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Original article

Perceived benefits of ICT-based rice technologies by farmers and agricultural extension workers

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ABSTRACT

Information and Communication technologies (ICTs) enhance information flow and facilitate delivery of ICT-based agricultural extension for sustainable development. This study aimed to describe the benefits that farmers and agricultural extension workers (AEWs) derived from using these ICTs for rice technologies. These are the *Pinoy* Rice Knowledge Bank with *Palay* Check and Nutrient Manager for Rice Mobile that are accessible through the Internet and mobile phone, respectively. The study obtained the data through in-depth interviews with six rice farmers and five AEWs. Results showed that farmers' access and use of rice ICTs: 1) make them look trendy, 2) facilitate finding of solutions to their farm problems, 3) enhance their farm skills on rice nutrient management, 4) link their produce to the local buyers, and 5) enable them to increase their crop yield. Likewise, the AEWs' access to rice ICTs provide them with the following benefits: 1) rice ICTs have become part of their daily lives, 2) facilitate their extension work, 3) serve as a guide in giving advice to farmers, and 4) give them a sense of empowerment. The farmers followed some recommended techniques in the *Palay* Check. Both farmers and AEWs considered the high cost of mobile phone load and weak signal from cellular networks as problems in accessing rice ICTs. In general, however, the rice ICTs enhanced the AEWs' work in promoting relevance, timeliness, and efficiency of their extension services. The study came up with a communication model for an improved extension delivery of ICT-based rice technologies.

KEYWORDS: *ICTs for rice technologies, extension delivery, PRKB, Palay Check, NMRice Mobile, CARAGA*

1 INTRODUCTION

An increasing number of the rural population in developing countries depend on the information and communication technologies (ICTs) in uplifting the livelihoods of the rural small landholder farmers. The reason for their dependence on ICTs is that these technologies help empower the rural people by providing them better access to natural resources, improved agricultural technologies, effective production strategies, markets, banking and financial services (Lokeswari, 2016). Likewise, Ramirez and Reyes (2013) pointed out in their study that integrating ICTs in technology transfer activities within the cyber-villages made the rice farmers more empowered and productive knowledge-seekers. However, in other studies of Azumah, et al (2018) and Nakano, et al (2018), they still proved that the use of household extension methods and farmer-to-farmer approach in disseminating rice information is more effective than using ICTs. The extension approach even gave their farmers better yield.

ICTs, according to the Agricultural Information Management Standards Portal (AIMS, 2019) of the Food and Agriculture Organization (FAO), include such technologies as the Internet, mobile phones, computers, and other media applications. These technologies facilitate users' access, retrieval, storage, and transmission of information in digital format. FAO (2013) suggested that to achieve food security, the smallholder women-farmers need to access ICTs potentials to get the appropriate information at the right time for informed decisions on their livelihood.

In collaboration with FAO, the Consultative Group of International Agricultural Research (CGIAR) Center has established online information resources for farmers and agricultural extension workers. An example of these information resources is the Rice Knowledge Bank (RKB) of the International Rice Research Institute (IRRI). RKB aims to bridge the gap between research and actual practice in rice production. The RKB is a digital extension service that provides practical knowledge solutions for small-scale farmers in developing countries. It highlights rice production techniques of IRRI's pool of knowledge from its research findings and presents a

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systematic technology on rice production stages from pre-planting to post production management. RKB online supports fast and effective transfer of technologies from the research laboratory to the farmers' field (IRRI, 2019).

In the Philippines, IRRI in cooperation with the Philippine Rice Research Institute (PhilRice) and the Department of Agriculture-Agricultural Training Institute (DA-ATI) launched the *Pinoy* Rice Knowledge Bank (PRKB). The PRKB gives advice to rice farmers on getting the right amount of fertilizers, obtaining optimal harvest, achieving more savings, and environmental protection. PRKB is a novel means to provide important information to remote farmers who lack access to expert advice (IRRI, 2019).

