**Farmer researchers, researching farmers: Enhancing researcher-farmer collaboration through Mobile Application**

**Abstract**

ICTs are allied to facilitate agricultural knowledge in the country. However, some farmers in the country remain unreached or have insufficient access to knowledge, information, and education on livelihood practices. Hence, information per se is not enough, but a communication system is also needed to ensure that information comes to farmers effectively and clearly.
In this study, a collaborative mobile app was developed to train, link, and assist farmers in the exchange of knowledge and information as well as to explore the factors that will hinder ICT use and success.

Keywords: *Information communication technology, ICT reliability, ICT use, ICT efficiency*

**Introduction**

By 2050, the world's population will reach 9.2 billion, which will require increased food production. However, the sad reality is, agriculture is dying (Ranganathan et al., 2018). Farmers are growing old and the youth have shifted into other careers. Besides, traditional extension works and agricultural programs (Dar, 2016) adequately serve only 1.5 million of the more than 5.5 million registered farmers.

Agriculture plays an indispensable role in the country's economy. Philippine agriculture has not progressed in ages; instead, it is experiencing a significant decrease in productivity, high production cost, and low government support to the sector. As a result, the Philippines always end up as a net importer of food (FAO, 2012).

Agricultural Information and knowledge play a key role in facilitating the participation of people relating to sustainable development and addressing food security. The application of modern information and communication technologies (ICT) have the potential to increase agricultural productivity through sharing and disseminating agricultural knowledge and information on enhancing farm technologies, food security, improved nutrition, increasing food production to rural agricultural communities, providing skills training and capacity building (Kiran, 2018; Munyua1 et al., 2008; Singh et al., 2014) state that ICT can play an important role in maintaining feasible information and can be assessed as a means of direct involvement to agricultural production, as an indirect means for empowering farmers. However, some farmers in the country remain unreached or have insufficient access to knowledge, information, and education on livelihood practices. Hence, information per se is not enough, and the communication system is also needed to ensure that information comes to farmers effectively and clearly.

This study was conducted to develop a mobile app using Moodle which will serve as a one-stop Centre for training and for linking farmers to assist in the exchange of knowledge and information and eventually improve agricultural production or practices (Munyua1 et al., 2008) and to analyze the possible obstacles in the utilization of the mobile app in the study area.

**Statement of the Problem**

As above mentioned, the main purpose of this study is to develop a mobile app to train, link, and assist farmers in the exchange of knowledge and information as well as to explore the factors that will hinder the employment of the said app. Specifically, this study aims to answer the following questions:

1. What is the current level of ICT knowledge of farmers?
2. What are the obstacles that will affect the utilization of the mobile app in the study area?
3. How receptive are the farmers to learn and use ICT?
4. How efficient is the mobile app in empowering farmers to improve intergenerational learning?
5. Is there a significant relationship of the problems encountered by the participants to the perceived efficiency of the mobile application in terms of:
   a. Functionality
   b. Usability
   c. Reliability

**Theoretical Background and Conceptual Framework**

**ICT for sustainable agriculture**

Agriculture is an important sector in the Philippine economy. It is the process of producing strategic food and meeting fundamental needs. Philippine agriculture is traditionally known as the major producer of food and an economic booster in the country. The concept of sustainable agriculture has been put forward which focuses on maintaining the economic stability of farms and helping farmers improve their techniques and quality of life. However, some farmers are resource-poor and face many challenges such as lack of access to agricultural knowledge. In this context, there are various technological transformations in farming for the last decades. Modern information and communication technologies (ICT) have the potential to increase agricultural productivity through sharing and disseminating agricultural knowledge and information on enhancing farm technologies, food security, improved nutrition, increasing food production to rural agricultural communities, providing skills training and capacity building (Munyua et al,2008). It is observed that with ICT tools, knowledge is acquired faster and is better incorporated into the field. Pandey et al (2014) state that ICT can play an important role in maintaining feasible information and can be assessed as a means of direct involvement to agricultural production, as an indirect means for empowering farmers.

Creation of 'one-stop Centre for training and linking farmers and restructured extension services that target farmer groups to improve agricultural production and assist in the exchange of knowledge and information (Munyua et al, 2008).

(Yimer, 2014) states that everybody is required to contribute once on due to attain sustainable economic and social development. Accessibility of relevant information to the farming community helps to improve production and productivity and brings higher returns.

