion when there were less stringent control and regulations from the government. Mangrove clearance has decreased mangrove forest contribution [1]. In the 1950s, the Mahakam delta area was dominated by Nypa planting and mangrove species. The shrimp pond was about 3% of the total area in the Mahakam Delta, and in 1996, the shrimp pond increased to 14% of the total area while degraded forest increased to 1,500 ha. In 1999, almost the Mahakam Delta lost its mangrove forest cover because of the expansion of shrimp ponds on a large scale. The decrease in covering mangrove and pond extension in the 1950s, 1992, 1996, and 1999 in the Mahakam Delta area were due to the growth of the built pond area [2]. Then, in 2020, mangroves in the Mahakam Delta were 49,311.2 ha, and ponds were 59,717.95 ha [3]. Depletion of mangrove areas was not only for aquaculture (shrimp farming) but also due to logging activities, land-use change (converted to agriculture), climate change, hydrological alterations, chemical spills [4], human settlement [5], and industry.

Besides pond development, in the Mahakam Delta area were also human settlements and agricultural land use [6]. Whereas, the land use pattern of forest aquaculture zones in the Mahakam Delta is missing coastal management if it is for cultivation and residence area because of the forest aquaculture area (KBK) [7]. A basis of territorial division in the Mahakam Delta area by DLHK (Dinas Lingkungan Hidup dan Kehutanan), the ponds area includes into community empowerment block, where pond management with a silvofishery approach has to be applied there. Silvofishery is trusted to support future forestry development policy priorities and sustainable shrimp farming [8], so there are local governments, other related institutions, stakeholders, and pond farmers cooperate to achieve this goal through the long-term management plan made at KPHP Mahakam Delta.

When we look at ponds in the Mahakam Delta that applied traditional and extensive ponds, we believe that pond farmers living in rural areas of the Mahakam Delta were the large ponds. Those ponds with this conventional method were formed earlier than the other shrimp farming system in mangrove areas. Based on observation, the vast ponds without mangroves in the field were mostly found, indicating that mangroves are not popularly planted within ponds by pond farmers with skill and knowledge hereditary in cultivation. Also, Dat and Yoshino [5] stated that local people control pond size and expansion.

In order to encourage sustainable shrimp farming management in the Mahakam Delta, the government and private companies initiated a mangrove planting program in the pond, the green belt area, the abandoned pond area, and the other degraded areas. The government has supported mangrove planting through the program for around 25 years (1999-2024). In 1999 and 2000, government institutions initiated and implemented the first mangrove planting programs. The gradual increase of mangrove areas in the Mahakam Delta is in line with the target of the mangrove planting program, although it has yet to be able to restore the lost mangroves to their original state. At least, the benefits of the mangrove ecosystem are more perceived.

Bosma et al. [9] stated that mangroves are fully connected to open water. Hence, mangroves may commercially function as nursery habitats for crab, prawn and fish species, support offshore fish populations and fisheries [10], shoreline stabilization, storm and wave protection, and reduction of coastal erosion [11], economic benefits, ecological services, screening the solar UV-B radiation, reducing the ‘green house effect’, minimizing the fury of cyclones, mitigation the fury of tsunami, controlling the flood, prevention of the coastal erosion, trapping the sediments, deepening the creeks, trapping and recycling of nutrients, supporting the fishes and wildlife populations, biomass and litter production, and litter decomposition and nutrients enrichment [12], influences increasing sedimentation and/or by direct organic contributions to soil volume (peat formation) [13], avoiding from habitat destruction, loss of ecosystem, water quality reduction, exotic species introduction, and disease [11]. The ponds based on the integrated mangrove-aquaculture indicate leaf litter that directly or by stimulating natural food production can help the farmer minimize the shrimp production cost by lowering the feed input [14]. Nevertheless, other research has revealed that aquaculture development following existing governmental policies may not directly reduce greenhouse gas emissions without advocating further expansion to cover the entire food system [15].

