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To cite this article: Khaerul Saleh and Suherman 2021 *IOP Conf. Ser.: Earth Environ. Sci.* **883** 012048

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Factors affecting the capacity of farming rice farmers in managing rice field in the District Tangerang

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Abstract. Farmers' capacity to manage rice paddy farming is closely related to individuals' behaviour in managing the farm. Farmer capacity building program has been widely and often conducted relevant government innovation lowland rice farm and delivered to farmers. Still, the farmers cannot give a proper response to lowland rice farm management innovation, especially in terms of strengthening farmers' capacity. This study aims to: (1) determine the level of farmer capacity in managing rice paddy farmers and (2) to analyze the factors related to the capacity level of rice paddy farmers. The research was conducted in the northern part of Tangerang Regency (Pantura), the centre for rice production in the Tangerang Regency. The research was conducted from July to November 2020. Data was collected through FGD interviews and observations of 150 farmers. The data analysis used descriptive test and multiple regression. The results showed that the farmer capacity in managing lowland rice farming in Tangerang district was classified as moderate, both in resource utilization, problem identification, farming planning, and adaptability. The main factor determining the level of farmer capacity in managing rice paddy farmers is formal education and nonformal education.

1. Introductions

Farmers' capacity to manage rice paddy farming is closely related to the individual farmer's behaviour to innovation. Lowland rice farming activities they describe activities that hereditary and conventional as the previous generation, most farmers commercialize farming is their parents' legacy. Farm management paddy field farmers such as the use of quality seeds, integrated pest management, crop rotation and balanced fertilization through the farming pattern of System of Rice Intensification (SRI), Low External Input Sustainable Agriculture (LEISA/LISA) and the Agricultural Input Organic [1]. However, most paddy farmers have not been able to respond to the rice field of innovation management. The ability or capacity of farmers is not conducive to produce products of profitable farming.

One of the internal factors is individual characteristics that are thought to be related to farmer capacity. The characteristics of individual farmers are characteristic for each farmer with various aspects of his life, often used as a distinguishing element in shaping behaviour between individual farmers. They can support their survival in managing their farming. The results of research Subagio [2] state that every individual naturally has a capacity inherent in himself. Furthermore, it is stated that personal characteristics affect farmers' capacity. Rogers [3] states that these characteristics underlie one's behaviour in work situations and other situations. [4,5] stated that the factors that affect the capacity of farmers in managing lowland rice farming are the characteristics of farmers (age and



farming experience), social, environmental characteristics, level of empowerment, cosmopolitan level, land area and performance of agricultural extension agents.

Veronice [6] stated that the low capacity of lowland rice farmers of paddy is due to the weak level of technical knowledge of farmers in managing rice farming. While Sudana and Subagyono [7], states that the factors that significantly affect the chances of accelerating the adoption of innovation are the age and level of education and the number of existing extension agents. Further Sudana and Subagyono [7], farmers' factor characteristics positively correlated with the level of fulfilment of farmers' needs. Farmers' capacity to manage the farm includes age, formal education, nonformal education, and farmers' experience in agribusiness [8].

Fatchiya [9] states that fish cultivators' characteristics that significantly affect nonformal education, experience, income, and business scale. Meanwhile, according [10] revealed the real effect of individual characteristics, including age, formal education, nonformal education, long effort, motivation, and scale farming. Capacity also influences the pace of innovation adoption, among others: the characteristics of the farmers such as age, education, farming experience, contact extension, annual income, economic motivation, and engagement counselling agencies [11, 12].

Farmers' capacity to manage rice paddy farming is farmers' ability in business planning, troubleshooting, and use resources. [13] argued that farmers know wetland rice PTT component 76-91%. Still, in practice, not all components recommended by the known technology can be applied very well, so paddy farming's success rate is still very low. This condition is seen from the level of productivity of farm produces.

Referring to the importance of the success of applying the principles of lowland rice farming, the purpose of this study were (1) to analyze the factors that determine the capacity of farmers to manage to the farm of paddy; and (2) analyze the pattern of the relationship of each element in supporting the farmers' capacity levels.

2. Methods

The research was conducted in Tangerang Regency. The research location was determined purposively, namely in three BPPs, eight BPPs were selected in Tangerang Regency (Table 1), namely 1) BPP Kronjo; 2) BPP Tegal Kunir; and 3) BPP Sukatani. Data collection was carried out from July to October 2020.

