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Farmer Group Role On Adoption Of Local Wisdom Innovation To Support Food Self-Sufficiency

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ABSTRACT: *Innovation adoption based on local wisdom needed be developed to reach toward the goal of food self-sufficiency which is environmentally friendly. Farmer group has role in this adoption process. Therefore, this study aimed at explaining factors influencing farmer group role, describe farmer group role on innovation adoption, and describing the effect of innovation adoption on rice productivity. The technologies adopted by farmers were seeds immersion in salt liquid with floating egg, use of banana leaf and plaited bamboo basket, use of bamboo roots, jajar legowo planting system, use of organic fertilizer and organic pesticide, seedlings planting in the early age to shape a letter of L, soggy-field and interval irrigation, and good harvest management. The research done in Prambanan Sub Districts took 60 farmers using simple random sample method. The result showed that farmers in research area had realized the important of innovations due to farmer group role. It acts as a unit of study, cooperation, and production. The result of multiple regression showed that landholding size and farmer group participation had positive and significant effect on farmer group role at α=5% and 1%, respectively. It was proven that the developed farmer group role increasing adoption level could raise rice productivity from 7.47 ton/Ha to 8.65 ton/Ha. Therefore, the strategy to increase rice yields was to improve farmers' participation so farmer group performs high role towards innovation adoption which can enhance the productivity of rice.*

Keywords: *food self-sufficiency, local wisdom, innovation adoption, farmer group role, productivity*

I. INTRODUCTION

Agriculture plays a vital role as a sector providing foods in the world. In a country where most of the citizens eat rice in daily life, for example Indonesia, the rice demand will increase rapidly along with the enhancement of populations. The population explosion in the world is caused by the birthrate in developing country. It doubled in Indonesia from 119.2 million people in 1971 to 237.6 million people in 2010. Furthermore, it is predicted that an increase of 305.6 million people will happen in Indonesia in 2035 (Agus, 2015). In this case, imported rice to maintain food security is one of the most serious challenges.

Food security is the terms of food availibility, food access, and food utilization (USAID, 1995 cit. Rivera and Qamar, 2003). Food availibility is the condition when a country can provide sufficient quantity of foods for all individuals. Food access implies that the individuals in a family can consume those foods due to the income and its smooth distribution to household and also achievable price of foods. Food utilization is defined as the right biological use of food (Rivera and Qamar, 2003). Therefore, the three terms can not be separated. Food security is achieved when there are enough amounts of foods which can be obtained by all individuals in appropriate time based on their financial capacity without harm their health and environment. However, food security does not always support food self-sufficiency but food security can be obtained from food self-sufficiency.

When the country can provide food for all citizens from domestic product, it means food self-sufficiency program is successful. Minot and Pelijor (2010) added that food self-sufficiency means the consumption needs of staple foods can be obtained from own production. On the other hand, on food sufficiency program, rice is provided from domestic product and international market. Wardoyo (2015) stated that one of the obstacles to succeed food self-sufficiency in Indonesia is the behavior in consuming imported product. It will menace the farmers and if it continues, it will be predicted that farmers' prosperity will be hindered. However, Triharyanto (2015) explained that Indonesian government has solution to raise food production that is program of national rice production enhancement (NRPE) is appropriate. By this program, the government aims at increasing the rice production, moreover, raising the surplus of 10 million tons in 2014 (Kirno, 2014). There should be a comprehensive implementation of NRPE program in Indonesia, especially in Yogyakarta where any amount of people work as crops farmer.

In implementing the government program to achieve food self-sufficiency, farmers should not exploit their field. Chaiphar et al. (2013) said that one of activities using natural resources is farming activity. In addition, farmers should also contribute in sustainable environment management. Therefore, the strategy of environmentally friendly based farming is needed through the practice of organic farming.

Farmers in Prambanan use local wisdom in their organic farming. In agriculture understanding, local wisdom is a local knowledge of farmers in particular area influencing their farming behavior. They are hoped to be able to live together with nature and society. Yunita (2012) added that local wisdom is not only showed in technical things but also beliefs and social norms. Therefore, it is necessary to have cooperation and technical training in farmer group.