The response of the surrounding village community and stakeholders (local people) has a role in the mangrove planting program's goal; hence, a satisfaction measurement of them needs to be highlighted in the programs. Queiroz et al. [16] stated that personal satisfaction, mental and physical relaxation, creation and maintenance of social relationships, and traditional ecological knowledge were considered in the social-culture dimension of mangrove service needs. In addition, gender, age, education level, income, marital status, and family members of participants correlated to further mangrove forest programs [17]. Race and perceived risk factors also influence willingness to participate in mangrove rehabilitation [18]. Like in the Mekong Delta, Vietnam, mangrove plantations and protection programs gained the farmers’ attitudes positively [19], as well as families of small fishermen, fisherwomen, and rice farmers on the west coast of

India possess a considerable willingness to participate in mangrove restoration [20]. These local people were the community who cause improvement of socio-economic development [21].

The objectives of the study were 1) to measure pond farmers' and stakeholders' satisfaction with the mangrove planting program, and 2) to analyze characteristics variables that correlate farmers' satisfaction with the mangrove planting program. We discussed the response of pond farmers around the village in the Mahakam Delta area to the mangrove planting program, and we also included the relevant stakeholders to measure their satisfaction and know their opinions. In hypothesis, the mangrove planting program would satisfy respondents in the Mahakam Delta. Also, there was correlation between the pond farmers' satisfaction with the program based on characteristics of pond farmers and pond system. As a framework, the study focused on the pond farmers' and stakeholders' satisfaction, and variables connecting pond farmers' satisfaction with the mangrove planting program for sustainability-enhancing of mangrove-shrimp farming management (Fig. 1). Where, the satisfaction factors were found during survey and observation, and supported by the other research results.

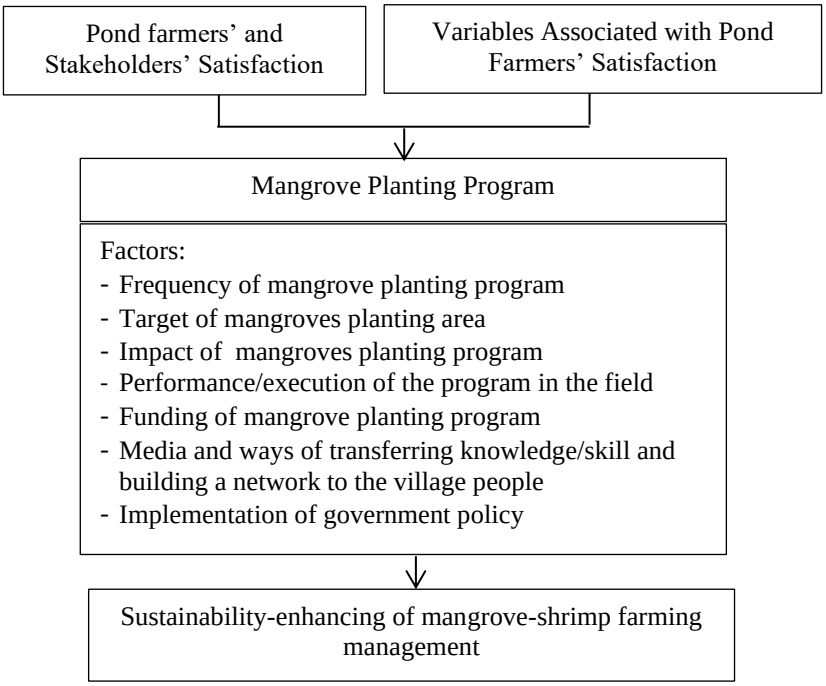

Figure 1. Framework of the study

2. RESEARCH METHOD

2.1. Study Site and Time

The study site was in the Sepatin village, Anggana sub-district, East Kalimantan, Indonesia. The Sepatin village is one of the large ponds in the Mahakam Delta area. The active ponds covered 446 km^2 [22] of 625 km^2 total Sepatin village area [23]. Data was gathered from data updated in 2022 and 2023.

