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Using information technology in the agriculture of APEC economies and beyond.

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

Collection of contributions received

in collaboration with

中国农业科学院农业信息研究所
Agricultural Information Institute of CAAS

宁夏回族自治区外事办公室
Foreign Affairs Office of
Ningxia Hui Autonomous Region

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Topic note

Dear Friends,

It is a matter of great pleasure to invite you to this online discussion organized in the context of the "*APEC Wisdom Agriculture Workshop"* which takes place in Yinchuan on November 24-25, China. The workshop is hosted by the Agriculture Information Institute of Chinese Academy of Agricultural Sciences (AII of CAAS).

Wisdom Agriculture, as it is known in China, is the holistic application of information and communications technology (ICT) to agriculture. This means taking full advantage of modern information technology achievements including computers and networks, internet of things, cloud computing, 3S technology (Remote sensing, Geographic information systems, GPS), and wireless communication technology in order to develop agriculture.

Using these technologies can provide farmers, policy makers and development organizations with information that is more complete thanks to improved remote sensing, more detailed data, better communication tools, intelligent control of agricultural production and management and a better provision of public services to agriculture. This carries huge potential for making farmers produce more and better food all while making them better off economically and improving food security and nutrition.

The "*APEC Wisdom Agriculture Workshop"* aims to review the existing methodologies, advanced technologies and best practices of *Wisdom Agriculture* in order to train young researchers from APEC economies and build their capacity in this field.

This online discussion will add additional value to the workshop by allowing for an inclusive exchange on how the use of ICTs in agriculture, as practiced in APEC economies and the rest of the world, fosters poverty reduction, and promotes the establishment of market linkages for smallholders. It will also allow you to share which technologies are best suited for the different local contexts and can provide the greatest benefit for local and global food security.

1. With information technologies becoming more common in agriculture, to what extent can they contribute to poverty reduction and increased food security?
2. What are the specific challenges and bottlenecks for the full realization of *Wisdom Agriculture* in APEC Economies? How can a conducive policy environment be created?
3. Are there any examples of effective applications of ICTs in the agriculture of your economy during the last decade that have had a positive impact on food security and rural livelihoods? What is the status of the use of technologies in your economy, such as the internet of things and agricultural robots?
4. How can smallholder farmers benefit from agricultural product traceability systems?

Anyone interested can join the discussion in either English, Chinese, French, Russian or Spanish. Please feel also free to circulate this information among your colleagues.

The comments received will help inform the workshop and foster the exchange of knowledge on this important aspect of agricultural development. On the days of the workshop we will share the preliminary results from the training sessions with all of you, while the inputs received through this online discussion will be discussed at the meeting.

Our sincere thanks go to all of you for the active participation and the open exchange of views!

We look forward to seeing you again!

Professor Zhou Guomin

and the

APEC Wisdom Agriculture workshop team

Contributions received

1. David Michael, Wondu Business & Technology Services, Australia

1. Information technology can contribute significantly to improvement in agricultural and non-agricultural productivity and applications are common across livestock, agriculture, horticulture, aquaculture, forestry and all the service providers to agriculture.

2. The bottlenecks to exploiting IT are widespread access to reliable electricity and communication system support. With the shift to mobile technology access to reliable and reasonable speed Internet is a crucial requirement for effective use of IT in agriculture and especially for smallholders, medium-sized holders and large operations.

3. Precision agriculture is growing quite rapidly, enabled by GPS receivers for mapping soils, weeds, diseases, yields and landform. Barriers to adoption of technology in contemporary agriculture include cellular connectivity, Internet speed and others.

4. Traceability systems have been applied in a mandatory way in Australia now for several years using RFID technology.

Smallholders can achieve many of the benefits of traceability systems that larger producers achieve: improved disease control and improved quality assurance for users. In addition, RFID tags offer the potential for improved animal tracking and management of genetic improvement. In many respects it's becoming the cost of not having a traceability system because competitors do have it. That means market access can be denied without adoption of effective traceability systems.

2. Thomas Amougou Obama, Croix Rouge Camerounaise, Cameroon

Original contribution in French

Bonjour à tous.

Le thème de cette discussion est d'une importance capitale, on s'est toujours demandé comment associer la technologie de l'information à l'amélioration des capacités des petites exploitations familiales plus exposées à la pauvreté et l'insécurité alimentaire et en même temps très attachées aux techniques d'exploitation agricole ancestrales.

