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Effectiveness of Farmers Learning on Adoption of Innovation in Organic Rice Farming of East Java

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Abstract - Organic rice farming system is one form of sustainable agriculture. The objective of this study was to: analyze the characteristics of organic rice farmers, analyze the level of adoption of organic rice farming innovations and analyze the effectiveness of farmers' learning processes towards the adoption of organic rice farming innovations. The study was conducted in September 2017 until February 2018 in Bondowoso and Banyuwangi Regencies, East Java Province. The study sample was 224 people. The analysis technique used was descriptive analysis and SEM. The results of the study showed that individual characteristics of organic rice farmers include; age (middle adult), formal education (elementary), non-formal education (low), farming experience (medium), land area (narrow), cosmopolitan level (very low) and motivation level (high). Individual characteristics of farmers had a significant effect on the level of adoption of innovations in organic rice farming, particularly age, non-formal education and farming experience. The variety of learning methods of farmers was in the medium category and the learning frequency of farmers was in a very low category. The level of adoption of organic rice farming innovations was in the medium category. The learning process had effective support for the application of organic rice farming.

Keywords - Learning Process, Adoption of Innovation, Organic Rice.

I. INTRODUCTION

The adoption of innovation in agriculture has been intensified by the Government of Indonesia to empower farmers. This is also an innovation in consumer demand for healthy food. Shifting patterns of food consumption to rice due to increasing levels of income of the Indonesian people. One of the government agendas in Nawacita is to realize economic independence by moving the strategic sector of the domestic economy, with a sub-agenda for increasing food sovereignty. The goal is "1,000 organic farming villages" which are in accordance with the "go organic" program launched by the Ministry of Agriculture in 2010. The development of 1,000 organic farming villages opens a good opportunity for the Ministry of Agriculture's commitment to improve critical land and grow independent farmers. For its broad application, it is deemed necessary to develop 600 organic farming villages in several regencies/cities where organic farming has developed and/or is specifically developed based on local wisdom (Directorate General of Food Crops 2015).

Organic rice farming innovations were introduced to farmers through the development of production and distribution of organic fertilizers, allocation of funds for fostering and subsidizing organic fertilizers, allocation of funds for procurement of facilities and development of needed supporting facilities, improvisation of manufacturing systems for organic fertilizers and training programs on the benefits of use organic fertilizer through demonstration plots and farmer groups. The activity aims to innovate organic rice farming can be adopted by farmers. According to Rogers (2003), adoption is a mental process in making decisions to accept or reject new ideas.

Adoption is also defined as the mental process of someone to hear, knowing innovation until finally adopting

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it. The decision to adopt an innovation occurs in the individual. This is also supported by Indraningsih (2011) and Maryani et al. (2014) which states that adoption in relation to agricultural extension is a process that occurs on the part of farmers since something new is introduced until the person applies the new thing. While Mardikanto (2009) states that adoption in agricultural extension processes can essentially be interpreted as a process of good behavior change in the form of knowledge, attitudes, and skills in a person after receiving the innovation delivered by the instructor to the target community.

The facts in the field show that the innovation of the organic rice farming system that has been introduced through various extension services has not been fully implemented by all farmers. Every stage of the process of disseminating innovation to farmers often seems not to be as expected. The development of adoption of organic rice farming is still slow (Widiarta and Adiwibowo 2011; Jumna 2015). This is also reinforced by the study conducted by Zulvera et.al (2014) which states that the rate of adoption of organic vegetable farming is in the low category.

Prior to adoption process, psychologically farmers try to understand something based on their desires and needs to know the meaning of the technology they receive. Farmers still take into account other risks that arise as well as prerequisites that should be met. Farmers' understanding of innovation is formed through the process of selecting or filtering various informations received by farmers. Farmers have the capacity to absorb what is happening around them and analyze and interpret as a result of both observation and experience, which in turn can be used as a basis for consideration in decision making.

Based on the background mentioned above, this study was aimed to analyze the characteristics of organic rice farmers, analyze the level of adoption of innovations in organic rice farming and analyze the effectiveness of farmers' learning processes on the adoption of innovations in organic rice farming.

