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Adoption Level of Environmentally Friendly Paddy Cultivated Innovation in Pringsewu District, Lampung Province, Indonesia

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Abstract. The condition of agricultural land if not managed properly will cause land to become more critical, for that the efforts from various parties to continuously look for the most appropriate strategy in anticipating this condition are needed. An environmentally friendly agriculture program, if implemented optimally, will increase land productivity and maintain environmental sustainability. The introduction of environmentally friendly rice cultivation innovations to the farming community has been done for years, however, it has not yet yielded significant results. That means, the process of adoption and diffusion (dissemination) of the innovations that were introduced took place slowly, even some farmers stopped adopting them. These constraints need to be known including the factors causing it. Therefore, this research aims to: (1) Analyzing the level of adoption of environmentally friendly agriculture by farmers, and (2) Analyzing the factors that influence the adoption of environmentally friendly agriculture systems. Samples were taken are 52 people from 525 population of farmers who had participated in the field school program from 2013 to 2017 in Gading Rejo subdistrict, Pringsewu Regency. The data that has been collected is then analyzed descriptively and a statistical regression test. Farmers in Gading Rejo Subdistrict, Pringsewu Regency, the ability to adopt environmentally friendly rice cultivation innovations are included in the low category because they are used to managing rice cultivation fields by utilizing chemical fertilizers and pesticides. The ability of farmers to adopt environmental innovations that are environmentally friendly is influenced by the level of cosmopolitanism, innovation skill, the support of extension services, and the ease of accessing information technology.

1. Introduction

The Green Revolution agricultural system since a few decades ago cause environmental problems on agricultural land currently [1]–[3]. This is due to the use of agricultural inputs (synthetic fertilizers, pesticide) that are continuous which causes a decrease in agricultural productivity, water pollution, damaged environment and cause ecological disturbance of paddy fields such as loss of local native biota, an imbalance between predator/pest, occurrence higher-intensity pest and disease epidemics of rice [4]–[6].



The condition of agricultural land, if not appropriately managed, will cause the land to become more critical [7]–[9]. Therefore, efforts from various parties need to search for the most appropriate strategy in anticipating that condition. The government has made several attempts through the implementation of environmentally friendly agriculture programs. One of which is by cultivating environmentally friendly paddy by implementing Integrated Pest Management Field Schools [10], Integrated Crop Management Field Schools [11], Climate Field Schools [12], System of Rice Intensification [13]–[16]. These programs, if implemented optimally, will increase land productivity and environmental sustainability.

The application of environmentally friendly paddy cultivation innovations still faces many difficulties and obstacles [17]. One reason is the difference between design and reality caused by a variety of contexts and different conditions also often cause the failure of a plan. This often happens in many development interventions, as well as innovative interventions for environmentally friendly paddy cultivation to support national food security, given the issues of data availability, technological infrastructure, work processes, cultural behavior and motivation, staff selection and expertise, deadlines, management structures and lack of budget, and mismatch of planning and implementation, lead to failure [18]–[20]. Whether or not environmentally friendly agriculture is a demand of globalization, so Indonesian farmers must prepare themselves to farm in an environmentally friendly manner. That will ensure that agricultural products from Indonesia will go in the global market, while environmentally friendly agriculture will guarantee business sustainability that will support national food security. So the study of increasing the empowerment of farmers in adopting environmentally friendly paddy innovations is very important to do.

Lampung Province as one of the centers of rice plants outside Java has a very good potential of paddy fields [21], [22]. However, some of the existing lands does not yet have high production, this can be seen from the productivity of rice in Lampung which only reaches about 5 tons/ha, has not yet reached the target of productivity of irrigated paddy land in Lampung Province, with these conditions there needs to be technology to increase rice production in Lampung province [23], [24]. Efforts to increase paddy production do not only pursue land productivity targets but must be supported by environmentally friendly agriculture [25], [26]. Government programs that support increased production and are environmentally friendly. These programs have not been able to be implemented optimally by farmers, so that the cultivation of lowland rice is still far from implementing environmentally-friendly agricultural activities. Therefore, we need support from all parties to reach the target.

