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The Effect of Farmer Knowledge, Farmer Attitudes, and Farmer Skills on Farmer Decisions in Bakalan Village, East Java Province, Indonesia

Didik Mulyo Wasono♥, A.Wahib Muhaimin, Riyanti Isaskar
Agribusiness Master Program, Faculty of Agriculture, Brawijaya University, Malang, Indonesia
♥Corresponding author email: didikmulyo@student.ub.ac.id

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Abstract. The Bakalan Village Government and the Bojonegoro Regency Agriculture Office in 2023, organized the Integrated Pest Management Field School to educate farmers about environmentally friendly agriculture and more sustainable pest control methods, to increase crop yields and farmer welfare. This study was conducted to analyze the influence of farmer behaviour in SLPHT activities on farmer decisions. Respondents were selected using the Slovin formula calculated by population. The study population was 80 farmers from 4 farmer groups in Bakalan Village. Thus, a research sample of 45 farmers was obtained. Data analysis was conducted using multiple linear regression methods with data processing tools using SPSS. The results explained that farmer knowledge, farmer attitudes and farmer skills influenced farmers' decisions in SLPHT activities. Farmer knowledge is the highest factor or influence in influencing farmers' decisions on SLPHT activities. This research is useful for farmers participating in SLPHT because farmers can continue to apply the farming methods obtained in SLPHT activities and provide information to other farmers, and further guidance needs to be held to determine the sustainability and application of farming methods obtained from SLPHT activities.

Keywords: farmer attitudes; farmer decisions; farmer knowledge; farmer skills; SLPHT

INTRODUCTION

As the backbone of the national economy, the agricultural sector plays an important role in generating gross domestic product, export earnings and providing employment for millions of people. Due to its importance in human development and food security, the sector is a top priority for the government (Bukhtiarova et al., 2019). Divided into food crops and horticulture, the food crops subsector includes rice, maize, soybean, and yam, which are essential for the livelihood of most Indonesians. According to the 2018 Inter-Census Agricultural Survey, 73.28% of the 27.68 million farm households are involved in the food crop (BPS, 2018). Rice (Oryza sativa L.) is the most strategic agricultural commodity due to its dominant position in food security. Rice is also the main food crop in Indonesia because most of the Indonesian population's staple food is rice. (Mara & Sativa, 2022)The availability of rice in Indonesia has always been a priority for the government because it involves food sources, so the lack of rice supply will have an impact on people's lives (Fanani et al., 2022).

Two factors that greatly affect rice production are seasonality and plant pest organisms (Utami & Cahyono, 2020). Pest and disease attacks are considered the most significant limiting factor of rice production because they can reduce production yields, impacting the supply of rice (Sugiyanto & Santoso, 2018). The use of pesticides by rice farmers in East Java is the main method in controlling pests and diseases, although their use tends to be excessive and can cause negative impacts such as resistance, secondary pest explosion, and environmental pollution (Haile et al., 2021). To overcome this problem, the application of Integrated Pest Management (IPM) is required, which is regulated in Law No. 22/2019 on Sustainable Agricultural Cultivation Systems (Law No. 22/2019) (Sharma, 2023). The IPM system is an effort that integrates various pest control techniques in an integrated manner to prevent economic losses and environmental damage (Magarey et al., 2019). The implementation of IPM must be carried out systematically and involve various parties, including the central government, local governments, farmers, business actors, and the community (Alam et al., 2016). The use of chemical pesticides in the IPM system is only considered the last alternative after other pest control techniques

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are unsuccessful (KEMENTAN, 2019). Farmer Field School of Integrated Pest Management/FFS of IPM (Sekolah Lapangan Pengendalian Hama Terpadu/SLPHT) is an adult education whose participants are farmer group members. The *Sekolah Lapang Pengendalian Hama Terpadu (SLPHT)* program was introduced by the Indonesian government as an effective way to improve the understanding of IPM in achieving sustainable agriculture (Nila, 2016).