The PRKB contains the *Palay Check*, which is a dynamic rice crop management system that presents the best key technology and management practices including Key Checks. The system includes the one-stop information shop on rice-based farming via the Internet. The project also promotes the Nutrient Manager for Rice Mobile (NMRiceMobile) which provides information for farmers via mobile phones on the optimal timing, amount, and type of fertilizer that they can apply in their rice fields to maximize profit and reduce waste.

Given the current efforts to harness ICTs to improve agriculture particularly on rice farming, there is a dearth of information on how farmers and AEWs access and use these ICTs for rice technologies (i.e., *Palay Check* and NMRice) in their farms. Thus, this study sought to explore and draw insights from the lived experiences of farmers and AEWs in accessing and using ICTs for rice technologies in CARAGA, Philippines and tried to understand how these ICTs affect the lives of farmers in terms of their crop harvest and income.

2 MATERIALS AND METHODS

Research Design and Study Areas

The study applied a qualitative phenomenological research design by Creswell (2013). This involved a systematic drawing out and in-depth looking at the lived experiences of farmers and AEWs in accessing and using ICTs for rice technologies. The study was conducted in Agusan del Norte, one of the five provinces in the CARAGA region in Mindanao. Agusan del Norte has a land area of 273,024 hectares and its economy is predominantly agriculture and is considered as a major rice producing area in CARAGA (DILG-CARAGA Region, 2019). The research covered two towns of Buenavista & Remedios T. Romualdez and one city in Butuan (Fig. 1). These are the pilot sites of PRKB and NMRice Mobile.

Participants of the Study

Participants in this study included six rice farmers and five agricultural extension workers (AEWs). All

Figure 1. Map showing the study sites (Source: https://www.CARAGA.dilg.gov.ph/)

participants have accessed and used ICTs for rice technologies. The number of participants was determined using the theoretical sampling method. This means that the data gathering would stop once no additional data emerged and the categories have reached a saturation point (Byant, 2017). Creswell (2013) emphasized that a phenomenology approach only needs a small number of subjects "through deep and long engagement to see patterns and relationships of meaning."

The farmer-participants in this study were all female. During the interviews, the farm wives were the ones left in their homes because their husbands went early to the rice fields to start their farm activities. Given their roles on the farm decision-making, the wives were deemed qualified as informants for this study. While in their respective homes, the wives prepared the food and brought them to the farm. After lunch, they participated in the farm activities. As Lamontagne-Godwin, et al (2016) have proven in their study that in terms of technical advising in the farm, there was no significant difference between male and female farmers at plant clinics. The AEWs, on the other hand, were rice specialists who accessed ICTs for rice technologies after they attended a training of trainers (TOTs) on upland/lowland rice production practices.

Data Gathering Methods and Instruments

Data were gathered through in-depth participant interviews using unstructured guide questions for probing. The interviews were audio-taped using a digital recorder. The data collection process lasted for a month. Each participant's name was replaced with a number code (e.g., Participant 1) to keep the confidentiality and anonymity of the participants. The audio-recorded interviews were transcribed verbatim using the Microsoft word processing software. The researcher listened to the audio tapes reiteratively to familiarize the participants' perspectives and ensure accuracy of the transcripts.

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In this study, the statements by the farmers and AEWs who accessed and used ICTs for rice technologies were transcribed verbatim and read reiteratively to find the common themes that represented the overall essence of the participants' lived experiences.

The following are the seven steps by Creswell (2013): 1) decide on the phenomenon to be explored, 2) identify a group of individuals who have experienced the phenomenon, 3) discuss the theoretical framework that guides the phenomenological study, 4) discuss the personal experiences with the phenomenon (known as bracketing), 5) use a data collection procedure involving the individuals who have experienced the phenomenon, 6) analyze procedures that move from narrower significant statements to broader units, and 7) describe the essence of the individuals' shared experiences. A qualitative software called, Dedoose, was used to facilitate organizing and categorizing the data. Follow-up meetings with the farmers and AEWs were conducted to validate the common themes that came out from the data analysis.

