Utilization of Digital ICT among Farmers in Brebes, Central Java

Ahmad Badari Burhan[1], Djuara P. Lubis[2], Rilus A. Kinseng[3], Andi M. Faisal Bakti[4]

{ahmadbadariburhan@univpancasila.ac.id[1], djuaralubis@gmail.com[2], rilus.kinseng@gmail.com[3], andi.faisal@uinjkt.ac.id[4]}

PhD student in Agricultual dan Rural Communication Development, IPB University and the Faculty of Communication Science, Pancasila University, South Jakarta Indonesia[1], Department of Communication and Community Development Science, Faculty of Human Ecology, IPB University, Jl. Raya Dramaga, IPB Dramaga Campus, Bogor, West Java, Indonesia[2,3], Faculty of Communication and Da'wa, UIN Syarif Hidayatullah Jakarta Jl. Ir H. Juanda No.95, Cemp. Putih, Kec. Ciputat Tim., Kota Tangerang Selatan, Banten 15412[4]

Abstract. This research is intended to elaborate the various digital ICT utilization among farmers in Brebes Regency. Through descriptive quantitative along with in-depth interviews and participatory observation methods, 75 farmers in Brebes Regency participated in this research. Farmers take advantages from the salient features of digital ICT aplications through their smartphones. Among them, 37.33% have installed agricultural or farmer applications on their smartphones, 70.67% follow farmer communities on Facebook, and 77.33% engage in farmer communities on WhatsApp group (WAG). Farmers differ in accessing the menus/features and information services available in agricultural applications according to their specific needs and conditions. Likewise, they differ in the intensity to get, share, ask, answer questions or comment on Facebook and WAG. Finally, this study argues that active individuals in the effective use of digital ICT for knowledge sharing and capacity development play an important role in the successful transformation of knowledge-intensive agriculture.

Keywords: Digital ICT, Information sharing, knowledge sharing, capacity development, development communication.

1 Introduction

The future of agriculture needs to be transformed from input-intensive farming to knowledge-intensive agriculture practices because the benefits of the green revolution go against limited natural resources [1]. In the Asia Pacific region, the limited and declining quality of natural resources greatly affects agricultural productivity and farmer livelihoods [2]. Currently, the call for knowledge-intensive agriculture is increasingly gaining empirical support, characterized by 21st century agriculture that is highly knowledge-based [3].

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In the knowledge-intensive agricultural paradigm, development communication has a strategic role to facilitate the creation and knowledge sharing for farmer capacity development. Huge data and information can be generated, stored, analyzed, disseminated, and used effectively to improve agriculture with the inclusion of digital ICTs [4]. In fact, both small and large-scale farms can benefit from the inclusion of ICTs into the agricultural value chain through increased productivity, improved quality, expanded services, and reduced costs. As a result, agriculture becomes more networked and resource utilization is more efficient [5]. In addition, digital ICTs also have the added appeal in attracting millennials and other newcomers to agriculture at a time when almost all countries are faced with the problems of an aging and declining farmer population [6]. Digital or modern ICTs such as the Internet, email, 3G and 4G mobile phones, personal digital assistant (PDA), and social networks have broadened the boundaries of communication to reach previously marginalized communities, especially rural farmers in developing countries [7]. The needs perceived by farmers are the availability of timely information, among others about technology, seasonal behavior, and market opportunities. Modern ICT provides new possibilities to address the information gap suffered by rural farming households, when regular extension services do not reach them at the right time and place [8].

Smartphone, a modern and digital ICT, combines the utility of mobile phones and personal digital assistant (PDA) into one device and are now equipped with high-resolution touch screen displays, innovative sensors, cameras, more memory and processing capabilities and effective mechanisms to save power [9]. Advanced smartphone packages have Web browsing capabilities, Wi-Fi connectivity and the ability to receive advanced applications, and access the Internet via 3G or 4G wireless networks [10]. These features offer a number of opportunities for future agricultural development, because among others they can facilitate the dissemination of agricultural innovations, knowledge creation through knowledge sharing mechanisms, fulfillment of agricultural information needs, network expansion, development of precision agricultural technology, increased efficiency and productivity, and in turn the development of sustainable farming.