Bojonegoro, known as a major grain producer in East Java, faces the problem of overuse of synthetic pesticides that pose risks to the environment and farmers' health. As a solution, in 2023, the Bakalan Village Government, in collaboration with the Bojonegoro District Agriculture Office, organized an Integrated Pest Management Field School (SLPHT) to educate farmers on environmentally friendly farming and improve their skills in adopting more sustainable pest control methods. The programme also aims to increase yields and farmers' welfare by introducing new varieties and reducing the use of inputs such as fertilizers and pesticides. This activity is funded by the Village Budget (APBDes) as part of efforts to restore the village's food security, especially after frequent crop failures in 2020-2022 due to dependence on chemical pesticides and fertilizers.

Although SLPHT has been implemented in various regions, there is still a knowledge gap regarding the effectiveness of this program in changing farmers' behaviour and increasing the adoption of IPM practices, especially at the village level. This study aims to explore the factors that influence rice farmers' decision to adopt the SLPHT program in Bakalan Village, Kapas Sub-district, Bojonegoro District. Bojonegoro, as a major rice producer in East Java, faces the problem of excessive use of synthetic pesticides, which threatens the environment and farmers' health. This research will focus on the following questions: By answering these questions, this research aims to fill the knowledge gap on the effectiveness of SLPHT at the local level and provide valuable insights for the development of sustainable agriculture policies in Indonesia. The results of this study are expected to make a significant contribution to improving the implementation of the SLPHT program and encouraging the adoption of more sustainable agricultural practices among rice farmers. This research will focus on the question of how farmer behaviour affects farmers' decisions to adopt the SLPHT program.

METHODS

This research is explanatory research with a quantitative approach, using interview and survey methods. According to (Sugiyono, 2017), explanatory research is a research method that intends to explain the position of the variables studied and the influence between one variable and another. This method emphasizes the objective measurement of social phenomena. To be able to take measurements, each social phenomenon is translated into several problem components, variables and indicators. Each variable determined is measured by giving different numerical symbols according to the category of information related to the variable. By using these numerical symbols, quantitative mathematical calculation techniques can be carried out so as to produce a conclusion that applies generally within a parameter. Although there have been many studies on the relationship between behaviour change and decision-making processes in agriculture, none of these studies examined decision-making by rice farmers in adopting the SLPHT program at the national and international levels.

1. Research Location

The research was conducted in Bakalan Village, Kapas Sub-district, Bojonegoro District. Consideration of this location was chosen based on the fact that in 2023 the Bakalan Village Government in collaboration with the Bojonegoro District Agriculture Office conducted SLPHT training for rice crops for the first time.

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2. Sampling Method

In this study, the population was determined to be farmers who belonged to 4 farmer groups. The population in the study can be seen in Table 1.

Table 1. Population of farmers participating in SLPHT of rice crops in Bakalan Village

No.	Village	Farmer Group	Number of Participants
1.	Bakalan	Tani Mulyo	20
2.	Bakalan	Farmer's Association	20
3.	Bakalan	Sido Rukun	20
4.	Bakalan	Sumber Agung	20
	Amount		80

Table 1 shows that each of which had 20 members who participated in SLPHT of rice plants in Bakalan Village, so the total population is 80 farmers from 4 farmer groups in Bakalan Village. The variables in the study can be seen in **Table 2**:

Table 2. Research variables

Variables	Operational Definition	Indicators
Farmer Knowledge (Y1)	A person's ability to recall something that has been done or learnt. The context of the research to be carried out is to see how farmers' knowledge of SLPHT technology components.	Rice variety (Y1.1) Land Preparation (Y1.2) Planting (Y1.3) Maintenance (Y1.4) Harvesting (Y1.5)
Farmer Attitude (Y2)	a person's more or less permanent feelings, thoughts and inclinations about certain aspects of their environment. The components of attitudes are knowledge, feelings and tendencies to act.	Farmers' attitudes towards the benefits and advantages of SLPHT Rice activities (Y2.1) Farmers' attitudes towards the planning and implementation of SLPHT Rice (Y2.2) Farmers' attitudes towards the application of rice SLPHT principles (Y2.3)
Farmer Skills (Y3)	The assumption or reaction made by farmers in the form of an answer to a stimulus or something new, in this case, regarding the behaviour of farmers towards SLPHT activities in Bakalan Village.	Activity planning and implementation (Y3.1) Frequency of attendance at SLPHT meetings and activities (Y3.2) Activeness in Rice SLPHT meetings and activities (Y3.3) Skills in the implementation of SLPHT Padi activities (Y3.4)
Farmer Decision (Z)	Innovations can be accepted or rejected by a person (individual) as a member of the social system or by all members of the social system who decide to accept innovations based on collective decisions or coercion (power).	Farmers' decision to adopt IPM

