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THE UTILIZATION OF INFORMATION AND COMMUNICATION TECHNOLOGY TO SUPPORT FARMING SYSTEM IN PURWOREJO REGENCY

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Abstract. Technological development has encouraged the use of information and communication technology (ICT) in agriculture to support smarter, more efficient, and sustainable farming systems. This study is novel in examining ICT utilization across three contrasting topographies within a single regency, and in finding that farming experience reduces — rather than increases — ICT use, while land area outweighs access-based factors such as device ownership. Purworejo Regency is a relevant area for such analysis due to its varied land characteristics. This study aimed to identify the factors influencing ICT utilization among smallholder farmers who are members of farmer groups in Purworejo Regency. A quantitative descriptive approach was employed through a survey of 87 farmers in three subdistricts representing topographical variation, namely Bener, Ngombol, and Purwodadi. The data were analyzed using multiple linear regression. The results showed that farming experience had a negative and significant effect, while land area had a positive and significant effect on ICT utilization. Meanwhile, age, education, status in farmer groups, land status, and number of ICT devices owned had no significant effect. The novelty of this study lies in its focus on smallholder farmers in a geographically diverse agricultural area and in examining the local level determinants of ICT use. These findings provide useful insights for developing more targeted agricultural digitalization policies and extension programs.

Keywords: Agriculture, Information and communication technology (ICT), Farming system, Digital agriculture, Smallholder farmers

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INTRODUCTION

Modernization supports rapid technological development, including Information and Communication Technology (ICT). ICT encompasses a wide range of technologies, from traditional communication tools to advanced systems such as cloud computing, the Internet of Things, and artificial intelligence (El Bilali, H., Bottalico, F., Ottomano Palmisano, G., Capone, 2020). Its use has been proven to increase the efficiency of farming businesses in various countries, such as the use

of agricultural applications by farmers in Germany (Michels & Mußhoff, 2020) and access to market information via mobile phones in India (Gupta et al., 2021). This phenomenon shows that the utilization of ICT in agriculture has become an important part of the digital transformation of the agricultural sector in various countries. In Indonesia, ICT utilization continues to increase, as reflected in its 2.83% growth in 2022 (BPS, 2022). Farmers in Yogyakarta, for example, have utilized television, radio, and mobile phones to access agricultural information (Subejo et al., 2017). The utilization of ICT makes it easier for farmers to access information that was previously difficult to obtain, such as the latest weather data, market prices, and the latest cultivation techniques. ICT also helps connect farmers to a wider market and provides opportunities for collaboration between farmers, extension workers, and researchers to develop innovations and disseminate knowledge more quickly.

Purworejo Regency, as a strategic agricultural area, has 27,784.04 hectares of agricultural land and 2,013 active farmer groups. Based on BPS data, 85.58% of Purworejo's population uses mobile phones and computers (BPS, 2022), but the utilization of ICT in farming has not been specifically studied. This study focuses on smallholder farmers who are members of farmer groups, as they represent the dominant agricultural actors in rural areas and play an important role in local farming systems. Three subdistricts were selected to represent different land characteristics in Purworejo Regency based on topographical conditions, namely Bener Subdistrict (upland/dryland farming), Ngombol Subdistrict (coastal lowland farming), and Purwodadi Subdistrict (irrigated lowland rice farming).

These topographical variations are important for representing the overall characteristics of Purworejo Regency, which covers a wide area with diverse land conditions. The selection of subdistricts with contrasting topographies was considered sufficient to capture the variation in agricultural environments across the region. Therefore, these differences in land characteristics are relevant for explaining variations in ICT utilization among farmers.