A number of studies have shown that in many circumstances, ICTs, particularly smartphones, increase access to information and opportunities for capacity developmet for rural farmers in various countries. In India, mobile phones are used in knowledge transfer via SMS, podcasts, video and audio netcasts, and others [11]. Research conducted to assess the pattern of using mobile phones to share agricultural information among farmers in Merta block, Nagaur district, Rajasthan shows that most farmers use mobile phones to contact retailers and fellow farmers, internet connection, and get information about weed, disease, pesticides, and disease control via mobile. More broadly, the use of mobile phones leads to greater social cohesion and better social relations among farmers [12]. In Ghana, smartphone use has increased significantly in recent times in rural, suburban, and urban locations [13]. Currently, an android smartphone application is being developed to convey location-specific information in a simple and efficient manner to assist farmers in planning agricultural activities, by anticipating long-term risks and making appropriate adjustments to increase the resilience of their farms. With the development of an android smartphone application, it should help farmers in Uasin Gishu District, Ghana to face the challenges of changing weather patterns and lack of access to accurate weather information through timely delivery of climate and weather information [14].

In Germany, research results showed that, among other things, farmer's age, education, and land area are determinants of smartphone adoption among farmers [15].

Mobile phones can help increase revenue, increase market efficiency, reduce transaction costs, and provide opportunities for intervention in service delivery. Through improved access to mobile phones, farmers can better plan how much to plant each season and how much investment and working capital is required to make a profit based on the principles of supply and demand [16]. Modern ICTs, such as smartphones are believed to have the potential to increase agricultural productivity by communicating knowledge and information to rural farming communities, providing capacity development, accessing markets and credit, restructuring extension services and increasing the scale of development interventions [17]. In addition, mobile phones can improve the circulation of information in interpersonal networks, increase farmers' access to "public" information, and improve the coordination of input and output supply chains [18].

However, in agriculture, despite the rapid spread and potential of ICTs to facilitate farmers' access to information, many initiatives face common challenges, such as issues of sustainability, affordability, ease of use, accessibility, scalability and availability of relevant information [19]. In this case, the relevance of the content to a particular local audience, as determined by geographic location, culture, or language or as socially, culturally, economically, and politically relevant content for a particular community and the extent to which the content is customized and adapted to the conditions of local farmers affect its relevance [20]. Preliminary interviews with several senior extension officers in Boyolali, Karanganyar, and Brebes Regencies of Central Java Province, Indonesia illustrated that the suitability of the content available in smartphone-based agricultural applications with local needs is an important factor in sustainable adoption. Socio-demographic factors are also a concern for the effective use of development initiatives based on digital ICT applications. Research findings in Manokwari Regency, for instance, showed that farmers perceived smartphones as a new technology for them. The level of smartphone utilization by farmer groups in the study area was still low, due to the low level of farmer income and smartphone ownership. On the other hand, farmers spend more time working in the fields so that at night it was time for them to take rest [21].

Based on this background, this research formulates the problem of how farmers, especially in Brebes Regency, Central Java, take advantage of the opportunities offered by digital ICT? Furthermore, this study aims to describe the behavior of using smart phone-based digital ICT applications for knowledge sharing and capacity development among farmers in Brebes Regency, Central Java.

2 Theoretical Framework

Food and Agriculture Organization (FAO), the United Nations believes in the important role of ICT in development communication as the main driver of agricultural and rural development. As a social process, development communication facilitates knowledge and skills sharing and capacity development through series of methods and tools, including the use of ICT for sustainable and meaningful social change, and maximizing the impact of development initiatives [22].

ICT means the use of modern technology to assist the capture, processing, storage and retrieval, and communication of information, whether in the form of numeric data, text, sound, or images [23]. The application of ICT in agriculture, often referred to as e-Agriculture, is a global community of practice that facilitates dialogue, exchange of information, and sharing of ideas related to the use of ICT for sustainable agriculture and rural development [24]. In this context, ICT is used as an umbrella term covering all information and communication technologies including devices, networks, mobile phones, services and applications; ranging from innovative Internet-era technologies and sensors to other pre-existing supports such as fixed telephone, television, radio, and satellite [25]. The capability of ICT in constructing this new reality is one of the important themes in this research.