The table above explains that this study identifies four main variables related to farmers' knowledge, attitudes, skills, and decisions regarding SLPHT (Integrated Pest Management Field School) technology. The first variable, Farmer Knowledge (Y1), refers to farmers' ability to recall information or experiences related to SLPHT technology components, such as rice variety selection, land preparation, planting, maintenance, and

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harvesting. The second variable, Farmer Attitude (Y2), reflects farmers' feelings, thoughts, and inclinations toward SLPHT activities, measured by their attitudes toward the benefits, planning, implementation, and application of SLPHT principles. Next, Farmer Skills (Y3) describes farmers' reactions or behaviors toward innovations, specifically in the context of SLPHT activities. This includes their ability to plan and implement activities, attendance frequency, activeness in meetings, and skills in carrying out SLPHT practices. Lastly, Farmer Decision (Z) focuses on the process of accepting or rejecting innovations, measured by farmers' decisions to adopt Integrated Pest Management (IPM). This study aims to understand the relationships among these variables to support the successful adoption of agricultural technology innovations.

The sample is part of the overall object to be studied and is considered representative of the entire population (Notoatmodjo, 2002). The sample size was determined based on the Slovin population formula (Equationn 1).

$$n = \frac{N}{1+N\alpha^2} \text{ ……(1)}$$

$$n = \frac{80}{1+80(10\%)^2}$$

$$= 44{,}44$$

Description: n = Number of Samples, α = Chance of Error (10%), N = Total Population

From the total population, 15 farmers from 4 farmer groups who participated in the SLPHT programme in Bakalan Village were selected by random sampling. The total number of respondents was 45 farmers.

3. Data Analysis Method

It is suspected that the better the behaviour of farmers in rice SLPHT activities, the higher the Farmer's decision to switch to using organic farming systems. This hypothesis was tested using multiple linear regression analysis (Equation 2).

$y = \alpha + B_1.X_1 + B2.X2 + B3.X3 + E$…….(2)

Description:
Y = Farmer Decision
A = A constant number
B = Regression coefficient
X_1 =Farmer knowledge
X_2 = Farmer Attitude
X3 = Farmer skills

The multiple linear regression is then tested with a significance test using the F sampling distribution because the variation involved in the equation is more than two. The percentage of the dependent variable can be explained by the variation of the independent variables using the adjusted R square coefficient of determination for the number of independent variables more than two. The hypothesis criteria for each variable are as follows:

Ho : bi = 0, (X_1-X3) does not significantly influence farmers' behaviour in SLPHT activities on farmers' decisions.

H1 : bi (X_1-X3) has a real positive effect on farmer behaviour in SLPHT activities on farmer decisions.

4. Research Variables

Research variables are shown in **Table 2**.

RESULTS AND DISCUSSION

In this study, the regression test was carried out to determine the effect and magnitude of the influence of the independent variable on the dependent. Based on the results of the SPSS 23 calculation:

1. T-test (partial testing)

a. Dependent Variable: Z

Based on Table 3, the mathematical equation is as shown in **Equation 3**.

Y = 45,077 + 0.243 Y1 + 0.249 Y2 + 0.198 Y3 + e ……..(3)

Based on the regression model and table of Equations above, the multiple regression results can be explained as follows:

1. The value of the variable Y1 (Farmer Knowledge) is positive 0.243, which means that the knowledge of farmers partially has a positive effect on farmers' decisions. Variable Y1 (Farmer Knowledge) t value of 3.841 > t table of

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2.01808 and has a significance of 0.000 < 0.05 (Sig α). Based on the decision-making criteria, if t count> t table and sig count < sig α, it can be said that Ho is rejected and H1 is accepted, which means that farmer knowledge has an effect on farmer decisions.