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2.2. Sampling Technique

There were 850 pond farmers. For sample size estimation, using a purposive random-sampling method and using the Taro Yamane formula at a 95 % confidence level for each stratum surveyed were performed; hence, the total sample is 272 pond farmers. Then, 33 stakeholders were taken using a snowball sampling method. Where, participation from the private sector and people's organizations need to be involved for more collaboration in mangroves program [24] like stakeholders [25]. Stakeholders of this study consisted of head of village, neighbourhood associations, head of government officers, head/vice of cold storage factory, head of home industry, academician/scientist, head of fisher groups, head of NGOs, and punggawa (local investor/trader).

2.3. Data Collection Method

The data collection method consisted of primary and secondary data. The primary data was directly collected from pond farmers and stakeholders. The data was gathered through a questionnaire. The secondary data was collected from recent statistical data, research, and project reports from government and private institutions, books, and monographs. Also, this study included a literature review and semi-structured reviews.

2.4. Analytical Techniques

The descriptive analysis measured the pond farmers' and stakeholders' satisfaction with the mangrove planting program. In analysis, measurement applied scoring and the mean scale of category. Scoring on the Likert scale consisted of 5 points, i.e., 1 (Strongly Dissatisfied (SD)), 2 (Dissatisfied (D)), 3 (Neutral (Nt)), 4 (Satisfied (S)), and 5 (Strongly Satisfied (SS)). Using the Likert scale is due to social sciences research with a number of descriptive anchors [26, 27]. The mean scale range and category consist of 5 classes, as shown in Table 1 below.

Table 1. Range of Mean Scale [28, 29] and Category

No.	Mean scale	Satisfaction level
1.	1.00 - 1.79	Lowest
2.	1.80 - 2.59	Low
3.	2.60 - 3.39	Moderate
4.	3.40 - 4.19	High
5.	4.20 - 5.00	Highest

Seven factors of the pond farmers' (M) and stakeholders' (L) satisfaction with the mangrove planting program were the frequency of the program, target, impact, performance, funding, media and way, and implementation of government policy as shown in Table 2. Pond farmers' satisfaction with the mangrove program using the chi-square test was analyzed to determine correlating variables [30, 31]. The variables were from characteristics and the pond system of pond farmers, namely the adopted pond system (Z_1), pond farmers' education (Z_2), and length of residency of farmers in the Mahakam Delta area (Z_3), which were independent variables. Then, pond farmers' satisfaction with the mangrove planting program was the dependent variable.

Table 2. Factors of Satisfaction in the Mangrove Planting Program and Its Description

No	Factors	Description
1.	Frequency of mangrove planting program in the Mahakam Delta area	The level of satisfaction of pond farmers at the regular mangrove planting program in the Mahakam Delta area
2.	Target of mangroves planting area	
	2.1. in the pond	Pond farmers' satisfaction at the program for planting of mangroves in the pond
	2.2. in the green belt and the abandoned ponds area as barren and inactive ponds	Pond farmers' satisfaction at the program for planting of mangroves in along Mahakam Delta river and abandoned pond areas
3.	Impact of mangroves planting program	
	3.1. Environmental of pond area	Pond farmers' satisfaction with the impact of the program, especially in changing the better pond environment
	3.2. Social and economic	Pond farmers' satisfaction with the impact of the program, especially impact to their social status in the farmer community, and income
4.	Performance/execution of the program in the field;	
	4.1. In planting	Pond farmers' satisfaction to mangroves with three leaves and propagules (mangrove's seeds) that are planted in the Mahakam Delta area, included distance among mangrove trees planted, and mangrove trees type and quality.
	4.2 Maintenance	Pond farmers' satisfaction at the program in ensuring that the mangrove trees planted do not fail to grow
	4.3. Monitoring and evaluation	Pond farmers' satisfaction to monitoring and evaluation of the