The eco-friendly farming system developed in Lampung Province can be said to be an innovation for farmers in Gading Rejo District, Pringsewu District, even though farmers have traditionally been familiar with conventional paddy farming. However, farmers do not yet know the right, environmentally friendly farming system. The level of adoption of environmentally friendly lowland rice innovations at the farm level has not been implemented according to the elements of environmentally friendly lowland rice technology, the number of adopters is not optimal in implementing, even some people stop implementing it after the program stops, and various other factors. Based on the description above, the following problems can be formulated: (1) What is the level of adoption of environmentally friendly lowland rice innovations by farmers in Gading Rejo District, Pringsewu Regency? (2) What factors influence the adoption of environmentally friendly lowland rice innovations by farmers in Gading Rejo District, Pringsewu Regency?.

2. Research Methodology

This research has been carried out in Gading Rejo District, Pringsewu Regency, Lampung Province. Pringsewu Regency is a district with a large potential for paddy farming, but environmentally friendly agriculture has not been implemented optimally so that Pringsewu District, particularly Gading Rejo subdistrict, is interesting to study. The population in this study were farmers who had participated in the field school program from 2013 to 2017 in Gading Rejo District, Pringsewu Regency, amounting

to 525 farmers. From that population, 52 people were randomly sampled (10 percent of the population).

Data collection was done by taking primary data, which is collected directly from the main source and secondary data collected from the literature and related agencies. Primary data collection is done through structured interview techniques (with questionnaire aids that are guided directly by researchers or enumerators), observations or direct observations in the field, in-depth interviews with informants and focus group discussions. In addition, data recording or process documentation will be used as a logbook. The collected data is then tabulated and analyzed descriptively and statistically. According to Creswell (2002), in integrated research design, specifically quantitative dominant with qualitative less dominant, data analysis was carried out with two approaches [27], [28]. First, statistical analysis for the dominant, and Second, emic and ethical analysis for the less-dominant. The statistical analysis used includes descriptive analysis and multiple linear regression analysis.

3. Results and Discussion

3.1 Farmer Characteristics

The results of the analysis of the characteristics of paddy farmers in Gading Rejo District, Pringsewu Regency show that the average age of farmers is classified as productive age (46.6 years) with the youngest age is 34 years and the oldest age is 70 years. The level of formal education as the majority of respondents were elementary school as many as 20 people, 16 junior high school, 14 senior high school, 2 undergraduates. This shows that all respondents had received formal education even though it was still in the low category. The average experience of paddy farming is 21 years; this shows that farmers are already master in cultivating paddy. Average moderate cosmopolitan level. The characteristics of these farmers are not much different from the conditions of other farming communities in Indonesia [29], [30].

3.2 Farming Experience

The experience of farming is something that has been experienced, lived, felt, and borne by farmers in carrying out farming activities. By exerting energy, mind, or body to achieve the objectives of farming, namely obtaining income for the needs of farmers and their families. The average experience of farming is 14 years. That shows that the average experience of farmers in trying to farm is relatively long. The respondent's experience in managing his farming business ranged from 0.15 to 41 years, with an average of 21 years. Farmers are relatively long in carrying out their farming business activities, although new farmers are working in paddy, previously also farmers, and their parents were paddy rice farmers. The experience of farming is one of the essential factors for farmers to carry out farming activities. The experience of farming is seen from the long period in running rice farming.

3.3 Formal education

Formal education functions to develop abilities, improve the quality of life and human dignity both individually and socially [31], [32]. The majority of farmers' formal education in the elementary category were 20 respondents, 16 junior high school respondents, 14 senior high school graduates, 2 respondent graduates. Formal education owned by someone is very important to develop their abilities because it is a tool to improve their knowledge, attitudes, and skills. Education affects the level of thinking and reasoning in making decisions and in acting. For a knowledge farmer, a positive attitude and high skills will make him able to find solutions to his farming business problems, as well as be more adaptive to change and be able to handle problems properly and plan and evaluate them appropriately. This is the same as Kusuma dan Putri (2012) and Ruhimat (2015), showing that the higher a person's level of education will affect the way of thinking, attitudes, and behavior towards a more rational way in accepting and understanding the technological innovations he gets [33], [34].

