

Use of Information and Communication Technology at the Farmer Level in Kebumen Regency, Indonesia

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ABSTRACT

Digital technology is crucial in advancing digital agriculture by enabling farmers to access valuable information such as planting schedules, pest and disease management, and market price trends. Despite its potential, the use of ICT by farmers remains limited due to inadequate internet access. In 2018, only about 25.7% of farmers in Indonesia had internet connectivity. Given this situation, it is essential to investigate the efficiency of ICT utilization among farmers, particularly in the Kebumen Regency. This research aims to understand farmers' perceptions of ICT usage and identify the diversity of ICT access at the farmer level. The study involved 90 rice farmers in Kebumen Regency. Access to ICT tools in this research refers to smartphones, computers, and laptops. Farmers' perceptions of ICT usage were assessed using a four-point Likert scale with the following options: strongly agree, agree, disagree, and strongly disagree. The development of the survey statements was guided by the Technology Acceptance Model (TAM) theory, which identifies two key factors influencing technology adoption: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). The findings reveal that smartphones are the most widely used among the various ICT tools available to farmers. The study also indicates that farmers generally perceive the usefulness (PU) and ease of use (PEOU) of ICT tools. Based on these results, future agricultural extension strategies should prioritize the development of applications that are easily accessible via smartphones.

Keywords: Farmer, ICT, Digital technology.

I. Introduction

Integrating digital technology into the agricultural sector holds significant potential to transform traditional practices into more modern, efficient approaches. To achieve this, it is essential to develop robust systems, enhance data utilization, and increase productive working hours. In the context of Industry 4.0, the agricultural sector is expected to adopt digital technologies that will enable more efficient and effective production processes. Digital technology is crucial in advancing digital agriculture by providing farmers with valuable information, such as planting schedules, pest and disease management, and market price trends. Burhan (2018) identified several challenges in leveraging Information and Communication Technology (ICT)



to support agricultural economic development during the Industry 4.0 era. These challenges include: a) transitioning agricultural development from simply transferring technology to facilitating communication, information exchange, and advocacy aimed at improving the living standards of rural communities; b) enhancing the rural economy through ICT-based services; and c) boosting productivity by enabling access to online markets, improving direct negotiations with buyers, and ultimately increasing income and overall welfare.

Despite its potential, ICT usage among farmers remains limited due to inadequate internet access. In 2018, only about 25.7% of farmers in Indonesia were connected to the Internet (Association of Indonesian Internet Service Providers, 2018). Similarly, Kadir and Prasetyo (2021) found that internet access among rice farmers was particularly low, with only 10.8% of the approximately 13 million rice farmers having connectivity. This highlights a significant disparity between the current level of access and the necessity of using ICT to facilitate access to relevant information and share digital data. Given these findings, it is crucial to investigate the efficiency of ICT utilization among farmers, particularly in the Kebumen Regency. This research aims to determine farmers' perceptions of ICT usage and identify the diversity of ICT access at the farmer level.

II. Literature Review and Hypothesis Development

Information and Communication Technology (ICT) is crucial in transforming the agricultural sector. ICT enables farmers to access information on weather patterns, markets, cultivation technologies, and sustainable farming practices (Misra et al., 2020). Additionally, ICT allows farmers to connect directly with markets, reducing the role of intermediaries and increasing their income (World Bank, 2017). As a result, applying ICT can enhance the efficiency and productivity of the agricultural sector as a whole. At the farmer level, the use of ICT offers several benefits: Farmers can utilize ICT applications to monitor weather forecasts, helping them plan agricultural activities more effectively (Aryal et al., 2019); ICT provides real-time access to market prices, enabling farmers to make more informed and strategic sales decisions (Kumar & Singh, 2021); and digital platforms, such as video tutorials, e-learning, and agriculture-specific apps, offer access to modern agricultural techniques (FAO, 2020).

