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# Using information technology in the agriculture of Asia-Pacific Economic Cooperation (APEC) economies and beyond

## The potential of Wisdom Agriculture for poverty reduction and improved food security

### About this online discussion

This document summarizes the online discussion *Using information technology in the agriculture of APEC economies and beyond – The potential of Wisdom Agriculture for poverty reduction and improved food security* which was held on the FAO Global Forum on Food Security and Nutrition (FSN Forum) from 9 to 30 November 2016. The discussion was organized in the context of the APEC Wisdom Agriculture Workshop, which took place in Yinchuan, China from 24 to 25 November, and was facilitated by Guomin Zhou from the Agriculture Information Institute of the Chinese Academy of Agricultural Sciences.

The aim of this discussion was to explore how applying information and communication technologies (ICTs) in agriculture can contribute to poverty reduction and increased food security, and to discuss the specific challenges and bottlenecks for realizing the holistic use of ICTs for agricultural development – an approach conceptualized in China as "Wisdom Agriculture". In addition, participants were asked to share information on the status of the use of ICTs in the agricultural sector of their respective countries, and to share examples of effective ICT applications in this regard.

Over the three weeks of discussion, participants from 21 countries shared 44 contributions. The topic introduction and the questions proposed, as well as all contributions received, are available on the discussion page:

[www.fao.org/fsnforum/activities/discussions/wisdom\\_agriculture](http://www.fao.org/fsnforum/activities/discussions/wisdom_agriculture)

## ICTs in agriculture and their role for poverty reduction and increased food security

The development of information and communication technologies is increasingly transforming the ways in which information is disseminated and obtained in the agricultural sector. Initially, interactive radio provided farmers with agricultural information (Vethaiya Balasubramanian), which for instance enabled farmer radio listening groups in Mali and Zimbabwe to double their yields (Themba Piri). Subsequently, television became important in information dissemination (Vethaiya Balasubramanian), and recently the holistic application of ICTs for agricultural development has increasingly gained attention. In practice, the holistic use of ICTs in agriculture – conceptualized in China as “Wisdom Agriculture” – means fully taking advantage of modern information technology achievements including computers and networks, the Internet of things, cloud computing, 3S technology (remote sensing, geographic information systems and GPS), and wireless communication technology in order to develop agriculture.

Worldwide, various ICT tools have already been used in agriculture, and positive impacts have been reported. Many participants stressed the need to further optimize the potential of ICTs, highlighting that they can contribute to reducing poverty and food insecurity because they allow for creating new capabilities and networks (Alastair Marke) among different stakeholders in the agricultural value chain (Kien Nguyen Van). These capabilities and networks can improve farmers' labour and resource efficiency (Edward Mutandwa, Kien Nguyen Van, Yrysbek Abdurasulov, Guilan Zhang, Fei Gao); boost agricultural productivity (Edward Mutandwa, David Michael); and, consequently, increase profitability. In Uganda for instance, access to market information through mobile phone technology could increase farmers' incomes by 16.5–36 percent (Alastair Marke).

ICTs can support farmers by providing access to information that falls under the following categories,<sup>1</sup> covering the entire agricultural production process:

- **Input procurement and marketing of agricultural produce.** By providing access to real-time market information and facilitating contact with other actors in the value chain, ICTs allow farmers to procure quality farm inputs at competitive prices, promote their

produce (Vethaiya Balasubramanian) in different online markets (Cavin Mugarura), and negotiate on prices (Vethaiya Balasubramanian). In general, they also enable farmers to better respond to market demands (Cavin Mugarura).

- **Strategic information.** ICTs can provide information regarding cultivation practices (Pradip Rey), support land planning and preparation, help determine the adequate amount of inputs, provide weather information, enable early detection and treatment of pests and diseases (Vethaiya Balasubramanian), and facilitate crop forecasting (Salvador Peña).
- **Past trends.** ICTs can play a crucial role in crop production decision-making by making information available on past trends in productivity, pest attacks and climatic conditions, among others. Information on climatic conditions may for instance help growers in scheduling cultivation activities to optimize production and control of stresses (Pradip Rey).
- **Government policy decisions.** A variety of ICT tools gives access to information regarding government policies related to agriculture (such as on marketing, labour laws and land holdings), which can be crucial for farmers when making decisions (Pradip Rey).