To understand the extent of the use of digital ICT among farmers, this research is based on the resource and appropriation theory or RAT, which was initiated by van Dijk [26]. RAT is about the diffusion, acceptance and adoption of new technologies. The core concepts of resource and appropriation theory can be understood and adapted that personal categories and positional categories in society (social-demographic), as well as unequal distribution of resources lead to unequal access to the use of digital ICTs, and in turn lead to unequal utilization for productivity and professionalism goals.

3 Methods

This study uses a quantitative descriptive method along with interviews and participatory observations to understand the use of digital ICT among farmers in Central Java, especially in Brebes Regency area. The population in this study were farmers in Brebes Regency area with samples selected purposively for them who have smartphones. A total of 75 farmers participated in this study. Participatory observations were made on relevant smartphone-based farmer application media, farmer communities on relevant Facebook social media, and several WhatsApp groups of farmer communities that were followed. This research took place from July to September 2021.

4 Findings and Discussion

4.1 Farmer characteristics

Seventy-five farmers participated in this research consisting of 67 men and 8 women with the youngest being 22 years old and the oldest 69 years old. A 22 years old farmer is a male with a high school education. According to his confession, he has worked to help his father for 4 years in cultivating an area of approximately 0.1 planted rice, onions, and tomatoes for the last 3 years. However, the agricultural land had to be sold due to other necessities of life, so they had to look for other alternatives, for example with a profit-sharing mode. The oldest farmer is 69 years old, graduated from elementary school, has worked in agriculture for 49 years, currently has 0.2 hectares of arable land with cultivation of rice, vegetables, and shallots in the last 3 years. Despite his relatively old, he still plays an active role in the communities, for example KTNA Brebes Regency, joining WAG of KTNA Brebes, WAG of Petani Makmur Sejahtera, WAG of PP. Swadaya, and others. He is also often asked to maintain intimacy

among members of KTNA Brebes Regency by reading poetry at appointed meeting. The existence of elderly farmers plays an important role in the farmer communities in this region.

In general the farmer ages range of 22 to 35 years old as much as 18.67%, 36 to 55 years old as much as 68%, and 56 to 70 years old as much as 13.34%. It can be said that the productive age of farmers in this research sample is up to 60 years. The distribution of farmer education shows that a small proportion of farmers (9.33%) have only reached elementary education, most of them have taken junior and senior high school education, combined amounting to 69.33%, and some even continue at a higher level education, namely diploma and undergraduate as much as 21.33%.

In term of distribution of farming experiences, most of them have been farming for more than 5 years and only a small part in the 1-5 years range, which is 14.67%, even in this range only half have been farming for 1-2 years, the rest have been farming for 3 years or more. Thus, overall, 93% of them have been farming for at least 3 years. Furthermore, the distribution of agricultural land area informs that most farmers (71.23%) cultivate 0.10-0.50 hectares of agricultural land, 20.55% of farmers cultivate 0.51-1.00 hectares, and only 8.22% of farmers cultivate 1.01-4.00 hectares. In the last 3 years, they have cultivated crops, including shallots, onions, rice, chili, cayenne pepper, corn, sweet corn, shelled corn, peanuts, long beans, green beans, red ginger, porang, melon, watermelon, vegetables, bitter melon, sorghum, tomato, cucumber, and kale.

In addition to cultivating crops, some of them work as marketers of pesticide products, own farm kiosks of agricultural products, raise cattle, construction/building workers, agricultural product traders, online modes of transportation, agricultural extension workers, religious instructors, civil servants, village heads and village officials, school guards, printing businesses, traders, and others. Other jobs, besides plant cultivation, become an important part in supporting farmers‘ household incomes so that they can mantain a sustainable farming with limited land area. Socio-economic factors have been cited as a major determinant of the use of extension agents and the eventual adoption of ICTs [27].