De notre petite expérience sur le sujet nous pouvons dire à la question :

1 les technologies de l'information comme dans tous les secteurs ont pour rôle principal de servir de lien entre les chercheurs et le producteur. Dans le sens où elle assure la vulgarisation directe des innovations en termes de techniques et de matériels agricoles. Le souci ici est d'assurer la transmission des bonnes informations (adaptées à apporter des solutions concrètes à un milieu/environnement donné), de faciliter l'accessibilité (les réseaux/ applications d'utilisation commune et facile) aux producteurs/paysans à l'information et enfin améliorer l'interactivité/échanges dans ces réseaux entre les porteurs (chercheurs, vulgarisateurs) de l'information et les personnes ciblées.

2. En Afrique particulièrement le besoin d'innovation Agricole n'est pas poussé, généralement les chercheurs sont confrontés à effectuer des recherches qui parfois ne cadre pas (technologie indisponible ou trop chère) avec les attentes des plus petits producteurs qui sont pourtant les plus représenté soit 80 % pour le cas du Cameroun. Ainsi les defis majeurs en ce qui concerne l'agriculture du savoir dans l'économie de l'APEC est de fournir la possibilité aux chercheurs de

s'approcher des besoins réels des petits paysans à fin de réaliser des innovations smart à chaque localité. La politique ici est de mettre en place une stratégie de collaboration participative entre le petit paysan qui décrit clairement ces difficultés rencontrées et les outils (techniques et matériels) qui lui sont accessible mais qu'il n'arrive pas à combiner pour résoudre ces difficultés d'exploitation et le chercheur porteur de l'Agriculture du savoir.

3 . Les TIC bien que très peu appliqué au Cameroun dans le domaine agricole ont néanmoins intégré la file de production Agricole, particulièrement en ce qui concerne le recensement Agricole (la détermination des bassins de production, les différents niveaux de production, la traçabilité des produits sur le marché).

L'utilisation des réseaux internet de partage d'expérience sur les techniques agricole s'améliorent de plus en plus bien que quelques réseaux de référence se distingue mais les producteurs eux même se battent à créer des petits réseaux de partage. La mécanisation agricole tarde à voir le jour néanmoins quelque expérience sont observés principalement dans les fermes animales plus précisément avicoles où on y investi plus de moyens.

4. la traçabilité des produits agricoles permet d'identifier des marchés potentiels pour les petits exploitants agricoles en quête de nouveaux marchés de commercialisation. La majorité se regroupent en coopérative principalement pour les cacaoculteurs et le café culteur à fin d'harmoniser les ventes et mieux se servir principalement de l'outil de traçabilité des produits agricoles pour non seulement comparer les prix des produits d'ici et d'ailleurs mais aussi de déterminer les zones de forte demande et la possibilité d'acheminer des produits agricoles vers des marchés ciblés.

English translation

Hello everyone!

The topic of this discussion is of great importance, we are always asking ourselves how to link information technology to the improvement of the abilities of those small family farms most exposed to poverty and food insecurity and, at the same time, very attached to their ancestral farming methods.

Drawing on our limited experience of this matter, we can respond to the questions as follows:

1 Information technologies, as in all sectors, have as their main role to serve as a link between researchers and the producer. In the sense of ensuring the direct popularization of innovations such as techniques and farming materials. The problem here is to ensure the transmission of good information (adapted to deliver concrete solutions in a given environment), to facilitate accessibility (the network/common and easy user applications) of information to the producers/farmers so as to improve the interactivity/exchanges within this network between the contributors (researchers, transmitters) of the information and the people for whom it is intended.

2. In Africa in particular, the need for agricultural innovation is not driven, in general researchers are forced to make studies that perhaps do not coincide (unavailable technology or too expensive) with the expectations of the small producers who are moreover in the majority, around 80%, in the case of Cameroon. Thus the major challenges in what concerns agriculture, for instance in the economy of APEC, is to enable researchers to come closer to the real needs of the small farmers so as to carry out innovations appropriate to each locality. The policy here is to implement a strategy of participative collaboration between the small farmer who describes clearly the difficulties encountered and the tools (techniques and materials) that are accessible to him but which he does not manage to combine, in order to solve the difficulties of exploitation and the researcher who brings the knowledge of agriculture.

3. The ICT, even though they are not much applied in Cameroon in the farming sector, have nevertheless, been incorporated into the agricultural production dossier and, in particular, in what concerns the Agricultural inventory (determination of production areas, the different levels of production, and the traceability of products in the market).