II. Research Method

A. Time and Place

The study was conducted in Banyuwangi and Bondowoso Regencies, East Java Province. Location selection was done purposively with the consideration that (1) the two regions were certified agricultural production centers for organic rice in East Java, (2) there was a program to develop organic rice farming. The research was conducted from September 2017 to February 2018.

B. Research Design

The study used a quantitative approach with a survey method design. This study was equipped with information based on qualitative data to support and sharpen quantitative analysis. The population and sample in this study were wetland rice farmers in observed village who had received an organic rice farming program. Determination of the sample in this study was carried out using the Slovin formula for organic farmer populations in the 2 regencies so that sample size obtained were 234 samples.

Primary data were collected directly from organic farmers through interview techniques using questionnaire, field observations, and in-depth interviews with organic farmers. Secondary data were obtained from data that were already available in agencies related to the focus of the study.

The variables in this study include the characteristics of farmers (X1) consisting of age, formal education, non-formal education, farming experience, land area, cosmopolitan, and motivation. Furthermore, farmer learning (X2) includes the learning method and the learning frequency. The further variables are the adoption rate (Y1) including the intensity of adoption and the level of adaptation to innovation.

C. Data Processing and Analysis

Data processing and analysis were performed using descriptive statistics and inferential statistics. For statistical testing, the results of measurements of variables using nominal and ordinal scales are transformed first in the form of interval scale or ratio scale (Sumardjo 1999).

Descriptive statistics are used to describe the distribution of respondents in each variable including respondents' characteristics, farmers' learning processes, the level of adoption of innovations in organic rice farming. Data processing for descriptive statistics were performed using the SPSS program.

Inferential statistics were used to examine the extent to which variables are interconnected and influence each other, and to examine the relationship model between variables (Kusnendi 2008). The inferential statistical analysis used in this study was Structural Equation Models (SEM) with LISREL 9.3. The SEM framework model built was as in Figure 1.

III. RESUTS AND DISCUSSION

A. Internal Characteristics of Farmers

The analysis of the characteristics of organic rice farmers showed that the age of farmers in general is in middle age (30-60 years), which means farmers are in a productive condition at work and looking for opportunities to improve their welfare. The age group generally still has the level of willingness, enthusiasm and ability to run a high business. The productive age of respondents has considerable potential in the sustainability of farming and the development of competencies in carrying out their farming. The age of organic rice farmers is in accordance with Roger and Shoemaker (1971) who states that a person's characteristics, particularly age, will also influence perceptions which are then followed by actions and behavior. This means that with increasing age and farming experience, perceptions of technology and its application are expected to be better.

