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Improving Farmers' Welfare by Enhancing the Ability of Information Technology Adoption

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ABSTRACT

Food security has become a global problem amid a war that resulted in an increase in fuel prices followed by an increase in the price of basic necessities. This article aims to find the link between the ability to adopt information technology and the welfare of farmers. The government is expected to pay attention to farmers' welfare so that farmers can still produce to be able to meet the country's food needs. Technology adoption theory is the main focus in improving the welfare of farmers. This is due to the benefits of information technology as a supporting sector in the production process so as to be able to increase output in a shorter span of time. The higher the ability of farmers to adopt technological developments, the higher their ability to cultivate production land which is able to increase production yields so that it will be followed by an increase in farmer welfare. The results show that farmers' perception as users largely determines the adoption of information technology in agriculture.

Keywords: Ability to Adopt Technology, Agriculture, Farmer, Food Security, Rice Production, Sustainability, Welfare of Farmers

INTRODUCTION

The development of the agricultural sector is an important point that must be considered by the government, both the local government and the central government, given the threat of a food crisis. Based on BPS data (2021), Indonesia is also dependent on rice imports from other countries, such as India as the largest rice supplier for Indonesia with 215,386.5 tons in 2021, followed by Thailand (69,360 tons), Vietnam (65,692.9 tons), then Pakistan (with 52,479 tons). In addition, the conversion of agricultural land functions occurs a lot along with the increasing population, which is not followed by the number of settlements, so a lot of agricultural lands is converted into settlements. In the period of 1993-2003, it is estimated that land conversion doubled from 1983-1993, namely around 80,000 to 100,000 hectares per year. The largest land conversion areas occurred in Java Island at 54 percent and Sumatra at 38 percent. The biggest change in land conversion was to village/residential land (69 percent) and 20 percent to industrial areas (Fatchiya & Amanah, 2016). The reduction in agricultural land is not matched by the development of agricultural technology to maintain the amount of rice production, as well as the low ability of farmers to adopt agricultural information technology.

Agriculture is an area that is expected to be one of support for the welfare of the people who live in rural areas (Usman, Hapsari, & Ayustia, 2019). As an agricultural country, Indonesia has abundant natural resources, but rural communities cannot make the best use of them for their management. However, legacy or traditional management causes relatively low productivity, which results in low competitiveness. In order to accelerate the recovery of the national economy, accelerate village progress and face global competition, it is necessary to accelerate rural development through community empowerment in various regions supported by the application and development of technology. The utilization of information technology can increases efficiency and effectiveness in the production process and decision-making, and broaden the reach of business cooperation to strengthen a competitive position in today's modern market competition. The existence of information technology can make the work of farmers easier and faster when it is properly adopted for processes during production, in developing agricultural products, and in transaction processes (O'Brien, 2006).

Progress and development in any field cannot be separated from technological advances. The agricultural revolution was driven by the invention of new machines and methods in agriculture. If technology does not change, the development of agriculture will stop. Production is no longer increasing and may even decline due to declining soil fertility or increased damage from still-prevalent pests and diseases (Nuryanti & Swastika, 2011). Eldert Van Henten developed identification technology and automated harvesting tools for pears, bananas, peaches, and plantains at the University of Wageningen in the Netherlands. This tool can detect levels of chlorophyll and anthocyanin pigments using a tool that is connected to the detected fruit. In addition, this tool is equipped with a Color Combination Detection camera that detects color depth to determine fruit size. When the data shows that the fruit is ripe, the tool picks the fruit in just two seconds. In addition, all fruit and plant health information, ripeness, and other conditions are installed in the smartphone so that it can be monitored in real-time. With the help of this technology, efficiency increases significantly, and harvest actuality is maintained (Garnett et al., 2013).

