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The Effect of the Implementation of Agricultural Extension Methods on Increasing Farmers' Capabilities

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ABSTRACT

This study aims to analyze the effect of agricultural extension methods on improving farmer capabilities in Kepuh Village, Palimanan District, Cirebon Regency. This study was conducted from June to July 2025. Farmer capabilities in this study were measured through four main indicators: agricultural insight, technical competence, decision-making ability, and attitude and independence. The extension methods studied included direct face-to-face, field schools, demonstration plots, and digital media. This study used a quantitative approach with a census method on 50 farmers as respondents. The data analysis technique used simple linear regression preceded by validity and reliability tests, as well as classical assumption tests. The results showed that agricultural extension methods had a positive and significant effect on improving farmer capabilities. The regression equation obtained was Y = 48647.719 + 0.476X, which means that every one unit increase in the extension method will increase farmer capabilities by 0.476 units. The significance value was 0.001 (<0.05) and the coefficient of determination (R^2) was 0.210. This indicates that 21% of the variation in farmer capabilities can be explained by the applied agricultural extension methods.

Keywords: Agricultural extension, extension methods, farmer capabilities.

INTRODUCTION

The agricultural sector plays a strategic role in supporting national food security and improving the welfare of rural communities (Neglo et al., 2021; Qureshi et al., 2015). However, the low capacity of farmers to adopt modern agricultural technology remains a major challenge, affecting both productivity and the sustainability of farming businesses. One of the key factors hindering technology adoption is the limited access to technologies that are suitable for local conditions, as evidenced by Sianipar (2022), who showed that solar-powered cocoa drying technology in Nias could be an environmentally friendly solution tailored to rural areas with limited resources (Sianipar, 2022). Additionally, demographic factors such as age, education level, and farm size also influence farmers' readiness to adopt new technologies, as highlighted by Diaz (2021), who emphasized the importance of socio-demographic factors in adopting mobile-based agricultural extension services (Diaz, 2021). Farmers' perceptions of technology also play a critical role in adoption decisions, as found by Sharifuddin et al. (2018), who showed that perceptions of usefulness and ease of use significantly affect the adoption of organic rice farming (Sharifuddin et al., 2018). Access to information and training has also proven to increase technology adoption, as demonstrated by Salam (2024), who emphasized the importance of education and farming experience in influencing adoption decisions (Salam, 2024). Moreover, limited economic resources remain a key barrier to technology adoption, as revealed by Dagunga (2020), who found that limited access to agricultural credit hinders farmers' ability to adopt new technologies (Dagunga, 2020). Social and institutional factors also play an important role, as explained by Pagliacci (2020), who highlighted the influence of technology accessibility, policy design, and social expertise in adopting climate-smart agricultural practices (Pagliacci, 2020). Therefore, a holistic approach is needed, including improving access to credit, continuous training, and institutional development to support these efforts and maximize agricultural potential in Kepuh and other regions.

Agricultural extension is a crucial tool for disseminating agricultural information and innovations to farmers. According to Ginting et al. (2020), agricultural extension serves as both an educator and a facilitator, fostering understanding and shaping attitudes toward the application of technology. Aslamia et al. (2017) added that the success of extension services is largely determined by active farmer participation and the effectiveness of delivery methods. Meanwhile, Rachmawati et al. (2021) stated that agricultural extension is a continuous, non-formal educational program aimed at modifying farmers' behaviour so that they understand and implement agricultural innovations to improve their welfare.

In practice, agricultural extension is delivered through various methods, such as face-to-face meetings (*anjangsana*), field schools (*Sekolah Lapang* or *SL*), demonstration plots (*demplot*), and digital media. Face-to-face meetings allow for intensive direct interaction between extension workers and farmers (Rahmawati et al., 2023), while field schools develop practical skills in a participatory manner (Prasetyo, 2020). Demonstration plots serve as visual media that stimulate farmers' interest in new technologies (Rahman, 2021), whereas digital media is considered efficient for conveying information quickly and widely (Agustina et al., 2022). Various extension methods have been implemented, including face-to-face meetings, field schools, and demonstration plots. However, their effectiveness needs to be reassessed at the local level. Based on initial observations, farmers in Kepuh Village still have limited access to digital-based agricultural information and have not fully adopted modern cultivation technologies. Data from the Agricultural Extension and Human Resources Development Agency (BPPSDMP) over the past five years (2019–2023) show that farmer participation in extension activities is still relatively low—only around 35% of farmers regularly participate (BPPSDMP, 2023). Nationally, the adoption rate of agricultural technology has only reached 86%–88%, still below the government's target of 90% by the end of 2024. Although in 2021 a total of 66,776 extension workers participated in technical training, the implementation of extension in the field has not been evenly distributed and has yet to significantly improve farmer capacities overall. Therefore, it is important to conduct research to assess the extent to which agricultural extension methods influence the improvement of farmer capacities in this village.