**Factors that are important to accessibility and ICT usage**

Various factors were reported to have a significant relationship to ICT usage and accessibility. These include affordability, ICT skills/ literacy, availability of the essential technology, the existence of applications and desired content, and other socio-cultural factors such as having no interest to use imported technology (Wong et al., 2010).

- ICT skills/ literacy- this refers to the ability of the user to digital technologies, communication tools, and network (Anyim, 2018; Wong et al., 2010)
- Affordability – this refers to the ability of the user to pay for the device and internet connection to continue using the service or the app
- Socio-cultural factors – this refers to the factors that may influence one's behavior towards and dissatisfaction with ICT usage(Goyal & Purohit, 2010)
- Availability of essential technology – this refers to the availability of the needed technology (e.g ICT gadgets and infrastructure) needed for learning and use of IC(Akinjide Aramide et al., 2015; Asenso-Okyere & Mekonnen, 2012)(Akinjide Aramide et al., 2015; Asenso-Okyere & Mekonnen, 2012; Goyal & Purohit, 2010)

**Conceptual Framework**

The conceptual framework of the study was shown in Figure 1. The primary source of data used came from the responses of the participants. It contained the demographics, gadgets in use, and the ICT knowledge and skills of the participants. The data gathered underwent pre-processing to prepare the data for data analysis. After data correction and data cleansing, the data was fed to a statistical tool for analysis. Descriptive statistics were employed to describe the features of the data. To determine the relationship of problems encountered in the app usage with the perceived efficiency of the mobile application in terms of reliability, usability, and functionality, spearman's correlation was utilized.
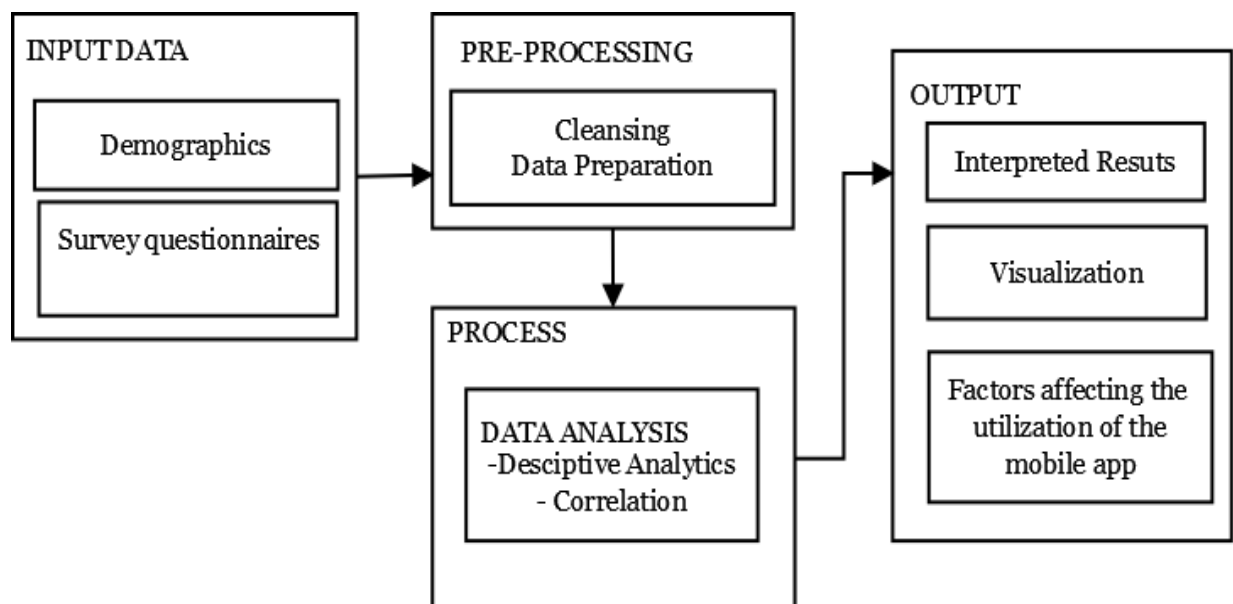


*Figure 1. Conceptual Framework*

**Methodology**

The study employed descriptive statistics to determine and describe the demographics of the participants, available ICT at their home, their ICT usage, ICT skills and knowledge, motivations, receptiveness, problems encountered in the ICT usage, and the evaluation of the App qualities.

Survey questionnaires were used as a data-gathering technique in the study. Two sets of survey questionnaires were deployed, the first survey was deployed at the start of the project which aimed to know the demographics and gadgets in use of the farmers/participants, this is to learn the characteristics of the target audience. The second survey aimed to assess the participants' ICT knowledge or skills, motivation, reasons for ICT usage, receptiveness, and user experience on the mobile app.