		program after steps of planting and maintenance, for example, about number of mangrove trees that grow well
5.	Funding of mangrove planting program	Pond farmers' satisfaction with amount of funding from government, international foundation, private institution, and the others funders for the program
6.	Media and ways of transferring knowledge/skill and building a network to the village people	
	6.1. Workshops, training and seminars	Pond farmers' satisfaction to getting knowledge and skills transfer from organizations or the government through workshops, training and seminars for the program
	6.2 Socialization on the mangrove planting program and its impact	Pond farmers' satisfaction with the program in an effort to spread the impact of mangrove planting
	6.3. Building of partnership/ network for applying the program	Pond farmers' satisfaction at the program that creates cooperation and relationships both individually and in groups of village people
7.	Implementation of government policy	Pond farmers' satisfaction toward implementation of the law, regulation, procedure, administrative action, incentive, or voluntary practice of governments and other institutions related for the mangrove planting program

3. RESULTS AND DISCUSSION

3.1. Pond Farmers' Satisfaction with the Mangroves Planting Program

In this descriptive statistic as shown in Table 3, the range of mean and standard deviation of pond farmers' satisfaction with the mangrove planting program are 1.89-4.10 and 0.36-1.03, respectively. Calculated, amounting to 7.7%, 53.8%, and 38.5% were in highest, high, and low scores, respectively. Pond farmers' satisfaction with the mangrove planting program was rated as high on factors of frequency (M_1), target of mangrove planting (in the green belt and the abandoned ponds area) ($M_{2.2}$), impact (M_3), performance/execution (in planting) ($M_{4.1}$), and the media and ways of transferring knowledge/skill and building a network to the village people (M_6). Among them, the three best factors of pond farmers' satisfaction with mangrove planting program basis on the mean scores were factors of frequency of mangrove planting program, M_1 (4.10), socialization on the mangrove planting program and its impact, $M_{6.2}$ (4.05), and workshop, training, and seminars, $M_{6.1}$ (4.04). In contrast, low scores of pond farmers' satisfaction were factors of target of mangrove planting areas in the pond, $M_{2.1}$ (2.27), performance/execution of the program (maintenance), $M_{4.2}$ (2.13), and monitoring/evaluation, $M_{4.3}$ (2.08), funding, M_5 (1.89), and implementation of government policy, M_7 (1.98).

Table 3. Pond Farmers' Satisfaction with the Mangroves Planting Program

No.	Factors	Mean	SD	Satisfaction level
1.	Frequency of mangrove planting program in the Mahakam Delta area (M_1)	4.10	0.54	Highest
2.	Target of mangroves planting area (M_2)			
	2.1. in the pond	2.27	1.03	Low
	2.2. in the green belt and the abandoned ponds area	3.90	0.69	High
3.	Impact of mangroves planting program (M_3)			
	3.1. Environmental of pond area	4.02	0.54	High
	3.2. Social and economic	3.92	0.58	High
4.	Performance/execution of the program in the field (M_4)			
	4.1. In planting	3.97	0.50	High
	4.2 Maintenance	2.13	0.51	Low
	4.3. Monitoring and evaluation	2.08	0.47	Low
5.	Funding of mangrove planting program (M_5)	1.89	0.42	Low
6.	The media and ways of transferring knowledge/skill and building a network to the village people (M_6)			
	6.1. Workshops, training and seminars	4.04	0.57	High

	6.2. Socialization on the mangrove planting program and its impact	4.05	0.58	High
	6.3. Building of partnership/ network for applying the program	4.03	0.60	High
7.	Implementation of government policy (M_7)	1.98	0.36	Low

Note: SD (Standard Deviation)