Based on Ministry of Agriculture Rules No. 82/Permentan/OT.140/8/2013 about guidance manual of farmer group and the association of farmer group, farmer group has role as a unit of study, unit of cooperation, and unit of production. Alihamsyah et al. (2000), Ananto et al. (2000), and Pranaji et al. (2000) cit. Wahyuni (2003) explained that in Indonesia, farmer group has role in paddy cultivation, such as determining the variety; choosing the applicative technology; supplying seeds, fertilizer, and pesticide; preparing farming aids; deciding soil management time; implementing soil management; deciding seeding and planting time; controlling weeds; and harvesting. It means farmer group performs important role on innovation adoption.

Innovation given through farmer group hopefully can raise productivity. Ofuoku and Agbamu (2012) explained that the level of adoption increased due to group cohesion so farmers are suggested to take part in farmers group. Furthermore, they also added that government should pay more attention to them by giving them credits through farmer group. It shows farmer group can be a medium between farmers and government. On the other hand, Mwaura (2014) showed the different research result on different commodities. He stated that farmers who do not belong to farmer group had better yield of sweet potato than farmer group members although they did not adopt organic fertilizer as the innovation. Nevertheless, farmer group members achieved the higher production of maize and banana. Surprisingly, there was no significant difference between group and non-group members on beans and cassava yields. It is interesting to be understood when there are factors influencing farmer group role, especially participation of farmers. It can be concluded that being a member of farmer group does not always mean being active in group. It shows that there is factor(s) inside affecting groups and non-groups' knowledge and skill. This study aimed at explaining factors influencing farmer group role, describe farmer group role on innovation adoption, and describing the effect of innovation adoption on rice productivity

II. METHODOLOGY

A. Research Method

This study is a quantitative and qualitative research. The basic method in this study is descriptive and the data collecting technique is survey. Survey is a method to find information by using a questionnaire containing questions. Meanwhile, the data is collected through observation, depth interview, and literature study.

B. Research location

This research takes place in Prambanan Sub District, Sleman Regency, Yogyakarta. It is chosen purposively due to the large area of paddy field. Prambanan are 7,821.126 hectares in width and almost half of the area, 3,204.74 is used as paddy field. From 71,432 people living there, 37,309 people are farmers. In addition, there are 182 farmer groups of crops and horticultures which are united to form 10 associations of farmer groups in that sub district. Furthermore, 10 of those farmer groups are high-performance farmer groups which have won several competitions.

C. Sampling technique

Prambanan Sub District is administratively divided into six villages: Madurejo, Bokoharjo, Sumberharjo, Sambirejo, Wukirharjo, and Gayamharjo. The sampling of villages uses purposive sampling. Madurejo, Bokoharjo, and Sumberharjo is chosen purposively as sample villages because those locations are suitable for the paddy to grow. On the other hand, Sambirejo, Wukirharjo, and Gayamharjo are located in plateau where the land is not as fertile as the other three villages and the farmers usually plant ginger there. Then, 60 samples of farmers from those three villages are taken randomly by using simple random sampling. Hopefully, those samples can represent all farmers in Madurejo, Bokoharjo, and Sumberharjo.

D. Data Analysis Method

First of all, the testing of reliability is used to know the consistency of questionnaire and validity checks whether the questions measure what should be assessed. The testing is done on variable of attitude, motivation, and participation. Both reliability and validity are tested with SPSS 16.0 software. The questionnaire is stated that it is reliable when the value of Cronbachs Alpha Based on Standardized Item (CABSI) > 0.7. If CABSI reaches 1, the reliability of questionnaire will be very high. The question is valid when the value of Correlated Item Total Correlation (CITC) > the value of r critical. Table of r is needed to see the r critical where df is got from the number of samples (n) minus 2. As the total of samples in this study is 60, so the degree of freedom (df) is 58. When the significance is 0.1, CITC reaches 0.2144. On the other words, item is valid when CITC > 0.2144. If the item is found to be invalid, it should be deleted from the list of questions.