The data gathered was analyzed using descriptive statistics, specifically, frequencies, percentages, mean, median, and standard deviation. To validate the hypothesis of the study, spearman's correlation which is a nonparametric approach was used to determine the relationship of problems encountered in the app usage with the perceived efficiency of the mobile application in terms of reliability, usability, and functionality using spearman's correlation. Moreover, the results of the analysis from the collected data will end up by recommending the actions to be taken such as conducting training for ICT use and awareness, establishment or upgrade of infrastructure, and input for the mobile app.

The locale of the study was comprised of farmers from Barangay Pinili, Nueva Ecija.

In the context of software development, the researcher utilized the Agile Method for the development of the mobile app to ensure transparency with the clients while maintaining high-quality software during and at the release of the finished product. With agile, the researcher can minimize the project effort and redundancy by focusing on the delivery of a specific feature(s) through a series of time-boxed iterations. After every development iteration, the client can see the result and understand if he is satisfied or not.

A single iteration in Agile Software development encompasses a streamlined process starting with a defining requirement, UI design, development, quality assurance, user acceptance test, client feedback, release and incorporate change request as shown in Figure 2.
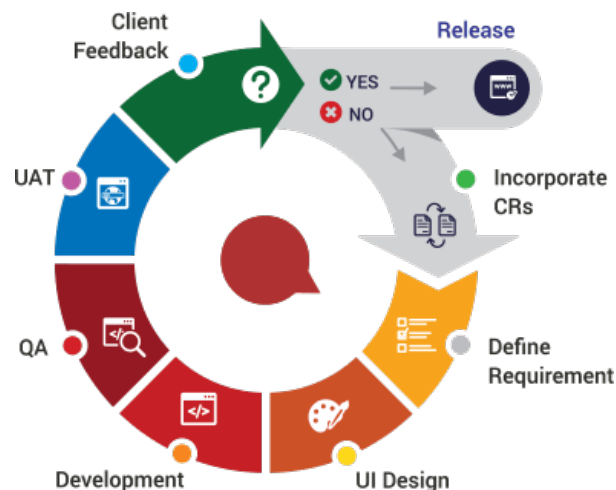


*Figure 2. Agile Software Development Model*

To evaluate the mobile app, an evaluation instrument was developed based on the ISO 9216 software quality model which includes functionality, reliability, usability, maintenance, and efficiency. In this study, the researcher focused on the first three characteristics.

**Hypotheses:**

H01: There is no significant relationship between the problems encountered by the participants to the perceived efficiency of the mobile application in terms of functionality.
H02: There is no significant relationship of the problems encountered by the participants to the perceived efficiency of the mobile application in terms of usability.
H03: There is no significant relationship of the problems encountered by the participants to the perceived efficiency of the mobile application in terms of reliability.

**Data Analysis and Interpretation**

Table 1 reflects the demographics of the Pinili participants. Twenty-one (21) farmers participated in the survey. The distribution of the participants based on gender revealed that there are more female (90.5%) than male (9.5%) participants among the respondents. The result on the educational attainment possessed by the Pinili Participants revealed that the majority of them are high school graduates or undergraduate (52.4%), 38.1% were elementary graduates and only 9.5% of them were college graduates or undergraduate. Further results on the background information revealed that the majority of the participants are Roman Catholic, married with 2 to 7 children, and agriculture was their main livelihood. Furthermore, the background information of the Pinili participants revealed that the main source of knowledge was as follows (1) Television or Radio (52%), (2) Consultation with experts (28.6%), (3) internet (14.3%), and, others such as cellphone and seminar.

*Table 1. Frequency and Distribution of the Moodle App Participants*

| PINILI FARMERS PROFILE | | |
|---|---|---|
| **sex** | Frequency | Percent |
| Male/ Lalaki | 2 | 9.5 |
| Female/ Babae | 19 | 90.5 |
| **education** | Frequency | Percent |
| Secondary/ Sekondarya | 11 | 52.4 |
| Elementary/ Elementarya | 8 | 38.1 |
| College/ Kolehiyo | 2 | 9.5 |
| **religion** | Frequency | Percent |
| Aglipayan | 2 | 9.5 |
| Bahai Faith | 2 | 9.5 |
| Catholic | 13 | 61.9 |
| Christian | 3 | 14.3 |
| INC | 1 | 4.8 |
| **Marital Status** | Frequency | Percent |
| Single/ Walang Asawa | 1 | 4.8 |
| Widow/ Biyudo or Biyuda | 3 | 14.3 |
| Married/ May Asawa | 17 | 81.0 |