4.2 Smartphone ownership

Seventy-five farmers in Brebes Regency who participated in this study had used smartphones and were connected to the WhatsApp (WA) application, although 16 people (21.33%) of them had to share their smartphone use with their families. For example, a farmer's wife said that she frequently use smart phones as she has better skills than her husband to operate digital device to meet information needs and knowledge sharing. A small number of farmers stated that they still need assistance in using smart phones for certain purposes. The assistance is usually coming from fellows, PPL (extension agents), or their children. Apart from owning a smartphone, the study also found 32 farmers (42.67%) had personal computers in their homes, with a farmer informing that his personal computer was not working any longer. This finding provides optimism for the availability of digital ICT resources owned by farmers in this area.

Smartphone ownership along with personal computer are an important indicator for accessibility to other digital ICT applications, for example agricultural applications that can be uploaded and installed from the Google Play Store, joining a farmer community on Facebook social media, joining a farmer's WA Group (WAG), accessing information through Google

search engines and websites of agricultural information service providers, and accessing Youtube channels that provide cultivation and farming information.

For internet quota needs, 84.49% of farmers have a budget of IDR 25,000-100,000 per month, 9.46% of farmers have a budget of IDR 100,001-200,000 per month, and the remaining 4.05% of farmers have a budget of more than IDR 200,000 per month. Availability of budget for internet quota is necessary to maintain accessibility to online information and connectivity with the communities in virtual environment to share information and knowledge for their capacity developments.

4.3 The utilization of smartphone

The use of mobile phones for agricultural applications can give positive results if farmers have experience in using other mobile applications such as social networking applications, mobile banking and remittance applications and weather information [28].

Smartphone based farming app. Several farming applications based on android smart phones are available in the Google Play Store application. Before installing farming applications, potential users can learn information regarding applications available on the Google Play Store. Searches for applications on the Google Play Store may use the name of the application or other keywords, such as agricultural applications, farmer, horticulture, pesticides, and other specific and relevant keywords.

The results of this study indicate that not all farmers are aware of agricultural applications that can be downloaded and installed through the Google Play Store and not all farmers who are aware of farming applications install it on their smartphones. Out of 75 farmers in the Brebes Regency area, only 28 farmers or 37.33% have installed agricultural applications on their smartphones. The list of android-based agricultural applications used by farmers are „Petani“ (8villages) as much as 53.57%, „MyAgri“ (Balista) as much as 46.43%, „Pak Tani Digital“ (Hagatekno Mediata) as much as 39.29%, „IPB Digitani“ (IPB) as much as 7.14%, and „Sipindo“ (Ewindo) as much as 7.14%. In addition, few farmers also mentioned the use of other applications, such as „Harga Pangan“ as much as 7.14%, „TaniHub“, „Agro Jowo“, and „Toko Tani Indonesia“, each 3.57%. Some farmers have installed more than one application.

Petani app was developed by 8villages and introduced since 2014 and it has been downloaded to android smartphones by more than 50 thousand users. It offers features such as cultivation methods, price information, market information, land management, weather information, and up-to-date program information. In addition, Petani app also provides a „Forum“ feature to ask other users and agricultural experts according to their fields. Agricultural experts, extension workers, or other users can answers or leave comments directly to the questions. Through the „Forum“ users can also share information or knowledge that allows interactivity to occur.

The „Article” feature contain of articles prepared and posted by 8villages where users are possible to send feedback as well as discuss with the others. Most of the articles made have references from books or external links. „Lisa Bulletin” is a new feature of the Petani app. It is a collection of selected agriculture articles from LISA. In addition to articles, Petani app also provides a „Video” feature which contains videos that can be watched to gain insight on agriculture, crop cultivation, and farming. Some of these videos can also be accessed through the 8villages channel on YouTube without having to access Petani app.