3.4 Cosmopolitan Level

The level of farmers' cosmopolitan in Gadingrejo Subdistrict, Pringsewu District, obtained an average score of 20 or relatively low. Of the 52 respondents, 23 people (44%) were in the less cosmopolitan category, 20 people (38%) were in the medium category, the rest were in the cosmopolitan category. In this case, it appears that farmers rarely interact with relevant government agencies as a source of information. Visits outside the area are carried out if there are only family events or celebrations. This gives an illustration that the activity of accessing information: market, technology search following the socio-economic and environmental conditions of farmers and other businesses. Farmers' visits to the agriculture extension agency and the Agriculture Service almost all farmers have never done it, the farmers who have visited the agriculture extension agent or the Agriculture Service are a farmer leader. Interaction of farmers related to environmentally friendly paddy farming activities is very rarely done, farmers take the initiative to contact extension agent when it comes to assistance with fertilizer, seeds, and production tools. Only a small proportion of farmers try to find information in the mass media such as agriculture, television, radio, and internet magazines, contacting agricultural service officials, as well as researchers at universities and research centers. The low level of cosmopolite is because farmers are quite satisfied with running their farms, so farmers do not need to contact other parties.

3.5 Nature/ Character of environmentally Paddy cultivated innovation

Innovation is readily accepted and sustainable, so the character of innovation also has an important role [35]–[37]. The form of technical innovation received by rice farmers reached more than 75 percent, while socio-economic innovation amounted to 25 percent. Innovation is an object in the form of ideas, ideas, and products that are considered new in a region. Forms of technical innovation that are widely accepted by farmers such as cultivation techniques, water management techniques, fertilizer techniques, pest and disease control techniques, and harvest and post-harvest techniques, and so forth. The character of innovation as an indicator in this study refers to opinions include the level of relative profit, the level of complexity of innovation, the suitability of innovation, the level of innovation ease to try, and the level of innovation ease to observe [35]. The innovation of environmentally friendly paddy technology is seen from the ability of farmers to rotate varieties, regulate water, use balanced fertilizers (organic and inorganic fertilizers), correct dosage, and use of vegetable pesticides or natural enemies. The results showed that overall, the level of adoption of farmers' innovations towards environmentally friendly agriculture was in a low category. Viewed from the five characteristics of innovation, the level of relative profitability, and the level of ease of innovation are tried in a low category. The level of complexity of innovation, the level of suitability, and the level of ease of innovation observed results included in the medium category (easy). The aspect of relative profit shows the highest percentage in the unprofitable category. The level of complexity of innovation in the low category, meaning that it is quickly done by farmers and in accordance with the habits and natural conditions. Most respondents expect a difference in the price of environmentally friendly rice products with conventional rice products (not environmentally friendly).

3.6 Extension Services Support

Enactment of Law No. 22 of 1999 (Undang-Undang) concerning Regional Autonomy (subsequently replaced with Law No. 32 of 2004) and currently also applies Law No. 23 of 2014 concerning regional government is one of the reasons for the resumption of "backup" counseling, where the existence of extension officers who work in areas that were previously under the authority of the Extension Coordination Agency, the re-instructors do not have administrative institutions and management is left to local governments (agricultural extension), while for the implementation of forestry extension is drawn to the province and the implementation of fisheries extension is pulled to the center. However, during this uncertain situation, agricultural extension services continue to run its role well [38]. Support of extension services through the placement of Field Instructors in each village is an essential aspect of spreading various innovations to farmers. The Agriculture extension fosters several farmer

groups in one village, and Agriculture extension disseminates innovations to farmers who are members of farmer groups. The average score of support from extension institutions in Gadingrejo District, Pringsewu Regency, was 27 (moderate). Most of the respondent farmers (32 people) rated that the support of extension workers was not good enough (moderate), 7 people rated it good, and 13 respondents rated the support of extension services as poor. The support of extension agencies in supporting farmers to implement environmentally friendly paddy innovations in the form of providing solutions to farming problems, helping to access government programs, facilitating farmers to get raw materials for environmentally friendly paddy innovations.