Participants were also asked on their socio-demographic attributes such as age, educational attainment, marital status, household size, monthly income, main source of income, membership in organizations, old and new ICTs owned, and ICTs for rice technologies accessed and used. Each transcript was organized into a file folder in the personal computer. The in-depth interviews were done face-to-face in an unstructured manner. Results were presented with direct quotes translated in English from the research participants.

3 RESULTS AND DISCUSSION

Profile of Farmers and AEWs

Based on the New Humanitarian report (2013), the average age of Filipino farmers is 57 years old. In this study, the six woman-participants had ages that ranged from 40 to 59 years old and with 2-6 household members. They typify the rice farmers when it comes to age range and number of household members. The average level of education of Filipino farmers is grade five only. Farmers in this study have reached or finished high school and have earned a monthly income that ranged from below Php10,000 to as high as Php50,000 ($200-1,000). This means that these women-farmers have higher educational attainment and higher income compared to the P2,500 average monthly income of typical Filipino rice farmers. As with their peers, these farmers depended solely on rice farming for their livelihood. All the six were members of the farmers' cooperative. As regards to their economic standing, the rice farmers usually apply for loans to finance for their cropping enterprise.

On the other hand, the AEWs were older (51-60 years old) than the farmers. They were all males, married, and with 2-5 household members. All had finished at least a BS degree in agriculture or agribusiness and received a monthly income that ranged from below Php10,000 to as high as Php20,000 ($200-400). This is taking into account the meager income of the AEWs monthly and most of them are retiring when it comes to their ages. The AEWs in this study have devoted some parcels of their land for rice farming to try out by themselves the rice technologies they are promoting to farmers. This demonstrates their sincerity in making sure that whatever technology they promote to farmers they know by heart and can honestly attest that it has been proven to work. A common practice also was for the AEWs to eventually become a member of the cooperative they have assisted. The AEWs have accessed rice technologies including the Palay Check of the PRKB mostly on nutrient management in the farmer cooperative's computer with Internet during daytime when the need arises. At the time of the study, computers were still a rarity and even if they had one or two in their local agricultural office, these were reserved more for the use of the agricultural officer. In other words, AEWs had no regular access to this computer equipment. The AEWs, however, had their personal mobile phones. The AEWs said that their access to rice technologies using mobile phones significantly enhanced relevance, timeliness, and efficiency of their extension work. Participants also revealed that the learnings they obtained from the training on NMRice Mobile organized by ATI in the CARAGA region made their extension service more relevant and timely because they were able to respond to farmers' needs for information on nutrient management. They also said that they were able to send information to farmers through their mobile phones. Two of the AEWs had an opportunity to participate in another training workshop in Vietnam. Sponsored by IRRI, the training aimed to familiarize participants with agronomic practices for hybrid rice cultivation.

Participants' Experiences in Accessing and Using ICTs for Rice Technologies

Five themes emerged from the farmers' narratives and four themes from the AEWs' on their experiences in accessing ICTs for rice technologies. For farmers, use of ICTs for rice technologies: 1) made them look trendy, 2) facilitated finding solutions to farm problems, 3) enhanced their farm skills on rice nutrient management, 4) linked their produce to the local buyers, and 5) enabled them to increase their crop yield. For AEWs, ICTs for rice technologies: 1) eventually became part of their daily lives, 2) facilitated their otherwise slow-paced extension work, 3) served as a guide in giving proper advice to farmers, and 4) gave them a sense of empowerment.

Farmers' Theme 1. Use of rice ICT made farmers look trendy.