The research of Ginting et al. (2020) highlighted the role of agricultural extension in disseminating information and fostering understanding of new agricultural technologies. However, their study focused more on a general approach to extension services and did not examine the impact of specific extension methods on farmer participation and technology adoption. In contrast, Aslamia et al. (2017) acknowledged that the success of agricultural extension depends largely on farmer participation and the effectiveness of delivery methods; however, their study did not evaluate how these methods perform in different rural contexts or how local farmer characteristics influence technology adoption. This gap is addressed by the current study, which focuses specifically on the agricultural extension methods implemented in Kepuh Village, Palimanan District, Cirebon Regency. It examines the effect of various methods—such as face-to-face meetings, field schools, demonstration plots, and digital media—on enhancing farmers' capabilities and technology adoption, a dimension not fully explored in previous studies.

This study aims to analyze the influence of agricultural extension methods on improving farmer capabilities, as a basis for developing extension strategies that are more appropriate and aligned with local farmer characteristics. The benefits of this research include contributing to the enhancement of extension services in rural areas, increasing farmer participation in extension activities, and accelerating the adoption of modern agricultural technologies, which will ultimately contribute to the sustainability and productivity of farming in Indonesia.

METHOD

This study used a quantitative approach with a descriptive survey method. The research was conducted in Kepuh Village, Palimanan District, Cirebon Regency—an area with high agricultural potential but low adoption of modern agricultural technology. The research took place from June to July 2025. The population in this study comprised all 50 active farmers in Kepuh Village, and the entire population was selected as respondents using a census method.

The data collected consisted of both primary and secondary data. Primary data were obtained through the distribution of questionnaires that had been tested for validity and reliability, as well as through direct observation and interviews with farmers. Secondary data were gathered from documents and reports provided by relevant agencies, such as the *Balai Penyuluhan Pertanian* (BPP) Palimanan. The independent variable in this study was the agricultural extension method, which included several approaches: face-to-face meetings, field schools (*Sekolah Lapang*), demonstration plots (*demplot*), and digital media. Meanwhile, the dependent variable was farmer capability, measured using indicators such as insight, technical competence, decision-making ability, and attitude and independence in managing farming businesses.

Data analysis was performed using simple linear regression techniques to determine the significant effect of extension methods on farmer capabilities. Prior to conducting the regression analysis, the data underwent classical assumption testing, including normality, linearity, and homoscedasticity tests. All data processing and analysis were carried out using SPSS version 26 software.

RESULTS AND DISCUSSION

Validity Test

Validity testing requires a significant correlation with the total score. Question items are considered valid if their correlation value (r count) is greater than r table (with a significance level of 0.5 or 5%).

Table 1. Validity Test Results

Variables	Item	Rcount	Rtable	Information
Agricultural Extension Methods (X)	1	0.649	0.284	Valid
	2	0.515	0.284	Valid
	3	0.711	0.284	Valid
	4	0.645	0.284	Valid
	5	0.707	0.284	Valid
	6	0.606	0.284	Valid
	7	0.657	0.284	Valid
	8	0.694	0.284	Valid
	9	0.688	0.284	Valid
	10	0.678	0.284	Valid
	11	0.725	0.284	Valid
	12	0.700	0.284	Valid
	13	0.782	0.284	Valid
	14	0.744	0.284	Valid
	15	0.701	0.284	Valid
	16	0.771	0.284	Valid
	17	0.768	0.284	Valid
	18	0.772	0.284	Valid
	19	0.783	0.284	Valid
Farmer Capability (Y)	1	0, 838	0.284	Valid
	2	0.829	0.284	Valid
	3	0.811	0.284	Valid
	4	0.781	0.284	Valid
	5	0.750	0.284	Valid
	6	0.687	0.284	Valid
	7	0.602	0.284	Valid
	8	0.729	0.284	Valid
	9	0.729	0.284	Valid
	10	0.662	0.284	Valid
	11	0.799	0.284	Valid
	12	0.800	0.284	Valid
	13	0.738	0.284	Valid
	14	0.400	0.284	Valid
	15	0.793	0.284	Valid
	16	0.389	0.284	Valid
	17	0.697	0.284	Valid
	18	0.674	0.284	Valid
	19	0.795	0.284	Valid
	20	0.657	0.284	

Source: Primary Data After Processing, 2025

The validity test results show that all items in both variables (X and Y) have good validity, because the correlation value of each item to the total score is greater than the table r value. Therefore, all items are considered capable of measuring the intended aspects and can be used in the data collection process of this study.