In this study, Respondents were selected purposively with the criteria of farm families who do rice farming rice fields. The study population as many as 850 people lowland rice farmers, selected respondents as many as 150 people—mechanical determination of sample using techniques random proportional sampling based on the number of populations. Types of data collected included primary data and secondary data. Primary data was collected through interviews using questionnaires, interviews, observation and documentation study.

The collected data were analyzed using descriptive statistics and inferential statistical analysis. The parameters used in this study of the characteristics of the farmers are limited to formal education, nonformal education, experience farming, tenure farming, and the capacity of farmers, the ability to utilize the resources, ability to plan to farm, ability to identify farming opportunities, ability to overcome the problem, ability to adapt with the environment. In this study, selected activities are generally carried out paddy farmers, among others: 1) perform rotation or rotation crop varieties; 2) perform intermittent irrigation (intermittent); 3) a balanced fertilizer that is inorganic and use of organic fertilizers and biofertilizers; 4) the application of PHT with emphasis on biological control with botanical pesticide and conserve natural enemies (parasitoids, predators and pathogens).

Table 1. Several members and farmer groups based on group class in Tangerang Regency in 2019.

No.	WKBPP	Total members	Class group				Total group
			P	L	M	U	
1	Kp Melayu	1.857	22	39			61
2	Sepatan	8.701	48	101	1		150
3	Tg Kunir	6.261	75	30			105

4	Sukatani	5.913	52	59		111
5	Kaliasin	12.260	59	97		156
6	Kronjo	11.213	98	56	2	156
7	Carenang	9.093	8	114	4	126
8	Caringin	6.064	56	105		161
Total in district		61362	418	601	7	1026

Source: The Tangerang Regency Agriculture and Food Security Service 2019

3. Analysis of Data

Indicators and parameters were analyzed using a scoring system assessment. Scoring follows the Likert scale with a scale of 1 to 3. Scores obtained from respondents further specified interval scale ranges or categories of high, medium, low. To determine the level of farmer capacity and characteristics, using the formula [14], namely:

$$\text{Hose (Range)} = \frac{(\text{maximum value} - \text{minimum value})}{(\text{number of answer categories})}$$

The following formula is used to determine the influence factors of each variable on the level of capacity of rice farmers,

$$Y = a + bX_1 + bX_2 + bX_3 + bX_4 + bX_5 + bX_6 + e$$

Where: Y = Farmer of Capacity; a = Constant; X₁: Age of farmer; X₂: The farmer's formal education level; X₃: Farmers' nonformal education; X₄: Farming experience; X₅: Area of land tenure; X₆: extension activities; b: Regression Coefficient; e = Error.

4. Results and discussion

4.1. Characteristics of lowland rice Farmers

Analysis of the characteristics of lowland rice farmers in Tangerang Regency shown in Table 2 shows that the level of formal education, nonformal education, land ownership area and farming experience is relatively the same, namely in the medium category. Age (age) of farmers is in the Adult Age group with an average age of 50.58 years. The young age group (20-40) years old still colour rice farming activities. This condition shows that agricultural activities are still in great demand by young age groups. The high interest of young farmers in running lowland rice farming indicates that agriculture is not just about sustaining life but able to be a source of community income.

Judging from the formal education level, 87.33 percent were in the moderate category between 6-12 years of age while those with low education (less than 6) were 12.66 percent. Similarly, the nonformal education amounting to 50.67 percent of farmers carry out training activities between 4-10 times a year. The level of education both formal and nonformal farmer indicates the power of innovation adoption are run by farmers.

The level of education experienced by respondents has an average of 7.86 years, meaning that the level of formal education that has been attended by farmers has graduated from Elementary School (SD) to Junior High School (SMP) so that farmers are quite literate. However, the research results by [7] state that in general, formal education has not been able to digest the technology conveyed through printed media independently. Meanwhile, the level of nonformal education obtained through training or extension activities is 2.78 times a year, meaning that farmers generally have a reasonably good technical ability to manage lowland rice farming. This was also revealed by [5] near related to the high level of nonformal education.

Table 2. Characteristics of lowland rice farmers.