Table 3. Effect of farmer knowledge, farmer attitude and farmer skills on farmer decisions

Coefficients						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	-45.077	11.589		-3.890	.000
	Y1	.243	.063	.465	3.841	.000
	Y2	.249	.066	.456	3.802	.000
	Y3	.198	.085	.281	2.337	.024

2. The value of variable Y2 (Farmer Attitude) is positive, 0.249, which means that the attitude of farmers has a positive effect on their decisions. Variable Y2 has a t count of 3.802 > t table of 2.01808 and has a significance of 0.000 < 0.05 (Sig α). Based on the decision-making criteria, if t count> t table and sig count < sig α, it can be said that Ho is rejected and H2 is accepted, which means that the attitude of farmers has an effect on farmers' decisions.
3. The value of variable Y3 (Farmer Skills) is positive 0.198, which means that farmer skills have a positive effect on farmer decisions. t value of 2.337 < t table of 2.01808 and has a significance of 0.024 > 0.05 (Sig α). Based on the decision-making criteria, if t count < t table and sig count > Sig α, it can be said that Ho is accepted and H3 is rejected, which means that farmer skills have an effect on farmer decisions.

2. F Test (Simultaneous Testing)

Table 4. Effect of farmer knowledge, farmer attitude and farmer skills on farmer decisions

ANOVA[a]						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	68.839	3	22.946	9.840	.000[b]
	Residuals	95.606	41	2.332		
	Total	164.444	44			

a. Dependent Variable: Z
b. Predictors: (Constant), Y3, Y2, Y1

Table 4 is the ANOVA table or F test, where the table is used to determine whether there is a significant influence between the independent and dependent variables in the regression test. In other words, this table is used to determine whether the hypothesis is accepted or rejected. Testing using a significance number or Sig with the provisions, if the research sig <0.05 and F count> F table (3.22), then Ho is rejected and Ha is accepted. From the Anova test or F test, the value of F count is 9.840> F table 3.22 with a sig value of 0.0000 <0.05. This states that there is an influence between farmer knowledge, farmer attitudes and farmer skills on farmer decisions.

3. Coefficient of Determination

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To find out the magnitude of the independent variable in influencing the dependent variable, it can be seen through the coefficient of determination.

Table 5. Effect of farmer knowledge, farmer attitude and farmer skills on farmer decisions

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.647[a]	.419	.376	1.527

a. Predictors: (Constant), Y3, Y2, Y1

Based on the table above, the R-value determines the coefficient of determination, which is one of the criteria for determining that the selected independent variables can appropriately explain the dependent variable. Table 5 shows the value of R 0.647, where the variation of the Farmer's decision variable can be explained by the variable knowledge of farmers, farmer attitudes and farmer skills by 64.7%, and the remaining 35.3% is explained by other factors outside the study (Afandhi, 2020).

4. The Effect of Farmer Knowledge on Farmer Decisions

The results showed that farmers' knowledge had a positive effect on farmers' decisions. Based on partial hypothesis testing, farmer knowledge has a positive effect on farmer decisions, where the better knowledge possessed by farmers will provide better decisions in terms of handling pests and harvesting. When farmers can absorb the knowledge and knowledge provided by extension workers during SLPHT activities, then farmers will be able to make better decisions related to crops, and this will have an impact on the yields that will be obtained (Sh. Al-Rimawi et al., 2006). Based on the research results from 45 respondents, there were 7 farmers with elementary school education, 31 farmers with junior high school education, 6 farmers with senior high school education, one farmer with diploma education and no farmers with education above diploma. Although the largest number of farmers are farmers with the final education of junior high school, this is not an inhibiting factor in decision-making by farmers in SLPHT activities.

Based on the results of research conducted by several researchers, it can be concluded that farmer knowledge has a positive effect on farmer decisions. Better farmer knowledge can influence farmers' decisions in using integrated farming technology, as well as in adopting technological innovations related to aspects of farmers' needs and preferences for local technology or integrated farming. Research conducted by Kurnia Suci Indraningsih (2020) shows that better farmer knowledge can influence farmers' decisions to adopt integrated farming technology. Better farmer knowledge can influence farmers' decisions in using more effective and efficient technology, as well as in adopting technological innovations related to aspects of farmers' needs and preferences for local technology or integrated farming. (Indraningsih, 2016).