Reliability Test

Reliability testing was conducted to determine the extent to which the research instrument (in this case the questionnaire) was reliable and consistent in measuring the intended variables, namely agricultural extension methods (X) and farmer capabilities (Y). Reliability testing used the Cronbach's Alpha technique , which was calculated using SPSS version 26 software . The reliability value was declared good if the Cronbach's Alpha value ≥ 0.60 (Sugiyono, 2017). The test results can be seen in the following table:

Table 2. Reliability Test Results

Variables	Alpha Coefficient (Cronbach's Alpha)
Agricultural Extension Methods (X)	0.942
Farmer Capability (Y)	0.948

Source: Primary Data Processed Using SPSS 26 Software, 2025

Based on the results of the reliability test shown in Table 2, it is known that:

1. The Agricultural Extension Method variable (X) has a Cronbach's Alpha coefficient value of 0.942.
2. The Farmer Capability variable (Y) has a Cronbach's Alpha coefficient value of 0.948.

Both values are above 0.90, which, according to general standards in quantitative research, falls into the "highly reliable" category. This means that the research instrument used to measure both variables exhibits a very high level of internal consistency. This indicates that each item in the questionnaire or measuring instrument used for variables X and Y has a strong correlation with each other and is able to consistently measure the same aspects. Therefore, it can be concluded that the research instrument used in this study is reliable and suitable for data collection, as it meets the requirements for excellent reliability. This high level of reliability also increases the validity of the research results as a whole, as measurement errors due to instrument inconsistencies are minimized.

Classical Assumption Test

Normality Test

The normality test in this study was conducted to determine whether the residual data was normally distributed, which is one of the prerequisites in linear regression analysis. This test was conducted through two approaches: by observing the Normal PP Plot graph and using the Kolmogorov-Smirnov statistical test . If the points on the graph follow the diagonal line, then the data is said to be close to a normal distribution. Furthermore, based on the Kolmogorov-Smirnov test , if the significance value (Sig.) is greater than 0.05, then the data is also considered normal. The results of the normality test in this study are shown as follows:

Table 3. Normality Test Results One-Sample Kolmogorov-Smirnov Test

Test	Unstandardized Residual
N	50
Normal Parameters	Mean = 0.0000000
	Std. Deviation = 10,546.77
Most Extreme Differences	Absolute = 0.105
	Positive = 0.094
	Negative = -0.105
Test Statistics	0.105
Asymp. Sig. (2-tailed)	0.200

a. Test distribution is Normal.
b. Calculated from data.

Source: Primary Data Processed Using SPSS 26 Software, 2025

Based on the results of the normality test using the One-Sample Kolmogorov- Smirnov Test, the Asymp. Sig. (2-tailed) value was obtained at 0.200. This value is well above the 0.05 significance level, so it can be concluded that the residual data is normally distributed. This indicates that the normality assumption is met.

The assumption of normality is crucial in classical linear regression analysis, particularly the Ordinary Least Squares (OLS) method. If the residual data is not normal, the model estimation results can be biased or inefficient. However, in this study, because the residual data were normally distributed, the regression model used was deemed appropriate and feasible for further analysis, including t-tests and F-tests. Therefore, the regression model in this study met the statistical assumptions and is reliable in revealing the relationships between variables.

Homoscedasticity Test

The homoscedasticity test in this study was conducted to determine whether the residual data exhibited a constant variance distribution. The test was conducted using a scatterplot graph between the predicted and residual values. If the points on the scatterplot were randomly distributed and did not form a specific pattern, the regression model was said to meet the homoscedasticity assumption. The results of the homoscedasticity test in this study are presented as follows:

