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Farmers' Digital Transformation Preferences: Acceptability, Affordability, Accessibility, Awareness, and Availability

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Abstract**—** *This research outlines the characteristics and preferences of rice farmers when it comes to incorporating digital advancements in farming practices. The study delves into their attitudes, towards the acceptance and use of technology in agriculture particularly focusing on aspects such as affordability, ease of access knowledge levels, and the availability of solutions. The findings reveal that while farmers recognize the benefits of utilizing tools for enhancing productivity various challenges such, as expenses, limited training opportunities, and constrained accessibility hinder their adoption. Farmers are well informed about technology, like the Palay Check App; however, affordability issues persist in markets while access remains limited. The perceived high costs of investing in solutions hinder their potential impact, on smallholder productivity. The research highlights the importance of improving assistance and making technology more accessible to support use among farmers. This could help them improve crop yield and lower expenses result in, in use of tools to advance agricultural methods.*

Keywords**— Acceptability, Agriculture, Digital Farming, Farmers, Food Problem, Sustainability**

I. INTRODUCTION

The Philippines, an agriculturally dominant country with a significant rural population, relies heavily on agriculture for livelihoods. As of 2022, about a quarter of employed Filipinos work in agriculture, which includes farming, fisheries, livestock, and forestry. Farming and fisheries are particularly crucial due to the country's terrain and tropical climate, with key crops like sugarcane, rice, coconut, and bananas being major national products and exports (Et. al., J.D.U., 2021; Zhang, et al., 2023).

Different levels of human capital, such as education, experience, and pertinent training, are displayed by farmers (Fronda, 2023). Since higher levels of human capital are typically associated with greater willingness and ability to utilize these tools, this diversity has a significant impact on the adoption of digital technology. The digital divide between adopters and non-adopters is frequently mostly caused by disparities in human capital. Therefore, evaluating the digitization of agriculture requires determining the baseline capacities of farmers and the investment required to improve human capital among farm workers. Farmers have different levels of human capital, such as education, experience, and pertinent training. Since higher levels of human capital are typically associated with greater willingness and ability to utilize these tools, this diversity has a significant impact on the adoption of digital technology (Li, et al., 2023).

The digital divide between adopters and non-adopters is frequently caused mainly by disparities in human capital. Therefore, evaluating the digitization of agriculture requires determining farmers' baseline capacities and the

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investment required to improve human capital among farm workers (De Gruchy, 2020).

Historically, Perkins Gilman identified three core issues in addressing the food problem: efficient food production, effective distribution, and economical meal preparation. Over time, advancements have improved food supply systems, reducing costs and time between production and consumption.

Currently, the agricultural sector is undergoing significant societal changes, referred to as "agriculture 4.0," driven by digitalization. Technologies such as the Internet of Things (IoT), cloud computing, big data analytics, and artificial intelligence (AI) are rapidly transforming agriculture. This digital revolution is leading to a paradigm shift with increased integration of physical and virtual systems, creating dynamic digital representations of agricultural processes. This enables real-time monitoring, direct interaction between consumers and producers, and advanced planning, prediction, automation, and optimization (Sweeney & Kabouris, 2020).

This study will focus on the emerging demands and implications of digitalization for farmers in the Science City of Muñoz, Nueva Ecija. It aims to update and enhance current research on agricultural digital transformation, assessing how these changes impact local farming practices and contributing to the broader understanding of digitalization in agriculture. Specifically, this study will describe the farmers profile, the farmers preferences of digital transformation in agriculture in terms of acceptability, affordability, accessibility and awareness, and availability of digital technology.

II. METHODOLOGY

A descriptive research design was adopted for this study. According to Kumar (2014) as cited by Zabala, Gutierrez, and Subia (2018),"descriptive survey can systematically describe a situation, problem, phenomenon, service or programs, or provide information or describe the attitude towards an issue".

The researchers gathered the primary data through a survey. Before the actual data gathering, the researchers secured a letter of permission from the Dean of the Graduate School that was duly signed by the adviser to conduct the study. Permission to perform these data collection methods was asked from the city mayor down to the barangay captain, who will serve as a key informant of the study.

Upon approval of the request to conduct data gathering, the researcher administered the survey through the combination of digital platforms and a survey questionnaire.

Secondary data such as the list of registered farmers, other data such as their farm location and other important information like farmers' addresses to find one another by the researcher were gathered by requesting the data from the Department of Agriculture in Science City of Muñoz, Nueva Ecija.

The data collected from the locale was encoded, tallied, and analyzed. Appropriate statistical tools were utilized in its analysis. The following table presents the four-point Likert scale to measure and interpret the data specifically for the demand and implication of transformation into digital farming.