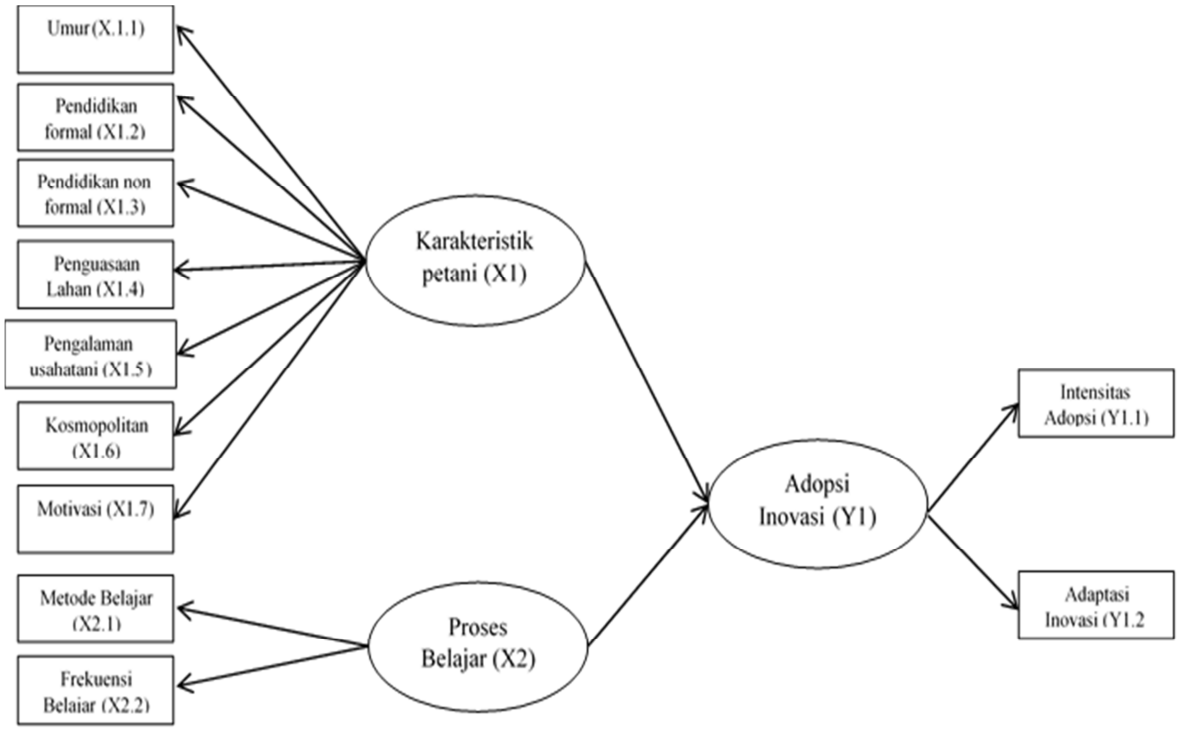

Figure 1. SEM Framework of Learning Process Effectiveness towards Innovation Adoption

Majority of the formal education level of farmers (65.38%) was Elementary Schools. This condition allows the lack of maturity of respondents' skills and knowledge, especially in terms of knowledge gained through formal education. Referring to the opinion of Soekartawi (2003), Roger and Shoemaker (1971) state that a challenge for agricultural extension in developing learning is interesting for farmers with relatively low levels of education so that they can implement innovation more quickly. The level of non-formal education in the form of training for farmers is still low. The lack of training time is due to the lack of opportunities available from government education and training institutions in providing and developing the capabilities of organic rice farmers. This is in accordance with the results of research obtained by Fatchiya (2010); Tahitu M.E (2015); Herawati et al. (2017) that non-formal education is classified as low in frequency following training or extension activities. This is because the implementation of counseling is not routinely conducted. In addition, there is a tendency for the same training participants in each training such as group leaders, administrators or successful members not to be followed up with so that they do not bring benefits.

Farming experience is measured based on how long the farmer runs his farm. Most farmers have run their farming for quite a long time. This condition shows that most farmers do farming because they are inherited, which means they plant rice from generation to generation. The long-term experience of farming tends to influence the decisions taken by farmers in the next farming activity. Have Lock (1971)

states that past experience possessed by someone will influence the tendency to feel need and be ready to accept new knowledge. This is also in accordance with the opinion of Rogers (2003) that experience in farming will affect decision making.

Table 1 Distribution of organic rice farmers according to individual characteristics of organic farmers in two research locations of East Java

Characteristis of Individuals	Category	Bondowoso N=167		Banyuwangi N=67		Total N=234		T-test
		Number	%	Number	%	Number	%	
Age (year) Average= 51	Early Adult (18-30)	3	1.80	2	2.99	5	2.14	0.01**
	Middle Adult (31-60)	130	77.84	61	91.04	191	81.62	
	Elderly (>60)	34	20.36	4	5.97	38	16.24	
Formal Education (year) Average = 8	Elementary School (6)	118	70.66	35	52.24	153	65.38	0.01**
	Junior High School (9)	31	18.56	16	23.88	47	20.08	
	Senior High School (12)	15	8.98	16	23.88	31	13.26	
	College (16)	3	1.80	0	0.00	3	1.28	
Non-Formal Education (score) Average= 40.74	Very Low(0)	2	1.20	8	11.94	10	4.27	0.00**
	Low (1-9)	160	95.81	14	20.90	174	74.36	
	Medium 10-19)	0	0.00	33	49.25	33	14.10	
	High (>19)	5	2.99	12	17.91	17	7.27	
Farming Experience (year) Average = 22	Short (1-16)	40	23.95	24	35.82	64	27.35	0.23
	Medium (16.1-31)	101	60.48	35	52.24	136	58.12	
	Long (31.1-45)	26	15.57	8	11.94	34	14.53	
Broad Lahan (hectar) Average= 0.62	Narrow (0.05-1.50)	162	97.01	56	83.58	218	93.16	0.00**
	Medium (1.51-3.00)	5	2.99	10	14.93	15	6.41	
	Broad (3.01-4.50)	0	0.00	1	1.49	1	0.43	
Cosmopolitan Level (score) Average= 13.62	Very Low (<25)	128	76.65	62	92.54	190	81.30	0.69
	Low (25-50)	17	10.18	3	4.48	21	8.97	
	Medium (51-75)	18	10.78	1	1.49	19	8.12	
	High (>75)	4	2.40	1	1.49	5	2.11	
Motivation (score) Average= 68.23	Very Low (<25)	3	1.80	3	4.48	6	2.56	0.00**
	Low (25-50)	5	2.99	49	73.13	54	23.08	
	Medium (51-75)	74	44.31	8	11.94	82	35.04	
	High (>75)	85	50.90	7	10.45	92	39.32	