Scatterplot

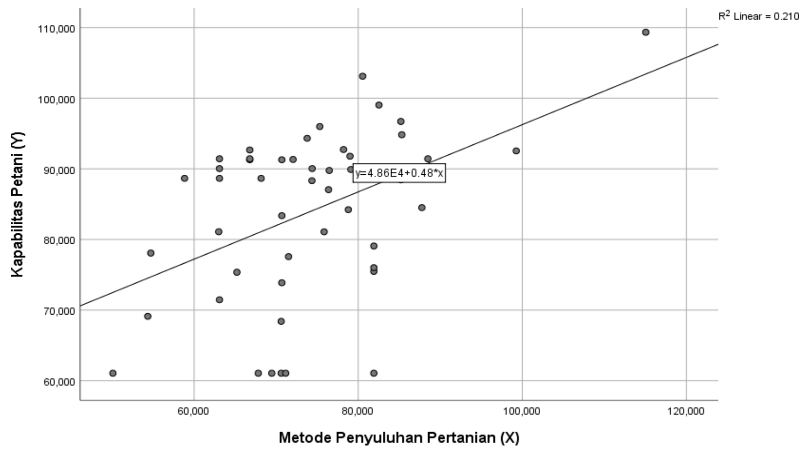

Figure 1. Scatterplot Diagram

Based on Figure 1, the points in the scatterplot are randomly distributed around the regression line and do not form a specific, regular pattern, such as conical or spreading out in one direction. This distribution indicates that the residual variance is constant, or homoscedasticity is met. Therefore, it can be concluded that the regression model in this study meets the homoscedasticity assumption, making it suitable for further analysis without the risk of deviations in the residual variance.

Linearity Test

A linearity test was conducted to determine whether the relationship between the independent variable (Agricultural Extension Method) and the dependent variable (Farmer

Capability) was linear. This test is essential before regression analysis to ensure the model conforms to the basic assumptions of the relationship between the variables. The following is a scatter plot diagram between Agricultural Extension Methods (X) and Farmer Capability (Y):

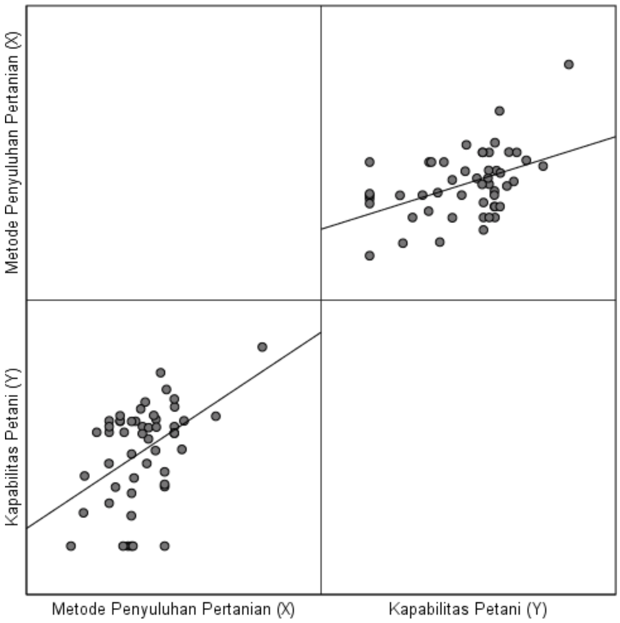

Figure 2. Scatter Matrix Graph

Based on the scatter plot above, it can be seen that the data points are spread along a straight line. This indicates a linear relationship between Agricultural Extension Methods (X) and Farmer Capability (Y). The relationship between agricultural extension methods and farmer capability is linear, meaning that the better the extension method used, the greater the farmer's capability.

Hypothesis Testing

T-test

A t-test is conducted to determine whether the independent variable has a partial effect on the dependent variable. If the significance value (Sig.) is less than 0.05, the variable is considered to have a significant effect. Conversely, if it is greater than 0.05, it does not have a significant effect. The results of the t-test in this study are presented as follows:

Table 4. T-Test Results

Coefficients [a]						
Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	48647.719	10047.603		4,842	.000
	Agricultural Extension Methods (X)	.476	.133	.458	3,567	.001
a. Dependent Variable: Farmer Capability (Y)						

Source: Primary Data Processed Using SPSS 26 Software, 2025

The Agricultural Extension Method has been statistically proven to have a positive and significant effect on Farmer Capability based on the t-test results, with a significance value (p-value) of 0.001 < 0.05. This is in line with the opinion of Rachmawati et al. (2021) who stated that agricultural extension is a form of non-formal education that aims to modify farmer behavior through the continuous delivery of information and knowledge transfer, so that farmers are able to understand, accept, and apply agricultural innovations to improve their capabilities and welfare.

F test

The F-test is used to determine whether independent variables simultaneously influence the dependent variable. If the significance value (Sig.) is <0.05, the regression model is considered significant, meaning all independent variables simultaneously influence the dependent variable. If the significance value is >0.05, the independent variables do not simultaneously influence the dependent variable. The results of the F-test in this study are presented as follows:

Table 5. F Test Results

ANOVA [a]					
Model	**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
Regression	1445084055.866	1	1445084055.866	12,726	.001 [b]
Residual	5450478347.814	48	113551632.246		
Total	6895562403.680	49			
a. Dependent Variable: Farmer Capability (Y)					
b. Predictors: (Constant), Agricultural Extension Method (X)					

Source: Primary Data Processed Using SPSS 26 Software, 2025

Based on the results of the F test, the F value was 12.726 with a significance value of 0.001 < 0.05. It can be concluded that the Agricultural Extension Method simultaneously has a significant effect on Farmer Capability. This means that the regression model used in this study can be said to be appropriate to explain the relationship between the independent variable (Agricultural Extension Method) and the dependent variable (Farmer Capability).

