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WORLD SUMMIT ON THE INFORMATION SOCIETY FIVE YEARS ON: INFORMATION AND COMMUNICATIONS TECHNOLOGY FOR INCLUSIVE DEVELOPMENT

(Item 4 of the provisional agenda)

INFORMATION AND COMMUNICATIONS TECHNOLOGY FOR FOOD SECURITY AND SUSTAINABLE AGRICULTURE IN THE KNOWLEDGE ECONOMY

Background information note

SUMMARY

The World Summit on the Information Society set forth a vision of the future information society and recognized the contribution that information and communications technology (ICT), including space-based technology, can make to the promotion of food security and sustainable agriculture. Indeed, with modern agriculture rapidly moving away from artisanal, labour-intensive traditional practices and towards information-intensive models, access to information and modern communications technologies has become a necessity for farmers, especially in the developing countries of the Asia-Pacific region.

In the present document, the potential benefits and opportunities of such technologies are discussed in the context of food security and sustainable agriculture in Asia and the Pacific. ICT can be applied in the areas of agricultural policy, resource management, marketing, extension and disaster risk reduction to help countries increase production and reduce threats. It has already been instrumental in the development of many cutting-edge applications, such as farm automation, precision farming and bioinformatics. In short, ICT has a central role to play in modern agriculture and the maintenance of agricultural sustainability and food security.

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CONTENTS

Introduction

A. Background

1. The Asia-Pacific region faces various challenges in meeting target 1 of the first Millennium Development Goal: to halve, between 1990 and 2015, the number of people suffering from hunger. Agricultural sustainability and food security could be threatened by low yields, poor management of land and water resources, and under-educated labour. They are also easily disrupted by major disasters, such as droughts, floods, earthquakes and landslides. Information and communications technology (ICT)[1] can be applied in the areas of resource management, marketing, extension and disaster risk reduction to help countries increase food production and reduce threats.

2. In recognition of the importance of these issues, the World Summit on the Information Society in 2003 highlighted the application of ICT in agricultural development as a priority. In action line C7 in the Geneva Plan of Action,[2] the Summit addressed e-agriculture, and noted that "public-private partnerships should seek to maximize the use of ICTs as an instrument to improve production (quantity and quality)," as part of an overall objective to support sustainable development in a number of fields.

3. It is clear that ICT applications are of vital importance for sustainable agricultural development in the ESCAP region, where agriculture represents a high proportion of the gross domestic product in most countries and percentages of agricultural populations are high. The Asia-Pacific region is growing rapidly in terms of both economic development and population, creating enormous pressures on land and water resources; the per capita ownership ratio of land and water resources has been dropping. The region's population stood at 3.2 billion in 1990, and reached about 4 billion in 2006.[3] Meanwhile, industrial development has steadily encroached on arable land. ICT applications that facilitate the rational use of natural resources could have a major impact on agricultural sustainability.

4. Countries in the ESCAP region have proven willing to adapt to new farming technologies. They have participated in global programmes, such as rice genome mapping and sequencing, that promote a bioinformatics approach to agricultural development. Many countries have also introduced precision farming and farm automation, practices that may revolutionize agriculture. In order to ensure the broadest impact on agricultural sustainability, there must be follow-up on and adoption of technological advances, with corresponding efforts to bring such knowledge to farmers.

5. The ESCAP region is one of the most disaster-prone regions in the world, and agriculture is perhaps the most vulnerable of all sectors. For example, Cyclone Nargis caused huge losses in

[1] The term "information and communications technology", as used in the present document, should be understood to include space-based technology, as appropriate.

[2] See A/C.2/59/3, annex, section B, para. 21.

[3] *Statistical Yearbook for Asia and the Pacific 2007* (United Nations publication, Sales No. B.08.II.F.1).

Myanmar—an estimated 2.4 million people were affected, with 130,000 people reported dead or missing and over 600,000 hectares of agricultural land flooded.[4] In view of the special importance of the role ICT can play in disaster risk reduction, particularly in regard to protecting agriculture, this issue will be dealt with under item 5 of the provisional agenda[5] (see E/ESCAP/CICT/2).

6. In short, ICT has a central role to play in modern agriculture and the maintenance of agricultural sustainability and food security. However, for the developing countries of the region, there are several obstacles. The most common challenge is that access to telephone and electricity networks in rural and remote areas is limited; telecentres that offer broader ICT services are still scarce because of the disproportionately high investment and operating costs required. Shortcomings at local levels are where the digital divide becomes most obvious. Innovative ways of combining modern technologies, such as agricultural information systems, with traditional technologies, such as radio broadcasting, should be considered when evaluating ICT development options. Furthermore, funding from donors, Governments and rural communities could be used to connect users who are otherwise overlooked by service providers on the basis of profitability.

7. In preparing the present document, the secretariat has taken into account the theme topic for the sixty-fifth session of the Commission: sustainable agriculture and food security.