### The benefits of product traceability systems

ICTs play a crucial role in facilitating product traceability, which can *inter alia* support farmers in terms of improved disease control, quality assurance (Gao Lois, David Michael), and by providing new markets for their produce (Thomas Amougou Obama). A concrete example mentioned by one of the participants involves the application of ICTs to help farmers in procuring quality inputs. For instance, all inputs can be provided with an identification number that corresponds to a number farmers need to dial when they wish to purchase the product concerned. After dialling the number, an SMS provides the farmer with relevant information on, for instance, the manufacturer of the product and the manufacturing and expiry date. In this way, product traceability can help counter the sale of fake inputs to farmers (Stella Kimambo).

1 Hasan, S.S. & Isaac, R.K. 2008. ICT for Sugarcane Farmers. *Information for Development* (i4d), March 2008, pp. 27–28. Cited by Pradip Rey.

Many participants stressed the importance of ICTs for agricultural development and their role as a major tool for "sharing" and "collaborating", which are regarded as the keys to addressing the issue of food insecurity as an interconnected global problem (Alastair Marke). In this regard, it was for instance highlighted that farmers obtaining information through the use of ICTs in turn often share their knowledge with other farmers who may not have access to modern communication technologies – hence, the impact of ICT use may go beyond that which can be measured (Edward Mutandwa). In addition, besides being information recipients, the role of farmers as "knowledge creators" is crucial: by sharing techniques and experiences on the Internet and via mobile phones, farmers can further the dissemination and adoption of best practices and agricultural innovation (Alastair Marke). Moreover, ICTs are not only relevant at the field level: their potential to generally enhance the coordination of agricultural activities at local and national levels, and their crucial role in generating data to inform development policies, was highlighted as well (David Michael).



## Challenges and bottlenecks for the full realization of Wisdom Agriculture

Some participants were, however, more sceptical regarding the extent to which using ICTs in agriculture can and does have a positive impact in linking technological developments to broader processes of societal change. One participant pointed out that in the race to develop, divisions between the "haves" and "have-nots" have increased, and that elites have become richer at the expense of the masses. This, in turn, has led to the use of all kinds of technologies to bridge gaps and improve lives – which, however, brings with it significant socio-economic challenges (Peter Steele). In terms of this discussion, this means that the use of ICTs should not be considered as a development objective in itself (Lal Manavado, Andrea Sánchez Enciso) and that their usage in development initiatives should be accompanied by empowering, inclusive processes of change (Andrea Sánchez Enciso). This requires carefully considering the local context and recognizing that agriculture is a part of a larger system (Lal Manavado). Hence, to expand on the possibilities of ICTs with a view to reducing poverty and improving food security, there is a need to revisit our capabilities to address the problems associated with their use (Raymond Erick Zvavanyange).

Moreover, if one decides to implement interventions involving ICTs, adequate government support is needed to establish an enabling operational environment (Senkosi

Kenneth). One needs to take into account that in many countries, the agricultural context is characterized by small households that are often engaged in subsistence agriculture. These households can be sceptical of the use of modern technologies, and they have limited access to capital (Yrysbek Abdurasulov). Hence, motivating smallholders to pay for yield-enhancing services and creating business models that allow them to benefit from high-tech, high-investment agri-services will be part of the challenge. Considering this context, the success of applying ICTs in agriculture may thus be more about getting services adopted than having the most elegant technical solution (Rick van der Kamp).

In addition to exploring the challenges associated with implementing ICTs, participants identified the following factors as having limited the intensification of ICT use in agriculture:

- **Discrepancies between research and local realities.** Studies often do not respond to the needs and capabilities of farmers, for whom proposed technologies may for instance be unavailable or too expensive. Context-specific innovations are needed, which requires closer involvement of smallholders in order to adequately address their difficulties, while also considering the tools that are available to them (Thomas Amougou Obama).