| number of children | Frequency | Percent |
|---|---|---|
| 2 | 3 | 14.3 |
| 3 | 5 | 23.8 |
| 4 | 4 | 19.0 |
| 5 | 3 | 14.3 |
| 6 | 2 | 9.5 |
| 7 | 2 | 9.5 |
| No Answer | 2 | 9.5 |
| **Main Livelihood** | Frequency | Percent |
| Agriculture/ Agrikultura | 16 | 76.2 |
| Business/ Negosyo | 1 | 4.8 |
| Carpentry/ Pagkakarpintero | 1 | 4.8 |
| Sewing/ Pananahi | 1 | 4.8 |
| Cooking/ Pagluluto | 1 | 4.8 |
| No asnwer | 1 | 4.8 |
| **Life Status** | Frequency | Percent |
| Permanent Job or Business/ Permanenteng trabaho or negosyo | 1 | 4.8 |
| Temporary worker/ Panandalian | 3 | 14.3 |
| Job hopper/ Paiba-iba o palipat-lipat | 6 | 28.6 |
| No Answer | 11 | 52.4 |
| **Worker_Type** | Frequency | Percent |
| community worker/ Nagtratrabaho sa isang pribadong kumpanya | 2 | 9.5 |
| government worker/ nagtratrabaho sa gobyerno | 1 | 4.8 |
| Businessman or businesswoman/ Ngtratrabaho sa sariling negosyo | 1 | 4.8 |
| Working on family ownership/ nagtratrabaho sa negosyong pag-aari ng pamilya | 2 | 9.5 |
| unemployed/ hindi naghahanapbuhay | 9 | 42.9 |
| No Answer | 6 | 28.6 |
| **Media / Source of Knowledge** | Frequency | Percent |
| TV or Radio/ Telebisyon o Radyo | 11 | 52.0 |
| Consultation with the experts/ Pagsangguni sa eksperto | 6 | 28.6 |
| Internet | 3 | 14.3 |
| Others/ Iba pa | 1 | 4.8 |

Analysis of the background information of the Pinili participants based on the gadgets in use presented in Table 2, revealed that the majority of the participants have mobile phones at home (85.71%). However, the results of the analysis revealed that only a few of the phones (23.8%) owned by the participants meet minimum requirements for the mobile app. Another 23.5% of phones possess qualifications but were owned by a family member. The majority of the

participants were using a keypad phone (8 or 38.1%) which not qualified for the mobile app deployment.

*Table 2. Gadgets in use at home*

| Phone model in use | Frequency | Percent |
|---|---|---|
| Own phone (meets the minimum requirements) | 5 | 23.8% |
| Phone own by a family member (meets the minimum requirements) | 5 | 23.8% |
| Keypad phone (mobile phone does not meet the minimum requirements | 8 | 38.1% |
| No answer | 3 | 14.3% |

The final survey conducted consist of items to assess the participants' ICT knowledge and skills, motivations, receptiveness, problems in ICT usage, and user feedback on the app.

The survey was participated by fifteen (15) participants but five of them did not complete the survey and so it was reduced to ten (10). The retention rate of the participants was greatly affected by the COVID-19 pandemic. Table 3 presents the distribution of participants grouped by age. All of them were female and married.