Since 2000, the Regency Government of Environment Affairs had planted 30,000 mangrove trees in green belts, inside ponds, and abandoned ponds as barren and inactive ponds under the first program, where ponds at that site were large ponds and extensive dominantly. This is in line with the suggestion of van Bijsterveldt [32] about landward mangrove expansion into abandoned aquaculture ponds. Further, two offices followed the program, namely the Regency Government of Forestry Affair in 2002 and Plantation and the Regency Government of Marine Affair and Fisheries in 2009. It is in line with KPHP-Delta Mahakam mentioned that frequency of institutions with the program came from KPHP Mahakam Delta, Dishut or DLHK of East Kalimantan Province, BPDAS Mahakam Berau, BRGM, NGO, PT. MHU, PT. Gunung Bayan, PT. Bara Tabang, and PT. PHM [8]. In 2001-2005, PT. Total E&P Indonesia-company replanted again around 3,549,997 trees covering 646 ha of Mahakam Delta [33], as well as, harvested shrimp in the pond with mangroves as a silvofishery pond pilot in 2003 [34]. Recently, KPHP Mahakam Delta recorded around 1,600 propagules/ha for 20 hectares planted in Mahakam Delta areas, especially in Muara Badak Ulu sub-district in 2020. Then, according to BRGM [35], 456 ha mangroves were planted in East Kalimantan by BRGM, where village people were satisfied by the frequencies of the program from these institutions.

Moreover, pond farmers in the field tended to approve that the mangrove planting target was outside in ponds because pond farmers did not want to take risks. Pond farmers needed to gain the skill and knowledge to manage falling mangrove leaves litter into the ponds, then decomposed and affected water quality. It can be seen from the 85% of farmers who adopted ponds without mangroves. Further, the type of mangrove tree planted was *Rhizophora* spp, planted in the form of a mangrove propagule, and three or five leaves of mangrove trees (Fig. 1). The location of the mangrove planting program in the Mahakam Delta area was well distributed in Muara Badak Ulu, Tani Baru, Sepatin, Muara Pantuan, Muara Jawa area, and Samboja area [8].

Fig.1. Mangroves Trees with Three or Five Leaves and the Mangrove Propagule

Also, respondents believed and agreed that mangrove trees protect many plants and animals; served as natural barriers to tsunamis, torrential storms, and typhoons; provided timber, fuel, food, medicinal herbs, and other products; and provided ecotourism attractions; then, mangroves area also provided place for nursery and spawning of shrimp, fish, and crab; sustainability of species diversity; nutrition and feeding; the barrier of salinity percolation; the wild of shrimp, crab, and fish; catching of sediments; holding of accumulation of mud; the natural abode of plant and animal; chemical process; shore buffer of abrasion and water wave or swell. Moreover, mangrove forests had a good potential for carbon storage with economic value [36], even supporting firewood and building materials [37].

Based on survey and observation, it was estimated to be around 50-70% of planted mangrove trees (propagules) in the field were washed away by the waves without enough proper maintenance, monitoring and evaluation. Therefore, most pond farmers were not satisfied with the program. A similar result was achieved by Erftemeijer [38], that some common reasons for the failure of mangrove planting are 1) use of inappropriate methods, 2) insufficient information, 3) inadequate site selection, 4) planting of the wrong

species, 5) inadequate monitoring of seedlings, 6) failure to involve communities, 7) poor coordination among institutions, and 8) decision makers' lack of awareness. Therefore, only a few plants survive in such places if it is without practical guidance and technical support. Some successful steps in mangrove restoration should be applied from mangrove nursery, land preparation, planting, maintenance, and monitoring [39].

Even though several factors were not high satisfaction, most pond farmers have participated in the program. Pond farmers in the field participated in workshops/training/ seminars at 85%. Next, around 84% of pond farmers participated in socialization of the mangrove planting program, and 86% of pond farmers have applied planting of mangroves especially in the green belt and the abandoned ponds areas (Fig.2). Likewise, with community participation in Manokwari,, Papua, they also had high participation in managing the Waranggui mangrove forest [40].

