



“e-Agriculture” A Definition and Profile of its Application

The Food and Agriculture Organization of the United Nations (FAO) has developed this statement on e-agriculture in relation to the Plan of Action of the World Summit on the Information Society (WSIS).

1. Definition of “e-Agriculture”

The WSIS Plan of Action¹ includes e-agriculture as an area of application of information and communication technologies (ICTs) under Action Line 7:

- a. Ensure the systematic dissemination of information using ICTs on agriculture, animal husbandry, fisheries, forestry and food, in order to provide ready access to comprehensive, up-to-date and detailed knowledge and information, particularly in rural areas.
- b. Public-private partnerships should seek to maximize the use of ICTs as an instrument to improve production, marketing and food safety standards.

FAO proposes the following definition:

“e-Agriculture” is an emerging field in the intersection of agricultural informatics, agricultural development and entrepreneurship, referring to agricultural services, technology dissemination, and information delivered or enhanced through the Internet and related technologies. More specifically, it involves the conceptualization, design, development, evaluation and application of new (innovative) ways to use existing or emerging information and communication technologies (ICTs).

E-Agriculture goes beyond technology, to promote the integration of technology with multimedia, knowledge and culture, with the aim of improving communication and learning processes between various actors in agriculture locally, regionally and worldwide. Facilitation, support of standards and norms, technical support, capacity building, education, and extension are all key components to e-Agriculture.

There are several types of activity related to e-agriculture applications that are widely recognized around the world today. The delivery of agricultural information and knowledge services (i.e. market prices, extension services, etc) using the Internet and related technologies falls under the definition of e-Agriculture. More advanced applications of e-agriculture in farming exist in the use of sophisticated ICTs such as satellite systems, Global Positioning Systems (GPS), advanced computers and electronic systems to improve the quantity and quality of production.

¹ *World Summit on the Information Society, Geneva 2003 – Tunis 2005, Plan of Action. Paragraph 21.* http://www.itu.int/dms_pub/itu-s/md/03/wsis/doc/S03-WSIS-DOC-0005!!PDF-E.pdf

2. Global Trends in e-Agriculture

2.1 Technology-based Solutions

Applications of e-Agriculture in intensive agricultural systems in developed countries are gearing towards using sophisticated technologies to improve the quantity and quality of production, in order to maximize profits. This is the case in precision agriculture in which farmers are harnessing computer and satellite technologies to cut costs, improve yields and protect the environment; and e-commerce (or e-marketing) in which the marketing and sale of agricultural products is conducted over electronic networks such as the Internet and extranets. On the other hand in many developing countries farmers' access to information is improved through grass root level initiatives of using ICTs as well as distance education modalities to enhance the knowledge base among service providers.

Precision Agriculture

In precision agriculture or site-specific farming, farmers are using ICTs and other technologies to obtain more precise information about agricultural resources which allow them to identify, analyze, and manage the spatial and temporal variability of soil and plants for optimum profitability, sustainability, and protection of the environment². Precision agriculture is described as:

*"a system to manage farm resources better. Precision farming is an information technology-based management system now possible because of several technologies currently available to agriculture. These include global positioning systems, geographic information systems, yield monitoring devices, soil, plant and pest sensors, remote sensing, and variable rate technologies for application of inputs."*³

Precision agriculture is an advanced e-agriculture application. It makes use of five major components of technology: 1) Geographical Information Systems (GIS) for analysis and management of spatial data and mapping; 2) Remote Sensing (RS) to identify and 3) Global Positioning Systems (GPS) to locate and define spatial features or activities that contribute to the quality of site-specific practices; 4) Variable Rate Technology (VRT) allowing targeted, site-specific input applications; and 5) Yield monitoring for recording crop productivity as an historical database for crop management⁴.

e-Commerce in Agriculture

Improved productions and high yields result in the need to look for profitable markets beyond local communities, and electronic markets are providing an opportunity to farmers to market and sell their produce to buyers at the global level. Electronic commerce (e-commerce), simply defined as the general exchange of goods and services via the Internet, is already having a significant impact on agriculture. For example, by 2000, one in 25 U.S.

² Jefferson County Cooperative Extension Services. 2000. *Precision agriculture - site specific farming*. <URL: http://jefferson.ifas.ufl.edu/ag_pages/PA-SST_page.htm>

³ Ibid.