„Shop“ feature facilitates farmers to sell their crops and also facilitates users to sell agricultural tools and machinaries All users can join and sell their products through Shop feature in Petani app and buyers in the application platform can place orders online. Some of the products sold include seeds of various plants, fertilizers, probiotics, ready-to-plant plants, various fruit trees, chilies, rice, and shallots. In addition, Petani app also provides several standard features, including „Weather" feature based on BMKG information to monitor the weather and assist farmers in agricultural activities. The „Commodity Price" feature contains national prices for several commodities and is expected to guide farmers to sell their harvests at reasonable prices.

The android-based „MyAgri“ app was developed by the Indonesian Vegetable Research Institute (Balitsa), the Ministry of Agriculture, Republic of Indonesia together with Wageningen University & Research, the Netherlands and Erlangga Studio and is described as an integrated pest control (IPM) support application to increase vegetable crop production. This application was released since August 9, 2015 and until September 6, 2021 has been downloaded by more than 50 thousand users with the most coming from West Java, Enrekang, South Sulawesi, and neighboring Malaysia.

This application has features that contain information about vegetable varieties, vegetable crop cultivation, calculating plant fertilizers, recognizing vegetable pests and diseases and how to control them, spraying pesticides, agricultural machinery, post-harvest, market information, video cultivation of vegetable crops, question and answer with experts via WhatsApp group of my Agry users. Farmers can find out information about commodity prices in the market based on their location of residence. Through this application, farmers can also raise questions to vegetable plant experts from Balitsa, especially regarding vegetable crop cultivation. In addition, the MyAgri application provides video of vegetable cultivation for farmers to learn independently and apply vegetable cultivation. Information on varieties and cultivation of vegetables in MyAgri app includes shallots, red chilies, potatoes, garlic, spinach, beans, kale, long beans, cucumbers, Chinese cabbage, tomatoes, chickpeas, white oyster mushrooms, ear mushrooms, and red chilies.

Although data showed that MyAgri app has been downloaded more than 50 thousand, users who join the WAG of my Agri users were only 257 participants (as of 27 September 2021). Based on participatory observations on the WAG of " my Agri users", farmers from different areas can share information and knowledge about cultivation issues, pests, types of insecticides and pesticides that are effective for pest control and their application, as well as fertilizer and fertilization. Extension workers from Balista actively responses and provide answers to the questions of farmers using the application. In addition, between users also respond each other.

Paktani Digital app was released on May 3, 2017 by Hagatekno Mediata as a digital market place platform in the agricultural sector aimed at bringing together farmers with final buyers. It service includes features related to offering agricultural, plantation, organic, hydroponic, livestock, fishery, and agricultural products and fertilizers. This feature is intended to easier for buyers to access commodity or product information, offer dates, stock, as well as send messages and make phone calls. The „Price Info" feature presents prices for commodities, agricultural products, and more from application users in certain regions. The „Inspiration & Tips" feature contains news about agriculture, articles on agriculture, plantations, animal

husbandry, fisheries, info related to various tips, soil and fertilization, pests and diseases, agricultural technology, processed products, inspiration, young farmers, opinions, reviews. books, import-exports, and bulletins. The „Ads" feature provides advertising space even before harvesting is done. The „Transporter" feature provides information on transportation services in various regions for delivery purposes.

IPB Digitani app was released on October 26, 2019 by IPB and has been downloaded by more than 1,000 users. It provides facilities for farmers to consult and discuss online with agricultural experts. Other facilities that can be utilized by farmers are agricultural articles by topic and commodity, including food crops, fruit horticulture, rice, soybeans, animal husbandry, artificial insemination of dairy cattle, herbal feed products, forestry/plantation, livestock breeding, organic rice, horticulture, watermelon, papaya, crystal guava, mangosteen, melon, vegetable horticulture, medicinal plants, freshwater aquaculture, brackish and marine, carp, mujair, catfish, shrimp, seaweed, orchid plants, meat products, products halal livestock, probiotics, SPR-1111, dragon fruit, beef, and sengon. The „News" feature provides the latest news about agriculture, various agricultural information. Other features are materials, price portal, buying and selling, and videos.