The area of land tenure is a depiction of the area of rice fields managed by farmers, both their own and cultivated lands or profit sharing. Rice fields cultivated by farmers generally are property rights obtained from the inheritance of parents. The average land area cultivated by farmers for wetland rice farming is 0.58 hectares or is categorized as narrow land. This shows that farming in a narrow area is less profitable for farmers and their families to live properly. The area of land owned by a person influences himself as a farmer in making decisions to implement or reject new innovations. According to Rogers (1971), land ownership is related to someone's innovation. Farmers who have large land tend to be more responsive to innovation. This is in accordance with the opinion of Hernanto (1993) which states that narrow land is a considerable weakness for farmers in managing their farming.

The area of land tenure is a depiction of the area of paddy fields managed by farmers, both their own and cultivated land or profit sharing. Rice fields cultivated by farmers generally are property rights obtained from the inheritance of parents. The average land area cultivated by farmers for wetland rice farming is 0.58 hectares or is categorized as narrow land. This shows that farming in a narrow area is less profitable for farmers and their families to live properly. The area of land owned by a person influences himself as a farmer in making decisions to implement or reject new innovations. According to Rogers (1971), land ownership is related to someone's innovation. Farmers who have large land tend to be more responsive to innovation. This is in accordance with the opinion of Hernanto (1993) which states that narrow land is a considerable weakness for farmers in managing their farming.

The motivation of farmers in farming is classified as medium to high. The high motivation of farmers is shown by the farmers' belief that the organic rice farming system

can be done easily, increasing income and being profitable. Field findings indicate that the drivers of successive farming of rice farming are to increase production, increase income, reduce production costs, maintain health and preserve the environment. Only a few farmers stated that they tried to maintain health and environmental sustainability as the main goal of farming. The last two motives are elements that should be embedded in farmers if they want to start organic rice farming. This is in accordance with the research conducted by Padel (2011) which revealed how important the motivation of farmers is in the diffusion of innovative organic farming.

B. Learning Process of Farmers

The learning process of farmers is an illustration of learning activities carried out by farmers as measured by indicators of various learning methods and frequency of learning. Farmers obtain information and knowledge through learning in bulk, in groups and independently. Various sources of information and knowledge also include fellow farmers, extension agents, the internet, private institutions, researchers, mass media and electronic media. The results of the study show that the various learning methods are in the medium category. The results of the T-test showed that there were no differences in the variety of learning methods between Bondowoso and Banyuwangi Regencies (Table 2). Field findings indicate that the farmers' learning method most often done is a method in groups. Farmers obtain information and knowledge about organic rice farming through field schools.

The frequency of learning of farmers in obtaining information and knowledge about agricultural organic rice is in a low category (Table 2). The source of learning often referred to by farmers is information from extension agents and fellow farmers. While other learning resources such as the internet, researchers, private institutions, print and electronic media are rarely done. Farmers learn from extension agents through counseling in farmer groups and field schools. Field schools are also used to share experiences between farmers. Advanced farmers are usually used as a model for other farmers. This is consistent with the research conducted by Sears et al. (1985) that the imitation learning mechanism means that someone behaves by imitating the attitudes and behavior of the role model. Imitation can occur without external reinforcement only through ordinary observation of the model.