The application of innovations in rural Indonesia is closely related to the implementation of advisory services. Field extension agents play a key role in introducing agricultural innovations to farmers (Pranadji, 2016). In essence, the advisor's role is not only to introduce farmers to technology but also to enhance their ability to run their businesses independently. This is a strong reason to increase the adoption of domestic farmers' technological capabilities to increase the amount of rice production so as to be able to

reduce rice imports for Indonesia. Of course, this cannot be separated from the government's attention in assisting in the form of high-tech agricultural equipment as well as training and assistance in the process of identifying and using the tool. So that if the adoption of information technology related to agriculture has been absorbed evenly, the amount of domestic rice production will be followed by an increase in the welfare of rice farmers. This article aims to find the link between the ability to adopt information technology and the welfare of farmers. This is important to study because most agriculture still uses conventional methods, which are still very dependent on human resources in the production process, which requires quite a high cost, so the existence of technology will be able to facilitate the production process. Apart from that, the ability of farmers to adopt technology is also a concern in this literature study.

Concept of Adoption of Information Technology in Agriculture

Information technology (IT) is a medium or tool for transferring knowledge between people (Riyadi, Khaddafi, Fuadi, Falahuddin, & Ilham, 2021). According to Isjoni and Ismail (2008), information technology is the combination of a set of technologies, especially microcomputers, the collection, storage, processing, and distribution of information data, and text, audio, video, graphics, and images. Based on some of these definitions, information technology can be interpreted as all technologies or tools that assist in efforts to retrieve, collect, process, store, disseminate, and present information to others. Adoption is the mental process of accepting or rejecting new ideas. Adoption is also defined as a person's mental process, from hearing and learning about an innovation to finally adopting it. Thus, innovation decisions are made in detail. Furthermore, according to Mosher (1991), innovation adoption is the process of presenting, viewing, and finally discarding or implementing a particular innovation.

The adoption rate of an innovation depends on the adopter's perception of the characteristics of the innovation (Rogers, 2003). The attributes that support the explanation of the adoption of innovation include the following: The relative advantage of innovation is assessed from the economic value of a new thing that is better or at a lower cost than what has been done before. This is called economic benefit, while technical benefits are seen from prestige and satisfaction (Edwina & Maharani, 2010). Through innovation, farmers can achieve their goals better at a lower cost. Siregar (2006) also emphasized that society as users of innovation must be more selective in choosing the innovations used because it is related to the costs incurred. Compatibility or the suitability level of an innovation relates to the extent to which an innovation is considered consistent and in accordance with sociocultural values and beliefs or ideas previously introduced to the needs of farmers. An innovation's complexity level is the level at which an innovation is considered complicated to understand and implement. Trialability, or the possibility of trying an innovation by farmers is related to the limited resources owned by farmers. Innovations that can be tried little by little will be used more quickly by farmers than innovations that cannot be tried, where the easier it is for new technology to be used, the faster the innovation adoption process by farmers will be. According to Gumbira & Harizt (2001), the determination of the type of technology is closely related to the scale of business, type of business, cost capability, human resource capabilities, and needs. Observability means that innovation can be observed by farmers and also seen by other people. Edwina and Maharani (2010) explain that to gain the trust of farmers, and the government must start promoting innovations that have been successful or have a high potential to succeed as expected.

The Concept of Adoption of Information Technology in Agriculture and the Benefits in Several Countries

The ability to adopt information technology in agriculture has very important benefits in supporting agricultural activities to increase production and improve farmers' welfare. Prior to that, a policy strategy needs to be taken that has context and priorities as well

as unique specifications according to the characteristics and targets of each country. In addition, this strategy is also based on conditions, the level of availability of resources and capital, and the technology used (Dabukke & Iqbal, 2014). In Thailand, the strategy for developing efficient agricultural production, management, and food security is carried out by developing production technology and creating added value. In India, the Five Year Development Program strategy is carried out by increasing the dissemination of appropriate technology through improving the quality of research accompanied by increasing skills. In Japan, the strategy is carried out by developing and promoting new technologies and varieties to increase added value and total production. In Indonesia, based on the Strategic Plan (Renstra) of the Ministry of Agriculture for 2010-2014, Indonesia's key agricultural policy strategy rests on the "Seven Echoes of Revitalization", one of which is the revitalization of technology and downstream industries, this needs to be implemented because it is still being implemented. Traditional technology, equipment, and the undeveloped agro-industry business optimally (Dabukke & Iqbal, 2014). If the application of information technology is complicated, farmers tend not to want to use it due to their limited ability to use it. Perception can be tried means that the information they get can be tried before it is applied further. Meanwhile, perceptions can be observed, meaning that the use of information technology can significantly increase their production and income (Dan, Hui-wei, Zi-min, & Qiao, 2021).