*Figure 3. Age Frequency Chart*
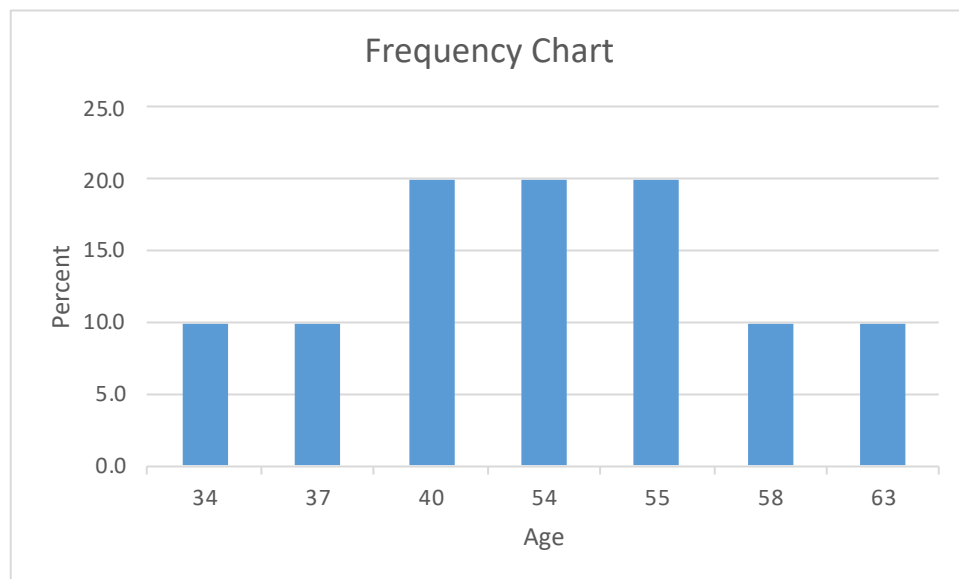


**Availability:**

Table 3 presents information on ICT availability at home by the Pinili participants and it revealed that all the participants have cell phones but only one or 10% has a television set and wireless network at home. The implication to be drawn from this is that ICT availability is limited to the Pinili participants.

| ICT Availability | Frequency | Percent |
|---|---|---|
| Avail1. Cellphone | 10 | 100.0% |
| Avail4. Digital Television set | 1 | 10.0% |
| Avail5. Wireless Network | 1 | 10.0% |

**Research Question 1: What is the current level of ICT knowledge of farmers?**

Table 4 presents information on the purpose of ICT usage by the Pinili participants. For communication (90%) topped the list of reasons in ICT use. This is followed by searching for news (60%). The third reason for ICT use is for searching information (50%), and the last reason is for online transactions (20%).

*Table 4. ICT Usage*

| ICT Usage | Frequency | Percent |
|---|---|---|
| Use1. To communicate /Sa pakikipag-usap | 9 | 90.0% |
| Use2. To search information/ Sa pagsisiyasat ng inpormasyon | 5 | 50.0% |
| Use3. To find news/Sa pananaliksik ng balita | 6 | 60.0% |
| use4. For online transaction/ Sa Online transaction | 2 | 20.0% |

Table 5 presents information on the ICT skills or experience of the Pinili participants. It revealed that half or 50% of the participants have little to no knowledge or skills on ICT, 20% have fair skills or knowledge on ICT, and only 30% of the participants have good skills or knowledge in ICT. This implies the need for seminars and training on ICT and app usage.

*Table 5. ICT Skills or Experience*

| ICT Skills or Experience | Frequency | Percent |
|---|---|---|
| 1-Very Poor | 5 | 50.0% |
| 2- Poor | 0 | 0.0% |
| 3- fair | 2 | 20.0% |
| 4- Good | 3 | 30.0% |
| 5- Excellent | 0 | 0.0% |

Table 7 presents information on the motivations of the Pinili participants for using ICT. It revealed that the participants' reasons covered all that was listed in the survey with Motivation 3 and 4 as the most common reasons. Motivation 3 pertains to interaction with family and friends while motivation 4 was to be updated. This implies that the primary reason for ICT usage was more for socialization purposes.

*Table 6. Motivations in using ICT*

| ICT motives | Frequency | Percent |
|---|---|---|
| Motive1. Curiosity/Pag-usisa | 7 | 70.0% |
| Motive2. Encouragement of the younger generation/ Paghihikayat ng mga nakababatang henerasyon | 5 | 50.0% |
| Motive3.To interact with family and friends/ Upang pakikipag-ugnay sa pamilya at mga kaibigan | 9 | 90.0% |
| Motive4.To be updated/ Upang maging updated | 9 | 90.0% |
| Motive5.To participate actively in the digital society/ Upang lumahok nang aktibo sa lipunang digital | 6 | 60.0% |

**Research Question 2: What are the obstacles that will affect the utilization of the mobile app in the study area?**

Table 7 presents information on the obstacles or problems in the ICT use of the Pinili participants. It revealed that the majority of the items were rated neutral which implies that there is a problem specifically for Problem 5 and Problem 6 respectively. The lack of training and lack of access to technological resources.

Before the pandemic or lockdown, three to four onsite training sessions on App usage were conducted. Smartphones and Wifi and/or mobile data were made available to the participants specifically for those who have no smartphones.

During training, the participants were highly participative but when the researcher no longer visits the study site due to travel restrictions and lockdown, they stop engaging.
Online training sessions were conducted to refresh their knowledge on how to use the mobile app however the participants were having difficulty adjusting to the new setup.

