Factors Affecting the Implementation of Rice-Livestock Integrated Farming System (RLIFS)

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Abstract: The government's efforts to increase rice production are carried out in various ways. The one introduced in 2002 was *SIPT* (*Sistem Integrasi Padi Ternak*/Livestock Integration System). Integrated farming system is a system that emphasizes linkages and synergism of farming units waste utilization to provide greater benefits. The sustainability of the system was examined in this study by analyzing the factors that influenced the Implementation of Rice-Livestock Integrated Farming System (RLIFS). The results of the study were that several factors significantly affected the number of cow cattle owned by farmers and the outpouring of male and female labor in the family in the cow cattle farming. The greatest opportunity to implement RLIFS was that the decision to implement RLIFS was influenced by internal (family) labor in cow cattle farming and the number of cows. The number of cows has a chance of 1.35 times in the decision to implement an integrated farming system of rice-livestock

1 INTRODUCTION

1.1 Background and Issues

The government through various programs continues to increase rice production which is the staple food of most of Indonesia's population. This effort shows a variety of achievements that are increasing, sloping and descending. Data from *BPS* showed that rice production had a rising trend, but it was undeniable that there were years where production sloped and even declined. During the last decade of 2000 - 2013 the rice production rate increased, but in the period 2004 - 2006 rice production showed slower and even declined during the period 2010 - 2011. Although the rate of decline in rice production by 1.07 percent from 2010 to 2011 not too big compared to the rate of increase of paddy production per year in 2006 - 2010 and 2011 - 2013 period, the government was trying to keep increasing rice production because rice is the staple food for the people of Indonesia.

Many factors cause the decline of rice production in Indonesia including the limitation of pproductive agricultural land and low productivity of rice. Limited lands due to conversion are a problem in increasing rice production. Data showed that during the period 1998 - 2002 the rate of conversion of agricultural land to non-agricultural land was about 110 thousands ha / year. Data from the Ministry of Agriculture in 2002 - 2006 that the conversion of agricultural land has reached 140 thousands ha / year for various purposes. The decline in the number of agricultural households from 31.17 million farm households in 2003 to 26.13 million farm households in 2013 is one indicator that land conversion is continuing massively

There is another factor besides the causes of limited productive land i.e. the decrease (degradation) of soil fertility. According to (Atmojo, 2006) one of the causes of degradation of agricultural land is agrochemical pollution. The level of pollution and environmental damage to agriculture can be caused by the disproportionate use of agrochemicals (fertilizers and chemicals). The system of plant intensification with the addition of fertilizers and chemical materials continuously and without the right dosage is not only harmful to humans but also to environmental sustainability and sustainable agriculture (Sustainable Agriculture).

Related to land constraints, land degradation and sustainable agriculture, the government through the agriculture department established an integrated farming program called Integrated Rice Productivity

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Improvement Program (P3T), which synergically worked with the ultimate goal of increasing farmer income. One integrated farming activity was implemented in the form of Plant-Livestock Integration System (SITT) known as the Rice-Livestock Integration System (SIPT). Integrated Farming System or a mixed farming system which consists of at least two farming units managed in such a way in one management, so there is a synergy between farm units with each other. Waste farming or by-product from one activity can be input for other activities and become raw material for other farming activities. According to Beattie et. al (1974) by-products increase the production of other farms in one household. Utilization of straw into animal feed and animal waste into organic fertilizer for rice crops not only benefit from the reduction of production costs but also additional revenue from products obtained from livestock that is in the form of meat and milk. Sewage processing in principle supports sustainability (sustainable agriculture) because it attempts to minimize waste of farming (zero waste) by a process that is ultimately reused in other farming activities.

1.2 The Objective of the Study

This paper analyzed the continuity and the implementation of the integrated farming system after the government program ended by analyzing the factors that influenced the implementation of integrated farming in West Java.

2 METHODOLOGY

2.1 Location and Time of Study

The study was conducted at West Java province as one of the provinces that ever implemented the program of Rice-Livestock Integrated Farming System (RLIFS). Locations purposively selected were Subang, Sumedang and Tasikmalaya.

2.2 Types of Data

The types of data were cross sectional and time series data, while the data sources were primary and secondary data. Primary data were obtained through direct interviews with respondents, whereas secondary data were obtained from the Bureau of Statistics Center (BPS) in West Java, Department of agriculture and animal husbandry, district or sub district as well as the village, related studies and references.

2.3 Method of Samples Determination

The sample of the study were farmers of Rice-Livestock Integrated Farming System (RLIFS) and non RLIFS. Determination of samples was done by the method of purposive sampling. The number of samples as many as 199 farmers consists of 134 RLIFS farmers and 65 non RLIFS farmers. Household sample distribution is presented in Table 1.