The data put on Likert scale is then analyzed by using regression. Internal and external factors influencing the role of farmer group are analyzed using multiple regression. The model is:

$$Y= A+b_1.X_1+b_2.X_2+b_3.X_3+b_5.X_5+b_6.X_6$$

Where:

Y: farmer group role, A: constant number, b: coefficient of regression, X_1-X_6 : age, attitude, education level, motivation in group, landholding size, farmer group participation, respectively.

Then, the role of farmer group to the innovation adoption is analyzed using single regression and the model is:

$$Y= A+b_1.X_1+b_2.X_2+b_3.X_3$$

Where:

Y: innovation adoption, A: constant number, b: coefficient of regression, X_1-X_3: farmer group role as a unit of study, unit of cooperation, and unit of production, respectively.

The effect of innovation adoption on rice productivity is also analyzed using single regression with the model of:

$$Y= A+b_1.X_1$$

Where:

Y: rice productivity, A: constant number, b: coefficient of regression, X_1: innovation adoption.

III. RESULTS AND DISCUSSIONS

A. Farmer Group Role

To understand farmer group role in detail, the data is presented in Table I.

Table I. Farmer group role in Prambanan sub district

No.	Indicator	Score Interval	Average	Percentage (%)
	Unit of study			
1	Farmers get knowledge about organic fertilizer	0-3	1.90	63.33
2	Farmers get knowledge about local microorganism	0-3	1.57	52.33
3	Farmers get knowledge about seeds immersion in salt liquid with floated egg	0-3	1.62	54.00
4	Farmers get knowledge about PGPR	0-3	1.43	47.67
5	Farmers get knowledge about the use of egg on seeds immersion	0-3	1.42	47.33
6	Farmers get knowledge about the use of plaited bamboo basket and banana leaf to keep seeds	0-3	1.47	49.00
7	Farmers get knowledge about shallow seedling (in the age of 15 days) planting	0-3	1.75	58.33
8	Farmers get knowledge about L-shape planting	0-4	1.58	39.50
9	Farmers get knowledge about soggy field irrigation and interval irrigation	0-3	1.98	66.00
10	Farmers get knowledge about jajar legowo planting system	0-3	2.10	70.00
11	Farmers get knowledge about organic pesticide	0-4	1.78	44.50
12	Farmers get knowledge about the good harvest system	0-3	1.88	62.67
	Total a	**0-38**	**20.48**	**53.89**
	Unit of cooperation			
1	Farmers take part in irrigation activities	0-3	1.60	53.33
2	Farmers take part in pests management	0-3	1.60	53.33
3	Farmers take part in harvest	0-3	1.67	55.67
	Total b	**0-9**	**4.87**	**54.11**
	Unit of production			
1	Farmers receive seeds	0-3	1.83	61.00
2	Farmers receive fertilizer	0-4	2.62	65.50
3	Farmers receive pesticide	0-3	1.65	55.00
4	Farmers are helped by labors (during planting or harvesting)	0-3	1.05	35.00
5	Farmers receive planting tools or machines	0-3	1.27	42.33
	Total c	**0-16**	**8.42**	**52.63**
	Total a+b+c	**0-63**	**33.77**	**53.60**

Source: Primary Data Analysis 2015

Based on Table I, farmer group has role to support sustainable agriculture and it gives performance of 53.60%. It means farmer group sometimes plays role in the program. It is a medium of innovation disseminating. The innovations are technologies before seedlings, technologies of planting, organic fertilizer and pesticide, and harvest activities. Farmers learn those technologies through farmer group. Its cohesiveness as a unit of cooperation also makes farmers become more active in participating in irrigation, pest management, and harvest. In addition, farmer group also facilitate the farmers to get help to do farm activities. The role as a unit of cooperation shows the higest score (54.11%), especially farmers' participation in harvesting (55.67%). It means farmer group becomes a medium where all farmers in particular area work together. Moreover, the group cohesiveness is prominent during the harvest time. Farmers cooperate with each other at that time.

