UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific

CAPSA
Centre for Alleviation of Poverty through Sustainable Agriculture

palawija forum

Vol 34. No 3. Dec 2017

MAIN ARTICLE

Implementation of Information and Communication Technology to Support Agricultural Development in Indonesia

By Dani Medionovianto and Ita Sualia

Dani Medionovianto
Senior Extension Worker,
Indonesian Center for Agricultural Technology Assessment and Development (ICATAD), Ministry of Agriculture
Bogor, Indonesia

Ita Sualia
Research Consultant,
CAPSA-ESCAP

Introduction

The development of information and communication technology (ICT) is snowballing. Digital technologies allow people, even those in remote areas, to connect across the globe at high speeds and at any time through telephone or Internet facilities.[1] ICT has a potentially important role in transferring information on agricultural practices from researchers to farmers, among farmers themselves and even from farmer to researcher. ICT allows farmers to obtain relevant up-to-date information, thus, it can help in decision-making processes to improve agricultural productivity. Along with information of on-farm practices, ICT is also able to offer information for post-harvest farming. ICT provides an easy way for farmers to access market information, such as bidding price, staple commodity price, information about consumer trends, as well as mobile applications for online markets that enable producers to advertise or sell their products through cellular phone applications.

In practice, ICT in agriculture also requires the active participation of farmers, not only in an information end-user role, but in supplying data and information on the amount of harvest, harvest conditions, selling price of crops, and on pest and disease outbreaks. ICT can improve communication and enhance interaction among agricultural researchers, extension workers, farmers and other stakeholders in agricultural innovations and rural development.

Agriculture is important in Indonesia as 31.7 per cent of its labour-force works in the agriculture sector.[2] It sees that effective ICT integration into the agricultural sector will support economic development and poverty reduction, and is also a strategy for achieving the Sustainable Development Goals (SDGs). In addition, it is believed that competitive farmers can increase agricultural productivity and manage the market through good quality agricultural products, therefore capacity-building for farmers is a high priority. The Indonesian Ministry of Agriculture with support from the World Bank during 2007-2013 developed a farmer empowerment project namely Farmer Empowerment through Agricultural

[1] Gartner, 2016. Top 10 Technology Trends Signal the Digital Mesh. Gartner Inc. Accessed online 12 December 2017 at: https://www.gartner.com/smarterwithgartner/top-ten-technology-trends-signal-the-digital-mesh/

[2] Badan Pusat Statistik, 2016. The New Statistical Table (Tabel Statistik Terbaru). Accessed online 12 December 2017 at: https://www.bps.go.id/statictable.html

Technology and Information (FEATI). FEATI was expected to address the geographical constraints of Indonesia as an archipelagic country and the low number of Indonesian extension workers; that is, 44,000 extension workers for 72,000 potential agricultural villages,[3] where one extension worker for each village is the ideal as stated in Law Number 19 Year 2013 on Farmers Protection and Empowerment.

Opportunity and challenges of ICT in agriculture

Global agriculture requires small farmers to adopt sustainable agriculture practices. Hence, there has been a shift from input-intensive agriculture to knowledge-intensive agriculture. Knowledge-intensive agriculture involves dissemination of information on sustainable agriculture practices, which focus on capacity-building, knowledge exchange to address needs of small farmers, and enhancing links between research and extension. Experts suggest that some technologies could generate enormous advantages for agricultural information management.

Utilization of ICT to support sustainable agriculture development

Access to appropriate information at the proper time plays a significant role in the agriculture supply chain, and ICT makes this possible. Precision agriculture has been growing, and it is now possible to collect large quantities of data and to control and monitor individual plants. Greater efficiencies of time, cost and quality of services and products can be attained using ICT. The following is an explanation of the role of ICT in assisting crop production at each stage of the three-stage farming life cycle: (1) pre-cultivation; (2) crop cultivation and harvesting; and (3) post-harvest.

1. Pre-cultivation

At the local level, farmers can use ICT to match cropping practices to climatic trends by using the Cropping Calendar Information System (discussed later). They can also access information and tutorials on farming practices for pre-cultivation preparation. A recent development in telemetry, i.e. GIS, allows the agriculture sector to build, access and use maps of land ownership, soil profiles, watersheds, landscape, cropping patterns and profiles at seasonal levels. The telemetry data can be stored and accessed through a big data facility. Big data allows information to be distributed at high speed and low cost, thus allowing efficient decision-making.

2. Crop cultivation and harvesting

Farmers can access timely weather information, information about on-farm management and various tutorials on farming practices. Inputting data from monitoring and evaluation and applying statistical or modelling software makes it possible to see crop productivity trends and develop reliable productivity projections. Digital data is also easier to disseminate, facilitating the exchange of information with other parties. Farmers can use ICT to identify and control pests and diseases, as well as report an outbreak on their own farmland or in their neighbourhood.