Table 1: Household Sample Distribution.

Village	Number of Household Sample	RLIFS Farmers	Non RLIFS Farmers	Total
Cikawung	17	53	21	74
Sindanglaya	5			
Cimanggu	5			
Pakuhaji	47			
Sukamukti	6	45	22	67
Kertamukti	24			
Awilega	34			
Kertaharja	3			
Puteran	11	36	22	58
Tanjungkerta	11			
Tanjungsari	25			
Sukaresik	11			
Total	199	134	65	199

2.4 Analysis Methods

The analysis method used the Econometric Model. The Logit Model was used to answer the factors influencing the farmers' decision to implement Rice-Livestock Integrated Farming System (RLIFS). The Linear Regression Model could not be applied to this condition because the response of the independent variable influence can be outside the range of 0 and 1. Based on the logit model, the cumulative logistic opportunity functions (Pyndyck and Rubenfeld 1998), are as follows:

$$P_i=F(Y_i)=F(\alpha + \beta x_i) \quad (1)$$

$$= \frac{1}{1+e^{-z_i}} = \frac{1}{1+e^{-(\alpha+\beta xi)}}$$

Pi : Opportunities of farmers to implement (apply) integrated farming of rice-livestock (grades 0 and 1)
x_i : Independent variable
e : Natural numbers (≈ 2.718);
α : Intercept
β : The expected parameter values

Transforming the above equation into a logarithmic form obtained a linear logit model in the form of the equation as follows:

$$P = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + U \quad (2)$$

Where:
P: Opportunities of farmers to implement RLIFS (value 0 = Decision not to apply UTPT and value 1 = Decision to implement UTPT)
X1: Formal education of respondents (years)
X2: Area of harvest of rice (ha)
X3: Number of cows (livestock units)
X4: Rice farming income (Rp / year / household)
X5: Cow Cattle farming income (Rp / year / household)
X6: Outpouring of male domestic worker in cow cattle farming (HOK / household / year)
X7: Output of female domestic worker in cow cattle farming (HOK / household / year)
X8: Participation in farm organization
X9: Frequency of counseling (times)

Equation analysis was solved through logit model estimation method and processed by using Minitab Program computer.

3 RESULT

Overall result of logit model estimation was value G = 26.146 with value p-Value = 0.002. This means that the model was good enough in explaining and identifying household characteristics and economic factors that influence farmers' decision to implement Rice-Livestock Integrated Farming System. Based on the total output obtained concordant value reached 67.7% which meant that farmers' opportunity to apply integrated farming was greater than the opportunity of farmers that without implementing the program.

Table 2: The Logit Model Estimation Results of Implemented RLIFS.

Variable	Coefficients	Value P	Odd ratio
Constanta	-0.354625	0.688	
EDUC	0.097092	0.371	1.10
LHAN	0.563005	0.657	1.76
JSAT	0.296943	0.192	1.35
PDUP	-0.0000047	0.921	1.00
PDUS	-0.0000259	0.295	1.00
TPDS	0.0000619	0.007	1.00
TWDS	0.0051865	0.15	1.01
KSOT	-0.301818	0.489	0.74
FRPY	0.275174	0.389	1.32
Log-Likelihood = -112.649			
G = 26.146			
DF = 9			
P-Value = 0.002			

Education of respondents tended not to have an effect on decision to implement Rice-livestock integrated farming system (RLIFS). Some peasants who were educated at senior high school or above did not implement RLIFS. Based on the interview the topographic factors of rice fields were quite far and hilly and farmers also lack of manpower to transport manure to the fields. The use of manure per large area of land compared to chemical fertilizers was also another factor. The use of chemical fertilizer 1 - 1.5 quintals / Ha was quite low compared to 2 tons of manure. In relation to the characteristics of farmers, it was agreed with previous researchers i.e. Basit (1996) and Priyanti (2007) that education did not affect farmers to apply a technology. Topographic factors, the distance of the cowshed with rice fields and labour became the main obstacle in the implementation of RLIFS in this study.

The variable of land area was not significant in influencing farmer's decision to apply RLIFS. However, the area of land gave a big enough opportunity for farmers to apply integrated farming of 1.76 times. In the research area farmers had an average land area of 0.18 Ha / household so that with a small enough / narrow area, farmers had

limited opportunities to increase income if they did not diversify the business. One way to increase farmers' income with narrow land in the village was to implement RLIFS.

The number of cattle had a significant effect on the decision to apply RLIFS. The number of cows provided a substantial opportunity of 1.35 for farmers in applying RLIFS. Increasing the number of cow cattle could increase the amount of manure that is the raw material for manure.