Different with the role as a unit of cooperation, the role as a unit of study and production shows the lower score, 53.89% and 52.63%, respectively. The two lowest scores also belong to these units. First, the information about L-shape planting system shows the score of 39.5%. The problems are there is not enough socialization and practice in demonstration plot for planting like the letter of L so they still worry about the risk. By this planting system, the roots are placed horizontally so they worry the seedlings will fall down due to the wind. In fact, this kind of planting shows the opposite. Farmer group function in giving information should be improved. Second, the availability of labors for planting and harvesting has the lowest score of all (35%). The labors for harvesting hired by farmer group are not available. Some farmers usually hire other people outside farmer group. The others usually work all together called as mutual assistance, for example Mr. A and others harvest Mr. B's farm and then Mr. B and others help Mr. A to harvest his farm. This is a social norm happening in every paddy harvest time and also found as local wisdom in Prambanan.

B. Factors of Farmers' Characteristic Influencing Farmer Group Role

Table II. describes the factors influencing farmer group role using backward method so insignificant factors have been eliminated.

Table II. Multiple regression result of factors affecting farmer group role in Prambanan sub district (Model 5)

Variable	Coefficient of Regression (B)	t test	Sig	Explanation
Landholding (X_5)	0.002	2.223	0.030	**
Farmer group participation (X_6)	1.174	6.867	0.000	***
Constant	12.062			
R	0.723			
Adjusted R Square	0.506			
F test	31.174		0.000	
Pearson correlation	0.229		0.039	

Note: **, *** : Significant at α = 5%, 1% respectively

Source: Primary Data Analysis 2015

Table II describes that landholding size and participation with sig value of 0.030 and 0.000, respectively, significantly affected farmer group role. Both give the strong influence shown by the R value of 0.723 (0.6−0.799). From the value of adjusted R Square, it is known that farmer group role is 50.6% influenced by landholding size and participation while another 49.4% is affected by other factors outside the model. Both factors positively influence the role so the larger landholding size and the higher participation, the higher farmer group role. Raut et al. (2011) also said that landholding size significantly influences farmers' adoption. By increasing the area of landholding, participation will be improved to reach the higher adoption level. Furthermore, there is also a positive correlation at 5% between landholding size so the larger landholding size can increase farmers' participation on group meeting but their correlation is weak (R=0.229). Nwaobiala (2014) added that farm size is significant at 1% to participation in Abia. In Prambanan, most of farmers (91.67%) hold less than 3.800 m^2 of farm size. In fact, they who have small size of landholding are more irresponsive to farmer group activities, for example they attend the meeting but they are not active in discussion. As known, most farmers in Prambanan hold their own land, and farm size indicates the level of economy. In fact, some of those farmers have another occupation outside, such as builder. Therefore, it is not often that farmers who are in the middle or low economic level and have another job are less interested in innovation. However, farmers who hold a large area of farm depend on farmer group because they worry about the harvest failure. It can be stated that the larger farm size, the higher loss due to the failure. So that is why, the large-landholders are likely to care about the innovation more often than the small-landholders. As landholding size is correlated to participation and participation is significantly affected farmer group role. Farmers who have small size of landholding and low participation need to be noticed and motivated by the field agricultural extension workers to be more active in farmer group.

C. The effect of farmer group role on innovation adoption

Farmer group role gives positive and significant effect towards innovation adoption (the effect is significant at 1%). It means the higher farmer group role, the higher innovation adoption level. To know the effect of each roles of farmer group, Table III is presented. Farmer group plays the significant roles of a unit of study, cooperation,

and production. However, the role as a unit of cooperation has the lowest performance.