LITERATURE REVIEW

Welfare Concept

Midgley (2000) defines social welfare as the condition or state of human well-being. Wealth can provide basic needs such as food, health, education, housing, and income. This makes human life safe, happy, and protects people from life-threatening risks. According to Albert and Hannel (as cited in Sari & Pratiwi, 2018), welfare theories can generally be divided into three types: classical utilitarian, neoclassical welfare theory, and new contractarian approach. The classical utilitarian approach emphasizes that satisfaction and pleasure can be measured and enhanced. At the same time, the principle of the individual is to maximize the level of welfare probability. For society, the main principle is to increase the welfare of the group. The approach of neoclassical welfare theory explains that the welfare function is that of every individual's well-being. In addition, welfare theory evolved and new contractual approaches emerged that promoted maximum freedom in the lives of individuals, emphasizing the freedom of individuals to pursue their ideas of goods and services without interference.

Friedlander also expressed a different view on welfare. Welfare is the organization of social services and institutions designed to assist individuals and groups in achieving satisfactory standards of living and health and personal and social relationships. A system that enables them to develop their full capacities and promote harmonious well-being, meeting the needs of their families and communities (Adi, 2013). In short, social care is about helping individuals and groups achieve satisfactory living and health standards, personal and social relationships, reach their full potential and improve their health. It is an organized system of social services and institutions aimed at - Being a farmer in line with the needs of your family and community. Based on some of the previous understandings, it can be concluded that welfare is the fulfillment of all individual needs, both social, material, and spiritual, and a sense of security obtained from interaction without any pressure from any party.

Several studies related to the adoption of information technology have helped improve the welfare of farmers, such as Adriani, Zahri, Wildayana, & Hamzah (2018). They used a t-test analysis technique and found that Telang Mandiri Integrated City is a development area for the rice production centers industry. The Telang Independent Integrated City Program in tidal land has great opportunities for success because of the

various technological innovations available. Farmer's income is already able to meet the needs of a decent life so that the household is prosperous. Another study by Dan et al. (2021) used Logistic Regression Analysis as the analysis technique in their research. The results show that technology adoption can also significantly increase the income and welfare of farmers, especially low-income farmers. Moreover, there is a significant correlation between farmers' decisions to join cooperatives and technology adoption. Technology adoption had a greater positive impact on income in the low-income sample than in the overall sample. This suggests that the adoption of agricultural technology may contribute to poverty reduction.

Tanko, Ismaila, and Sadiq (2019) used inverse propensity score weighting techniques and the local average response function method. They found that agricultural techniques implemented as part of the Growing for Food and Employment program have a positive impact on rice productivity and the welfare of rice farmers in northern Ghana. The study recommends governments use local media and subsidy policy tools to increase benefits to beneficiaries by encouraging the use of fertilizers and superior rice varieties. Martey, Etwire, and Mockshell (2021) show that 86% of farmers surveyed prefer climate-friendly cowpeas. Although there is greater variability in his WTP for cowpea farmers compared to male cowpea farmers, participation in cowpea training reduced the variability in his WTP for both males and females. Moreover, controlling for farmer risk aversion further reduces the variance of her WTP for all respondents. Our experiments reemphasize the need for participatory plant breeding programs. Moreover, such programs are well suited to meet the needs of different population groups based on risk, gender, and geographic characteristics. Another research taken from Hartati, Budhi, and Yuliarmi (2017) used Path Analysis. It showed that arable land and working capital had a significant positive impact on sweet corn production in Denpasar City. In contrast, technology and farming experience did not have a significant impact on yield. Technology, arable land, working capital, and production have a large positive impact on farmer welfare, whereas farming experience does not have a large impact on farmer welfare.

Adams and Jumpah (2021) found that the introduction of technology has a significant effect on improving the welfare of farmers in Northern Ghana and that the introduction of information technology has a large positive impact on welfare indicators (consumption expenditure on food, clothing, and health). A literature study by Wayan and Sri (2021) discover that the agricultural sector plays an important role in Bali's economy. Factors accelerating growth in the agricultural sector are factors that can encourage growth in the non-agricultural sector. The application of agro-industrial technological innovations in rural areas is sought to have credibility and adapt to food crop development plans, can inspire enthusiasm to move forward, and be used as a basis for planning the development of food security in rural areas.