The use of internet networks to share experience on farming techniques is getting better and better, even though some reference networks stand out, but the producers themselves struggle to create small shared networks. Agricultural mechanization is slow; nevertheless some experiences are observed mainly among stock farms, in particular poultry where they have invested more resources.

4. Traceability of agricultural products enables the identification of potential markets for the small farmers in the quest for new sales outlets. The majority are grouped in cooperatives, mainly for the producers of cacao and coffee, so as to harmonize the sales and to take advantage of the traceability of agricultural products, not only to compare prices of the local products with others, but also to determine the areas of strong demand and the possibility of channeling agricultural products towards the targeted markets.

3. Durlave Roy, Northern Agro Services Ltd, Bangladesh

The smart agriculture in Bangladesh

The Ministry of Agriculture usually deals with the crop sector, but agriculture is a multi-sectoral subject that also includes the participation of fisheries, livestock, forests and agro-processing sectors. The draft policy would prioritise agricultural production, generating employment and poverty alleviation and thus ensure food security. Apart from production, agro-processing, marketing, agricultural equipment, irrigation, seeds, fertilizer and mechanisation, the role of women in agriculture and financing would also get priority in the draft National Agriculture Policy. Besides the effects of climate change and environmental pollution on the aspects of agricultural production must be taken into account and solutions formulated for optimum agricultural production and also increased income of farmers. Farmers must be trained in mechanised irrigation and use of fertilizers as also freeing surface water from pollution for proper irrigation of farmlands.

“National Organic Agriculture Policy", aimed at promoting use of "organic and balanced" fertilisers.

The policy focuses on increasing use of "organic and balanced" fertilisers to compensate for erosion and reduction of fertility of land due to use of chemical fertilisers.

Digital Bangladesh Smart agriculture with Smart Technology

Attachment:
http://www.fao.org/fsnforum/sites/default/files/discussions/contributions/Digital%20%20Bangladesh%20Smart%20agriculture%20with%20Smart%20Technology.pdf

4. Themba Piri, Livelihoods Consultant, Zimbabwe

Colleagues

Information technology is the strongest tool in offsetting poverty and food and nutrition security. Zimbabwe and Mali in the past had made numerous strides in communicating farmer messages through the radio, and this led to Zimbabwe becoming one of the food baskets of Africa from the 19702 to the early 1980s, this was exacerbated by the fact that, farmer radio listening groups used extension messages to double their yields and produce the best livestock in Mali and Zimbabwe.

There is need to take a cue from these two countries and introduce new technologies especially in Africa, where we can even give farmers iPads so that they can be able to calculate yields, income and google pests and disease incidences this will make farming more easier and information technology more accessible,.Organisations and governments should set out satellite stations or experimental projects that will set up internet networks in the rural areas, which will be used by farmers and these would be termed technology innovation centers of excellence, which will offset all the challenges that are being faced by farmers now, climate change challenges, can only be tackled by providing rural and urban farmers with access to internet. Internet service providers such as MTN, Vodacom and other international networks should plough back to the communities by engaging farmers in technology advancement where they have access to internet at affordable rates, but at the same time benefiting and this will cut even the current challenges faced by departments of extension where farmer ratios to extension officers are a great challenge.

Regards

Themba Phiri

Livelihoods Consultant

5. Guilan Zhang, China

In my opinion, the smart agriculture is very important for the poverty reduction. Because when we master the technology, we can improve the production efficiency and reduce the farmers‘ cost. Like the US, the farmers' income are very high, and they needn't input too much energy. So as a farmer in the US, the life is very comfortable. But in China, on the contrary, our farmers have to work all days, and the income is very low. The main reason is that technology lag behind. Therefore, the technology is helpful to reduce poverty.

6. Chuanchuan Zhang, China

Imagining about the Wisdom Farm
I'm just a student and would like to take advange of my version. Supposing we could live in a wisdom Farm. By combining advanced agricultural technology with a traditional farming ethic, a new rural fringe economy can be created, this can bring some advantages:

- maintaining the open green space of the city edge, if we construct farms around city.
- informing current and future generations on global food productivity issues.
- continuation of traditional productive use of land.
- creating income and local employment from tending market gardens, ‘green food’ sales, indoor cafes and outdoor tent bbq and function catering, together with tourism income from visitors.