Unlike previous studies that primarily examined ICT utilization among farmers in homogeneous agricultural settings or at the provincial and national scale (Subejo et al., 2017; Luqman et al., 2019; Ntsoane & Ndoro, 2025), this study contributes a sub-district-level analysis that explicitly accounts for topographical heterogeneity within a single regency. The juxtaposition of upland dryland (Bener), coastal lowland (Ngombol), and irrigated lowland (Purwodadi) environments within one analytical frame allows for intra-regional comparison that is rarely attempted in the Indonesian ICT-agriculture literature. Furthermore, by demonstrating that farming experience exerts a negative effect on ICT utilization — a direction that contrasts with the prevailing assumption that experience broadens information-seeking behaviour (Juniarti et al., 2022) — this study offers a counter-narrative that carries implications for how extension programs targeting experienced farmers should be designed. The study aims to analyze the factors that influence the utilization of ICT in supporting farming businesses in Purworejo Regency.

METHOD

Location and Data Collection

The research was conducted in Purworejo Regency, selecting three subdistricts as study locations, namely Bener Subdistrict, Ngombol Subdistrict, and Purwodadi Subdistrict. The selection of locations was based on geographical variations that reflect the characteristics of the Purworejo region, as well as the level of farmer activity in agricultural activities. This classification was reinforced through Focus Group Discussions (FGD) with the Food Security and Agriculture Agency. Next, farmers were randomly selected from predetermined farmer group members, with a total of 87 respondents.

Data collection in this study was carried out through three main methods, namely observation, interviews, and literature study and recording. Observations were carried out directly in the three subdistricts to obtain a real picture of the situation in the field. Interviews were conducted using a structured list of questions in the form of questionnaires for farmers to explore primary information related to the utilization of ICT and factors that influence its use in farming. Meanwhile, literature studies and documentation were conducted by reviewing various literature in the form of books, scientific articles, journals, and official documents from agencies such as BPS. The results of the literature review were recorded and summarized to strengthen the theoretical basis and support data analysis in this study.

Analysis Method

This study analyzed the factors that influence the utilization of ICT by farmers in Purworejo Regency using multiple linear regression tests with a significance level of 5% or 0.05. The independent variables (x) used included age (years), length of education (years), status in farmer groups (member and administrator), length of farming (years), land area (square meters), land status (owned and non-owned), and number of ICT devices owned. The multiple linear regression model used in this study is formulated in equation (1).

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + e \quad (1)$$

Where: Y = total ICT utilization score; a = constant; b_1–b_7 = regression coefficients; X_1 = age (years); X_2 = length of education (years); X_3 = status in farmer groups (1 = administrator, 0 = member); X_4 = length of farming (years); X_5 = land area (m²); X_6 = land status (1 = owned, 0 = non-owned); X_7 = number of ICT devices owned; and e = error term.

Before conducting multiple linear regression testing, classical assumption testing was carried out as a testing requirement. In this study, classical assumption testing included normality testing, multicollinearity testing, and heteroscedasticity testing. Normality testing was carried out using a graphical approach (P–P Plot) and Kolmogorov-Smirnov statistical testing. The graphical results showed that the residual points were scattered along a diagonal line, indicating a distribution pattern that was close to normal. Meanwhile, the Kolmogorov-Smirnov test produced a significance value of 0.88 (> 0.05), so the residuals were declared to be normally distributed. Next, the multicollinearity test was performed using the Tolerance and Variance Inflation Factor (VIF) values. All independent variables in the model had Tolerance values above 0.1 and VIF values below 10, indicating no multicollinearity. The heteroscedasticity test was performed through a scatterplot analysis between the residuals and the predicted values. The scatterplot results show that the residual points are scattered randomly around the horizontal line without forming a specific pattern, indicating that there is no heteroscedasticity in the model. Thus, it can be concluded that the regression model in this study has met all classical assumptions.

RESULT AND DISCUSSION

The utilization of ICT in agriculture refers to the extent to which farmers use various digital devices and media to support their farming activities. Table 1 shows the variation in ICT utilization by farmers in Purworejo District. The most widely utilized ICT media overall is YouTube, with 25% of farmers using it to obtain agricultural information. Farmers access YouTube to learn about cultivation techniques, organic fertilizer production, and pest control in a visual and practical manner. These findings show that visual content that is easy to understand is the main attraction of this media. However, these results differ from the research by Nurrahmah & Sulistiawati (2022) which found that farmers in East Java utilize YouTube mainly to search for the latest agricultural technology.