Sipindo app (Indonesian Agricultural Information System) is an android-based agricultural application released on April 26, 2017 by Ewindo developer. As of September 7, 2021, it has been downloaded by more than 50 thousand users. SIPINDO powered by SMARTseeds with several features and functions. the Article feature provides various articles such as plant nursery techniques, crop rotation as an alternative to reduce pest attacks and maintain soil fertility, soil health for maximum production, steps to restore neutral pH, increase production yields by installing stakes, potential for cucumber cultivation and marketing, lighting indoor hydroponic plants, vegetable cultivation techniques, and more.

The „Consulting" feature offers a communication space with agricultural experts exclusively. „Planting Mapping" feature is attached to find out information on mapping of vegetable growing areas in Indonesia. This information is used for planting planning so as to avoid oversupply at harvest which can lead to lower harvest prices. The „Agricultural Practices" feature includes horticultural cultivation and production cost estimates for the planned land area. „Plant Disease and Pests" feature is to identify plant pests and diseases appropriately and integrated pest control technology. The „Fertilization Recommendation" feature provides fertilizer recommendations for several regions in Indonesia including East Java, Central Java, and Lampung. „Rainfall Info" feature to find out monthly rainfall predictions (CH) for the next 6 months as well as predictions of the beginning of the dry season (AMK) and the beginning of the rainy season (AMH). Users can also view more detailed daily weather forecast information. „Irrigation" feature provides accurate crop irrigation suggestions. „Vegetable Price Info" feature to find out the latest vegetable price information so that it is easier to negotiate with traders. „Buy and Sell" feature is equipped with farmer data, phone numbers, commodities, quantity, location, price, estimated harvest, and chat menus. Hence, „Farm Shop" feature provides access to nearby agricultural input products. Sipindo can also be accessed via YouTube, Facebook, Instagram, and Website.

Harga Pangan Nasional or Harga Pangan app was released on May 25, 2020 by egov.co.id and has been downloaded by more than 10 thousand users. National Food Prices is an application of food price information throughout Indonesia based on the http://hargapangan.id/ page.

Information on food prices covers various commodities, including rice, granulated sugar, cooking oil, beef, chicken, eggs, wheat flour, soybeans, chili, shallots, and garlic. This application is equipped with several features such as: Daily Food Price Information, Food Price Information in Other Regencies/Cities, Food Price Comparison Between Regencies/Cities, and Graphic Information on Commodity Price Fluctuations.

Tani Hub app was released on December 5, 2018 by PT Tani Hub Indonesia, and has been downloaded by more than 500 thousand users. This market place application offers farmers' crops. Toko Tani Indonesia (TTI) application was released on March 23, 2018 by BPD Agro, Ministry of Agriculture (Kementan) and until September 7, 2021 it has been downloaded by more than 10 thousand users. This application provides features of the farmer's shop, ordering, ordering details, and ordering processes. Furthermore, the AgroJowo application is offered by the Department of Agriculture and Plantation of Central Java Province and was released on April 24, 2019. Currently, it has been downloaded by more than 1,000 users and can be accessed via Android and the web. This application is a B2B marketing medium for farmers or SMEs in the field of processing agricultural, fishery, and livestock products for local and export markets. This application provides product catalog features, supplier and buyer information abroad.

In Indonesia, special considerations used in smartphone applications to be adapted to farming activities are centered on the needs of farmers in production, post-production and as a consultation, as a unit which ultimately represents the usefulness and economic value for farmers [29].