Variable	Category	Total (Percent)
1) Age Average 50,58 year.	1) Young (20– 40)	20,33
	2) Adult (41 – 55)	64,00
	3) Old (> 55)	15,67
	Total	100,00
2) Formal educations Average, 86 year.	1) low (<6)	12,66
	2) Moderate (6- 12)	87,33
	3) Hight (> 12)	1,00
	Total	100,00
3) Nonformal educations Average 2,78 times/year.	1) never	32,67
	2) Rarely (4- 10)	50,67
	3) often (> 10)	16,67
	Total	100,00
4) Ownership of Farm Land Average 0.23 Ha	1) Low (<1)	54,67
	2) Moderate (1- 2)	32,00
	3) Hight (> 2)	13,33
	Total	100,00
5) Farming experience Average 19,56 year	1) Low (<10)	28,66
	2) Moderate (10-20)	36,00
	3) Hight (>20)	35,33
	Total	100,0

The results showed that almost half (32.67%) of the respondents answered that they rarely participate in extension activities, even if there are farmers who have never attended nonformal education in the form of extension activities or training specifically in agriculture. The low level of nonformal education is caused by the lack of intensity of extension activities. Both carried out by the extension agents themselves and other parties carrying out technology promotion. This condition is also the same as the results [15] research that farmers in participating in organic rice counselling (nonformal education) are only 0-2 times. In line with the results of research by [9, 10] shows that low nonformal education is correlated with a low level of extension services even tends to be the same training participants. Such as group leaders or members who are successful but are not followed or followed up technically so that it does not benefit participants/farmers.

Rice fields are used as farming land farmers generally are in the form of sakap with the result. Still, some farmers are farming landholding of own property, farming landholding 54.67 percent of respondents are currently on a narrow category tenure of less than 1 ha. The average area of land cultivated to paddy farmers is 0.23 hectares, including a narrow land category (Table 2). Farmers Tangerang district does have a narrow field. The condition is caused due to high land conversion to non-agricultural (residential, industrial and Tourism) acquisition of farmland by farmers in some areas experiencing the transfer of ownership and is only used as farmland for the land has not been used by its owner.

The low level of land ownership also results in the insufficient application of farming technology. The application of farming technology (technological innovation) is mostly driven by high land tenure as a result of research [5] states that land ownership is positively correlated with the level of an innovation application, so that farm productivity is higher. Ownership of land controlled by someone shows the level of one's social structure in the community. According to [16,17], states that ownership of land (resources) shows the source of one's power in rural communities.

The success of farmers in managing lowland rice farming cannot be separated from farmers' experience in cultivating this commodity. It is known that the experience of respondent farmers in the study area varies, the farming experience of respondents is 36.00 percent in the medium category (10-

20 years) with an average experience of 19.56 years (Table 2). This shows that farmers' average experience in the research location is good enough in conducting lowland rice cultivation activities.

The farmers' experience can be a measure of farmers' knowledge or lessons in running lowland rice farming, especially in making decisions about implementing innovations such as controlling pests and plant pests, applying superior seeds, or using balanced fertilizers, and can be used as a guide in achieving their farming success.

4.2. Extension support in increasing the capacity of lowland rice farmers

Extension role is the main tasks and functions of counseling in analyzing, providing stimulation, facilitating and motivating farmers. Extension activities in increasing the capacity of lowland rice farmers are included in the medium category (60.17%). Extension activities in lowland rice farmer capacity building include the method, the material intensity and extension capabilities, which contribute to the capacity building of farmers. In general, extension capability in performing their duties well enough, but due to lack of agricultural extension personnel field (PPL) resulting in a lack of extension services, farmers will need innovation to address both technical and social farming.

The goal of the outreach activities, as expressed in the Law System of Agriculture Fisheries and Forestry Extension No. 6 in 2006 is to increase knowledge and skills of entrepreneurs and protagonists, so has the readiness to enter the wider area. Figure 1 explained that the method, the material extension and extension capabilities respectively by 64.00 percent, and 76.66 percent were in the moderate category. Simultaneously, the intensity of the new extension reaches 50.67 percent of medium in the category, the need to increase both the capacity and the amount of extension of existing personnel.