7. Valerian Kidole, Ministry of Agriculture Livestock and Fisheries, United Republic of Tanzania

I did my research in one of the area in Tanzania let share with you the following;The main aim of the study was to determine the impact of mobile communication on performance of agriculture based

SMEs in Kilombero district. Both qualitative and quantitative data were collected using structured questionnaire. Random sampling was employed to select 120 agriculture based SMEs. This was accomplished by SPSS version 16.0 computer software programme.

The study revealed that majority of SMEs (98.3 %) acknowledged to use innovatively mobile phone beeping, (93.3 %) loudspeaker, (88.3 %) voice recording and (80.8 %) camera with the intention of minimizing communication costs. The research found (99.2 %) of beeping originated from friend and relatives, (92.5 %) from customers and (76.7 %) from suppliers. In addition, 91.4 % reported that, mobile telephone usage had contributed to increased customers' satisfaction and (90.5 %) gross profit.

The regression results suggests that, the increased number of customers, operating capital, number of years in business, uses of mobile phone and number of years of using mobile telephone in business can increase agriculture based SMEs output and hence increase businesses profit level with its resultant effects towards poverty reduction. The electricity was major constraint for mobile phone recharging and poor phone batteries were major problems facing owners of SMEs in the study area. Based on the findings of the present study, improvement on access and reliable electricity to rural areas by strengthening of the existing TANESCO and Rural Energy Authority (REA), provision of network coverage to the rural areas and reduction of the airtime to reduce the costs of making calls.

8. Saydagzam Khabibullaev, Land of Plenty Agro Distribution LLC, Uzbekistan

Original contribution in Russian

Доброго и Благоприятного времени суток!

Конечно же я очень рад, что обращаете такое внимание на данную тематику. Я просто поделюсь своими мнениями по указанным Вами пунктам.

1. В какой степени информационные технологии в сельском хозяйстве могут способствовать снижению масштабов нищеты и повышению продовольственной безопасности, учитывая их все более широкое распространение? Умение использования информационных технологий имеет значение для тех, кто реально нацелен достичь чего-либо использованием в своей деятельности. На самом деле информационные технологии очень мало используются в сельском хозяйстве, потому что мало кто обучает специалистов сельского хозяйства эффективному использованию этих технологий. Если считать, что эти технологии призваны быть индикаторами или регистраторами получаемых объёмов плодов, урожая и всего другого, то это лишь часть использования.

2. Какие специфические проблемы и сдерживающие факторы стоят на пути полной реализации Wisdom Agriculture в странах-участницах АТЭС? Как создать благоприятные условия для политики?Благоприятные условия возможно создавать через разработку стратегических планов по внедрению и расширению использования информационных технологий в сельском хозяйстве.

3. Имеются ли примеры эффективного применения ИКТ в сельскохозяйственном секторе экономики вашей страны за последнее десятилетие, которые оказали положительное влияние на продовольственную безопасность и экономическое положение населения сельских районов? Каков статус использования технологий, таких как «Интернет вещей» и сельскохозяйственные роботы, в вашей стране? В нашей стране всё это в этапе зарождения. Но, я видел как по настоящему вся ИКТ работает в сельском хозяйстве, когда проживал в Японии, в Южной Кореи, в Канаде, в ряде Европейских странах. Главное не перемудрить этим, ибо каждое

использование ИКТ должно являться комплексным решением, но никак не частное применение.

4. Какую пользу могут извлечь мелкие фермерские хозяйства от использования сельскохозяйственных систем отслеживания продукции? Фермерские хозяйства должны понять единственную вещь: - продукция приносит реально большую эффективность тогда, когда эта продукция является самой востребованной на рынке. Значить, применение ИКТ должно основываться на навыках и достижениях знаний по ИКТ в экономике не только своей страны, но и на других рынках мировой экономики.

English translation

Good whatever time of day it is where you are,

Of course I'm very glad, that you call so much attention to this topic. I would like to share my opinion on the stated questions.

1. *With information technologies becoming more common in agriculture, to what extent can they contribute to poverty reduction and increased food security?* The ability to use information technologies is important for those who really aims to achieve some results using ICTs in their activities. In fact, information technologies are little used in agriculture, because not many agricultural experts are trained to use these technologies in an efficient way. If we assume, that these technologies are intended to indicate or detect the produced volumes of fruit, crops etc., then it is only one part of its use.

2. *What are the specific challenges and bottlenecks for the full realization of Wisdom Agriculture in APEC Economies? How can a conducive policy environment be created?* A conducive policy environment can be created though development of strategic plans for introduction and promoting the wide use of information technologies in agriculture.