Determination Test

To determine the extent to which the independent variables in this study are able to explain the dependent variable, the coefficient of determination (R^2) analysis is used. The coefficient of determination is a statistical measure that shows the proportion of variation in the dependent variable that can be explained by the independent variables in a regression model. The R^2 value ranges from 0 to 1. The closer it is to 1, the stronger the independent variable's ability to explain the dependent variable. Conversely, if the R^2 value approaches 0, it indicates that the independent variable is unable to significantly explain the variation that occurs in the dependent variable.

Based on the determination test results, the R Square value was 0.210. This indicates that 21.0% of the Farmer Capability variable can be explained by the applied Agricultural Extension Method. This means that the regression model has sufficient ability to explain the relationship between extension methods and farmer capabilities. Meanwhile, the remaining

79.0% is influenced by other factors/variables outside the model that were not examined in this study.

The results of this study indicate that the implementation of agricultural extension methods has a positive and significant impact on improving farmer capabilities. This finding aligns with various previous studies. Research by Andi Nur Imran et al. (2019) shows that extension methods such as demonstration plots, field visits, training, and field schools are highly effective in improving farmers' knowledge and skills. This is consistent with the findings of this study, which found that the field school and demonstration plot methods used in Kepuh Village were proven to significantly improve farmers' knowledge and technical competence.

Simple Linear Regression Test

The Influence of Agricultural Extension Methods on Farmer Capabilities

Simple linear regression analysis is used to determine the extent of the influence of the implementation of agricultural extension methods (X) on farmer capabilities (Y) partially. According to Ghozali (2021), simple linear regression is appropriate for determining the direction and strength of the relationship between two quantitative variables. Simple linear regression is a statistical technique used to analyze the relationship between two variables: one independent variable and one dependent variable. Assuming that the relationship between the two variables is linear, this analysis can indicate whether the applied extension methods have a significant influence on improving farmer capabilities, which include aspects of insight, technical competence, decision-making ability, and farmer attitudes and independence. To obtain accurate results, this regression analysis is preceded by instrument validity and reliability tests, as well as classical assumption tests such as normality, linearity, and homoscedasticity.

Once all statistical prerequisites are met, linear regression can provide an empirical picture of the relationship between extension methods and farmer capabilities. The results of this test are expected to explain not only the direction of the relationship (positive or negative), but also the strength of the influence of extension methods on improving farmer quality in Kepuh Village, Palimanan District, Cirebon Regency.

Table 6. Simple Linear Regression Test Results

Coefficients [a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	48647.719	10047.603		4,842	.000
	Agricultural Extension Methods (X)	.476	.133	.458	3,567	.001
a. Dependent Variable: Farmer Capability (Y)						

Source: Primary Data Processed Using SPSS 26 Software, 2025

Based on the results of the simple linear regression test, the following equation was obtained:

Y = 48647.719 + 0.476X

This means that every one-unit increase in the Agricultural Extension Method will increase Farmer Capability by 0.476 units, with a significance value of 0.001 < 0.05. This indicates that the influence of variable X on Y is positive and statistically significant. These findings are supported by the opinion of Ginting et al. (2020), who stated that agricultural extension services serve as educators and facilitators for farmers in understanding and implementing agricultural technology. Good extension services can instill in-depth attitudes and understanding, which ultimately improve farmers' technical and managerial capabilities.

CONCLUSION

Based on the research findings, it can be concluded that the most effective agricultural extension methods in Kepuh Village are face-to-face interactions and field schools, as indicated by the respondents. The capabilities of farmers in the village are relatively good, particularly in terms of decision-making and maintaining an independent attitude. The results of the regression test show that agricultural extension methods have a positive and significant effect on farmer capability, with a significance value of $p < 0.05$ and a coefficient of determination of $R^2 = 0.210$. This indicates that 21% of the improvement in farmer capability can be attributed to the extension methods applied. However, it is recommended that further efforts be made to expand the reach and enhance the effectiveness of these methods, particularly through the integration of digital tools to improve access to information for farmers who may be geographically or digitally isolated. In addition, further research should investigate the long-term impact of these extension methods on the sustained development of farmers' skills and evaluate how these improvements contribute to increased agricultural productivity and income within the community.

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