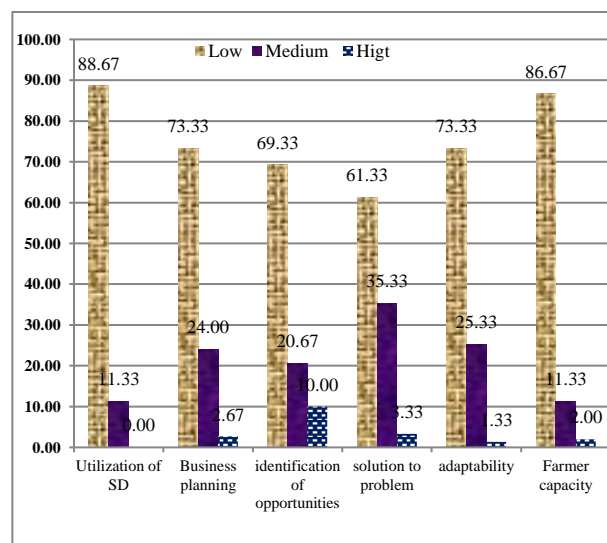
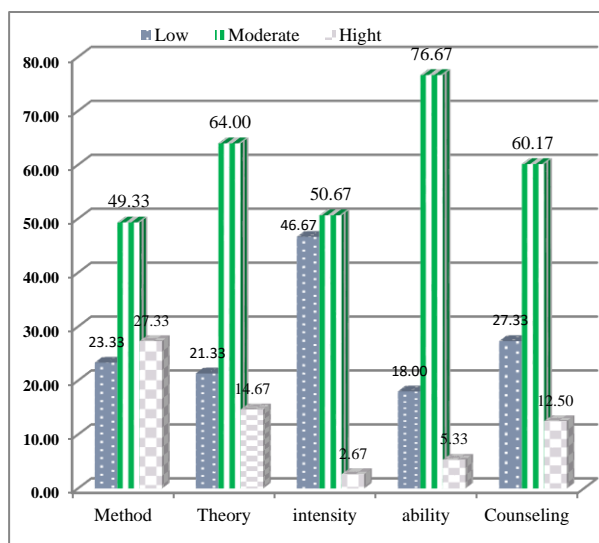


Figure 1. The education function in supporting the capacity of lowland rice farmer

Figure 2. Level capacity lowland rice Farmers

4.3. Paddy Farmers' Capacity Level

The power capacity of farmers is a picture or personal capacity owned by farmers in supporting farmers' activities. The ability needs to be continuously improved by the time, and it is by the philosophy of the education continuum that starts from the idea, willing and able. The capacity of farmers studied includes; 1) The Ability to utilize resources; 2) the Ability to Busines plan farming; 3) the ability to identify farming opportunities; 4) the ability to address the issue of farming, and 5) the ability of environmental adaptation (Figure 2).

Five indicators of a lowland rice farmer's capacity in Tangerang district entirely within the category of being, as Figure 2, Indicators capacity have a higher category of indicators coping skills and the ability to identify business opportunities other indicators are in the moderate category. In general, the

capacity of a lowland rice farmer in Tangerang Regency that is in the category of being the 81.3 percent (Figure 2).

4.4. Factors Affecting Farmers capacity of paddy in running the farm

The estimation model of factors that affect farmers' lowland rice in running the farm using Regression Model Ordinary Least Squares (OLS). Regression analysis obtained the following predictive model:

$$Y = 2.452 + 0.047X_1 + 0.160X_2 - 0.227X_3 - 0.050X_4 + 0.037 X_5 + 0.031 X_6$$

Before the models used testing, data used in statistical and econometric criteria. Econometric testing includes the assumption of normality, multicollinearity and heteroskedastic. While statistical testing includes statistical tests include T-test and F-test:

4.4.1. Assumption testing

4.4.1.1. *Normality assumption test.* The normality test is carried out to detect whether the data used is normally distributed or not. The normality test results show that the data can be said to meet the requirements for multiple linear regression analysis.

4.4.1.2. *Multicollinearity assumption test.* Collinearity test is conducted to determine the collinearity among the independent variables. From the calculation, it is known that there is no multicollinearity in the multiple regression line model.

4.4.1.3. *Heteroscedacity assumption test.* The analysis results showed that the data were homoscedasticity or heteroscedasticity did not occur and met the regression analysis requirements.

4.4.2. *Results of estimated factors affecting lowland rice farmers in managing rice farming.* The results of the F test show that simultaneously the variables of age (X_1), level of formal education (X_2), nonformal education (X_3), farming experience (X_4), the area of land tenure (X_5) and, participation in extension activities (X_6), have a significant effect. On the level of farmer capacity in running rice farming (Y).

The value of $r = 0.290$ indicates a very strong relationship. Meanwhile, the value of the coefficient of determination was 60.3%, which means the capacity of farmers in carrying lowland rice farming of 60.3% can be explained by the performance variables of age (X_1), the level of formal education (X_2), Nonformal education (X_3), the experience of farming (X_4), land tenure area (X_5), and participation in extension activities (X_6). In comparison, the remaining 39.7% was influenced by other factors not examined. These results indicate that the model is quite good.