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As the communication technology of the time, mobile phones are usually associated with being modern and innovative. In a study in Tanzania, Kalema (2017) found that almost three-fifths (57.3%) of farmers are using ICTs to access agricultural information particularly from mobile phones. As mobile phones have become more common in the Philippines even in rural communities, if one does not own and use the gadget yet, one is considered as belonging to the old generation, traditional or conservative, and lagging behind in terms of news and current events. Thus, the mobile phone has become a symbol of modernity or of being trendy, a shift from the usual old fashioned attribute of rice farmers.

"Without the mobile phones, I will be outdated and isolated and not updated with the new technologies in rice farming."

Other participants were proud to say that their access to ICTs for rice technologies kept them on the loop and, thus, readily updated. *"I wonder what would my farm be now if I don't have a mobile phone. I will be wasting fertilizers because I'm not updated on the nutrient management technology that minimizes its use."*

Likewise, the farmers found the use of mobile phones to access rice technologies as quite simple; it just involves pressing the keys of the mobile phone *(laughs out loud).* Whereas, first time users of mobile phones would find its operation quite confusing.

Farmers' Theme 2. ICTs facilitated finding solutions to farm problems.

Farmers recognized that farming is a risky business and is beset with a wide range of problems that require immediate solutions. Given the fact that the extension workers cannot be in their community most of the time, the mobile phone serves as an important resource for farmers in finding solutions to their farm problems. With just a click, they are able to find answers to their questions. In nutrient management, for example, farmers said that by sending a message through either hotline * for Globe or * Smart subscribers, they are able to determine at once the right amount of fertilizer to apply in their rice fields.

"With the free mobile phone service and using the NMRice Mobile hotline number, I could ask right away the appropriate nutrient management method in the farm because it is location-specific." [Participant 2]

"This innovative phone technology provides me an immediate answer when it comes to the optimal timing, amount, and type of fertilizer that are needed in my farm to reduce waste." [Participant 6]

Some participants mentioned that working in their farms using these ICTs for rice technologies makes their farming easier now compared to the time when they did not have mobile phones yet. According to them, "in rice production and cooperatives' daily transactions, mobile phones are one thing that we could not live without nowadays." Through this gadget, we're informed of the latest rice technologies by PhilRice and IRRI." Essentially, the gadget has become a necessity. Thus, the gadget has been part of the grind of their daily life.

Farmers' Theme 3. ICTs enhanced their farm skills on rice nutrient management.

Most of the farmer-participants said that the rice ICTs are "really a big help" because these enhanced their knowledge and skills in farming, especially on rice nutrient management.

"Accessing rice technologies through my mobile phone enhanced my knowledge on techniques for neutralizing soil conditions, which I had no knowledge beforehand. Among these new learning techniques is the mixing of sawdust with charcoal as organic fertilizer and applying it in my rice field before transplanting. I learned this from the messages sent via my mobile phone. This was in addition to the insights I gathered from the seminars conducted by PhilRice-Agusan, DA-City Agriculturist and ATI-CARAGA." [Participant 5]

Farmers' Theme 4. ICTs helped them link their produce to local buyers.

Another important function of the ICTs in the farmers' farming enterprise was to link up their produce directly with local buyers. This link freed them from the hassles in selling their farm produce that they often encounter every harvest time. They confided that before, they had to look for buyers, which was quite a challenge as they usually end up with the lowest bidder. However, these days, the buyers are the ones contacting them to buy their harvest right at their farms. This has substantially reduced their waiting time and the trouble of transporting their harvest.

"Sometimes, I sell our produce to the Muslim traders who have become my suki because they buy our produce at a higher price (16 pesos/kilo) compared to the buying price mark-up of our farmers' cooperative (15 pesos/kilo). Because of that, we're now able to pay our loan." [Participant 2]

Other farmers, on the other hand, said that they sell their farm produce directly to their farmers' cooperative even if it offers a lower buying price. This was because in the cooperative, they could still avail of the loyalty or patronage refund that they get at the end of the year, or after two cropping seasons.

Farmers' Theme 5. ICTs enabled them to increase their crop yield.