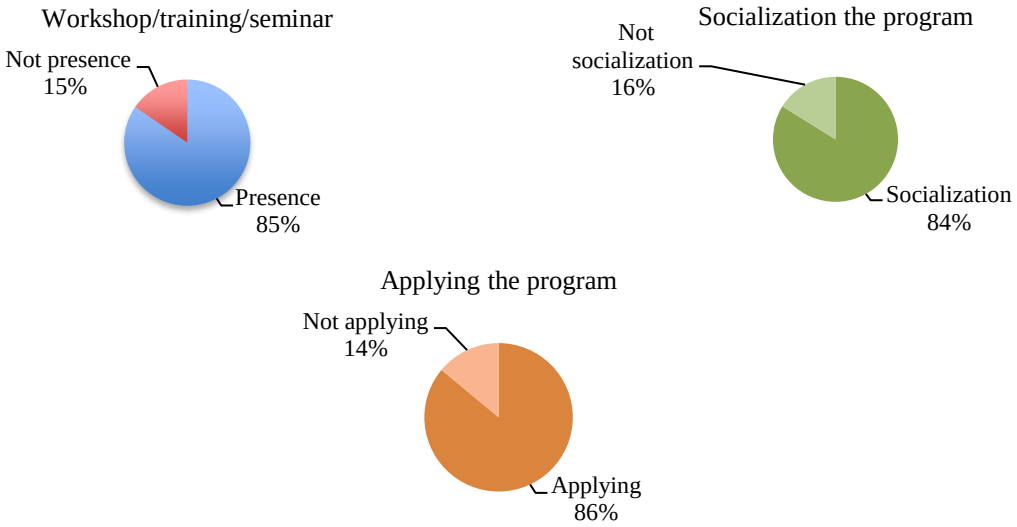

Fig. 2. Pond Farmer Participations with the Mangrove Planting Program

3.2. Stakeholders' Satisfaction with the Mangrove Planting Program

In this descriptive statistic as shown in Table 4, data variances (mean ± SD) of stakeholders' satisfaction with the mangrove planting program are ranged 2.06-3.88 for the mean, and 0.51-1.21 for the SD. Overall, amounting to 7.7%, 38.5%, 38.5%, and 15.4% are in highest, high, moderate, and low score, respectively. Stakeholders' satisfaction with the mangrove planting program was rated at a high scores, covering the target of the mangrove planting area factor in the green belt and the abandoned ponds area ($L_{2.2}$), the impact of the mangrove planting program in on the pond area environment ($L_{3.1}$), performance/execution of the program in the field (in planting) ($L_{4.1}$), and media/ways of transferring and building a network to the village people (L_6). Moderate scores covered factors of frequency of the mangrove planting program (L_1), target of mangrove planting area in the pond ($L_{2.1}$), impact of social and economic ($L_{3.2}$), and performance of the program in the field on maintenance ($L_{4.2}$), monitoring and evaluation ($L_{4.3}$). There were also not satisfied by two factors as funding (L_5) and implementation of government policy (L_7) due to low scores.

The three best factors of stakeholders' satisfaction with mangrove planting program basis on the mean scores were factors of impact of mangroves planting program in environmental of pond area, $L_{3.1}$ (4.51), socialization on the mangrove planting program and its impact, $L_{6.2}$ (3.88), and performance of the program in the planting, $L_{4.1}$ (3,85).

Table 4. Stakeholders' Satisfaction with the Mangrove Planting Program

No.	Factors	Mean	SD	Satisfaction level
1.	Frequency of mangrove planting program in the Mahakam Delta area (L_1)	3.27	1.21	Moderate
2.	Target of mangroves planting area (L_2)			
	2.1. in the pond	3.06	0.99	Moderate
	2.2. in the green belt and the abandoned ponds area	3.64	1.08	High
3.	Impact of mangroves planting program (L_3)			

	3.1. Environmental of pond area	4.51	0.51	Highest
	3.2. Social and economic	3.00	1.06	Moderate
4.	Performance/execution of the program in the field (L_4);			
	4.1. In planting	3.85	0.79	High
	4.2 Maintenance	3.06	1.03	Moderate
	4.3. Monitoring and evaluation	3.09	0.84	Moderate
5.	Funding of mangrove planting program (L_5)	2.27	0.94	Low
6.	The media and ways of transferring knowledge/skill and building a network to the village people (L_6)			
	6.1. Workshops, training and seminars	3.57	0.83	High
	6.2. Socialization on the mangrove planting program and its impact	3.88	0.99	High
	6.3. Building of partnership/ network for applying the program	3.40	1.12	High
7.	Implementation of government policy (L_7)	2.06	0.83	Low