The results of the T-test showed that there were significant differences regarding the frequency of learning of farmers between Bondowoso and Banyuwangi Regencies. This difference occurs because organic farmers in Banyuwangi Regency are more open in accessing information and knowledge of learning resources compared to Bondowoso Regency farmers. Organic farmers in Banyuwangi Regency are more often associated with researchers and private institutions such as organic certification institutions or marketing institutions. This is in accordance with Mudjiman (2007) who revealed that the frequency of learning is closely related to learning resources, learning places, study time and how to learn.

Table 2 Distribution of organic rice farmers according to the level of learning process of organic farmers in two research locations of East Java

Learning Process	Category	Bondowoso N=167		Banyuwangi N=67		Total N=234		T-test
		Number	%	Number	%	Number	%	
Learning Method (Score)	Very Low (<25)	3	1.80	4	5.97	7	2.99	0.55
	Low (26-50)	37	22.16	11	16.42	48	20.51	
	Medium (51-75)	110	65.87	42	62.69	152	64.96	
	High (>75)	17	10.18	10	14.93	27	11.54	
Learning Frequency (Score)	Very Low (<25)	120	71.86	19	28.36	139	59.40	0.00**
	Low (26-50)	44	26.35	46	68.66	90	38.46	
	Medium (51-75)	3	1.80	2	2.29	5	2.14	
	High (>75)	0	0.00	0	0.00	0	0.00	

C. Level of Adoption of Organic Rice Farming

The level of adoption of organic rice farming systems is reflected by indicators of the intensity of adoption, and the degree of innovation adaptation to organic rice farming. The intensity of adoption of organic rice farming systems is measured based on the level of application of organic rice farming technology systems, which consist of straw straw to land, alternation of rice varieties, regular water supply, utilization of livestock waste into organic fertilizer, biological pest control, and manufacture of vegetable pesticides. Distribution of samples based on the level of adoption of organic vegetable farming systems is presented in Table 3.

The results showed that the level of adoption of organic rice farming systems was in the medium category. This can be seen from the average intensity of adoption score, and the level of adaptation. The adoption intensity which is in the medium category is characterized by the use of production facilities which ignore chemical elements, such as chemical fertilizers, exterminators and chemical pest controllers, and the production process carried out by farmers in accordance with the organic farming rules set by the Organic Certification Agency. The results of the T test indicate a difference between the intensity of farmer adoption in Bondowoso and Banyuwangi Districts. The percentage of the intensity of farmer adoption in Banyuwangi Regency tends to be higher than that of farmers in Bondowoso Regency. The tendency of higher intensity of adoption can be seen in the application of elements that support organic rice farming such as straw straw to the land, replacement of rice varieties, regular water supply, utilization of livestock waste into organic fertilizer, biological pest control, and the manufacture of vegetable pesticides.

Table 3 Distribution of organic rice farmers according to the level of adoption of organic rice farming in two research locations of East Java

Level of Adoption	Category	Bondowoso N=167		Banyuwangi N=67		Total N=234		T-test
		Number	%	Number	%	Number	%	
Adoption Intensity (Score) Average= 65.53	Very Low (<25)	0	0.00	0	0.00	0	0.00	0.02*
	Low(26-50)	1	0.60	7	10.45	8	3.42	
	Medium (51-75)	131	78.44	29	43.28	160	68.38	
	High (>75)	35	20.96	31	46.27	66	28.21	
Adoption Intensity (Score) Average= 66.75	Very Low (<25)	0	0.00	0	0.00	0	0.00	0.4
	Low (26-50)	50	29.94	8	11.94	58	24.79	
	Medium (51-75)	86	51.50	39	58.21	125	53.42	
	High (>75)	31	18.56	20	29.85	51	21.79	

The level of adaptation to the technology of organic farming systems was in the medium category, which means that farmers often try innovation on a small scale to test the level of suitability of innovation with the environmental conditions in which farmers are located. In addition, farmers also use local materials to support the implementation of organic rice farming systems such as the utilization of livestock waste for organic fertilizer, the manufacture of local microorganisms (MOL) from local materials and the utilization of livestock urine for liquid organic fertilizer. Sustainable agricultural practices lead farmers to have a lot of knowledge and should be adapted according to different ecological situations within the farmer's area (Leeuwis 2009).