Table III. Farmer group role as a unit of study on innovation adoption

Variable	Sig	Explanation
Farmer group role as a unit of study	0.000	***
Farmer group role as a unit of cooperation	0.002	***
Farmer group role as a unit of production	0.000	***
Note: *** : Significant at α = 1%		

Source: Primary Data Analysis 2015

We can see the reason on Table I, it is found that the intensity of farmers participating on irrigation is the lowest in a unit of cooperation. They consider irrigation is not the main problem of their farming activities. As known, there is enough water in Prambanan even in dry season. In addition, most of them have more than one jobs so they do not have adequate time to work together to control water or even pests. They only spend more time in agriculture sector in harvest time so the real cooperation among farmers can be seen only during the harvesting. On the other hand, from the data got in the field, farmers' participation of collecting information about irrigation also shows the lowest result. Therefore, in order to optimize the role of farmer group, the role as a unit of cooperation should be improved by increasing the level of participation.

D. The effect of local wisdom innovation adoption on rice productivity

Farmers in Prambanan try to reach the sustainable agriculture. To develop their farm, they apply the innovations of environmentally friendly farming. The innovations based on local wisdom are: (1) Seeds immersion in salt liquid by adding an egg on liquid. Egg is used as an indicator whether the solution is ready to use. When the egg is floated, seeds are put into the solution. The sunk seeds are selected because they are plump and have good quality. (2) Seeds keeping by using banana leaf and plaited bamboo basket. (3) Use of bamboo roots. Bamboo root is immersed in water. Then that solution is used to immerse the seeds. (4) Jajar legowo planting system. (5) Use of organic fertilizer from muck and organic pesticide from gadung and mimba leaves. (6) Seedlings planting in the early age to shape a letter of L. (7) Soggy-field and interval irrigation. (8) Good harvest management by using good quality of gunny and wider size of tarpauline. Innovation adoption means a way of implementing innovation(s) as the recent technology gradually. Those innovations have strong effect on rice productivity.

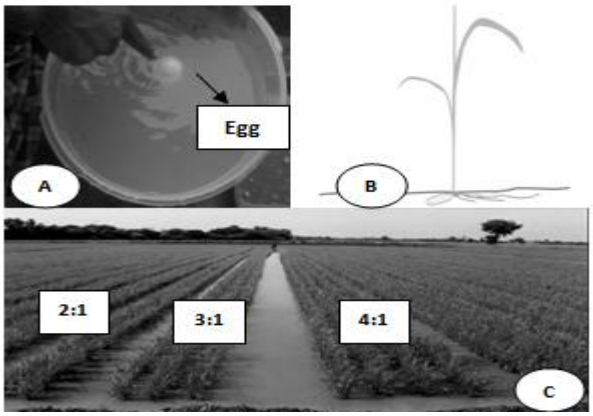

Figure 1. Innovation of: (A) seeds immersing with floated egg; (B) L shaped planting; and (C) jajar legowo

Table IV. Single regression result of innovation adoption effect on rice productivity

Variable	Coefficient of Regression (B)	t test	Sig	Explanation
Innovation adoption (X_1)	0.093	5.782	0.000	***
Constant	6.263			
R	0.605			
Adjusted R Square	0.366			
F test	33.434		0.000	
Note: *** : Significant at α = 1%				

Source: Primary Data Analysis 2015

From Table IV, it can be seen that innovation adoption significantly affects the rice productivity. Besides, innovation adoption also has strong influence on rice productivity (R=0.605). The impact of adoption is 36.6% while another 63.4% comes from the other factors outside the model. From the possitive score of B, it can be stated that innovation adoption positively affects the productivity. It means the higher level of innovation adoption, the higher rice productivity. If the value of innovation adoption is 0, the value of rice productivity will be 6.263. The increase of one unit of innovation adoption raises 0.093 unit of productivity. By adopting the the environmentally friendly innovations, selected seeds grow well as healthy plants which are more resistant to pests and disease. salty solution for immersing seeds makes pests' eggs brought by seeds can not hatch. In addition, the seeds are also protected by lignin when they are kept inside banana leaves. The plants from selected seeds also have adequate nutrients and sunlight due to small competition. Jajar legowo gives enough space for plants to absorb water, fertilizer, and light without harshing each others. Moreover, the spaces also make sunlight able to come inside the micro area to control the temperature. In interval irrigation, there are few days which the land is not swamped by water so the oxygen in the air can come into the soil. In addition, by implementing L-shape planting, there are many rice tillers appearing from the enhances as well.