5. The Effect of Farmer Attitudes on Farmer Decisions

The findings from recent studies underscore the significant influence of farmers' attitudes on their decision-making processes, particularly in agricultural contexts. A comprehensive analysis reveals that positive farmer attitudes correlate strongly with improved decision-making outcomes, leading to enhanced agricultural practices and increased yields. For instance, (Widyastuti et al., 2022) demonstrated that farmers exhibiting favourable attitudes are more likely to make informed decisions regarding crop management, emphasizing that maturity in decision-making is crucial for optimizing agricultural outputs. This aligns with the conclusions drawn by (Indraningsih,

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2016), who found that farmers' perceptions of extension services significantly affect their willingness to adopt innovative practices, thereby enhancing their decision-making capabilities (Indraningsih, 2016). Moreover, research conducted by (Yakub et al., 2020) highlights that a positive attitude towards the use of farmer cards can facilitate better access to resources and information, which further supports effective decision-making among farmers. This notion is echoed in a study by (Boza et al., 2024), which indicates that farmers' reluctance to engage in associations stems from a lack of trust and perceived economic benefits, ultimately affecting their decision-making power.

The interplay between individual attitudes and broader socio-economic factors is critical; as noted by (McCormack et al., 2024), farmers who embrace environmental conditionality are more likely to comply with sustainable practices, demonstrating how attitudes shape not only personal decisions but also collective agricultural outcomes. In summary, the literature consistently illustrates that enhancing farmers' attitudes through targeted interventions such as education and improved access to resources can lead to more effective decision-making processes in agriculture. This approach not only benefits individual farmers but also contributes to broader agricultural sustainability goals.

6. Effect of Farmer Skills on Farmer Decisions

The results showed that farmers' skills had a positive effect on farmers' decisions. Based on partial hypothesis testing, farmer skills have a positive effect on farmer decisions, where the better skills possessed by farmers will provide the best decisions for the crops they grow. Recent research has consistently highlighted the positive impact of farmers' skills on their decision-making processes in agriculture.

The ability of farmers to make informed choices significantly enhances their productivity and the quality of the crops they cultivate. For instance, (Nazuri et al., 2018) found that improved skills among farmers lead to better agricultural decisions, which in turn maximize crop yields. This finding is corroborated by (Indraningsih, 2016) Indraningsih (2016), who emphasized that farmers' skills are critical determinants in their decision-making, suggesting that those with higher skill levels are more adept at navigating the complexities of agricultural management.

Further analysis by (Sasmi et al., 2022) supports this notion by indicating that specific farmer characteristics, including skills and knowledge, serve as vital indicators of their decision-making capabilities related to farming activities. This aligns with the findings of (McCormack et al., 2024), who noted that farmers' perceptions and experiences significantly influence their willingness to adopt new practices and technologies. Their study revealed that when farmers possess strong technical skills, they are more likely to engage in innovative agricultural practices, thereby improving their overall productivity.

Moreover, a recent study conducted by (Kong et al., 2021) illustrates how both individual skills and external factors such as market conditions and access to resources often shape decision-making processes among farmers. This highlights the need for targeted educational programs that not only enhance individual skills but also address broader socio-economic challenges faced by farmers.

By fostering a comprehensive skill set among farmers, agricultural policies can be better aligned with the realities of farming practices, ultimately leading to improved outcomes for both farmers and the agricultural sector as a whole. In conclusion, the literature underscores the critical role of farmers' skills in shaping effective decision-making processes. Enhancing these skills through education and training can lead to more sustainable agricultural practices and increased productivity.

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CONCLUSION

From the description of the research results in the previous chapter, it can be concluded that farmer knowledge, farmer attitudes and farmer skills affect farmers' decisions in SLPHT activities. The highest factor or influence in influencing farmers' decisions on SLPHT activities is farmer knowledge. In addition, this research also contributes to the government and related agencies; this research can be used as input in the implementation of SLPHT activities for rice plants, so it is hoped that SLPHT activities for rice plants can run even better in the future. This research is also expected to provide input for the Bakalan village government and the Bojonegoro Regency Agriculture Office, which has established the SLPHT activities of Rice Plants in Bakalan Village, so it is expected that there will be even better cooperation in the future.

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