⁴ Rains, G. C. and Thomas, D. L. 2000. *Precision farming: an introduction*. <URL: <http://pubs.caes.uga.edu/caespubs/pubcd/B1186.htm>>

farms had already bought or sold agricultural products on the Internet⁵ and Goldman Sachs had estimated that 12% of all agricultural sales in the U.S. would be conducted over the Internet in 2004, compared to only 4% in 1999⁶. Further, a study conducted by Rockwood Research on Internet use by commercial farmers in the US found that farmers were primarily using the Internet to access information on commodity prices, weather, farm chemicals, and machinery. The study also showed that farmers were migrating quickly toward Web-based transactions such as purchasing seed, crop chemicals, and farm equipment on the Internet⁷.

2.2 Agricultural Information Exchange and Communication

The most frequently encountered e-Agriculture approach relates to improved information exchange and communication for the benefit of rural communities, farm households, and the rural service providers involved in the provision of agricultural, financial and communication services.

Case Studies

- *Egypt VERCON⁸ (Virtual Extension and Research Communication Network)*: Government researchers and extension workers in institutes and rural villages are now actively using a web-based portal system to exchange critical information with district offices and Ministries in Cairo. Researchers and extension workers presently access information resources such as *extension brochures, statistical databases, decision support systems*, and can participate in special interest *forums, online discussions, news and events*. An online query system called *Farmer's Problems* answers technical questions raised by smallholder farmers.
- *FoodNet*: This network in Uganda comprises a national system that was established to gather and disseminate agricultural market price information via newspapers, the Internet, radio and mobile phones (SMS). FoodNet is a typical example of an e-agriculture application that can be found in many countries, showing how small-scale farmers in rural communities can overcome their marginalization through a mix of media including ICT-based information access.
- *Rural Radio, ICTs and Food Security*: For billions of people in rural areas, where illiteracy rates are high and access to electricity, phones and Internet is marginal to say the least, radio is still the most accessible, economic, and popular means of communication. FAO is working with the World Association of Community Broadcasters, AMARC, an international community radio network, and the Developing Countries' Farm Radio Network (DCFRN) to enhance networking and sharing by assisting radio stations to use the Internet to access alternative information on a range of subjects of interest to rural communities, including health, education, credit and local projects.

⁵ U.S. Department of Agriculture, Economic Research Service, Agricultural Resource Management Study, 1999.

⁶ Rolf A.E. Mueller. 2000. Emergent e-commerce in agriculture. AIC Issues Brief, no. 14, December. <URL: <http://aic.ucdavis.edu/pub/briefs/brief14.pdf>>

⁷ Farmers go online in the US - fast. Online Publishing News, No. 16, 5 July 1999. <URL: <http://www.onlinepublishingnews.com/htm/n9975oIn9.htm>>.

⁸ Arabic Website: <http://www.vercon.sci.eg>, and English Website: http://www.vercon.sci.eg/Vercon_en/vercon.asp

3. FAO's Approaches to Information and Communication for Development

The Food and Agriculture Organization of the United Nations is involved in several activities aimed at bringing rural stakeholders into the mainstream of ICT developments and participation in the information revolution.

FAO has initiated a strategic *Programme for Bridging the Rural Digital Divide (BRDD)*⁹, aimed harnessing its various activities to contribute to efforts to reduce food insecurity and poverty. The rationale for the BRDD Programme is that the rural digital divide is not only concerned with technology infrastructure and connectivity, but rather is a multi-faceted problem of *ineffective knowledge exchange and management of information content*, as well as the *lack of human resources, institutional capacity, and sensitivity to gender and the diverse needs of different groups*. Even though the goal of bridging the rural divide transcends the technologies, the means to that end are coupled to ICT infrastructure. The drawback is that too many proposed solutions are driven not by empirical evidence from studies of how people use the technologies, but by ICT developers and providers who are usually a great distance from the locales (or local users?) and contexts in which their tools are to be used. Bridging the rural digital divide requires an understanding of how persons in different cultures learn to use and apply ICTs, access to which is central to overcoming the divide.

A critical need is content development to ensure the suitability of knowledge and information for the local client needs in rural communities and agriculture societies. A crucial agent of change developed through this Programme will be the mobilization and harnessing of previously inaccessible knowledge and information in digital form, derived from or adapted to the local context. Innovative participatory approaches to knowledge exchange will be implemented by the Programme in several countries, and will provide access to appropriate content. These approaches have to build on past experiences while also being innovative, and will aim to prove the case and learn lessons from implementation in a wide range of environments, using a mix of media based on traditional and new technologies. This Programme is a reflection of FAO's continued commitment to ensuring wider access to knowledge and information in support of food security and the eradication of poverty.