3. *Are there any examples of effective applications of ICTs in the agriculture of your economy during the last decade that have had a positive impact on food security and rural livelihoods? What is the status of the use of technologies in your economy, such as the internet of things and agricultural robots?* In our country it is still in its infancy. But I saw the real performance of ICTs in agriculture, when I was living in Japan, South Korea, Canada and in a number of European countries. The main thing is not to go too far, since the use of ICT should be an integrated solution, but not a customized application.

4. How can smallholder farmers benefit from agricultural product traceability systems? Smallholder farmers need to understand one thing: product brings actual high efficiency when it is the most popular in the market. Hence, the use of ICTs should be based on skills and achievements in the field on ICT in the economy not only of their country, but also in other markets of the world.

9. Lal Manavado, University of Oslo affiliate, Norway

The problem we face is not the difficulties we have to overcome if we are going to use information technology as just a tool in agriculture, but the consequences of doing so unless we adapt a holistic approach. The reason for this is quite obvious. Agriculture is an important part of a larger system, and it would be imprudent to improve just a part of a system, hoping that the rest would take care of itself. Therefore, I have made a change in the title of my comments, which however embodies the questions posed in first call for contributions.

Just to emphasise my point, I think we all agree that agriculture is the sub-system at the very top of a food system. But, a food system is a tool devised by man in order to satisfy his nutritional needs.

Unless one could do this, the question of other needs becomes academic. Further, its use enables one to produce enough food reserves to provide one certain degree of food security. Hence, justifiable use of appropriate food systems is the key to adequate global nutrition and food security.

Moreover, hunger and certain types of malnutrition are definite indicators of poverty, and according to the FAO, around 2 billion people are believed to be so affected. So, I think what we need to carefully ascertain here, is how we may use information technology through out food systems with a view to improve global nutrition and enhance food security. Otherwise, our efforts will not be categorically different from making plans to improve transport by trying to get an air bus to use a landing strip meant for a DC-3, the famous Dakota.

Thus, it is possible to identify some principles of usage, before we proceed.

1. Make certain information technology used in different sub-systems of a food system is qualitatively and quantitatively compatible.
2. Ensure that there are a sufficient number of technicians, programmers, maintenance workers, etc., are available at each sub-system.
3. Ensure that the technology in use is the most suitable to perform the specific tasks you have planned to assign to it.
4. Make sure the technology is robust, proven and above all, easy to repair and maintain with the resources at your disposal. Remember that robustness ought to be ascertained not only with respect to durability, but durability under your own local climatic and environmental conditions.
5. Recall the primary purpose of the exercise, viz., better nutrition and food security. Food systems are getting more and more commercialised, hence, tend to adopt automation and other labour-saving methods to increase profits. This entails that fewer will be employed in food systems. You will often find it difficult to reconcile use of these capital-intensive types of food systems with better nutrition and food security, especially if your country has a high rural unemployment rate and migration of youth into urban centra is a serious social issue.
6. So, carefully consider the context and what do you intend to achieve. I do not reject humane and sensible use of information technology in food systems. It is already in use most countries, at least in one or two sub-systems of a food system. For instance, retail shops and restaurants often have an electronic cash register.
7. UHF links needed to wireless WWW and land-lines used for the same purpose require a reliable power supply, skilled technicians for maintenance and spare parts. Moreover, establishment of such a system from the scratch is immensely expensive. If your access to financial resources is limited, investment in railways/roads/canals, food storage facilities, etc., may prove far more effective tools in fighting hunger, providing employment and securing some food security.
8. Do not hesitate to put information technology to the acid test. After all, it is just a tool, and it is you who use it, and not the reverse. If it does not give the result you want, but only a bit of prestige, decide quickly whether you want many of your people to go hungry with prestige, or you want them to be adequately nourished.
9. Do not be mislead by hyperbole in which every new technology is packed. For instance, you may hear that illiterate youth 'can click on icons and get information!' Then, ask exactly how? Is the illiterate youth informed by the appearance of more icons? If so, how can icons express ideas and facts? Beg for an example, and let me know if you hear one! By short videos on 'smart phone' screen? What sort of bandwidth one might need to communicate with 100 illiterate youth by this marvel, especially in a country where there is crying need for basic education? Does not reason demand investment in education here, rather than in IT infra-structure?

10. After all, if you decide to introduce or expand the use of information technology in food systems, do please make certain---

- Employees will not be made redundant
- Changes are introduced gradually.
- Food wastage is cut down.
- Food producers and end-users get a fair deal, and the number of middlemen is reduced to shorten the cost-chain.
- Information technology is not used for speculation in food prices (commodity futures).