The process of ICT adoption among farmers can also be explained through several theoretical frameworks. The Diffusion of Innovation Theory (Rogers, 2003) suggests that adopting ICT is influenced by trust, ease of use, and perceived benefits. The Technology Readiness Theory (Parasuraman, 2000) assesses technology readiness based on optimism, innovation, discomfort, and insecurity. Farmers who are more technologically prepared tend to adopt ICT more quickly. Meanwhile, the Theory of Planned Behavior (Ajzen, 1991) emphasizes that farmers' decisions to use ICT are shaped by their attitudes toward technology, social norms, and perceived ease of access, all of which influence their intentions and behaviors regarding technology adoption. Despite the potential benefits, farmers face several obstacles in utilizing ICT. These challenges include limited infrastructure, such as uneven internet access in rural areas (Pertiwi et al., 2022), low digital literacy due to a lack of technical skills in using ICT devices (Setiawan & Andini, 2021), and the high costs of technology devices and services, which remain unaffordable for some farmers (Rahman et al., 2020). Programs like "Farmers Go Online" and applications such as Tani Hub demonstrate the significant potential of ICT in supporting Indonesian farmers. These initiatives help farmers improve efficiency and market knowledge through digital access (Ministry of Agriculture, 2021). Additionally, platforms such as e-Fishery have supported the productivity of fish farmers.

III. Research Method

This research employs a descriptive quantitative approach, which involves collecting and analyzing numerical data through surveys, questionnaires, and interviews. The study aims to determine the number of farmers with internet access and their ability to use technological tools to obtain agriculture-related information. This will help assess the efficiency of using applications for agricultural activities. Additionally,

the research examines the role of relevant agencies in promoting the use of such applications and improving internet access for agricultural purposes. The subjects of this research were 90 rice farmers in Kebumen Regency, selected using the purposive sampling technique. This method involves selecting data sources based on specific criteria. The purposive sampling approach was chosen because the researcher believes that the selected sample—rice farmers in Kebumen Regency—has the most relevant knowledge regarding the issues being studied (Sugiyono, 2019). This research focuses on the utilization of information and communication technology by rice farmers in Kebumen Regency.