Farmer-participants recounted their low income before the Palay Check was introduced to them by the AEWs. They were thankful for the new rice technologies on Palay Check System that have become accessible via the mobile phone. According to them, "the technologies enabled them to have higher yield and better income" .

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"Before, when we didn't have access to the rice technologies through our mobile phone yet, our harvest was low because we lacked the knowledge on proper nutrient management. Now that we already know the right amount of fertilizer, kind of organic fertilizer to apply, and the right timing when to apply the fertilizer, we are able to obtain higher yields and bigger income. We could now pay our debts and buy food. We are happy." [Participant 1]

On the other hand, the AEWs also derived benefits from their access to the ICTs for rice technologies. These benefits included: 1) use of ICTs has become a part of their daily lives, 2) ICTs facilitated their extension work, 3) ICT contents served as guide in giving advice to farmers, and 4) ICTs gave them a sense of empowerment.

AEWs' Theme 1. Use of ICTs for rice technologies has become a part of their daily lives.

When asked why they access ICTs on rice, most of the AEWs answered that these ICTs have already become part of their life as extension workers. They bring with them their mobile phones wherever they go because these have become a basic gadget and a necessity in their day-to-day work. All they had to do was to charge their mobile phones regularly so they would not run out of battery. In addition, they access and use the Internet easily for the Palay Check. In a way, the mobile phone has augmented their fieldwork that used to be constrained by the limited number of AEWs serving the needs of a vast number of farmers out there.

"Using these ICTs to access new rice technologies has become my routine because wherever I go I have with me my phone, be it in the office or at the farmers' field. [Participant 9]

AEWs' Theme 2. ICTs facilitated the otherwise slow pace of extension work.

Related to Theme 1, the AEWs revealed that the rice ICTs made their typically slow-paced extension work more efficient, easier, and faster. With rice ICTs, they could already store the content of the rice technologies in their phones, and the needed details as well. They could also respond quickly to the questions raised by farmers who could access the same.

"Rice ICTs make our work easier and faster as an AEW since computations like number of bags of organic and inorganic fertilizers are already provided including the timing of application…. so, it is a great help for me." [Participant 7]

AEWs' Theme 3. ICTs served as a guide in giving advice to farmers.

With the nutrient manager for rice mobile, AEWs did not have problems anymore on what to recommend to the farmers particularly on the nutrient management. Based on the narratives of most AEWs, the NMRice mobile is a complete package that serves as their guide when it comes to the optimal timing, amount, and type of fertilizers. These are information that their client-farmers need to apply to their rice crop to maximize production and profit as well as reduce waste. To ensure the accuracy of information they gave to the farmers, one AEW revealed that:

"I myself tried out the rice ICTs on Palay Check right on my own farm so I could give an appropriate advice to farmers. Since I have tried it, I am confident that my advice is correct. This is especially helpful to those farmers who run out of e-load and those who have not yet accessed rice ICTs." [Participant 11]

AEWs' Theme 4. ICTs developed their sense of empowerment.

In Kenya, using their ICT tools such as the Kenya Rice Knowledge Bank (KRKB) not only empowers farmers but also increases their farmers' capacity to arrive at good decisions in their farms (Akuku et al, 2014). In this study, the AEW-participants said they are happy that the package of rice technologies have become readily accessible through the ICTs. This in a way gave them a sense of empowerment to share, disseminate, and demonstrate the technologies by themselves.

One of them said that, *"the Palay Check has contributed much to her well-being and personal growth. I am happy that aside from my personal growth as an AEW in recommending to the farmers the proper nutrient management, I am now empowered to share and help farmers in using these rice ICTs coming from IRRI, PhilRice and DA-ATI."* [Participant 10]

Farmers' Experiences in Using ICTs for Rice Technologies

The farmers mentioned the Palay Check, a package of technologies that was made readily accessible through mobile phones and Internet by IRRI and Philrice. This consisted of seven rice production technologies: 1) variety and seed selection, 2) land preparation, 3) crop establishment, 4) nutrient management, 5) water management, 6) pest management, up until 7) harvest management. Most of the farmers were adept in saying that they were "keen on doing what is recommended in the Palay Check." The farmers' access and use of these rice technologies led them to adopt practices that eventually improved their rice production system. In turn, this improvement led to increased harvest and higher income on their part. These practices are discussed below.