Nuryanti and Swastika (2011) show that subsidies are generally applied to government-supported programs such as fertilizer distribution, agricultural technical advice, agricultural credit subsidies, and other programs distributed through farmers' groups or collective farmers' groups (Gapoktan). Farmers who want new technologies and various government support programs should become members of the group or Kapokutan. Thus, the role of farmers' groups is not only as a vehicle for state assistance but also as an agent for the application of new technologies. Rahmat and Izudin (2018) show that modern agricultural technical assistance is the strategic policy implementation of government programs to improve people's welfare.

Verkaart, Munyua, Mausch, and Michler’s (2017) results indicate that the introduction of technology may improve production levels and improve the welfare of farmers. Meanwhile, Beza, Reidsma, Poortvliet, Belay, Bijen, and Kooistra (2018) used Moderated Regression Analysis (MRA) and discovered that increasing farmers'

intentions in using SMS technology in recording agricultural products it girly helped increase the ability of farmers to adopt technology in assisting recording related to agricultural data. Simões, Nicholson, Novakovic, and Protil (2020) reveal that the use of information technology can increase output, increase profits and increase welfare.

RESEARCH METHODS

The research methodology used in this study is a descriptive research type or simply a descriptive phenomenological approach based on the topic and research objectives. The phenomenological approach is an interpretive study that follows the facts about the human experience, which aims to understand and describe human situations, events, and experiences "as something that appears and is present every day" (Eckartsberg, 1998, p. 3). Phenomenological research prioritizes finding, studying, and conveying the meaning of phenomena, events that occur, and their relationship with ordinary people in certain situations. In contrast, descriptive research is research that combines the results of previous research and then summarizes it in the form of a research report (literature study). This research observation focuses on farmers and the development of information technology in agriculture. The journals reviewed in this study were twelve journals dealing with the development of information technology in agriculture to improve farmer welfare.

RESULTS

Based on the description above, there are still several obstacles faced related to the ability to adopt information technology of farmers in Indonesia, namely constrained by a low level of education. This is another phenomenon that affects the welfare of farmers, where the low level of education of farmers will greatly affect the lack of ability to absorb technological developments related to innovation in agriculture (Bancin, Kusrini, & Imelda, 2019). This is also in line with Fadholi (2020), who revealed that the education level of farmers is important in adopting agricultural technological developments in supporting the production process to increase production yields in a shorter or at least the same period able to improve their welfare. Another phenomenon that is an obstacle to adopting information technology in the agricultural sector is aging farming. Based data from the Central Statistics Agency (BPS) for 2019 states that the age group that dominates the farming profession is in the age range of forty-five to fifty-four years old, with a total of 9.19 million people. The profession of a farmer is more in demand by the elderly population. This means there needs to be more interest in the younger generation to work in the agricultural sector. This is because income as a farmer is considered insufficient to meet the needs of the farmer's household (Dan et al., 2021).

DISCUSSION

Based on some of the literature used in this study only discusses the importance of information technology in supporting agriculture production processes, which will improve farmers' welfare. Adopting information technology can overcome land limitations because, with the ability of farmers to adopt information technology, even though the land used is limited, it will be able to increase the added value of production and shorten the production time process. In addition, another phenomenon, namely land conversion, also needs to be an essential concern which results in a decrease in the amount of crop production due to the conversion of agricultural land to housing, restaurants, hotels, and other public facilities. This phenomenon was also revealed in Priyanto (2018), related to the decline in agricultural land, which has resulted in a decrease in crop production, making it increasingly difficult for farmers to make ends meet. This makes it essential to increase the ability of farmers to adopt agricultural technology during high land

conversion so that with reduced land but the production of agricultural products obtained is still the same or even more so that the welfare of farmers can be increased.