The implication that can be drawn from this is that the lack of training due to lack of access to technology (availability of smartphones and strong internet) resulted in a high attrition rate for App usage. Participants were not that familiar with the app or the technology, thus, requires additional training sessions. Also, it may be inferred that with the ongoing curbs of the COVID and lockdown implementation to certain areas, thereby decreases the mobility and productivity of the people. The end-user specifically the farmers have set their priorities with their families by helping each other cope up with their livelihoods and educational aid for their children rather than paying attention and familiarize themselves with the mobile app.

*Table 7. Problems in ICT use*

| Problems in ICT use | Mean | Std. Deviation | Verbal Interpretation |
|---|---|---|---|
| Problem1. Learning difficulties/ Kahirapan sa pag-aaral | 3.00 | 0.943 | Neutral |
| Problem2. Lack of confidence/ Kulang sa tiwala | 3.20 | 0.919 | Neutral |
| Problem3. Fear of technology/Technophobia or takot sa teknolohiya | 3.10 | 1.101 | Neutral |
| Problem4. Lack of time and support for learning/ Kakulangan ng oras at suporta para sa pag-aaral | 3.40 | 1.075 | Neutral |
| Problem5. Lack of Training/ Kulang sa pagsasanay | 3.80 | 0.789 | Agree |
| Problem6. Lack of access to technological resources/ Kakulangan ng pag-access sa mga mapagkukunanng teknolohikal | 3.80 | 0.789 | Agree |
| Problem7. Lack of understanding of the benefits of technology/ Kakulangan ng pag-unawa sa mga pakinabang ng teknolohiya | 3.10 | 0.994 | Neutral |

**Research Question 3: How receptive are the farmers to learn and use ICT?**

Table 8 revealed the willingness or acceptance of the participants to learn and use ICT. It can be inferred from the information that Pinili participants are receptive to learn and adapt a new technology ($\bar{x}$= 3.80).

*Table 8. The receptiveness of adults to learning and ICT use*

| Receptiveness | Mean | Std. Deviation | Verbal Interpretation |
|---|---|---|---|
| Receptive | 3.80 | 0.632 | Agree |

**Research Question 4: How efficient is the mobile app in empowering farmers to improve intergenerational learning?**

The following tables present the information on the mobile app qualities. The mobile app aims to train, link, and assist farmers in the exchange of knowledge and information. The efficiency of the mobile app was determined by considering the system requirements namely the functional and non-functional requirements (reliability and usability).

Table 9 presents the information on mobile app functionality attributes. Results revealed that the available functionality of the app was acceptable. It provides the desired outcome, enhances work effective and prevents unauthorized access (security).

## Table 9. Mobile App Functionality

| FUNCTIONALITY (Pag-andar) | Mean | Std. Deviation | Verbal Interpretation |
|---|---|---|---|
| Functionality1: Using the mobile app would enhance effectiveness on the job/ Ang paggamit ng mobile app ay mapapahusay ang pagiging epektibo sa trabaho | 3.80 | 0.919 | Agree |
| Functionality2: Ang mobile app ay gumagawa ng mga inaasahang resulta (The mobile app produce expected results) | 3.70 | 1.059 | Agree |
| Functionality3: Pinipigilan ng system ang hindi awtorisadong pag-access (System prevents unauthorized accessed) | 3.60 | 1.075 | Agree |
| Functionality4: Ang paggamit ng system ay magpapagana sa akin ng mga Gawain nang mas mabilis (Using the system would enable me accomplish tasks more quickly) | 3.70 | 1.059 | Agree |

From table 10, it can be inferred that in terms of usability, the participants agreed that the app was easy to navigate and understand as well as it can be used without much effort. However, Use2 and use3 were neutral. These agree or coincide with problem5 and problem 6 which implies that the participants still lack training and access to technology.

## Table 10. Mobile App Usability

| USABILITY (Kakayahang magamit) | Mean | Std. Deviation | Verbal Interpretation |
|---|---|---|---|
| Usability1: Ang app ay madaling manavigate at maunawaan (The App can be easily navigate and understood) | 3.70 | 0.823 | Agree |
| Usability2: Ang app ay madaling natutunan (The App can be learned easily) | 3.20 | 1.135 | Neutral |
| Usability3: Ang pangkalahatang layout ng system at pag-navigate ng interface ay naiintindihan (The overall layout of the system and navigation of the interface is understandable.) | 3.20 | 1.229 | Neutral |
| Usability4:Ginagamit ng gumagamit ang system nang walang labis na pagsisikap (User use the system without much effort) | 3.70 | 0.949 | Agree |

Table 11 presents the information for app reliability. It revealed that the participants agreed with reliability1 and 4 but they are neutral for reliability 2 & 3. It can be inferred from that the possible reasons for these were: when the app crashes (e.g. compatibility issues), they may not have used it again, or when they are prompted with error messages such as maximum limit for file upload was reached or the supplied password was incorrect, they think the app is not functional or experiencing an error.