Other media that are also widely used by farmers are television, WhatsApp, Facebook, and radio, with utilization rates above 10%. Christian & Subejo (2018) also confirmed that the media commonly used by farmers to obtain agricultural information include television, radio, mobile phones, and smartphones.

When viewed by sub-district, farmers in Bener Sub-district tend to use conventional media such as television (25.64%) and radio (20.51%). Radio Irama FM is one of the important media because it broadcasts weekly agricultural extension programs. Television is relied upon to obtain information about agricultural policies, as Christian & Subejo (2018) also found that around 24.14% of farmers utilize television for similar purposes. In contrast, Purwodadi Subdistrict shows a dominance in the utilization of internet-based social media such as Facebook (25%) and WhatsApp (20.83%). Farmers use Facebook to join agricultural communities such as chili communities to obtain market price information and cultivation innovations. Nurrahmah & Sulistiawati (2022) also found that farmers utilize Facebook to share price information after harvest.

Meanwhile, the utilization of more specific digital media such as websites and agricultural applications is still limited in all subdistricts, with only around 5–10%. The Purwodadi Subdistrict has the highest average ICT utilization, driven by high smartphone ownership, good internet access, and the dominance of the productive age group among farmers. Farmers in this region also tend to solve agricultural problems independently, without relying too much on extension services, due to various environmental challenges such as soil salinity, limited fresh water, and the risk of abrasion. The complexity of these challenges increases the need for technical and adaptive information for farmers, although limitations in infrastructure and technology may be barriers to accessing this information through ICT in Table 1.

Table 1. The extent to which farmers in Purworejo Regency utilize ICT to support their agricultural businesses

Types of ICT Utilization	Bener District		Ngombol District		Purwodadi District		Total	
	Number (people)	Percentage (%)	Number (people)	Percentage (%)	Number (people)	Percentage (%)	Number (people)	Percentage (%)
Television	10	25,64	7	15,56	13	18,06	30	19,23
Radio	8	20,51	7	15,56	3	4,17	18	11,54
YouTube	7	17,95	15	33,33	17	23,61	39	25,00
Facebook	4	10,26	3	6,67	18	25,00	25	16,03
WhatsApp	4	10,26	8	17,78	15	20,83	27	17,31
Website	4	10,26	3	6,67	2	2,78	9	5,77
Agricultural Application	2	5,13	2	4,44	4	5,56	8	5,13
Total	39	100,00	45	100,00	72	100,00	156	100,00

Source: Data Processed, 2024

Factors Affecting the Amount of ICT Utilization by Farmers

ICT utilization by farmers is an important aspect in improving the efficiency and sustainability of farming businesses. The factors affecting the extent of ICT use by farmers can vary greatly. To determine the extent to which these factors affect the overall use of ICT, a multiple linear regression analysis was conducted, as shown in Table 2. The first model in the multiple linear regression analysis uses the backward method to identify factors that influence the amount of ICT utilization by farmers. Of the seven variables tested, only the land area variable was found to be significant at a 95% confidence level, with a t-value of 3.218. This indicates that the larger the land area owned, the

higher the tendency for farmers to utilize ICT. Meanwhile, other variables such as age, education, length of farming, status in farmer groups, land status, and ICT device ownership were not significant, so they will be gradually eliminated in the next backward stage. The R-square value of 0.3 indicates that the model is able to explain 30% of the variation in ICT utilization. Thus, the table below shows the results of the multiple linear regression analysis on the final model.