3. Post-harvest

The use of ICT at the post-harvest stage can include marketing, transportation, packaging, food processing and product traceability. ICT applications vary, ranging from simple spreadsheets to more sophisticated tailor-made applications. ICT improves efficiency and predictability, and reduces waste in value chains, with a positive impact on all market actors.[4] The producer can use ICT to sell their products through the online market, and manage inventories and rural distribution networks using applications that enable communication with the buyer, orders to be processed and electronic invoices to be issued. Buyers can use a range of management information systems to order the goods, track where the purchased goods are and ensure the food safety of the product by tracing it along the market chain from individual farms to the retail shelf by using cell phone systems and barcodes.

(continues on page 4)

[3] Kompas Online, 2017. Indonesia Lack of 28,000 Agriculture Extension (Indonesia Kekurangan 28.000 Penyuluh Pertanian). Accessed online 12 December 2017 at: http://ekonomi.kompas.com/read/2017/08/09/190000126/indonesia-kekurangan-28.000-penyuluh-pertanian

[4] World Bank, 2011. ICT In Agriculture, Connecting Smallholders to Knowledge, Networks, and Institutions.

Opportunity

Rural agricultural development can be boosted through ICT initiatives that can disseminate information to rural communities, exchange information between rural farmers, improve research and extension linkages and promote rural agricultural growth. The increasing number of mobile phone and internet users, as well as the improved electricity infrastructure and transmitter networks that have reached remoter areas provide great opportunities for ICT in agricultural development.

Datkata (2017)[5] found that the number of cell phone subscriptions in Indonesia is increasing rapidly, from 282 million in 2015[6] to 371 million users in 2017. This figure is equal to 142 per cent of total Indonesian population of 262 millionpeople. Even though the information on the number of cell phone users in rural area is insufficient, the primary support of mobile transmitter networks has spread to rural and remote areas across Indonesia.[7] Mobile phones and mobile broadband connections are affordable and are driving the growth of Internet access in Indonesia. Currently, the number of Internet users is 132.7 million people[8] or almost 51 per cent of the total population of Indonesia. Indonesia is ranked sixth in the world in terms of Internet users after China, USA, India, Brazil and Japan.

Widespread broadband connectivity and cloud computing with fourth-generation technology (4G), which has been operating in Indonesia since 2010, is bringing almost unlimited capacity for farmers and other actors to connect with each other and engage in complex agricultural market

Number of Internet users in Indonesia per January 2017

Source: Hootsuite, 2017

[5] Datkata, 2017. Indonesia Cellular Phone Users Reach 142% of Population (Pengguna Ponsel Indonesia Mencapai 142% dari Populasi). Accessed online 13 December 2017 at: https://databoks.katadata.co.id/datapublish/2017/08/29/pengguna-ponsel-indonesia-mencapai-142-dari-populasi

[6] Ramadhan, B. 2016. Number of Cellular Phone Users in Indonesia is Exceeded the Number of Population (Jumlah Pengguna Ponsel di Indonesia Melebihi Jumlah Populasi). Accessed at https://www.goodnewsfromindonesia.id/2016/01/21/data-terbaru-ternyata-jumlah-ponsel-di-indonesia-melebihi-jumlah-populasi

[7] Kemeninfo, 2017. Indonesia Ranked the Sixth Internet User in The World (Pengguna Internet Indonesia Nomor Enam Dunia). Accessed online 13 December 2017 at: https://kominfo.go.id/content/detail/4286/pengguna-internet-indonesia-nomor-enam-dunia/0/sorotan_media

[8] Hootsuite, 2017. Digital in 2017: South East Asia

chains to access and use information for decision support. Smartphone technology and cloud-based computing can effectively be used to transform smallholder agriculture in developing countries.

Challenge

ICT utilization in Indonesian agriculture, however, faces some challenges in its adoption:

- The spread of the population across an archipelago makes the distribution of ICT devices and infrastructure costly and time-consuming.
- Power supplies in some remote areas are still insufficient and Internet connection networks are still limited.
- The telecommunication infrastructure such as transceiver base station and technical control facilities is still relatively expensive.
- The amount of resources and capacity of government personnel is low, preventing agriculture data input and processing from running optimally.
- Budget allocation for operational application of ICT in agriculture from local government or other parties is limited.[9]
- Lack of capacity and knowledge of extension workers and small-scale farmers in implementing ICT on agricultural practices.
- From a sociocultural point of view, culture sharing is still not entrenched. The culture of information and knowledge is still insufficient and the culture of documenting information and data is not routine, especially for small-scale farmers.[9]

Lessons learned from FEATI project

The Indonesian Ministry of Agriculture, with support from the World Bank, managed the FEATI project during 2007-2013. The objectives of the project were to empower farmers and farmers' organizations in improving productivity, income and welfare through increased accessibility to information, technology, financial capital, production facilities, agribusiness development and business partnerships. The implementation of the FEATI project involved agricultural researchers, non-governmental organizations working in agriculture, farmers, agricultural extension workers and the private sector/entrepreneurs in agriculture and government.