Note: SD (Standard Deviation)

We have known each of stakeholders had different interests and intentions, and these stakeholders highlighted unsatisfactory funding and implementation of government policies in this study. Related with funding, according to Joetarto et al., [41], when "the village fund" through the programs worked, it had a positive influence on the increase in expenditure per capita of the rural population. However, in fact, the low labor wages, and non-compliance and adoption of government policies with the mangrove planting program were found at the site. The wages of workers who work to plant mangrove plants in this program were only around IDR300-500 per tree or propagule. Therefore, the people who are directly involved in mangrove planting want an increase in wages and grants for additional income. It is in line with Kapur [42] mentioned that besides having a major occupation in agriculture, the rural people were engaged in a number of other activities for income, and usually, the rural people's choice of livelihood is based on their knowledge of farms, calculation of potential failure, family's economic capacity, and outside assistance [43]. A different result was achieved in some provinces of Vietnam, that most people participating in conservation schemes received non-monetary benefits (such as training and knowledge sharing) rather than money [44]. Also, in the Philippines, village people could improve the social capital [45], and local livelihood [46] on impact of the mangrove program.

At the same time, the implementation of the distance between the pond and the river/canal in the field did not follow the provision of the government. The distance between the pond dikes and the Mahakam river or canal was too close and without mangrove trees at that distance. Pond farmers applied less than 50 meters, whereas, based on Directorate General of Forestry Planning and Environmental Management of the year 2012, and President Decree No.32, year 1990, the distance is a minimum of 50 and 50–100 meters between the main rivers or canal and pond dikes. Also, implementation of the planted mangrove trees in the ponds was a challenge because most pond farmers did not agree.

In Table 5, there are valid government policies implemented for integrated mangrove and shrimp farming. There are government regulation PP 8/1995 (Decentralization of part of authorities to 26 districts of the pilot project), rehabilitation of forest and land (The law, No.41 1999), government regulation PP 25/2000, fishery law (The law, No.31 2004), Ministry of Marine Affairs and Fisheries of Republic of Indonesia No. Kep.28/Men/2004, aquaculture and fisheries management (The law, No. 45 2009), Regulations of the chair of Kutai Karatenegara District No.47, year 2014, and general guidelines for the development of a forestry-based rural conservation community (Ministry of Forestry of Republic of Indonesia No. P.20/Menhut-II/2014) applied. Officially, all aspects of the integrated mangrove and shrimp farming sustainability have been arranged by the government. However, there are several challenges and solution realized and implemented. Also, the greater mangrove loss was associated with low regulatory quality of the nation [47].

Table 5. Government Policy with the Integrated Mangrove-Shrimp Farming in Indonesia

Title of the policy	Concerning
Government regulation, PP 8/1995 (Decentralization of part of authorities to 26 districts of pilot project	Assessment of fisheries resources, Development of fisheries resources, Guidance of production input development (seeds, feeds, gear, boats, medicine), Issuing certificate of enterprise, Development of quality of

	fisheries product, market information, fisherman housing, and human resources development
Rehabilitation of forest and land (The law, No.41, year 1999)	Rehabilitation of forest and land
Government regulation, PP 25/2000	Setting policy and management of exploration, conservation management, and utilization of marine resources beyond 12 miles
Fishery law (The law, No.31, year 2004)	Fisheries management and control for fishery and aquaculture, surveillance, criminal act, and procedure
General guidelines for shrimp aquaculture in the pond (Ministry of Marine Affairs and Fisheries of Republic of Indonesia, No. Kep.28/Men/2004)	Forestry management system through silvofishery concept
Aquaculture and fisheries management (The law, No. 45, year 2009)	Aquaculture and fisheries management
General guidelines for the development of forestry-based rural conservation community regulation (Ministry of Forestry of Republic of Indonesia No. P.20/Menhut-II/2014)	Forestry management and silvofishery system