Based on some of the literature used in this study, it only discusses the importance of information technology in supporting agriculture production processes, which can later improve the welfare of farmers. Some of the technologies used in previous research results, such as SMS technology in Beza et al. (2021) obtained the result that the increasing interest of farmers in using SMS technology in recording agricultural products helped increase the ability of farmers to adopt technology in assisting with recording related to agricultural data making it easier for farmers to estimate costs and profits to be obtained. A dual selectivity model (DSM) was applied to correct for sample selection biases due to both observed and unobserved factors, and a propensity score matching method (PSM) was applied to estimate differences in farmer incomes compared with counterfactual analysis and calculated using 396 survey data of farmers in fifteen provinces of China. As a result, it was found that farmers who joined agricultural cooperatives and introduced agricultural technology increased their agricultural income by 2.77% and 2.35%, respectively, compared to non-participating farmers and farmers who did not adopt agricultural technology. Nuryanti & Swastika (2011) research shows the importance of increasing the ability of farmers to adopt information technology in agriculture. In general, government assistance programs such as the distribution of subsidized fertilizers, agricultural technology extension, subsidized farming credit, and other programs are distributed through farmer groups or combined farmer groups (Gapoktan). Farmers who want to get new technology and various government assistance programs must become a member of the group or Gapoktan members. With this, the role of farmer groups is not only as a medium for channeling government assistance but also as an agent for the application of new technologies.

Features are forums, articles, videos, information storage, and privacy settings. Also, there is information from Gadjah Mada University on Short Messenger Messages (SMS) which provides a two-way service between farmers and agricultural experts. Eldert Van Henten developed identification technology and automated harvesting tools for pears, bananas, peaches, and plantains at the University of Wageningen in the Netherlands. This tool can detect levels of chlorophyll and anthocyanin pigments using a tool connected to the detected fruit. In addition, this tool is equipped with a Color Combination Detection camera that detects color depth to determine fruit size. When the data shows that the fruit is ripe, the tool picks the fruit in just two seconds. In addition, all fruit and plant health information, ripeness, and other conditions are installed in the smartphone to monitor it in real time. However, based on some of the above references, the critical role of information technology in improving farmer welfare and maintaining sustainability in the agricultural sector is evident in several countries. Therefore appropriate strategies and policies from the government are needed to increase the ability of farmers to adopt agricultural technology developments in the form of procurement subsidies. Free training with agricultural extension workers integrated with the local government to facilitate collecting data on farmers who need training and assistance regarding the use of agricultural technology. In future research, qualitative methods can be used by holding focus group discussions with stakeholders and related agricultural institutions so that policy directions can be determined so that farmers with low educational backgrounds can adopt agricultural technology to increase production and their level of welfare. Tanko et al. (2019) reported that the results of the study show that agricultural techniques implemented under the Growing for Food and Employment program have a positive impact on rice productivity and the welfare of rice farmers in Northern Ghana.

CONCLUSION

Based on the above description, the perception of farmers as users largely determines the adoption of information technology in agriculture. Perceived relative advantage means that farmers will consider whether using information technology is beneficial in increasing their agricultural yields. Perceived suitability means whether the information technology is following the circumstances, for example, the information they get is in accordance with their farming culture, or the information they receive is following their needs. Perception of complexity means complexity in obtaining information. If the application of information technology is complicated, farmers tend to want to avoid using it due to their very minimal ability to use technology. Perception can be tried means that the information they get can be tried before it is applied further. While perceptions can be observed, it means that information technology can be proven significantly to increase production and farmers' income. One source of farming information that farmers receive is social media. Most farmers get their social media information from YouTube, WhatsApp groups, and mobile apps. Their goal in opening an online medium is to find a way to properly plant and produce. Farmers find both ministry advice and social media to provide easy-to-understand, clear, and useful information. The type of information most often displayed relates to how to use technology to plant and how to cultivate the land properly. The Farmers mobile application offers different functions with different information.

This study recommends that governments should extend benefits to beneficiaries using local media and subsidy policy tools to encourage the use of fertilizers and superior rice varieties. However, before that the government is expected to expand socialization regarding the use of agricultural technology to remote and remote areas where the education level of farmers tends to be low so that continuous training and assistance can be provided so that the program to increase the ability of farmers to adopt agricultural technology can be achieved evenly in all regions of Indonesia.

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