B. Structure of the report

8. The present document contains three sections in addition to the introduction. In section I, opportunities for ICT in promoting food security are identified. Topics discussed include: (a) ICT as a main driver in modern agriculture, within the contexts of agricultural production, nutrition, the marketing and distribution of agriculture produce, and food security mapping and profiling; (b) the role of ICT-enabled technology, including biotechnology, in increasing farm yields and improving the nutrient content of food; and (c) the monitoring and forecasting of climate, weather and crops. Section II contains a description of the benefits of public-private partnerships as well as partnerships among United Nations agencies on e-agriculture initiatives. Finally, themes highlighted in section III include: (a) the identification of emerging priorities in terms of Government and other stakeholder actions on various fronts, and (b) the catalytic role envisaged for ESCAP in applying ICT to promote food security and sustainable agriculture in the Asia-Pacific region.

9. Mention of firm names, commercial products and specific technologies does not imply the endorsement of the United Nations.

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[4] United Nations, “Myanmar Cyclone Nargis”, OCHA Situation Report No. 35, Office for the Coordination of Humanitarian Affairs, 26 June 2008. Accessed from www.reliefweb.int/rw/RWFiles2008.nsf/FilesByRWDocUnidFilename/EDIS-7FYSXY-full_report.pdf/$File/full_report.pdf on 2 July 2008.

[5] E/ESCAP/CICT/L.1.

I. OPPORTUNITIES FOR USING ICT TO PROMOTE FOOD SECURITY

A. ICT and modern agricultural technologies

10. ICT is a major driver of technological advancement in agriculture, as evidenced in such fields as bioinformatics, farm automation and precision farming. Other advanced studies, including explorations of genetic engineering and space seed processing, rely heavily on ICT. In the ESCAP region, developed countries, such as Australia, Japan, New Zealand and the Republic of Korea, as well as developing countries, such as China, India, Malaysia and some of the Central Asian countries, have been experimenting with these new technologies.

11. Bioinformatics is the field of science that combines information technology and computer science with biology. The initial focus of bioinformatics was the creation and maintenance of a database to store biological information. The field has since evolved to encompass other key areas, such as the analysis and interpretation of various types of biological data, including genome sequencing.[6] In 2005, a rice cultivar became the first commercially important plant to have its genome fully mapped. This is particularly important because rice is a staple food for much of the world's population. The rice sequence can be used to locate genes, with a view to improving yields and making rice more nutritious.[7]

12. Precision farming, or precision agriculture, is a technique that uses technology to collect and analyse data for the assessment of variations in soil or climate conditions, in order to guide the application of the right agricultural practices, in the right place, in the right way, at the right time. It relies greatly on new technologies, including the Global Positioning System, sensors, satellite or aerial images, and information management tools, to collect information on such variables as optimum sowing density, fertilizers and other input needs. This information is then used to apply flexible practices to a crop.

13. Farm automation involves the use of control systems, such as computers, to derive higher yields with more predictable results through farming processes that are more efficient, less labour-intensive and less time-consuming.

14. In addition to the above applications, the agricultural community has embarked on experimental studies, which include genetic engineering and a space seed programme.

15. In space seed programmes, now mainly in the test phase, the agricultural community works with satellite companies to send plant seeds into space; the seeds are then returned to Earth. Chinese researchers have reported sowing over 600,000 hectares of land with space-exposed seeds. Reportedly, trees grown from such seeds produce more fruit, which is also reported to taste sweeter,

[6] The genome is all the hereditary information encoded in the DNA of an organism. Genome sequencing is a process that identifies the order of the structural units of the DNA (adenine, guanine, cytosine and thymine).

[7] International Rice Genome Sequencing Project, "The map-based sequence of the rice genome", *Nature*, vol. 436, No. 7052, pp. 793-800.

have more vitamins, be more resistant to disease and have a longer shelf life. Rice, cotton, oil seeds and vegetables have also been sent into space. However, the scientific community has not reached a conclusion on the benefits of the space seeds. Some who have experimented on seeds in space say the benefits do not justify the cost.[8]

16. Biotechnology offers considerable potential as an instrument for achieving food security and sustainable agriculture. It uses advanced plant breeding techniques, including genetic modification and manipulation, to directly modify the structure and characteristics of genes, with a view to introducing beneficial traits to crops grown for food and fibre.

17. Biotechnology has been used to improve crop technology. Several commercially important species of plants have been modified to incorporate transgenic traits that provide tolerance to herbicide, viruses or fungi; insect resistance; or quality improvements. Important crops that have been modified genetically include maize, soybean, cotton, tomato, potato, alfalfa, petunia, rapeseed, mustard, rice, wheat, beet, barley, chickpea, cabbage and tobacco. There is considerable potential for genetic engineering to contribute to improved yields and reduced risks in developing countries, provided that it focuses on the needs of poor farmers and consumers in those countries.[9]

18. The application of biotechnology in developing countries of the Asia-Pacific region could reduce the need for inputs and increase efficiency of input use. This could lead to the development of crops that use water more efficiently, fix nitrogen from the air, extract phosphate from the soil more effectively, and resist pests without the use of synthetic pesticides.