*Table 11. Mobile App Reliability*

| RELIABILITY (Kahusayan) | Mean | Std. Deviation | Verbal Interpretation |
|---|---|---|---|
| Reliability1. Bumubuo ng tama at tumpak na mga resulta ang mobile app (Generates right and accurate results) | 3.70 | 1.160 | Agree |
| Reliability2. Ang system ay nagbibigay ng error na mensahe sa maling mga entry ng data (The system provides error messages in wrong data entries) | 3.30 | 1.252 | Neutral |
| Reliability3. Ang system ay walang system error or craches (Free from system error or crashes) | 3.40 | 0.966 | Neutral |
| Reliability4. Pinapaalam ng app sa gumagamit hinggil sa hindi wastong pagpasok ng data (The App informs user concerning invalid data entry) | 3.60 | 1.075 | Agree |

**Research Question 5: Is there a significant relationship of the problems encountered by the participants to the perceived efficiency of the mobile application in terms of (a) Functionality; (b) Usability and, Reliability.**

H01: There is no significant relationship between the problems encountered by the participants to the perceived efficiency of the mobile application in terms of functionality.

From Table 12 it can be inferred that Problem4 has a significant positive relationship with perceived functionality 2 and 3, that is if Problem 4 increases then functionality 2 and 3 also increases. Therefore, the null hypotheses for problem 4 concerning functionality 2 &3 are rejected. It was further observed that there is a moderate positive relationship between Problem 4 to functionality 2 and a strong positive relationship between Problem 4 to functionality3.

*Table 12. Functionality Correlations*

| Correlations | Problem2 | Problem3 | Problem4 | Problem5 | Problem6 | Problem7 |
|---|---|---|---|---|---|---|
| **Functionality1** | -0.053 | -0.218 | 0.542 | 0.408 | 0.408 | -0.029 |
| **Functionality2** | 0.308 | 0.086 | .670** | 0.541 | 0.541 | -0.371 |
| **Functionality3** | 0.123 | -0.115 | .816** | 0.422 | 0.422 | -0.155 |
| **Functionality4** | 0.308 | 0.086 | .670* | 0.541 | 0.541 | -0.371 |
| **. Correlation is significant at the 0.05 level (2-tailed).* | | | | | | |

H02: There is no significant relationship between the problems encountered by the participants to the perceived efficiency of the mobile application in terms of usability.

Table 13 presents information on the relative contribution of problems encountered by the participants and usability as a contributing factor to the perceived efficiency of the mobile app. Results imply that problem7 has a significant negative relationship with perceived usability 2 and 3, that is if Problem7 increases then usability 2 and 3 decreases and vice-versa. Furthermore, there is a strong negative relationship of Problem7 to both usability 2 and 3.

*Table 13. Usability Correlations*

| Correlations | Problem2 | Problem3 | Problem4 | Problem5 | Problem6 | Problem7 |
|---|---|---|---|---|---|---|
| Usability1 | 0.193 | 0.201 | 0.408 | 0.422 | 0.422 | -0.489 |
| Usability2 | 0.088 | 0.017 | 0.490 | 0.159 | 0.159 | -.804[**] |
| Usability3 | 0.017 | 0.086 | 0.463 | 0.186 | 0.186 | -.762[**] |
| Usability4 | -0.031 | 0.303 | 0.337 | 0.328 | 0.328 | -0.165 |
| **. Correlation is significant at the 0.05 level (2-tailed). | | | | | | |

H03: There is no significant relationship between the problems encountered by the participants to the perceived efficiency of the mobile application in terms of reliability.

From Table 14, it can be inferred that problem4 has a significant positive relationship with perceived reliability 2 and 3, that is if Problem4 increases then reliability 2 and 3 also increases. Furthermore, there is a moderate positive relationship between problem 4 to reliability 2 and a strong positive relationship between problem 4 to reliability 3. Also, Problem7 has a significant negative relationship with perceived reliability 2, that is if problem number 7 increases then reliability 2 decreases and vice versa. Furthermore, there is a moderate negative relationship of problem 7 to reliability2.