Table 2. Results of multiple linear regression analysis on factors affecting the amount of ICT utilization by farmers (first model)

Variables	Regression Coefficient	t calculated	Sig.	Note
Age	-0,024	-0,901	0,371	NS
Length of Education	0,003	0,045	0,964	NS
Status in Farmer Group	-0,034	-0,075	0,941	NS
Length of Farming	-0,027	-1,289	0,201	NS
Land Area	0,000	3,218	0,002	*
Land Status	0,283	0,683	0,497	NS
Number of ICT Devices Owned	0,197	1,469	0,146	NS
Constant		2,211		
R square		0,30		
Adjusted R-Square		0,238		
F-Statistic		4,827		

Note:

*: Significant at 5% alpha

Source: Data Processed, 2024

Table 3. Results of multiple linear regression analysis on factors affecting the amount of ICT utilization by farmers (final model)

Name of Variables	Regression Coefficient	t calculated	Sig.	Note
Length of Farming	-0,047	-4,221	0,000	*
Land Area	0,00014	3,822	0,000	*
Constant		2.354		
Adjusted R-Squared		0.251		
ANOVA Sig.		0,000		

Note:

*: Significant at 5% alpha

Source: Data Processed, 2024

Table 3 presents the results of the final multiple linear regression analysis model, which has been simplified using the backward method. The change in the regression coefficient and significance of the length of farming variable between the full model (Table 2) and the final model (Table 3) is attributable to the backward elimination process. In the full model, the presence of correlated predictors — particularly age — may have suppressed the independent contribution of farming experience. Once non-significant variables were removed, the effect of farming experience became more precisely estimated, resulting in a larger and statistically significant coefficient in the final model. Only two variables were retained because they were proven to significantly affect farmers' use of ICT, namely length of farming and land area (Table 3). The length of farming variable

has a negative regression coefficient of -0.047 with a t-value of -4.221 and a significance of 0.000. This value indicates that the longer a farmer has been involved in agriculture, the more significant their tendency to utilize ICT decreases. Conversely, the land area variable shows a positive and significant effect on ICT utilization, with a regression coefficient of 0.00014 and a t-value of 3.822 at a significance level of 0.000.

Overall, the final model has an Adjusted R-square value of 0.251, indicating that the final regression model is able to explain approximately 25.1% of the variation in the dependent variable based on the independent variables in the model. While this value suggests a moderate explanatory power, it also indicates that a substantial proportion of variation is influenced by other factors not captured in the model, such as farmers' socio-economic conditions, access to infrastructure, digital literacy, and institutional support.

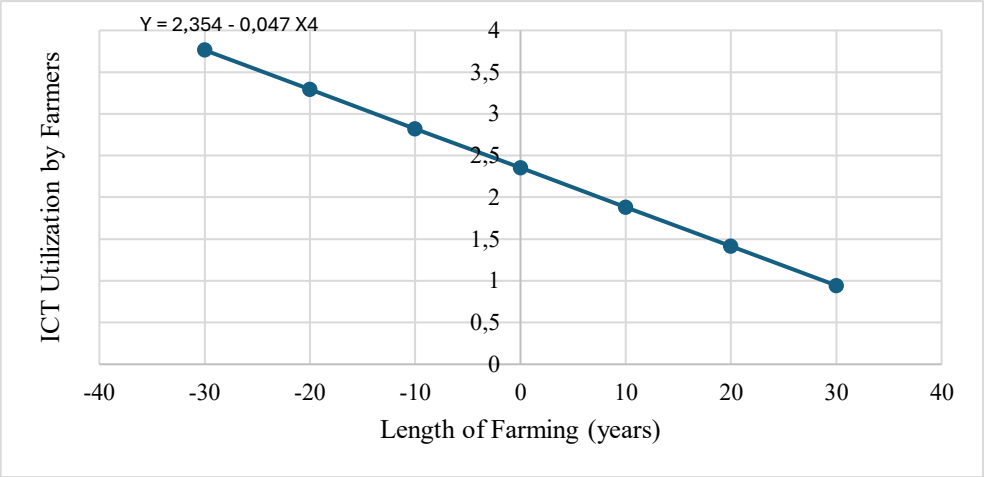
Despite this limitation, the model remains statistically significant, as indicated by the ANOVA significance value of 0.000, which is lower than the alpha level of 0.05. This confirms that the independent variables jointly have a significant effect on ICT utilization. Based on the results of the multiple linear regression analysis in Table 3, the result of regression formula in equation 2.