3.3. Variables Associated Pond Farmers' Satisfaction with the Mangrove Planting Program

Pond farmers' satisfaction with the mangrove planting program was correlated with three variables of characteristics and the pond system, namely the adopted farming system (pond with and without mangroves), education, and length of residency. In chi-square analysis, there is a significant correlation between the pond farmers' satisfaction (M) and the farming system adopted (Z_1), education (Z_2), and length of residency (Z_3), each ρ-values < α = 0.000 (Table 5). There were differences in the farming system, education, and length-residency of pond farmers to their satisfaction in the mangrove program. The others characteristics of pond farmers such as gender, marital status, pond ownership status, experience in farm, number of farm household family, and age did not include in the analysis because almost similar for each pond farmer. Namely male, married, pond owner, had more than one year of experience, and had more than four family members, as well as the ages were in productive age range.

Table 6. Analysis of Variable Correlating Pond Farmers' Satisfaction with the Mangrove Planting Program with Chi-Square Test

Variables	df	Asymp.sig. (2-sided)*
Farming system (pond with and without mangrove) (Z_1)	3	0.000
Education (Z_2)	9	0.000
Length of residency (Z_2)	3	0.001

*Likelihood ratio

About 15% of pond farmers employ integrated mangrove-shrimp farming in the field; otherwise, ponds without mangroves amount to 85%. Most pond farmers who apply for ponds with mangrove systems permit mangroves to be planted in their ponds; however, most pond farmers prefer mangroves planted in other areas to their within ponds such as the green belt area and abandoned areas. Next, the education level of all pond farmers participating in the mangrove planting program is from senior high school and junior high school. There was also participation from elementary and non-educational pond farmer groups, but not all of them, because these groups also did not participate in the mangrove planting in the ponds. In detail, eighteen farmers had no formal education, and 254 farmers had formal education. Among the farmers with formal education, 223 finished primary school, 15 finished junior high school, and 16 finished senior high school. Then, those who mainly support the program have a settlement length in the Mahakam Delta area of five years and more (82.4%). The remaining (17.6%) are pond farmers who lack support for the mangrove planting program, and they have lived in the Mahakam Delta for less than five years. This is in line with the skills and knowledge of pond farmers that have been passed down from generation to generation, where the education level has been related to a personal quality that might cause the productivity of the farm [48]. Education provides individuals with the necessary skills and knowledge can improve their lives, like the economy, and contribute positively to society [49, 50].

4. CONCLUSION AND RECOMMENDATION

Most pond farmers were satisfied with the mangrove planting program based on data variance (mean±SD), where1 out of 13 factors was at the highest score (7.7%), and 7 of 13 factors were at a high score (53.8%). Those pond farmers' satisfaction covered factors of frequency (M_1), target of mangrove planting (in the green belt and the abandoned ponds area) ($M_{2.2}$), impact (M_3), performance/execution (in planting) ($M_{4.1}$), and the media and ways of transferring knowledge/skill and building a network to the village people (M_6). Also, most stakeholders were really satisfied by the program. Amounting to 7.7%, 38.5%, and 38.5% of stakeholders' satisfaction were in the highest, high, and moderate scores, respectively. Those stakeholders' satisfaction covered frequency (L_1), target of mangroves planting area (L_2), impact of mangroves planting program (M_3), performance/execution of the program (L_4), and the media and ways of the transferring and building a network to the village people (L_6). Even though, there are a lot of factors had been satisfied, the most pond farmers and stakeholders were not satisfied by two factors, namely funding and implementation of government policy. In chi-square analysis, there was a significant correlation between pond farmers' satisfaction with the mangrove planting program (M) and the farming system adopted (Z_1), education (Z_2), and length of residency (Z_3), each ρ-values < $\alpha = 0.000$.

Pond farmers' and stakeholders' awareness and participation in the mangrove planting program should be increased continuously because those local people' satisfaction with the program and their characteristics can be considered in developing a strategy for the sustainability-enhancing of mangrove-shrimp farming management. Also, there are several challenges for the government to realize the policies to mangrove trees planting within ponds, distance setting of green belt areas, and improvement of skill and knowledge of the local people in the Mahakam Delta area including optimization and allocation of the funding.

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