Table 1. Features utilization of smartphone-based agricultural application

Utilization of menus/features in the application	Never	Seldom	Often enough	Frequently	Very often	*N**
Discussion forums or questions and answers	23.08%	53.85%	11.54%	11.54%	0.00%	26
Cultivation and/or farming articles	15.38%	26.92%	42.31%	15.38%	0.00%	26
Cultivation and/or farming videos	15.38%	26.92%	30.77%	26.92%	0.00%	26
Shops or catalogs	26.92%	42.31%	11.54%	19.23%	0.00%	26
Fertilizer information	12.00%	16.00%	36.00%	32.00%	4.00%	25
Fertilization recommendations	12.00%	20.00%	44.00%	24.00%	0.00%	25
Fertilizer calculator or fertilizer calculation method	28.00%	40.00%	16.00%	16.00%	0.00%	25
Information on types of pests	12.50%	16.67%	20.83%	41.67%	8.33%	24
Pesticide information	15.38%	11.54%	23.08%	46.15%	3.85%	26
Information on pest management	12.50%	4.17%	41.67%	37.50%	4.17%	24
Information on agricultural machinery and agricultural production facilities	11.54%	38.46%	30.77%	11.54%	7.69%	26
Supplier information	30.77%	34.62%	15.38%	15.38%	3.85%	26
Market information	12.00%	28.00%	28.00%	28.00%	4.00%	25
Agricultural commodity price information	11.54%	19.23%	30.77%	30.77%	7.69%	26
Weather information	8.00%	48.00%	16.00%	24.00%	4.00%	25

Remark. N = Number of farmers responded

Table 1 provides an overview of the intensity of utilization of smartphone-based agricultural application menus/features. Farmers take advantage of the features available in applications with varying intensities, but in general it can be explained that articles and videos on crop cultivation and farming, fertilizer information and fertilizing recommendations, information on plant pests and diseases, pesticides, management of plant pests and diseases, market information and commodity prices are more frequently accessed, while agricultural machinery information, discussion forums or questions and answers, calculators for calculating fertilizer needs, and supplier information are rarely accessed.

Participation in farmer community on Facebook. This study found 53 out of 75 farmers (70.67%) followed the farming community on social media Facebook. Some of the Facebook accounts of farmer communities followed include onion farmer communities (Brebes Red Onion Farmers, Indonesian Red Onion Association, etc.), rice farmer communities (Millennial Rice Farmers Community, Indonesian Rice Farmers Community, etc.), agricultural extension communities (Agricultural Extension Information, etc.), farmer communities (Komunitas Tani Unggul, KTNA), female farmer communities (KWT, etc.), Young farmer communities (Generasi Muda Brebes, Central Java), community of buying and selling agricultural production, hydroponic communities, organic farming communities, vegetable and horticulture communities (Community of Melon, Watermelon, Pare, Sorghum, Chili Farmers, Indonesian Porang Farmers, Ginger Farmers Community, etc.), and livestock farming communities. Some farmers followed some farming communities on Facebook. A farmer told that he left farmer community on Facebook because occasionally someone posted inappropriate photos.

In addition, as shown in Table 2, farmers use Facebook for various knowledge sharing activities, including to obtain information and knowledge, share knowledge, ask questions, and answer questions or provide comments on other members' posts. In general, they use Facebook more often to obtain and share information and knowledge than to ask and answer questions or leave comments.

Table 2. Knowledge sharing activites in farmer communities on Facebook

Knowledge sharing activities	Never	Seldom	Often enough	Frequently	Very often	*N**
Follow farmer community on FB to get information/ knowledge	12.24%	22.45%	34.69%	24.49%	6.12%	49
Follow farmer community on FB to share information/ knowledge	9.43%	30.19%	28.30%	22.64%	9.43%	53
Follow farmer community on FB to ask questions	14.00%	40.00%	18.00%	24.00%	4.00%	50
Follow farmer community on FB to answer questions, leave comments or opinions	18.37%	55.10%	6.12%	14.29%	6.12%	49

Remark. N = Number of farmers responded

Engagement in farmer community on WhatsApp group (WAG). Furthermore, as presented in Tabel 3, this study found that 58 out of 75 farmers (77.33%) engaged in WAG.

This study also found there were different levels of intensity in various knowledge sharing activities of farmer community in WAG. In general, the use of WAG by farmers for activities to obtain information and knowledge, share information and knowledge, ask and answer questions or provide comments is relatively rare to quite frequent.

Table 3. Knowledge sharing activites WhatsApp group (WAG) farmer communities.