To success the program of food self-sufficiency in Indonesia, rice productivity needs to be increased. One of the ways is to raise the productivity in Prambanan sub district as one of the big rice producers in Indonesia. Productivity can be raised by increasing the level of innovation adoption. To know the increase of rice productivity before and after farmers have adopted the innovation, the data is shown on Figure 2.

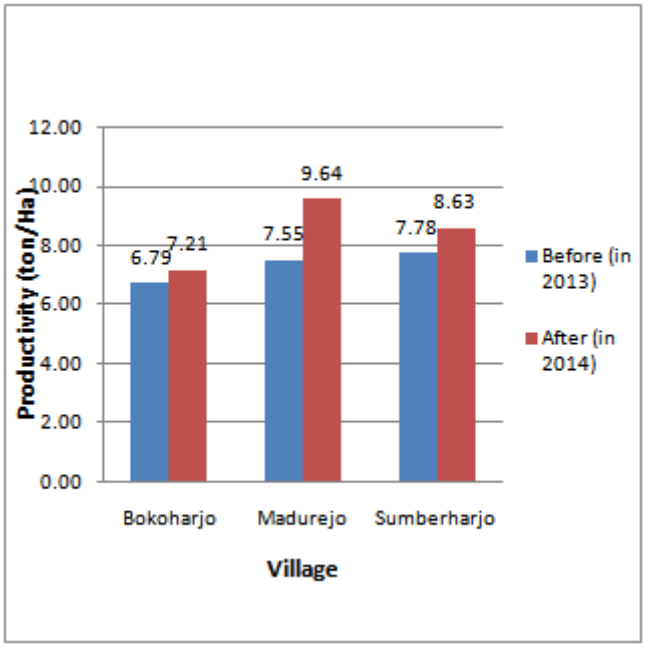

Figure 2. Increased rice productivity between two years in Prambanan sub district

The data supports the regression analysis result on Table IV showing that innovation adoption gives strong effect on productivity (R=0.605). In addition, the highest enhancement of rice productivity happens in Madurejo that is 2.09 ton/Ha because most of farmers there have been implementing jajar legowo 2:1, the most recommended planting system. Then, it is followed by Sumberharjo and Bokoharjo with the increase of 0.85 ton/Ha and 0.42 ton/Ha, respectively. The average productivity in those three villages is 8.65 ton/Ha in 2014 and 7.47 ton/Ha in 2013. In short, local wisdom innovation adoption helps the government program to enhance the productivity of 15−20% between two years.

IV. CONCLUSION AND RECOMMENDATION

A. Conclusion

Farmer group has three roles: as a unit of study, as a unit of cooperation, and as a unit of production. It is significantly influenced by landholding and participation. Farmer group role is significantly and positively affects the innovation adoption at 1%. However, it needs to be improved, especially for the lowest items in role as a unit of study, cooperation, and production. These farmer group roles show significant effect on innovation adoption. The adoption of local wisdom innovation also gives positive and significant effect on rice productivity in Prambanan at 1%. In short, farmer group has role in supporting food self-sufficiency.

B. Recommendation: The strategy to improve farmer group role

All farmer group roles need to be well-maintained. (1) To increase the role as a unit of study, farmers and field agricultural extension workers need additional time of interpersonal communication (2) To enhance the role of farmer group as a unit of production, there should be a special socialization about technology to labors of harvest, as well as the members of farmer group who practice mutual assistance of harvesting (3) To raise the role as a unit of cooperation, their cohesiveness be enhanced by giving more attention to those who have small landholding and low participation.

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