The main key activities of FEATI project include:

1. Provision of ICT facilities
2. Training needs assessment
3. Training and workshops on ICT in agriculture
4. Internal staff capacity-building (i.e. audiovisual training, scientific writing)

Two approaches were considered in implementing the FEATI project: (1) providing ICT facilities, training and capacity-building for extension workers; (2) only providing ICT facilities to extension workers. The evaluation revealed that there are significant differences resulting from these two approaches. The first approach made extension workers more independent, more knowledgeable and confident in utilizing ICT and disseminating it to farmers. In contrast, the second approach made extension workers less independent and less confident in utilizing and disseminating ICT to farmers as they had to teach themselves how to use the ICT and they had little support.

Lesson learned from FEATI project were:

- ICT can be used as a strategic tool to support agricultural development at each stage of the farming life cycle, including pre-cultivation; crop cultivation and harvesting; and post-harvest.
- ICT in agriculture is also part of disaster risk reduction efforts, because ICT can help in disseminating early warnings of pest and disease outbreaks, presenting information on cropping calendars in accordance with climate predictions and providing information of food stocks (staple food).
- Capacity-building for extension workers in utilizing the ICT in agriculture is needed.
- Aspects of the FEATI project were continued after the main project ended: the web portal, **Cyber Extension** and **Cropping Calendar Information System** application are still operated. This continuity is due to commitment from the government to follow up and maintain the project results by allocating human resources and funding.

[9] Sumardjo, Lukman M. Baga, and Retno S. H. Mulyandari, 2009. Kajian Cyber Extension. Faculty of Agriculture. Bogor Agricultural University

a. Cyber Extension

The Cyber Extension, which can be accessed at http://cybex.pertanian.go.id/ is an information portal that aims to support extension workers throughout Indonesia in providing agricultural information among regions. This information includes news, and location-specific agricultural technology and market information. It is expected that communications between agricultural extension workers and other extension workers in Indonesia will improve.

Activities include:

- Provision of ICTs tools and facilities to extension workers
- Training for extension workers on how to operate various type of ICTs and how to produce extension material, including how to upload it into Cyber Extension
- Development of a web application that provides extension workers with agricultural materials and a platform for sharing information among extension workers.

Conventional counselling meant extension workers had to wait for agricultural information materials (such as leaflets, brochures, posters) and in electronic information (such as films, interactive dialogues, radio broadcasts) to be prepared by the Ministry of Agriculture. This information was limited, often late and relatively expensive. The ICT-based extension system is expected to increase the level of interactivity (communication), add speed (information), deepen two-way communication, expand the range of communication, increase quality/quantity of information, reduce costs, improve speed and be accessible anywhere, anytime and by anyone.

b. Cropping Calendar Information System (CCIS)

This application provides recommendations on cropping season and appropriate innovations based on climate conditions at a subdistrict level. It has been launched as web and android versions. The information provided by CCIS include:

1. Information on season and rainfall predictions
2. Information on cropping season and potential planting area
3. Information of endemic areas, droughts and floods
4. Recommendation of varieties
5. Recommendation of fertilizers
6. Recommendation of tools and machines

The ability of CCIS in presenting the information as mentioned above and recommendation of adaptive technology according to climate prediction, allows farmers to determine (1) time planting and cropping patterns; (2) potential planting area for each season on rainy, normal, and dry conditions; (3) adaptive technology on varieties, fertilization systems and pest control mechanism.

Room for improvement

There is now growing evidence of how new ICTs are creating a discontinuity between agricultural development in developed and developing countries. The issues for smallholders, beyond adopting and adapting technology as its cost declines, are in availability and access to relevant, timely and useful content. This requires the significant transformation of current agricultural organizations and how they address farming. These organizations will need to be able to manage and promote effective use of data and information that the new ICTs will generate to improve production efficiency for all actors. These organizations will also need to make the entire information-sharing process participatory. The agricultural information manager now has to consider the challenges of using new ICTs and transforming organizations to enable community participation for agricultural development and progress.

Provisions of standards, norms, methodologies and tools, as well as the development of individual and institutional capacities, and policy support are all key components of ICT in agriculture. Some of the areas to be developed include:

- Capacity-building for extension workers on the implementation of ICT into agriculture practices
- Intensive training for smallholder farmer groups
- Providing information on agricultural extension material to extension workers
- Increasing the number of extension workers with a target of one village one extension worker
- Disseminating information and agricultural ICT to all stakeholders
- Providing adequate ICT equipment and its infrastructure
- Enabling policy support