Knowledge sharing activities	Never	Seldom	Often enough	Frequently	Very often	*N**
Follow farmer's WAG to gain information, knowledge, skills or experience	7.14%	33.93%	30.36%	23%	5.36%	56
Follow farmer's WAG to share information, knowledge, skills or experiences	10.53%	36.84%	26.32%	16%	10.53%	57
Follow the farmer's WAG to ask questions about cultivation and/or farming	6.90%	37.93%	22.41%	26%	6.90%	58
Follow the farmer's WAG to answer questions, leave comments or opinions	21.15%	34.62%	23.08%	17%	3.85%	52

Remark. N = Number of farmers responded

In general, both on the Facebook account of the farmer community and WAG, farmers in Brebes regency involved in digital ICT-based knowledge sharing process to seek information, share information, ask questions, and answer questions or provide comments related to cultivation and farming activities, including among others related to (1) maintain soil fertility and soil health with standard operating procedures that minimize residues, agricultural land, soil processing, and soil microorganisms, (2) information on superior seeds, especially the price of superior shallot seeds, (3) methods and cultivation techniques that especially good for shallots and rice to increase productivity, plant care, etc. (4) problems of plant pests and diseases, resistance of pests and plant diseases to drugs, pesticides, insecticides, and management of pests and plant diseases which are ideal especially for vegetables and horticulture plants, as well as pesticide innovations, (5) information on the types of fertilizers, the benefits of fertilizers, and the application of balanced fertilization, (6) applications of biological agents, microbiology, and organic fertilizers to reduce chemicals, (7) market and price information for vegetables and horticulture, shallots, business development opportunities, advertising and promotion, marketing, and online business transactions, (8) crop yields, (9) agricultural technology innovation, (10) climate, (11) knowledge, skills, and experience of other farmers, especially in plant cultivation and farming of shallots, cayenne pepper, chili, corn, rice, sorghum, and ginger, (12) visits to agricultural fields, and (13) agricultural news and information, booming cultivated crops, responding to complaints from other farmers, farming analysis, etc.

The application of ICT in e-agriculture should fulfill the main stages of the agricultural production including crop cultivation, water management, application of fertilizers, fertilization/fertigation, pest control, harvesting, post-harvest handling, transportation of food/food products, packaging, food preservation, food processing/value added, food quality management, food safety, food storage, food marketing. All agricultural stakeholders need information and knowledge of these phases to manage them efficiently. Any system implemented to obtain information and knowledge to make decisions with accurate, complete, concise information in a timely manner or on a timely manner. The information provided by the system must be in a user-friendly, easily accessible, cost-effective, and well-protected form from unauthorized access [30].

5 Conclusion

All farmers in this research have used smartphones for their daily farming activities. Through this smart phone, some of them take advantage of Android smart phones based of agriculture/farmer applications such as “Petani”, “MyAgri”, “Pak Tani Digital”, “Sipindo”, “IPB Digitani”, “TaniHub”, among others. They also accessed the features/menus on agricultural/farmer applications in various intensity. The menus/features used include “discussion forums or questions and answers”, “cultivation and/or farming articles”, “cultivation and/or farming videos”, “shops or catalogs”, “fertilizer information”, “fertilization recommendations”, “fertilizer calculator or fertilizer calculation method”, "information on types of plant disease and pests ", “information on pesticide”, “disease and pest management” “information on agricultural machinery and agricultural production facilities”, “supplier information”, “market information”, “agricultural commodity price information”, and “weather information”.

In addition most of them join the farmer communities on Facebook social media and WAG. Farmers engage in Facebook communities and WAG to obtain information, share information, ask questions, and address questions through a knowledge sharing process. However, the intensity of usage of digital ICT varies between farmers in the Brebes Regency area.

As a development communication platform, digital ICT do facilitate information and knowledge sharing for capacity development among farmers. However, this study argues that the effective use of digital ICTs for knowledge sharing will depend on the activeness of individual farmers in the communities in meeting their information needs and sharing knowledge to improve their capacities on agricultural cultivation and farming. Therefore, active individual plays an important role in the successful transformation of knowledge-intensive agriculture.

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