D. Effectiveness of the Learning Program on the Adoption of Organic Rice Farming

According to the results of Goodness of Fit (GoF) test, the size of the absolute fit of the Root Means Square Error Of Approximation (RMSEA), the estimation result obtained was 0.0069. Based on the criteria/requirements, a model is said to be good if the amount of RMSEA value obtained is <0.80, thus the model obtained can be said to be good as presented in Figure 2 (Good Fit). The incremental fit measure value for The Ratio of X2 / df is 2.14 so that the model in Figure 9 can be said to be Good Fit because based on the criteria of the ratio value <3, this result was obtained from the chi-square value divided by the degree of freedom

(df). The results of the incremental fit test conducted on the Incremental Fit Index (IFI) show an estimated value of 0.90, and based on criteria/requirements, a model is said to be good if the IFI value obtained is >0.90 so that the model Figure 9 is Good Fit, the further data can be seen in Table 4.

Table 4. Results of the Goodness of Fit (GoF) test

No	GoF Size	Cut of Value	Result	GoF Level
1	Chi-Square	Small value	23.55	Good Fit
2	The Ratio of X^2/df	≤ 3.00	2.14	Good Fit
3	RMSEA	≤ 0.08	0.069	Good Fit
4	NFI	≥ 0.90	0.95	Good Fit
5	NNFI	≥ 0.90	0.93	Good Fit
6	CFI	≥ 0.90	0.94	Good Fit
7	IFI	≥ 0.90	0.90	Good Fit
8	RFI	≥ 0.90	0.90	Good Fit
9	PNFI	0.60 – 0.90	0.63	Good Fit
10	PGFI	0.50 – 1.00	0.60	Good Fit
11	P-Value	< 0.05	0.01	Goof Fit

Based on the results of SEM analysis (Figure 2), the adoption of innovation is influenced significantly by the characteristics of farmers and the learning process. However, the adoption of innovation is more dominantly influenced by farmer characteristics of 0.29 compared to the learning process of 0.02. The positive influence shows that the higher the characteristics of farmers and the learning process, the adoption of innovative organic rice farming is increasing.