- **Resistance of policy-makers.** Drones, for instance, can be very useful for the efficient gathering of data over expansive distances, but their usage has met resistance for security reasons. Policy-makers need to be convinced that the drones will only be used for gathering agriculture-related data, and that the data will be treated with confidentiality ([Senkosi Kenneth](#)).
- **Infrastructure that is lacking or unreliable.** Access to reliable electricity and communication system support, which is a crucial requirement for effective ICT use, is lacking ([David Michael](#)). In rural Africa, Internet infrastructure is sometimes totally absent ([Hamisi Mtimbuka](#)); investments in this field are thus urgently needed ([Themba Piri](#)).
- **High financial costs** ([Kien Nguyen Van](#), [Yrysbek Abdurasulov](#)) of both hardware and software. Smallholders generally lack the necessary financial means, and the absence of financial incentives such as tax benefits makes scaling up ICT use complicated. The following saying in Colombia clearly sums up the issue: "A Mercedes-Benz is cheaper than an agricultural tractor" ([Salvador Peña](#)).
- **Gender inequality.** ICT use has been characterized by a significant gender gap; constraints such as high costs, social norms and illiteracy hinder women's ability to take full advantage of ICTs. For instance, even when women have access to mobile phones, their devices tend to be less sophisticated than those of men and their usage less frequent, as they generally borrow rather than own mobile phones ([Andrea Sánchez Enciso](#)).
- **Lack of training.** Not many agricultural experts are trained to use ICTs in an efficient way ([Saydagzam Khabibullaev](#)).



## ICTs in agriculture: country-specific examples and suggestions

### BURUNDI

In a Burundian project aimed at supporting passion fruit production, technological and product development was identified as one of the sectors deserving particular attention, with investment specifically needed in hardware, training and management, and the adoption of good agricultural and manufacturing practices. To participate, people needed access to a portal and were directed to implement selected field practices with the use of mobile phones. This was however problematic, given the fact that especially in rural areas, mobile phone use has been limited due to poverty, inadequate infrastructure and high costs (Peter Steele).

### CHINA

Although extensive research on Wisdom Agriculture has been conducted in China, the extent to which the knowledge generated has been applied in practice has come into question. Intensifying the implementation of Wisdom Agriculture may however give China the chance to catch up with other countries in terms of agricultural development (Fei Gao). Chinese provinces such as Henan, Sichuan and Shandong Zibo have already undertaken action in this regard; the latter has for instance established a so-called "Wisdom Agriculture centre" (Xiuming Guo).

Practical interventions involving ICTs have addressed different issues. An important one is the reliance on traditional farming fertilization in orchards, which is mainly based on experience (Jun Hao Li, Yanran Li) and thus lacks systematic scientific guidance (Yanran Li). This has led to large inputs of pesticides and fertilizers, which not only wastes resources, but also poses a serious threat to the environment. In order to address this, a project has been implemented that uses a real-time, dynamic agricultural information gathering system to facilitate the intelligent fertilization and irrigation of farmland (Jun Hao Li).

### INDIA

In India, ICTs have been of great use to farmers, and a number of initiatives have been implemented. A particularly interesting example is "aAqua", a multimedia and multilingual agricultural portal that facilitates information exchanges among farmers and deals with context-specific questions. It operates on a large scale, and engages researchers while simultaneously providing accessible content for rural populations. The aAqua portal has resulted in the establishment of various operations support databases, such as aAQUA-QoS (Ramamritham, 2006, cited by Pradip Rey). Other independent Indian projects involving ICTs include: e-Choupal, e-Procurements, Kisan Kerala, Project Friends, a rice knowledge management portal, e-Mitra, Lokvani, e-Krishi, Mahindra KisanMitra, and the IFFCO Agri-Portal (Dhanya Praveen).

### INDONESIA

In West Sumatra, the average plot of agricultural land is only 5 000 m<sup>2</sup>, and smallholders face relative high production costs. In order to address this, a project was executed which focused on implementing low-cost precision farming in order to reduce the costs of inputs. The approach has proven to be suitable for smallholders and has yielded positive results (Muhammad Makky).

### IRELAND

The Irish VirtualVet project has been building a knowledge and data collection service focused on animal health and drug usage. Gathering of on-farm data allows farmers to benchmark performances or warn of nearby animal disease outbreaks. Mobile technology and an analysis platform facilitate information exchanges, and also promote social inclusion and outreach (Sinead Quealy).

## KENYA

E-farming is a text-messaging service that provides farmers with advice on crop management, fertilizer use and the cultivation of different maize varieties. Farmers can register via SMS and indicate the crops and type of information they are interested in. In addition, they can request specific information (at a cost of US\$0.12 per message) on ways to boost food production on their individual farms. Some users of E-farming have seen their maize yields double.

Another initiative is M-Farm, which provides smallholders with market pricing information on 42 crops in five different markets via a free mobile phone application or SMS. In addition, it offers farmers the possibility to sell their crops as a collective and allows for group purchases of seeds and fertilizers, which can be done via mobile phones or on the M-Farm website. Currently, about 5 000 farmers are using M-Farm; some farmers selling collectively have more than doubled the returns for their produce ([Alastair Marke](#)).