Through the past centuries, we have embraced diverse technologies in the name of a nebulous notion, progress, which very successfully hid the real reason for our using technology, viz., making unlimited gain. And now, even the champions of technology are willing to do something about the environmental disasters resulting from the uncritical and inappropriate use of technology in the past. Certainly, information technology cannot harm our environment directly, but it can indeed harm our cognitive abilities making us prone to mind manipulation and loss of critical faculty. Therefore, let us not just remember the past errors, but not make them with this new tool, because the consequences of its misuse could be horrific.

10. Bibhu Santosh Behera, Ouat Bhubaneswar, Odisha, India

Dear UNEP/GFFSN FAO Family Members,

Greetings From Hasinipur Village, Bhadrak, India!

We have collectively worked and invented the method of “Go back to village” in order to support our traditional people’s wisdom in terms of agriculture and village development. Please go through our report, share your views and learn the best innovations. If possible, please support our village and our development activities.

With Best Regards

Bibhu Santosh Behera
Independent People's Scientist
(Climate Smart Extension Education)
Chief Mentor and Patron: "Go back to village" campaign to stop migration and support traditional wisdom

Abstract of the Program
In order to stop migration and to love our traditional wisdom and development of village with villagers this program has been started in Hasinipur Village with a great effort by Bibhu Santosh, a 27 year Young People’s Scientist who is presently a PhD Research Fellow of OUAT, Bhubaneswar and working as an Independent Scientist(Climate Smart Extension Education) for establishing climate smart and agriculture smart villages through extension education approaches by making awareness, campaign, village meetings, road show and street play methods.

Attachment:

http://www.fao.org/fsnforum/sites/default/files/discussions/contributions/Go%20back%20to%20village.docx

11. Edward Mutandwa, UZ, Zimbabwe

It's great to be back after a two-year hiatus. I agree with most of the previous contributors (David Michael, Themba Phiri, Lal Manavado) on the critical role that ICT plays in reducing the transactions cost associated with accessing strategic information, which may, in turn helps to boost productivity and efficiency of resource use.

I, however, wanted to delve on the monitoring and evaluation of ICT projects particularly focusing on project attribution. To illustrate my point, I will randomly pick on two in Sub-Saharan Africa: There are a number of interesting projects that have been developed over the years in East and Southern Africa. In Rwanda, for instance, they have a project called E-Soko, run under the auspices of Rwanda Agricultural Board (RAB) and provides market-based information on prices of various agricultural products. This helps farmers to make informed decisions when selling and buying. Down in Southern Africa, Zimbabwe's Econet has also developed an initiative called "Eco farmer" and it is a platform that seeks to provide a wide array of agricultural information on the farmers' phones. While the impact of such kind of initiatives cannot be denied, there is a possibility of "under/over-estimating" benefits. For example, when a farmer receives information about weather patterns or new crop varieties, it is typical for them to share with other farmers in the community who may have phones but not necessarily participating in such projects. Moreover, they can also share information with others who may not even have phones at all. This implies that if we were to compare "participants" and "non-participants" (i.e. the with and without comparison), we are essentially observing groups of farmers that have been interacting to an extent that the control group now has experienced "information gains" because rural communities tend to be closely knit societies.

This brings me to the question that I would like to pose to other members: what techniques can we use to properly measure the benefits emanating from ICTs?

12. Chuan Gong, China

First of all, I think 'IOT' (*internet of things*) should be the key issue of the wisdom agricultue. Internet application example could be mentioned and the prospects of application of IOT's technology in agriculture as well as the role in promoting scientific and technological progress and industrial development.

13. Xiuming Guo, Agricultural Information Institute of CAAS, China

Wisdom agriculture has made great progress in China. And quite a few projects have been set in some provinces, such as Shandong province, Henan province and Sichuan province.

The county of Henan Shangshui proposed the method for poverty reduction through "internet+wisdom agriculture". On the food security premise, the leader group made a deep thought on how to overcome poverty in 2018. Based on the traditional agriculture big county, the county determined the basic thought through precision poverty reduction: change and update the traditional agriculture using "internet+ agriculture", develop wisdom agriculture. Meanwhile, introduce the handicraft and help the poor women get a job at home, so that they can both take care of the farmland and help reduce poverty.

In Chengdu city of Sichuan province, it proposed "develop wisdom agriculture, push transition and update" in Xieyuan town, it's pushing new town and country build.