$$Y = 2{,}354 - 0{,}047x4 + 0{,}00014x5 + e \quad (2)$$

Where: Y = Total ICT utilization by farmers; x4 = Length of farming (years); x5 = Land area (m^2); and e = Error term

The length of farming generally refers to the duration of time that a person has spent carrying out agricultural activities, calculated from the first time they started actively farming until a certain time when the measurement was taken. The length of farming reflects not only how long a farmer has been involved in crop cultivation or land management but also the depth of understanding of agricultural practices obtained through direct learning in the field. The longer a farmer is involved in agricultural activities, the higher their level of experience, which is ultimately reflected in more focused and efficient land management practices (Pratiwi & Sudrajat, 2012).

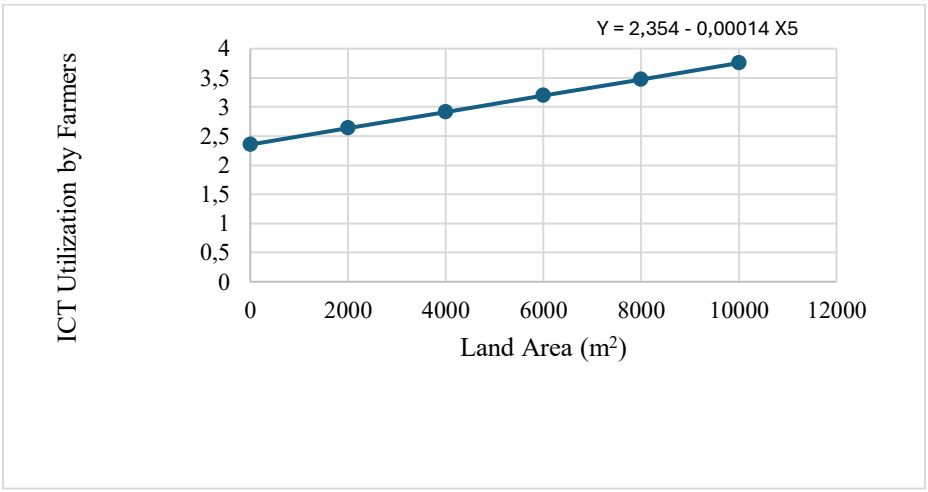
According to Juniarti et al. (2022), the duration of a farmer's farming experience also influences the intensity and tendency to seek information related to agricultural activities. Farmers who have been farming for a long time generally have a strong accumulation of experience-based knowledge, especially in terms of traditional cultivation techniques, seasonal management, and local marketing practices. However, this long experience often forms habits and mindsets that tend to be conservative towards innovation, including ICT. This study found that there is a difference between long experience and the amount of ICT utilization, because experienced farmers tend to maintain conventional methods that have been proven successful in their opinion. The following is a graph of the influence of farming experience on the amount of ICT utilization by farmers.



Source: Data Processed, 2025

Figure 1. The Effect of Farming Experience on the Level of ICT Utilization by Farmers

Figure 1 shown the regression line shown in the graph has the equation Y = 2.354 − 0.047x4, which indicates that each additional year of farming tends to reduce the utilization of ICT in agricultural activities by 0.047 units. Thus, the longer a person works as a farmer, the less likely they are to use ICT. This is in contrast to the findings of Juniarti et al. (2022) , who stated that the length of farming has a positive correlation with the tendency to access agricultural information. The more farming experience a farmer has, the more likely they are to seek and utilize information to support their business activities. This difference is due to obstacles in the process of technology adaptation, especially among experienced farmers. This is supported by the results of interviews, which show that farmers with long farming experience tend to prefer conventional methods in running their businesses. They show a tendency to maintain methods that have been considered effective, and are relatively less interested in using digital technology, which is considered too complex or not relevant to their daily needs.