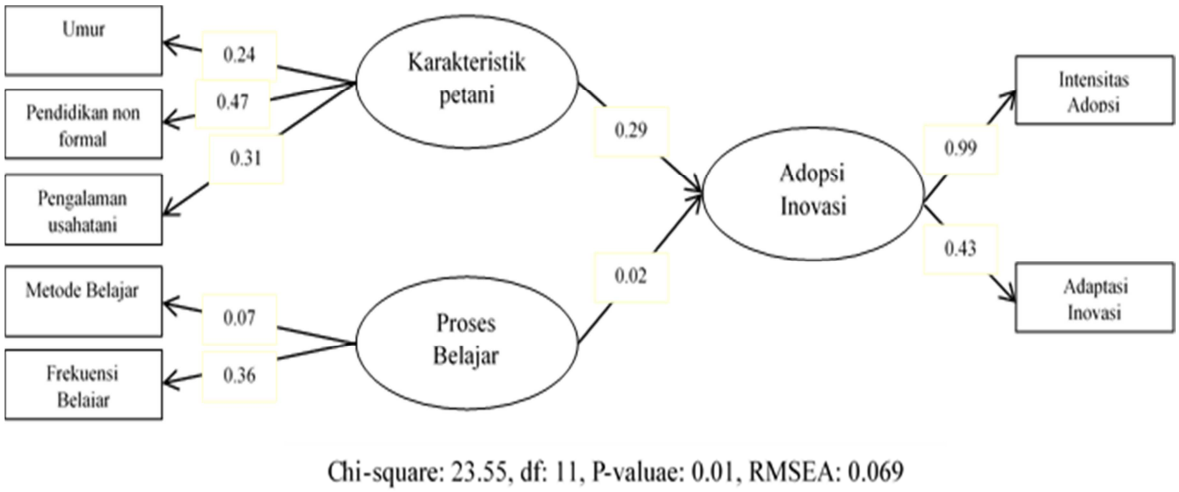

Figure 2. SEM Results of Learning Process Effectiveness on Adoption of nnovation

Farmers' characteristics indicator that have a significant influence on adoption of innovation are age (0.24), non-formal education (0.47) and farming experience (0.31). Indicators of formal education, land tenure, cosmopolitan and motivation are not included in the model because they do not have a significant influence on innovation adoption. These results indicate that the age of farmers in productive categories has a significant effect in increasing the adoption of innovative organic rice farming. Non-formal education which includes training and field schools has significantly influenced the application of organic rice farming. The results of field observations show that non-formal education

is now being felt by farmers in increasing the adoption of innovative organic rice farming. Most farmers have been running their farming for quite a long time. The long-term experience of farming tends to influence the decisions taken by farmers in the next farming activity. Have Lock (1971) states that past experience possessed by someone influences the tendency to be ready to accept new knowledge. This is also in line with the opinion of Rogers (2003) that experience in farmin will affect decision makin

The learning process of farmers is one of the factors that can increase the adoption of innovative organic rice farming. Indicators that reflect the learning process of farmers are the variety of learning methods and frequency of learning. This is because farmers in seeking information about organic rice not only rely on extension support but also independently seek information from fellow farmers and other sources of information. The research findings support a learning approach that states that behavior is determined by what the individual has learned in the past (Sears et al. 1985). Farmer learning activities both in groups and independently with various learning resources can significantly increase farmers' confidence in organic rice farming. The learning process of farmers is influenced by mental attitude in the affective domain. Basically, mental attitude is the tendency of farmers towards various information or innovations that have been received so far. This is in line with the research of Mulyadi et al. (2007) which states that farmers express their likes or dislikes, and can further influence the actions of farmers in accepting or rejecting any innovations that enter or receive. Mental attitude can determine interest to learn, give great values, appreciations and opinions for the innovations they receive.

The influence of individual characteristics and learning processes of farmers on adoption of innovations includes the intensity of adoption and the degree of innovation adaptation. The intensity of adoption indicator is more dominant, which is 0.99 compared to the level of innovation adaptation, which is 0.43. This shows that with individual characteristics and a good learning process will increase the intensity of innovation adoption. The intensity of adoption of organic rice farming systems is measured based on the level of application of organic rice farming technology systems, which consist of straw straw to land, alternation of rice varieties, intermittent water supply, utilization of livestock waste into organic fertilizer, biological pest control, and manufacture of vegetable pesticides. While the level of adaptation of innovation in organic organic farming systems is shown by how much farmers often try innovation on a small scale to test the level of suitability of innovation with the environmental conditions in which farmers are located. In addition, farmers also utilize local materials to support the implementation of organic rice farming systems such as the utilization of livestock waste for organic fertilizer, the manufacture of local microorganisms (MOL) from local materials and the utilization of livestock urine for liquid organic fertilizer. This is in line with Leeuwis (2009) who states that agricultural practices lead farmers to have a lot of knowledge and should be adapted according to different ecological situations within the farmers' area.

IV. CONCLUSION

Characteristics of individual organic rice farmers include; age (middle adult), formal education (elementary), non-formal education (low), farming experience (medium), land area (narrow), cosmopolitan level (very low) and motivation level (high). This shows that individual characteristics of farmers have not supported the application of organic rice farming.

Individual characteristics of farmers that significantly influence the level of adoption of organic rice farming innovations include age, non-formal education and farming experience. The variety of learning methods of farmers in the medium category and the frequency of learning of farmers in the category is very low. This indicates the learning method of farmers in accordance with the conditions of local farmers, yet the frequency of learning is still very lacking.

The level of adoption of innovative organic rice farming is in the medium category. This shows that the intensity of adoption and adaptation of innovation is quite good. Factors that support the increasing adoption of organic rice farming innovations are age, non-formal education, farming experience and learning processes. This confirms that the individual characteristics of farmers and the learning process have good support for the application of organic rice farming.

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