In Shandong Zibo city, a wisdom agriculture centre was built, hierarchical platforms were created in every county. Greenhouse vegetable high-standard building is developing quickly, and it has become

one light spot in the agricultural development history of Zibo. Wisdom agriculture is the necessary phase from traditional agriculture to modern agriculture, and it will provide good practise and experience.

14. Jun Hao Li, China

I am very happy to express my opinions here. Over the last 30 years, the high yield of orchard mainly relied on the large input of pesticides and fertilizers. Most of the fertilizer and water resources were not effectively utilized and discarded, resulting in a lot of nutrient loss and environmental pollution. China's traditional agricultural production is still the main mode of production, traditional farming fertilization only by experience, not only a lot of waste of human and material resources, but also a serious threat to environmental protection and soil and water conservation, sustainable development of agriculture to bring serious challenges. Based on real-time and dynamic agricultural information gathering system, the project realizes the real-time monitoring of orchard information in a fast, multi-dimensional and multi-scale way, and realizes the intelligent irrigation, intelligent fertilization and irrigation of farmland based on the information and planting expert knowledge system. Intelligent spraying and other automatic control. Breaking the orchard information access difficulties and the low level of intelligent technology bottlenecks.

15. Yanran Li, China

At present, the majority of fruit production in China relies mainly on human experience to manage, lack of systematic scientific guidance. The development of facility cultivation technology has a far-reaching impact on the process of agricultural modernization. In order to solve the consumption structure of urban and rural residents and increase farmers' income, facilities cultivation has played an important role in promoting the adjustment of agricultural structure. Greenhouse cultivation has played an important role in agricultural production. To achieve a high level of facilities for agricultural production and optimization of facilities for bio-environmental control, access to information is one of the most important key technologies. As a modern information technology based on three (sensor technology, communication technology and computer technology) and the formation of a highly integrated wireless sensor network is a new information acquisition and processing technology. The network consists of a large number of low-energy, low-power smart sensor nodes, which can collaboratively be monitored. The wireless transmission network is transmitted to the base station host and to the user who needs the information. At the same time, the user can send the instruction to the target node through the network to perform the specific task.

16. Xiuming Guo, Agricultural Information Institute of CAAS, China

The production of cereals, the main staple and cash crops for millions of farmers in sub-Saharan Africa (SSA) is severely constrained by parasitic striga weed Striga hermonthica, stemborers and poor soil fertility. A companion cropping system known as ‘push–pull’ overcomes these constraints while providing addi-tional soil fertility and forage grass benefits to smallholder farmers. To ensure the technology’s long-termsustainability in view of the current and further potential aridification as a consequence of climate change,drought-tolerant crops, Brachiaria cv mulato (border crop) and greenleaf desmodium (intercrop), havebeen identified and incorporated into a ‘climate-adapted push–pull’. The aims of the current study wereto evaluate effectiveness of the new system (i) in integrated control of striga and stemborer pests and(ii) in improving maize grain yields, and to evaluate farmers’ perceptions of the technology to assesspotential for further adoption. 395 farmers who had adopted

the technology in drier areas of Kenya, Uganda and Tanzania were randomly selected for the study. Each farmer had a set of two plots, a climate-adapted push–pull and a maize monocrop. Seasonal data were collected in each plot on the number ofemerged striga plants, percentage of maize plants damaged by stemborers, plant height and grain yields.Similarly, farmers' perceptions of the benefits of the technology were assessed using a semi-structuredquestionnaire. There were highly significant reductions in striga and stemborer damage to maize plantsin the climate-adapted push–pull compared to the maize monocrop plots: striga levels were 18 timeslower and stemborer levels were 6 times lower. Similarly, maize plant height and grain yields weresignificantly higher. Mean yields were 2.5 times higher in companion planting plots. Farmers rated theclimate-adapted push–pull significantly superior in reducing striga infestation and stemborer damagerates, and in improving soil fertility and maize grain yields. These results demonstrate that the tech-nology is effective in controlling both weeds and pests with concomitant yield increases under farmers'conditions. It thus provides an opportunity to improve food security, stimulate economic growth, andalleviate poverty in the region while making agriculture more resilient to climate change.