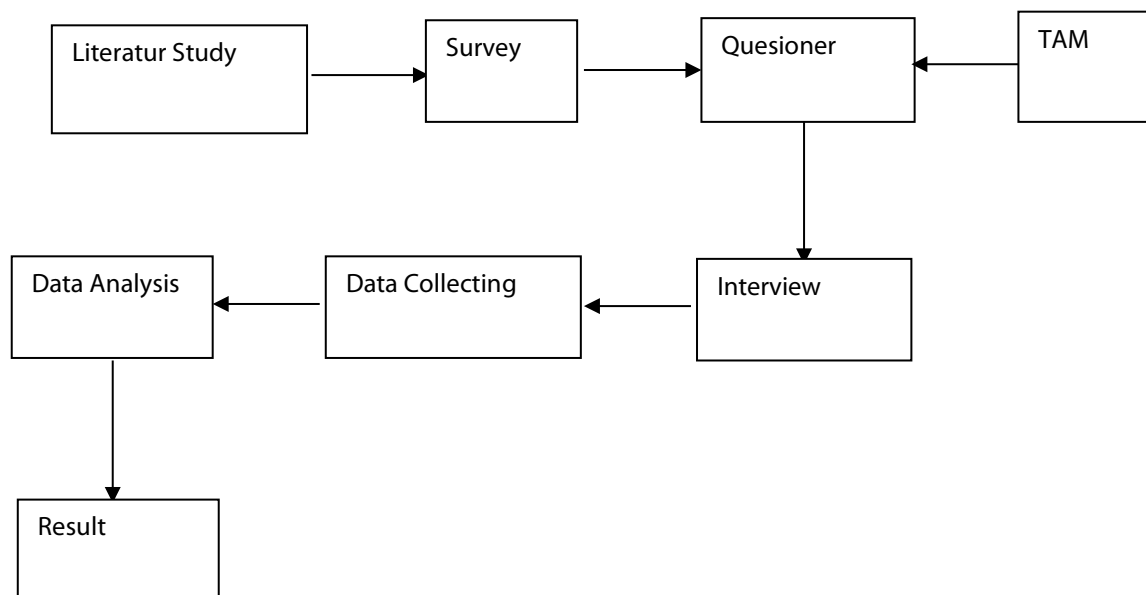


Figure 1. Conceptual Framework

In this study, access to ICT tools refers to access to smartphones, computers, or laptops. Respondents' perceptions of ICT usage were assessed using a four-point Likert scale with the following options: strongly agree, agree, disagree, and strongly disagree. The development of the statement items for this research was guided by the Technology Acceptance Model (TAM), which identifies two key factors influencing technology adoption: Perceived Usefulness (PU) and Perceived Ease of Use (PEU) (Davis, 1989). Each factor was evaluated using five statement items, as shown in Table 1. The reliability of these items was analyzed to determine whether the constructs for PU and PEU were sufficiently reliable. The reliability test results indicated Cronbach's Alpha values of .803 for PU and .866 for PEU. Morgan et al. (2019) state that a Cronbach's Alpha value above .70 indicates strong construct reliability. The data were further analyzed using SPSS version 23 software. Statistical analyses included an Independent Samples T-test to compare two groups and Pearson product-moment correlation and Spearman's rho tests to examine the relationships between variables.

Table 1. Items in the construct of perceived usefulness and perceived ease of use

Construct	Item	Cronbach's alpha
Perceived usefulness	ICT is useful for finding the information I need	.803
	My search for information is faster when using ICT.	
	Using ICT when searching for information saves time.	
	The information available on ICT is very diverse.	
	The information available on ICT is more up-to-date and newer.	
Perceived ease of use	ICT is quite easy to use	.866
	It does not take long to learn how to use ICT.	
	I have never had any difficulties using ICT.	
	I am never confused when using ICT.	
	I very rarely make mistakes when using ICT.	

IV. Results and Discussion

Data processing results show the diversity of farmers' access to ICT media, namely smartphones, computers/laptops. This is shown in Table 2.

Table 2. Diversity of Respondents' Access to ICT Media

Access to ICT	Smartphone		Laptop	
	N	%	N	%
Have access	90	100	7	7,78
Do not have access	0	0	83	92,22

Source: Primary Data after processing, 2024

As shown in Table 2, all farmers have access to smartphones, but most lack access to laptops. This indicates that smartphone ownership among farmers in the research area is exceptionally high, reaching 100%. In contrast, access to laptops remains very low, with only 7.78% of farmers owning one—a figure significantly below the national average of 23.83%. These findings highlight that smartphones are far more prevalent among farmers than laptops. Smartphone ownership among farming families in rural areas offers several advantages. In addition to providing access to internet-based information, smartphones serve their primary function as two-way audio communication devices, effectively acting as mobile phones. By owning a smartphone, farmers gain a tool for accessing ICT and the internet and a reliable means of communication. The high level of smartphone access among farmers underscores their potential as tools for internet-based extension services. In contrast, computers and laptops currently lack similar potential due to their limited accessibility among farmers. This highlights the importance of utilizing smartphone applications—whether Android or iOS-based—particularly those designed to disseminate agricultural information. Smartphone-based internet access offers significant advantages, including sharing information widely without physical contact and delivering information much more quickly than conventional methods. To maximize the benefits of ICT in agriculture, it is essential to identify the specific information needs of farmers, as these needs can vary from one individual to another. By addressing these needs, ICT can become more efficient and impactful.

4.1. Farmers' Perceptions of ICT

This study examines respondents' acceptance of ICT through two perception aspects: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). Each construct—PU and PEOU—consists of five items that measure the usefulness of ICT tools (PU) and the ease of using them (PEOU). The analysis of farmers' perceptions revealed positive results for both PU and PEOU, with most respondents agreeing that ICT saves time searching for information and is beneficial for their informational needs. The highest PU scores were observed in the statements, "My search for information is faster when using ICT" and "ICT is useful for finding the information I need." Respondents noted that ICT tools are especially valuable for quickly obtaining diverse, up-to-date information compared to traditional agricultural extension media such as brochures, pamphlets, or magazines. Farmers perceived that the speed of access provided by internet-based media saves significant time by eliminating the need to wait for physical access to traditional information sources. Additionally, the variety of online information was considered advantageous, offering farmers multiple options to support informed decision-making.