1. Variety and seed selection. The rice farmers learned to appreciate the practice of choosing good rice varieties and of sowing quality seeds. Others produced their own good seeds that are certified seeds with Php1,200/bag. Whereas before they were only relying on what is left from their harvest or the cheaper ones, now

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they have learned the value of exercising good judgment in seed selection since they already realized that a good seed will produce a better yield.

2. Land preparation. Farmers mentioned that preparing the rice field is crucial to make ready for their planting. They said that they clean and repair dikes and ditches, harrow the field at least on a two-week's interval, and have learned to use a wooden plank or leveler. For lowland rice fields, they usually puddled to maintain a hard pan and reduce water loss.

3. Crop management. Farmers mentioned that preparing the rice field is crucial to make ready for their planting. They said that they clean and repair dikes and ditches, harrow the field at least on a two-week's interval, and have learned to use a wooden plank or leveler. For lowland rice fields, they usually puddled to maintain a hard pan and reduce water loss.

4. Nutrient management. Farmers said that nutrient management is crucial to rice production because it gives higher yield and consequently higher income to farmers. They recognized that their rice fields are not anymore fertile due to excessive use of chemicals or inorganic fertilizers through the years.

"We learned about neutralizing soil conditions like putting sawdust and mixing it up with charcoal and organic fertilizer to apply in the rice fields before transplanting. In our farms, we now apply fertilizers as follows: before transplanting, 2 bags of complete fertilizer towards booting stage, 2 bags of urea; and foliar application, 1 liter, which is an organic fertilizer for every hectare."

The rice technologies via ICTs have somehow guided them on the right amount of fertilizers and their systematic applications. This has negated their earlier practice and belief that 'the more it is, the better."

5. Water management. Farmers revealed that they always allot money every cropping season for their irrigation system for better water management. This was because most of their farms are not rainfed and so they relied solely on the irrigation provided for them by the National Irrigation Authority (NIA) in Agusan del Norte. They learned that continuous flooding helps ensure sufficient water and control weeds.

6. Pest management. Farmers narrated that one way of controlling pest infestation and/or diseases of rice plants is by weeding. They said that it is very important to constantly monitor their rice fields to avoid any disastrous event brought about by insects or pests. Thus, they spend money for regular weeding activities per cropping season to prevent pests from attacking their rice fields. They even pointed out the adage that 'prevention is cheaper than the amount of its cure' with the help of their rice ICTs.

7. Harvest management. Farmers revealed that in harvesting palay for seeds, money for hauling, drying, and using of blowers must be allocated before these seeds can go further into the re-bagging stage. They would usually sell it at P1,200 per bag (40 kilos). For farmers who were selling it only on a per kilo basis, they had it at P15.00/kilo from Musli.m traders who had the highest palay buying price among the local buyers. They learned that their previous harvesting practices such as field drying and stacking/piling could lead to fast quality deterioration of rice harvest.

All this information found in the Palay Check were consistent with the study of Mimodu (2002) on agricultural information needs of farmers such as: on fertilizers, pesticides, storage, processing of farm produce, loans, market situations, and other government assistance that could be afforded to them but only through traditional ICTs like radio & TV, and extension workers, etc. as well.

Problems encountered by both Farmers and AEWs

In this study, both the farmers and AEWs encountered two major problems in the use of ICTs: high cost of mobile phone load and weak signal from the cellular communication networks (Globe or Smart). Such problems are understandable given that in the Philippines, the telecommunication system has yet to be fully developed.