19. Biotechnology, nonetheless, must be viewed as just one element in a comprehensive sustainable agriculture and food security strategy focused on broad-based agricultural growth, not a technological quick fix for region-wide hunger. Furthermore, many Governments have restricted the field applications of gene-altering technologies. The ongoing debate on biotechnology calls for national, regional and international management measures. Such measures may include laws and institutions that deal with ways of maximizing the impacts of biotechnology, while reducing its risks. This would entail capacity-building in research, international partnerships, enterprise development, and community participation in technology development. It would also include the formation of institutions and laws that ensure that biotechnology research and commercialization are undertaken according to specific safety protocols, and take into account intellectual property rights and the preservation of biodiversity. These measures would require close cooperation between a wide range of actors and cannot be reduced to simplistic public-private partnerships. Many of these institutional arrangements would depend on the nature of the technology and local ecological conditions, as well as the political cultures at the national level.

[8] Kelly Young, "Space seed idea falls on stony ground", *New Scientist Space*, 6 June 2005 (available at http://space.newscientist.com/article/dn7472).

[9] Centre for Alleviation of Poverty through Secondary Crops Development in Asia and the Pacific, "Biotechnology and Farm Yields", CAPSA Flash, vol. 6, No. 2.

B. Conventional applications of ICT in agriculture

20. In most countries of the ESCAP region, due to various limitations, ICT applications in agriculture are confined to the more conventional uses. However, with agriculture rapidly moving away from artisanal, labour-intensive, traditional practices and towards information-intensive models, access to ICT and other technologies has become a necessity for farmers, including those in developing countries of the Asia-Pacific region. ICT can play a key role in achieving much-needed improvements in regional agriculture productivity, agriculture planning and practices and food distribution, as well as in the area of information on weather impacts and disasters.

21. Empirical evidence suggests that, in the area of agricultural production, prices of inputs such as seeds, fertilizers and pesticides are the most frequently telecommunicated information. The telephone (mobile or fixed-line) is the communications technology most commonly used by farmers in the Asia-Pacific region. The use of other ICTs could also contribute significantly to agricultural productivity.

1. Nutrition

22. The most important ICT applications for addressing malnutrition relate to educating personnel and enabling efficient networking. The Food and Agriculture Organization of the United Nations (FAO), for instance, provides online training materials on many nutrition-related topics. Monitoring nutrition status—and reacting to large-scale threats—is an area of assessment and analysis that relies heavily on ICTs. Food insecurity and vulnerability information and mapping systems are increasingly being implemented to assemble, analyse and disseminate profiles of food insecure and malnourished groups: who they are, where they are located, and why they are at risk.

2. Marketing and distribution of agricultural produce

23. The link between food security, markets and ICT are obvious when it comes to integrating farmers into national, regional and international trade systems. ICT improves the ability to search for information and increase the quantity and quality of information available, ultimately reducing uncertainty and enhancing market participation (box 1). Answers to questions such as: “How do buyers and sellers find each other, and what prices can be achieved?” and “Is it better to store the produce or sell it immediately?” open opportunities, support the functioning of markets, and hence the availability of food, and increase income. Positive externalities affect all aspects of development, ranging from better education opportunities and lower fertility rates to increased productivity, which eventually feed back to food security.

24. On that basis, it is not surprising that most efforts to make ICT available to farmers have sought to improve the availability and quality of information either indirectly through producer associations, extension workers, among others, or directly through broadcast radio information, mobile phone messaging and community e-centres (box 2). For the most part, small farmers do not

use ICT to market products beyond local and regional markets. Instead, there are nationally and globally active organizations that aim at mobilizing small-holders to join a programme and market their produce. Such programmes use ICT to provide overall coordination, transfer knowledge, arrange transportation and exchange market information.

Box 1

Agmarknet: an agricultural marketing information system

In India, almost all the states and union territories provide producers, traders, consumers and other market users with some form of market information. However, the information is collected and disseminated through conventional methods which can cause inordinate communications delays, thus adversely affecting the economic interests of affected target groups. In order to provide an effective information exchange on market price, the Directorate of Marketing and Inspection, Department of Agriculture & Cooperation, Ministry of Agriculture, and the Agricultural Informatics Division, National Informatics Centre, Ministry of Communications & Information Technology, collaborated to create the Agricultural Marketing Information Network. The project aims at establishing an efficient nationwide system for the collection and dissemination of market information, and computerizing data on market fees, market charges, storage and modes of transportation.

Source: The Agricultural Marketing Information Network website (www.agmarknet.nic.in).

Box 2

Community e-centres to improve agricultural productivity

Rural access to ICT through community e-centres can be used to improve agricultural productivity by connecting the rural poor to direct markets, and by giving them ready access to information on the prices of inputs and products. Better information would also give farmers a sense