These findings align with research conducted by Sirajudin and Kamba (2020), which concluded that most farmers in Milangodaa Village, Bolaang Regency, South Mongondow, North Sulawesi, agreed that the Internet serves as a valuable source of agricultural information. Farmers perceive the use of ICT tools as relatively easy and not confusing. This is reflected in the positive scores on the five items related to the Perceived Ease of Use (PEOU) aspect of ICT tools, where farmers generally agree that ICT is simple to use. The ease of learning to use these tools is attributed to their uncomplicated features, which are easy to understand, allowing farmers to quickly adapt to using them. The user-friendliness of ICT tools positively impacts farmers' ability to access the agricultural information they need. Access to information is crucial in agricultural

extension, as accurate information supports informed decision-making. In line with this, Purnaningsih and Asngari (2015) stated that farmers' access to information significantly influences technology adoption in agricultural extension.

4.2. Comparison and Relationship between Characteristics and Perceptions of ICT

This research examines whether there are differences in farmers' perceptions based on characteristics such as ICT access diversity, education level, and involvement in farmer groups. Additionally, it investigates whether these characteristics are related to farmers' perceptions. The analysis uses an independent t-test to compare two groups and correlation analysis to explore the relationships between two variables.

Table 3. Results of Comparison of Farmers' Perceptions Through Comparison of Characteristics in the T-test.

Comparison of group characteristics	Independent T-Test	Information
Access to ICT tools		
PU	-1,086	Not significant
PEOU	-0,067	Not significant
Activeness in farmer groups		
PU	-1,618	Not significant
PEOU	-1,228	Not significant

Source: Primary Data after processing, 2024

The results of the data analysis using the independent t-test, shown in Table 4, indicate no significant difference in farmers' perceptions between the two groups—those with access to ICT and those without. This suggests that access to ICT does not necessarily improve or worsen perceptions of ICT compared to those without access. Additionally, the independent t-test comparing activity levels within farmer groups revealed no significant differences in perceptions between highly active farmers and those less active in the groups.

Table 4. Relationship Between Farmer Characteristics and Farmer Perceptions

Characteristics	Technology Acceptance Model		
	Pearson correlation	Sig	Information
Age			
PU	-.147	.168	Not significant
PEOU	-.067	.532	Not significant
Level of education			
PU	.110	.303	Not significant
PEOU	.219	.038	Significant

Source: Primary Data after processing, 2024

Table 4 presents the results of the Pearson correlation test, which shows no significant relationship between farmers' age and their perceptions of the usefulness (PU) or ease of use (PEOU) of ICT. This finding contradicts research by Hendrawan et al. (2023), which suggests that the age of farmers is a key factor in ICT adoption, with farmers aged 40 to 50 experiencing benefits and ease in using ICT. The Spearman's rho correlation test results between education level and farmers' perceptions of usefulness (PU) also did not reveal a significant relationship. However, there was a significant positive relationship between farmers' education level and their perceptions of the ease of using ICT tools, with a correlation coefficient of .219, indicating a very weak strength of the relationship. This finding aligns with research by Michels et al. (2019), which showed a relationship between farmers' education levels and their perceptions of ease of use (PEOU) when using smartphones for livestock management in Germany.

V. Conclusion

The results of this research reveal that smartphones are the most widely used among the various ICT tools available to farmers. Smartphones have significant potential for agricultural extension due to their high accessibility among farmers. Based on this, it can be concluded that future agricultural extension strategies should focus on utilizing applications easily accessible via smartphones. Additionally, the research shows that farmers generally have a positive perception of the usefulness (PU) and ease of use (PEOU) of ICT tools. The study also indicates a positive correlation between education level and farmers' perceptions of the ease of using ICT tools (PEOU), suggesting the need for strategies to enhance the ease of smartphone use, particularly for farmers with lower levels of education.

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