## KYRGYZSTAN

In Kyrgyzstan, ICT systems are being designed and introduced into local industries, but this has not fostered major developments regarding the use of ICTs in the agricultural sector in particular. For instance, the Internet of things is only used for weather forecasts and forecasts of agricultural prices in the national market. However, some initiatives have been undertaken. For instance, a Norwegian Government project has established a farm-level information base, which has had a positive impact ([Yrysbek Abdurasulov](#)).

## MALI

In Mali, conventional broadcast channels such as radio, television and newspapers have generally disseminated generic market information, but this has not been sufficient to respond to farmers' needs. The Sénèkela project tries to address this issue by providing access to quasi-personalized market information to already almost 60 000 monthly subscribers through the use of mobile phone technology. However, users have to pay for the service, which risks excluding low-income users and also threatens the sustainability of the platform ([Djouma Sadou](#)).



## THE RUSSIAN FEDERATION

Although in other countries, intensifying the use of robots in agriculture might not be advised due to the negative consequences on employment, in the Russian Federation it may offer a solution as the country's population density is low. Deploying robots will facilitate the more efficient use of ploughed lands, engage new territories in agriculture, allow for the implementation of landscape-specific technologies, and significantly reduce food production costs in the long term. The goal of this robotized agriculture should be to produce with the lowest possible cost and to achieve optimal yields, while having as little impact as possible on the environment ([Boris Karpunin](#)).

## THE UNITED REPUBLIC OF TANZANIA

AgriSense, a "Spurring a Transformation for Agriculture through Remote Sensing" (STARS) Project, has been implemented in the Morogoro region of the United Republic of Tanzania. STARS uses satellite remote sensing technology to improve the basis and flow of crop condition monitoring information before, during and after the growing season, in the context of the agricultural monitoring and food security forecasting by the Ministry of Agriculture. The so-called GeoODK application, available on tablets and smartphones, enables efficient submission of field data to governmental departments. FAO Tanzania has extended the use of the STARS technology in order to facilitate timely interventions during post-harvest management ([Stella Kimambo](#)).

Concerning farmers, a study conducted in the Kilombero district revealed that the large majority of small and medium enterprises use mobile phone technology, and more than 90 percent reported positive effects on customer satisfaction and gross profit. However, challenges include poor electricity and malfunctioning phone batteries. To address these challenges, farmers could inter alia be supported by strengthening the governmental energy supply organizations in order to improve access to reliable electricity ([Valerian Kidole](#)).

## International initiatives

The **Agricultural Information Management Standards** portal facilitates networking and information exchanges among agricultural information management specialists, with an aim to harmonize efforts regarding the development of methodologies, standards and applications for the management of agricultural information systems ([Pradip Rey](#)).

The FAO **Dimitra Clubs** address the broader issue of rural development by providing gender-sensitive communication spaces where people discuss daily challenges and identify solutions to overcome them. By combining capacity development with the use of ICTs – using radios and mobile phones to facilitate access to information – the clubs contribute to people's empowerment ([Andrea Sánchez Enciso](#)).

**FarmNet** facilitates knowledge generation and information exchanges, such as extension services, among farmers and organizations. Linking farmers to the resources and services they need improves their productivity ([Pradip Rey](#)).

**Seeds4Needs**, led by Bioversity International, investigates how agricultural biodiversity can help minimize cultivation risks associated with climate change, identifies crop varieties suited to existing or projected conditions, and aims to strengthen local seed systems. It uses a geographic information system (GIS) to identify seeds for field trials executed by farmers, who in turn report to researchers through Internet-based or mobile technology ([Alastair Marke](#)).

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**Zvanyange, R.E.** 2016. How can data and digital services secure rural and food futures in Africa? *Rural Reporters*, 19 November 2016 (available at <http://ruralreporters.com/how-can-data-and-digital-services-secure-rural-and-food-futures-in-africa>).

## WEBSITES AND VIDEOS

Agricultural Information Management Standards  
<http://aims.fao.org/home>

E-agriculture  
<http://www.e-agriculture.org>

FAO Dimitra Clubs  
<http://www.fao.org/dimitra/dimitra-clubs>

ICT, Agriculture, Market Information Systems  
<https://www.youtube.com/watch?v=IGVM55SWxHU>

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