*Table 14. Reliability Correlations*

| Correlations | Problem2 | Problem3 | Problem4 | Problem5 | Problem6 | Problem7 |
|---|---|---|---|---|---|---|
| Reliability1 | -0.053 | -0.218 | 0.542 | 0.408 | 0.408 | -0.029 |
| Reliability2 | 0.296 | 0.347 | .674[**] | 0.263 | 0.263 | -.645[**] |
| Reliability3 | 0.059 | 0.213 | .729[**] | 0.219 | 0.219 | -0.478 |
| Reliability4 | 0.480 | 0.201 | .816[**] | 0.422 | 0.422 | -0.489 |
| **. Correlation is significant at the 0.05 level (2-tailed). | | | | | | |

**Discussion of findings**

On the current level of ICT knowledge of the farmer or Pinili participants, the finding from the study revealed that half or 50% of the participants have little to no knowledge or skills on ICT. Participants mainly use ICT for communication or socialization.

The study also investigated the obstacles that may affect the utilization of the mobile app. The finding revealed that that the lack of training due to lack of access to technology (availability of smartphones and strong internet) resulted in a high attrition rate for App usage. This corroborates (Akinjide Aramide et al., 2015) that emphasized the significance of making ICT resources available in locations where participants can easily access them.

Additionally, the ongoing curbs of the COVID and lockdown implementation to certain areas, thereby decrease the mobility and productivity of the people. The end-user specifically the farmers

have set their priorities with their families by helping each other cope up with their livelihoods and educational aid for their children rather than paying attention and familiarize themselves with the mobile app.

The success of the app utilization requires both knowledge and the means for transmitting it must be both available. Furthermore, it requires the participants' willingness and ability to use the better knowledge that is accessible (Goyal & Purohit, 2010).
The study also investigated the relationship of the problems encountered by the participants to the perceived efficiency of the mobile app in terms of functionality, usability, and reliability.

**Relationship between problems in ICT use, mobile app characteristics, and Mobile app efficiency by the Pinili participants or farmers.**

Findings from the study revealed that lack of time and support to study the mobile app was found to have a positive relationship on the efficient mobile app functions exploration and app use. This is in line with (Goyal & Purohit, 2010) findings which reported that the time required to learn the use of technology and providing encouragement and support to the learners/users are factors affecting critical success or outcomes of ICT.

Lack of understanding of the benefits of technology was also found to be negative but significantly related to ease of learning and overall layout and navigation of the App. This confirms Eligi (2017) findings that the usability of ICT facilitates learning.

Lack of time and support to study has a significant positive relationship with perceived system errors. This is in line with Anyim (2018) findings which reported a lack of enthusiasm to training in ICT and (Goyal & Purohit, 2010) findings which reported that reliability of ICT results in inadequate ICT literacy skills and critical success for ICT use respectively.


**Conclusion**

The study investigated the ICT skills or knowledge, receptiveness to use and learn new technology, motivations in using ICT by the Pinili participants, and the relationship between problems encountered and software attributes to the perceived mobile app efficiency. The study revealed that half of the participants have little to no knowledge, they use ICT mostly for communication or for socialization.

Lack of training due to lack of access to technology (availability of smartphones and strong internet) resulted in a high attrition rate for App usage. Participants were not that familiar with the app or the technology, thus, requires additional training sessions.

Furthermore, the study also revealed that the lack of time and support to study the mobile app was found to have a positive relationship with ICT or mobile app use. This implies that participant willingness, time commitment, and ability to use the better knowledge that is accessible are indispensable in the mobile app efficiency.

**Recommendations**

The following recommendations were made based on the findings of the study:
conducting training for ICT use and awareness, establishment or upgrade of infrastructure, and input for the mobile app.

1. Adequate funding for ICT infrastructure and skill acquisition programme for the Pinili participants
2. Provision for access to ICT facilities (gadget availability and establishment or upgrade of infrastructure) should be made available to the participants by the research team.
3. There is a need for training and re-training of Pinili participants on ICT use and awareness including the mobile app usage and potential digital information resources
4. Involvement strategies through the Local government unit, private companies, universities, and research institutes.
5. Participants should endeavor to use the mobile app for its intended purpose. Participants should go the extra mile on their own to acquire ICT skills
6. Evaluate the impact of the mobile app in promoting sustainable agriculture, family literacy, and intergenerational learning.

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