While the partial test results showed variable levels of education followed by farmers, both formal and nonformal factors influence farmers' capacity to carry out paddy farming (Table 3).

Table 3. Regression test results factors that are the capacity of farmers in managing lowland rice farming

Variabel	Coefficient	Standard Error	Significant
Constant	2.452	0,641	0,049
Age	0,047	0,066	0,476
Farmers Education Level	0,160	0,095	0,094*
Non formal education	-0.227	0,075	0,003**
Farming Experience	-0,050	0,066	0,448
Control of farm land	0,037	0,044	0,399
Extension Activities	0,031	0,189	0,868

***) Sign at $\alpha < 0,05$, *) Sign at $\alpha < 0,1$

The regression analysis in Table 3 above shows that farmers' age, farmers' level of formal education, tenure and extension activities positively affect the level of farmers' capacity in managing the lowland rice farm. This shows that the better farmers' education level, the wider the mastery of

farming and extension activities, the farmers tended to have a high capacity. While nonformal education and experience of farming can negatively affect the level of farmers' ability.

The level of education both formal and nonformal significant effect on the level of capacity in managing the Farmers' lowland rice farming, [9, 5]; said that farmers with higher education are relatively faster in adopting an innovation. Most of the research location lowland rice farmers have a relatively good education level, namely junior high school and several people educated to high school level and even Bachelor.

The level of education-related knowledge and the ability of farmers in analyzing the information received before they apply it into paddy fields. Some research also suggests that the education level influence the farmers' decision to adopt an innovation [18; 19; 20; 21]

The experience of farmers in carrying out farming of paddy correlated negatively on the capacity level farmers. This is possible because, it experienced a change in both the techniques and ways of cultcultivating paddy fields, the development of farming technology lowland rice can only be applied if the farmer has good knowledge and qualified as seed selection fertilization, and in an organic and pest control (OPT).

Most farmers in the location has not yet fully using certified seeds, and low use of inorganic fertilizers for reasons other than price is relatively higher too rare in the market, as well as pest control generally more farmers look at the effect produced when the pesticide was applied and tended to ignore the environmental sustainability.

Level tenure positive effect on the capacity but not significantly, the majority of wetland that is used as a farm instead of property rights, but through a system of revenue sharing, in which when the owner of wetland uses the land for other activities then the farmers will easily relinquish control of the land.

Higher than function land occurred in Tangerang Regency [22] resulting in increasingly smaller mastery paddy fields owned by farmers of paddy, for it needs the intervention of the government towards governance paddy fields either through a policy of zoning (Industrial zone, residential and agricultural) and given sanctions if the fields are transformed to enable land to non-agricultural, so the green area as a place of farming of paddy farmers can sustainably [23].

Extension activities have a positive effect on the level of farmer capacity. Extension activities as part of nonformal education activities can increase farmers' knowledge, change attitudes, and skills in running rice farming. Several studies also show that extension activities have a significant effect on farmer behaviour in adopting new technology [24; 17; 5]

The instructor's role is to implement the primary duties and functions of the extension agent in analyzing, stimulating, facilitating and motivating farmers. The role of extension in enhancing the capacity of respondents to manage rice farming rice fields was included in the classification. This condition shows that extension activities in increasing the capacity of lowland rice farmers in Tangerang Regency are still not optimal, and it would be excellent.

5. Conclusion

The farmer capacity level needs serious attention, especially in resource utilization capabilities and the ability to plan business considering the limited amount of land available. Farmers growing lowland rice is not marginalized by changes in the environment are continually changing. Simultaneously lowland rice farmer capacity is determined by age, formal education, tenure and extension activities. Simultaneously, partially lowland rice farmer capacity level is determined by farmer education, both formal and nonformal. Counselling activities primarily related to the extension materials need to be tailored to the needs of more applicable farmers and extension capability, which is still in the moderate category that received special attention from stakeholders through technical training as well as an increase in service education if they were supported by routine extension intensity accompanied by the increased capacity of extension workers and equipped with the availability of infrastructure and supporting facilities for the implementation of the extension. Because, to increase the capacity of lowland rice farmers, it is necessary to support extension activities.

6. Recommendation

For local governments to establish land use is mainly agricultural land that sustainable rice paddy farming through spatial planning policy. For the extension, mostly freelance Power status (THL) will be improved gradually and supported with education and training programs for field extension.

Acknowledgment

Our thanks to the PIU of food security (Food security) University of Sultan Ageng Tirtayasa which has provided funding to carry out this research through Internal Research scheme.

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