The Programme stakeholders within FAO Member States have been identified and these are the following:

- Rural communities and households
- Rural service providers in the public and private sectors providing agricultural, financial, and communications services
- Policy-makers and their advisers

FAO has built a substantial knowledge base through pilot studies, workshops, expert consultations and publications related to the application of ICT to further rural development

⁹ The content in this section was adopted from the FAO's document - A FAO draft programme for Bridging the Rural Digital Divide to Reduce Food Insecurity and Poverty: a strategic initiative to assist developing countries and countries in transition to bridge the rural digital divide through the effective use of information and communication in support of improved rural development and food security.

and enhance food security¹⁰. A set of key determinants for the successful application of information and communication have been derived from lessons learned through these activities, which will guide the Programme:

- Locally-adapted content and context – how to ensure that useful information is repackaged and mobilized in the right format, so that it meets the different information needs and preferences of a variety of groups, so that it can be stored, retrieved, and exchanged with ease, and taking into account issues of ownership and copyright.
- Building on existing systems – how to capitalize on, rather than replace and lose the value of existing indigenous and therefore highly trusted, information and communication systems.
- Addressing diversity – how to respond to the different information and communication requirements of men and women, the youth and other marginalized groups.
- Building capacity – how to strengthen capacity of institutions and people involved in information provision to ensure the right information in the right formats, as well as building the capacities of the information users to access and appropriate a wider range of information and ICT.
- Access, empowerment and democratization – how to ensure that relevant information actually reaches and empowers poor people, especially women, and is not captured by wealthier or more powerful sections of the community.
- Strengthening partnerships – how to build the new horizontal and vertical inter-organizational, inter-departmental and inter-sectoral partnerships that are necessary to ensure information is available to all stakeholders.
- Realistic approaches to technologies to support information and communication – how to build sustainable systems that enhance existing systems, are expandable and extendable, and exploit multiple and diverse communication tools and the full range of existing media.
- Information costs, value and financial sustainability – how to value and finance the establishment of appropriate information infrastructure and the provision of appropriate information content, particularly in remote rural areas.

¹⁰ Examples of publications and consultations: The *first* mile of connectivity - Advancing telecommunications for rural development through participatory communication (1998) (www.fao.org/waicent/faoinfo/sustdev/CDdirect/CDre0025.htm): The role of information and communication technologies in rural development and food security (2000) www.fao.org/sd/CDdirect/CDre0055.htm; Discovering the 'Magic Box'- Local Appropriation of Information and Communication Technologies (ICTs) (2001). www.fao.org/sd/2001/KN0602_en.htm; Telecenter Sustainability: Myths and Opportunities, FAO-ITU-IADB publication (2001) (www.fao.org/Waicent/FAOINFO/AGRICULT/ags/Agsp/pdf/ProenzaTelecenter.pdf); Handbook for Telecenter Staff (a Cornell University publication with FAO and ITU support (<http://ip.cals.cornell.edu/commdev/handbook.cfm>) ; A Livelihoods approach to communication and information in support of rural development and food security (2002) (www.fao.org/waicent/portal/outreach/livelihoods/index-en.html)

4. Conclusion

There is great potential for e-agriculture applications in developing countries however; e-agriculture applications such as precision agriculture and e-commerce in agriculture can only work in an environment where there is a good ICT infrastructure. Precision agriculture requires expensive advanced technologies, which are only viable in intensive farming systems. Participation in e-commerce activities requires that both buyers and sellers have access to the Internet, and that they are able to use the required hardware and software effectively¹¹. Unfortunately, in most developing countries, there are many constraints blocking the development of e-agriculture. These include lack of sustainable ICT infrastructure, absence of appropriate skills among potential users of ICTs (farmers, rural communities, extension staff and researchers etc), lack of appropriate content, and lack of access to ICT facilities.

For e-agriculture to benefit rural communities in developing countries, the rural digital divide must be bridged. Locally relevant digital content has to be developed or adapted; and access to ICTs should be made affordable for rural populations. Otherwise e-agriculture applications will remain beyond reach of rural communities, and will merely exacerbate the existing rural digital divide - leading to an ever-widening knowledge gap between information "haves" and "have-nots".

¹¹ Rolf A.E. Mueller. 2000.