3.7 Information & Communication Technology Support

Farmers urgently need information technology and communication support for the application of environmentally friendly paddy cultivated innovations so that management can be carried out following the right way of trying to farm paddy. Information on the adoption of innovations on environmental friendly paddy cultivated is traced through information sources, accessing information on environmentally friendly paddy cultivated innovation seen from its simplicity, conformity to the needs, and the level of farmers' trust in information sources [39]. The primary source of information technology is obtained from counseling activities, farmer groups (Gapoktan), and sourced from electronic media and mass media. According to van den Ban and Hawkins (1999) identified seven sources of information that are often used by farmers, including: (1) other farmers (fellow farmers); (2) government owned extension services; (3) private companies that sell inputs, offer credit and buy agricultural products; (4) other government agencies, marketing institutions and politicians; (5) farmer organizations and private organizations and their staff; (6) journal of farming, radio, television and other mass media; and (7) private consultants, lawyers and veterinarians [40]. West Java from 20 identified agricultural information sources there are 40 percent whose performance is relatively strong (its existence is recognized by various parties, especially farmers) namely; fellow farmers, contact / farmer figures, middlemen / dealers, radio, television, sellers of agricultural production facilities, brochures / leaflets, farmer groups and cooperative management [41]. Farmer information access to researchers, extension workers, and mass media (internet, TV, radio, farmers' magazines/newspapers) is more difficult to obtain than access to farmers, farmers group leaders, and input traders [42]. Indraningsih's research (2010) states that the main source of information is generally obtained from fellow farmers and or from the head of the farmer group or Gapoktan [43]. The average score of information and communication technology support in Gading Rejo District, Pringsewu Regency, Lampung Province, is included in the medium category. Most respondents stated that information and communication technology support was included in the category of 27 respondents (51.9%). Information sources obtained by respondent farmers in conducting their farming business activities consisted of agricultural extension workers/officers, fellow farmers, formulators, and traders. Some farmers have accessed electronic and print media even though they are still in the medium category. Agricultural technology information through printed media (such as magazines, newspapers, brochures, and books) and electronic media (radio, television, and internet) are increasingly following the development of science and technology such as Listiana et al (2019) Conventional information technology that is printed can increase the capacity of extension workers. These media are very potential for extension workers and farmers as sources of agricultural information [44]. However, their availability does not guarantee extension agents or farmers will use that information.

3.8 The Factors Influence the Adoption of Environmentally Friendly Paddy Innovations by Farmers

The results of hypothesis testing indicate that the factors influencing the capacity of farmers are farmer characteristics (X1): the level of cosmopolitanism, (X2) the character/nature of environmentally friendly paddy cultivated innovation, and (X3) support of extension services. However, the adoption rate of environmentally friendly paddy cultivated innovation is still in the low category. The positive influence of the three variables shows that the higher the level of farmers' cosmopolitanism, the character/nature of the innovation of environmentally friendly paddy cultivated and the support of

extension institutions, the more it will increase farmers in applying environmentally friendly paddy cultivated (Mutolib, Yonariza, Mahdi, & Ismono, 2017; and Yanfika, Listiana, Mutolib, & Rahmat, 2019). Also, the current level of application of environmentally friendly paddy cultivated innovations is the best solution to support sustainable agriculture. The factors that influence the adoption of environmentally friendly paddy cultivated innovations were analyzed using multiple linear regression analysis using SPSS 20, which was initially estimated or tested on the parameters of the mindset. Mathematically the equation of the regression model of the factors that influence the level of application of environmentally friendly paddy cultivated innovations are:

$$Y1 = 0.06 * X1 + 0.10 * X2 + 0.23 * X3 , R2 = 0.31 \dots\dots\dots (1)$$

This means that simultaneously, the influence of the three variables on the application of environmentally friendly paddy cultivated innovations by farmers was 0.31. This means that the diversity of data that can be explained by the model is 31 percent, while the rest is explained by other variables (which are not yet included in the model) and errors. The level of application of environmentally friendly paddy cultivated innovations by farmers is in the low category in its three constituent indicators, namely technical ability, ability to overcome problems, evaluation ability, and adaptability. The support of extension services has proven to have much influence on the ability of farmers to implement environmentally friendly paddy cultivated innovations, especially in the learning process, in adapting to climate change. Associated with the influence of the implementation of extension services, extension activities have the potential to increase farmers' knowledge or insight. They can be used as an alternative decision making for efficient farming while maintaining the environment. As Hawkins and van den Ban (1999) stated, that counseling can help a person achieve his goals from various alternative knowledge available so that he can make the right decision in his own farming business. The role of the instructor is not as a party that makes decisions for farmers, but instead provides data and information so that farmers can make the right decisions they decide on their own.

4. Conclusion

This study concludes that farmers in Gading Rejo Subdistrict, Pringsewu District, can adopt environmentally friendly paddy cultivated innovations included in the low category because most farmers are used to managing paddy fields by utilizing chemical fertilizers and pesticides. The ability of farmers to adopt environmental innovations that are environmentally friendly is influenced by the level of cosmopolitanism, nature/character of innovation, the support of extension services, and the ease of accessing information technology.

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