The decrease of income due to the decrease of rice production has enabled farmers to have 1.0 times chance in implementing Rice-Livestock Integrated Farming System (RLIFS). The Manure that produced in RLIFS could improve soil fertility. The improvement of soil fertility by processing manure was expected to increase the production and income of farmers. The use of manure in study site could increase farmers income. This was due to higher selling prices due to the use of organic fertilizer. In addition, the use of manure could reduce the use of chemical fertilizers in stages. Interviews with the head of the farmer group revealed that the use of chemical fertilizers was small enough where the use of urea, KCl and Phonska ranges from 5 to 10 kg per 1400 m2. The use of chemical fertilizers was small enough to raise the bargaining position of farmers so that the price of Harvest Dry Grain (*Gabah Kering panen*/GKP) in this District was quite high (Rp 5300 - Rp 5500) per kg. The increase in the price of GKP was able to ultimately increase the income of farmers. However, the income variable did not significantly influence the farmer's decision in applying RLIFS. Likewise, the decline in cow cattle farming income could motivate farmers to conduct RLIFS activities. The animal waste processing was expected to increase the income of livestock farming.

Outpouring of male family labour for cow cattle farming had significant effect on 1% level, while the female labour force empowerment for cow cattle farming had significant effect on <20% real level. The outpouring of male and female labour force in cow cattle farming had an opportunity to apply RLIFS. This indicated that farmers understand that the activities of rice and cow cattle farming had a beneficial relationship with each other where the straw could be the input of cattle feed and cattle waste could be input for rice crops, so that the outpouring of labour for cattle was a factor that supports RLIFS adoption/implementation. In this research, the outpouring of male and female family labour was a factor which was quite good opportunity in RLIFS implementation. This was understandable because in the farm household, two interconnected farms are also cultivated with labour in the same family in each farm. By this the limitations of the workforce can be overcome by complementing and fulfilling the two farms. However Lightfoot (1997) stated that the implementation of IFS had constraints on aspects of time, labour, government policies that were less conducive. The introduction should consider the ability of the farmers to absorb in terms of the quantity of introduced components and their consequences for the additional costs, labor and time spent. (Sariubang and Qomariah 2008; Panjaitan *et al*. 2009). So this research only agrees on only several aspects that were time and government policy that were not conducive to implement RLIFS.

Estimation results in the information technology group showed that the participation of family members in agricultural organizations as well as the frequency of contact with agricultural extensions did not significantly affect farmers in applying RLIFS. However, the frequency of contact with the agricultural extensions provided a great opportunity that was equal to 1.32 times for farmers to apply Rice-Livestock Integrated Farming System (RLIFS). Meeting with field extension officers (PPL) was able to motivate farmers in applying RLIFS technology. Extension ability by directly demonstrating the processing of organic fertilizer containing many nutrients and explaining the benefits of organic fertilizer would attract farmers in implementing integrated farming system. Panjaitan *et al*. 2009 said the institutional introduction needed to consider the existing institutional system and ran on the local community. So this study did not fully agree that the existing institutions were one of the factors that must be considered when implementing RLIFS, but this study agreed that the frequency of following the counselling had the opportunity to farmers in applying RLIFS

4 CONCLUSION

1. The implementation process of Integrated Farming of Rice-Livestock in West Java Province ran quite well. This was demonstrated by the findings of farmers who did not conduct RLIFS than those who conducted RLIFS. Of all the farmers of the respondents, it was found only ± 32.67 percent of farmers who did not implement integrated farming, the rest did the implementation of RLIFS. Some farmers were motivated to implement RLIFS mainly because

there was government assistance, but some were self-employed because of considerable benefits for farming.

2. The main obstacle for farmers who did not use organic fertilizer was the topography of the area that most of the hills and roads in rice fields were small enough to complicate the application of organic fertilizer. The use of organic fertilizers was more difficult because the use of organic fertilizers in quantities was far greater than the use of inorganic fertilizers (chemical).
3. The decision of farmers to implement RLIFS tended to be more influenced by the number of cow cattle, the allocation of outpouring of the use of male and female labour in the family for cow cattle farming. The number of cows owned by farmers provided a great opportunity for farmers to apply RLIFS

POLICY IMPLICATIONS AND ADVANCED RESEARCH

1. The results showed that the production of manure was carried out independently and has not been managed properly and optimally. Manure production was used to meet the needs of fertilizer itself or was subsistence agriculture.
2. Rice-Livestock Integrated Farming System (RLIFS) can be an alternative government policy to be developed in the countryside but needs a comprehensive attention related to the influence of external factors that affect the continuity of integrated farming system
3. A need for further research related to the utilization of other crop wastes other than rice and non cow livestock wastes that were interrelated between each farming of rice / other crops and cattle and non-cattle farming
4. A need for further research on integrated farming which was carried out institutionally. Initial observations indicated that the production of manure was quite good and there were quite a lot if managed in a farmer group.

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