Source: Data Processed, 2025

Figure 2. The effect of land area on the amount of ICT utilization by farmers

In Figure 2, agricultural land area is an important indicator in measuring production capacity and the scale of farming businesses run by farmers. By definition, agricultural land area refers to the total area of land used for agricultural activities, whether privately owned or obtained through other

mechanisms such as leasing, profit-sharing systems, or other forms of cooperation. Land area is not merely a matter of quantity, but is also closely related to aspects of management, access to means of production, and labor capacity. Farmers with small plots of land often face limitations in applying modern agricultural technology, accessing financing, or even obtaining support from government policies, making them vulnerable to economic instability and the risk of crop failure. Conversely, farmers with larger plots of land have greater opportunities to access agricultural inputs on a more efficient economic scale, including the use of agricultural tools and machinery, fertilizers, and information and communication technology.

Based on Figure 2, the regression equation obtained is Y = 2.354 + 0.00014x5, indicating that every 1 m² increase in agricultural land area is followed by an increase in ICT utilization of 0.00014 units. Although the coefficient value appears relatively small due to the unit of measurement (square meters), it still reflects a positive relationship between land area and ICT utilization. This suggests that the larger the land managed by farmers, the greater their tendency to utilize ICT in agricultural activities.

This relationship can be explained by the increasing complexity of farm management as land size expands. Larger farms generally require more intensive planning, coordination, monitoring, and access to market and production information, thereby increasing the need for efficiency and decision support through ICT. This finding is consistent with previous studies. Arimbawa & Widanta (2017) found that land area has a positive and significant effect on productivity, which in turn increases farmers' income through more efficient farm management. Similarly, Fadliyah et al. (2019) reported that land area positively affects production, although the elasticity is less than one, indicating that other factors such as capital and labor also play important roles. Furthermore, Luqman et al. (2019) showed that larger land ownership increases farmers' information needs, which subsequently encourages greater ICT utilization.

In addition, land area is often associated with farmers' welfare. Yani et al. (2022) found that larger landholdings are positively correlated with higher levels of household welfare. This condition may increase farmers' capacity to access and utilize ICT. Likewise, Shemfe & Modirwa (2026) reported that farm size positively influences ICT adoption, as larger-scale farmers tend to have greater financial capacity and stronger incentives to invest in technology. Ntsoane & Ndoro (2025) also found that farm size positively influences the use of communication technologies among farmers. However, this finding contrasts with (Subejo et al., 2018), who found that land area does not significantly affect ICT ownership and usage. This suggests that the influence of land area on ICT utilization may depend on contextual factors such as infrastructure availability, farmer characteristics, and regional conditions. Overall, these findings reinforce the argument that land area not only plays a role in agricultural production but also influences farmers' ability and incentives to access and utilize ICT as part of agricultural innovation.

CONCLUSION

The conclusions of this study were developed to address the research objective of identifying the factors influencing the utilization of Information and Communication Technology (ICT) among smallholder farmers who are members of farmer groups in Purworejo Regency. The findings indicate that the highest level of ICT utilization was observed in Purwodadi Subdistrict, which may be associated with better smartphone ownership, more adequate internet access, and a higher proportion of farmers in productive age groups that support technology acceptance.

Multiple linear regression analysis shows that farming experience has a negative and significant effect on ICT utilization, indicating that farmers with longer farming experience tend to

rely more on conventional farming practices and are less inclined to adopt digital technologies. In contrast, land area has a positive and significant effect on ICT utilization, suggesting that the larger the land managed by farmers, the greater their tendency to utilize ICT for farm management and access to agricultural information. Other variables, including age, years of education, status in farmer groups, land tenure status, and number of ICT devices owned, were not found to have significant effects.

Theoretically, this study contributes to the literature on digital agriculture by highlighting the importance of farm structural characteristics, particularly land area, alongside behavioral factors such as farming experience, in explaining ICT utilization among farmers. Practically, the findings suggest that agricultural digitalization programs should be tailored to farmers' characteristics and local conditions. Blended learning approaches that combine face-to-face extension services with digital training are recommended to improve farmers' readiness to utilize ICT. In addition, farmers with larger landholdings may serve as early adopters or demonstration actors to accelerate ICT diffusion among surrounding farmers. These strategies are expected to promote a more efficient, adaptive, and inclusive agricultural system in Purworejo Regency.

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