A MODEL FOR AN EFFECTIVE RICE-ICT INTERVENTION

Based on the results, this paper proposes a model (Fig. 2) for an effective implementation of an ICT intervention. First, the genuine implementation of ICT interventions requires new infrastructures, policies, and institutional reforms. To attain this, an enabling environment for ICT infrastructure has to be put in place. Effective design, consistent and transparent implementation of appropriate policies and regulations on the provision of ICT infrastructure such as connectivity, computer units and computer centers; tools and services for rice technologies in particular and the agriculture sector in general are needed.

The local government units (LGUs), as purveyors of development in their respective communities should be at the forefront of these efforts. Research and development institutions such as IRRI, PhilRice, and ATI-CARAGA could provide the LGUs with the needed technical support in designing policies and provisions aimed to sustain the effective delivery of these ICTs for rice technologies by making these affordable and accessible to farmers. One mechanism is to forge partnerships with the telecommunication service

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providers as a subsidy for the AEWS and farmers in their subscription of mobile phone and internet services.

An equally important component is an assessment of the human capital available for developing and disseminating the ICTs for rice technologies. If needed, training and extension support may be designed prior to installing the ICT infrastructure. Non-government organizations (NGOs) also play a big role in supporting farmers like the technology information, inputs, training, technology transfer, credit, and monitoring & evaluation of extension activities for the farmers' benefit (Davis, 2013).

The appropriateness of the ICT facilities is also an important consideration. Based on the situation of the target communities, the ICT infrastructure combined with the traditional media like radio to give farmers a voice to share with their fellow farmers their farm experiences. ICT interventions require that farmers, the target clientele of these initiatives, need to be involved from the start of the project design. As exemplified in the study of Davis (2008) that the lack of involvement of the clientele in defining and solving their own problems, limited incentives for extension agents, and less interaction between and among extension, research, and farmers could lead to a failure in the extension delivery systems. Many projects have demonstrated the sustainability of a project when farmers are involved in planning, implementation, and evaluation. Platforms for active participation by stakeholders and regular monitoring and evaluation mechanisms should be established.

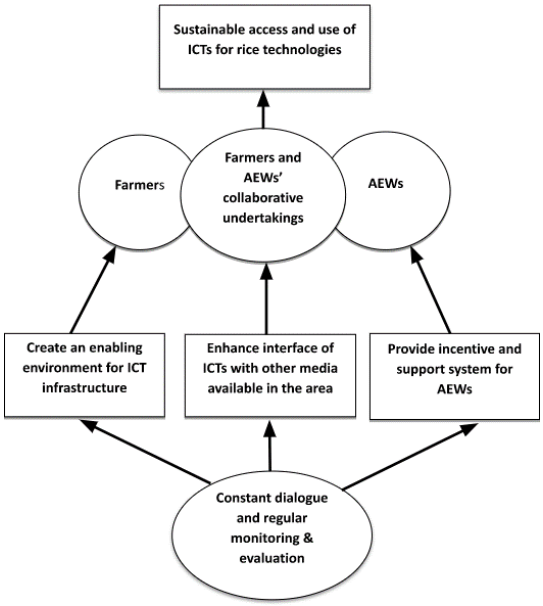

Figure 2. A communication model for an effective service delivery of ICTs for rice technologies among farmers and AEWs

4 CONCLUSIONS AND RECOMMENDATION

Since this study only involved six farmers and five AEWs, further research could be done to enrich our understanding on how farmers and extension workers access and use ICTs for rice technologies. Potential research is a replication of this qualitative study in other communities installed with rice ICTs. Quantitative research on the socioecological factors influencing the access and use of ICTs for rice technologies at the community level could complement this study. Further research on how the elements of the proposed communication model could make empirical contributions in view of achieving sustainable development in creating a better world (Sajida, 2015).

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CONFLICT OF INTEREST

No conflict of interest was declared by the authors.

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