III. RESULTS AND DISCUSSIONS

1. Describe the profile of participants in terms of:

Years of Farming

Most surveyed individuals have over 16 years of farming experience, likely making it their primary income source. The next largest group has 6-10 years of experience, suggesting stability. Fewer have 1-5 or 11-15 years, indicating possible turnover or slow entry.

Farm Size

The data provided reveals a clear pattern in the distribution of land holdings among farmers. Most farmers own small plots of 1 to 5 hectares, indicating a prevalence of smallholder agriculture focused on subsistence or small-scale commercial farming.

Types of plants (or crops)

Rice cultivation dominates, with 59 out of 60 instances, highlighting its central role in the region's agriculture. This prevalence reflects rice's importance as a staple food and economic driver in agricultural communities, particularly in Asia (Bellwood, 2023).

Available agricultural technology

The data indicates a significant gap in the adoption of agricultural technologies, with the majority (58 out of 60 instances) reporting the absence of any available technology. This suggests that the majority of farmers within the studied context are operating without the support of modern agricultural tools and innovations. Such a scenario may stem from various factors, including limited access to technology, financial constraints, lack of awareness or training, and infrastructural challenges.

2. The farmers' preferences for digital transformation in agriculture

Acceptability

The weighted mean for the first statement is 250, indicating that, on average, respondents leaned towards disagreement.

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The verbal interpretation suggests that the respondents, as a whole, did not find the statement to be particularly acceptable, but not strongly disagreeable either. For the second statement, respondents also rated their agreement on the same scale. This statement has a slightly larger tendency toward disagreement, as indicated by its weighted mean of 2.42. According to the verbal interpretation, the respondents thought this statement was unacceptable. The findings indicate that the respondents tended to disagree or strongly disagree with the comments made about the use of contemporary technologies in agriculture.

Affordability

According to study results, respondents generally believe that current digital technology in agriculture is too expensive. Both statements expressed disapproval of the concept of affordability, with the first receiving a weighted mean of 2.17 and the second displaying an even lower mean of 1.95. These results draw attention to perceived financial constraints that may provide serious obstacles to the uptake and accessibility of cutting-edge digital technology in the agricultural sector. As a result, this view could affect farmers' attitudes and choices about using these technologies, which would ultimately affect agricultural output.

Accessibility

According to the survey's findings, a sizable portion of respondents felt that digital technology in farming was inaccessible. Strong disagreement regarding accessibility was indicated by the weighted mean of 2.33 for the first statement. Similar views were also expressed by the second and third statements, which had weighted averages of 2.37 and 2.28, respectively. These results imply that respondents believe local marketplaces and retailers do not carry digital agricultural technologies. All things considered, the evidence indicates significant obstacles to obtaining and utilizing these technologies, which may prevent the agricultural community from adopting and effectively utilizing them. Farmers' desire to adopt digital tools may be impacted by this sense of limited accessibility, which could eventually have an effect on agricultural innovation and production.

Awareness

The replies to two statements about how the respondents view digital technology in farming are compiled in the table that is presented. With a weighted mean of 3.18, respondents mainly showed agreement with the first statement. This implies that a sizable percentage of participants are aware of the use of digital technologies in agricultural operations. The second statement also showed a substantial trend towards agreement, with a weighted mean of 2.90. This implies that those surveyed are aware of the potential advantages of digital technology in raising agricultural wealth and production. In conclusion, the results of the study show that most participants are aware that digital technology is used in farming and believe it can help to improve agricultural results. This awareness and positive perception suggest a potential openness to embracing and adopting digital solutions within the agricultural sector (Kudama, et al., 2021).

3. Availability of Digital Technology

Different rates of adoption of contemporary digital technologies in agriculture are revealed by the survey. Drones have the lowest adoption rate at 30%, whereas the most popular app is Palay Check (65%), followed by KROPS (43.33%) and AgriDOC (38.33%). These results point to the necessity of increasing these tools' accessibility and awareness. Furthermore, respondents believe that digital technology offers only modest financial advantages, citing slight reductions in the price of seeds, fertilizer, and pesticides (weighted averages of 1.93 to 2.40). They do, however, substantially concur (2.85) that this technology boosts crop yields (2.77) and lowers overhead expenses.

IV. CONCLUSION

Based on the findings of this study, the following are concluded:

1. Farmers with extensive experience and small land holdings primarily focus on rice, emphasizing its role as a staple crop but face limitations in adopting modern agricultural technology.

2. Limited access to agricultural technology among farmers reflects barriers such as cost, availability, and training, which significantly affect technology adoption rates.

3. Farmers view digital technology as generally beneficial for productivity, yet perceive it as unaffordable and largely inaccessible, potentially limiting broader adoption.

4. While farmers show awareness of digital tools in agriculture, affordability, and accessibility issues reduce their likelihood of investing in these innovations.

5.Adoption of available digital tools like the Palay Check App suggests potential, yet broader availability and cost benefits are needed to increase digital integration in farming practices.

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