Attachment:

http://www.fao.org/fsnforum/sites/default/files/discussions/contributions/Climate-adapted%20companion%20cropping%20increases%20agricultural%20productivity%20in.pdf

17. Vethaiya Balasubramanian, Freelance consultant, India

Prior to 1990s, we used the one-way rural radios or interactive HAM radios to communicate with farmers. Then came the TVs to spread the technological messages and commodity prices to farmers. Now, the widely spread smart phones are handy to interact with farmers with all sorts of information: up to the minute price updates for commodities of interest in various markets, weather information, advice to farmers on pests and disease incidences and how to control them, showing pest-damage or diseased crops to researchers and getting timely advice on control measures, showing samples of farm produce to dealers or whole salers in various markets and negotiating the price for such commodities, and so on. The introduction of video chatting in WhatsApp will further enhance the face-to-face interaction between different actors in the commodity value chain. Farmers or farmer groups can be effectively linked in the commodity value chain and empowered to deal with produce collectors and dealers, and to procure all the farm inputs at a competitive price. If properly used, all the actors in the value chain will benefit from the appropriate use of the ICTs in agriculture.

18. Jabar Khattak, Agriculture and education, Sweden

I would suggest that poverty and food security can be reduced by providing right information at the right time and right place. Cold storages are needed in order to save our excessive production and reduce the wastage of excess food. If we save a single grain we save a lot. So the developing countries have enriched nutrients gifted soil and only need to save our food by building cold storages. The next step is to build the industry to use and make available the stored food for generations.

19. Dhanya Praveen, Environment Protection Training and Research Institute, Hyderabad, India

Thanks for the opportunity to share and express our views.

Since the Bali Action Plan arised out of COP-13 in December 2007 Information and Communication Technologies (ICTs) gained focus and are used in a number of ways to meet the requirements of climate change adaptation and mitigation.

ICT revolution in India serves as a great support especially to the small and marginal farmers with information, input supplies and marketing. It also facilitates socio-economic development in rural India.

The latest telecom policy also ensures improved broadband penetration in India. Some of the ongoing facilities of ITC in India are- *e-choupal, e procurements, Kisan Kerala, Project Friends, Aaqua, Rice knowledge management portal, e Mitra, Lokavani, e-krishi, Mahindra Kisan Mitra, IFFCO Agri-portal, Village knowledge centers (VKCs), village resource Advisories/centres (VRA/Cs)- Indian Space research organisation*, etc.
Digital Inclusion of farmers, farms, their perceptions, concerns and needs, strategic intervention of ICT in farming systems etc has been launched in Indian agriculture as part of Climate SMART Village projects, however it can go a long way in our country to revive and make the agriculture ecosystem more resilient to climate variability and change.

20. Chuan Gong, China (second contribution)

Inspiring from "4 Secrets to ICTforAg Social and Behavior Change Communication", it describes a ICTforAg project. Most ICTforAg projects have specific behavior change goals. For example, the goal may be for farmers to change their practices to improve soil quality. Or for farmers to adopt a new ICT technology to understand weather patterns.
The Secrets to Social and Behavior Change Communications session focused on integrating social and behavior change communications into ICTforAg project design to help to ensure successful project outcomes, **it does help a lot I think**. The session presenters included:

- PLAN International;
- VOTO Mobile;
- Farm Radio International;
- International Center for Tropical Agriculture (CIAT).

21. Senkosi Kenneth, Forum for Sustainable Agriculture in Africa, Uganda

Dear Moderator,

My contribution to this particular topic will focus on a critical and sensitive challenge.

Indeed, we all embrace the fact that ICT has lots of potential to enhance coordination of agricultural activities at both national and local levels and should be a basic vehicle for generating data to inform policies and development interventions. However, in many African countries, embracing of some ICT options still has a long way to go. Adoption of some ICT options such as UAVs (drones) which are very handy in gathering data over expansive loci in a short time for purposes of agricultural statistics and national planning has met resistance due to security reasons. The challenge is for the promoters to convince governments that while flying UAVs, the focus will only be on agricultural related data and that the resultant imagery will be treated with caution and guarded against landing into unsafe hands. It is, therefore, imperative that deliberate efforts of enhancing the role of ICT in contributing to poverty reduction and enhancing food security should start with the requisite awareness to the

political class. This will stimulate adequate government support in terms of provision of an enabling operational environment.

22. Raymond Erick Zvavanyange, Young Professionals for Agricultural Development, Zimbabwe

Thanks very much for facilitating an important topic on "information and communication technologies (ICTs)" and their relation to efforts aimed at poverty reduction/eradication and increased food security in our world regions. The APEC region reminds me very much of my student-interactions, knowledge and lessons gained during my two-year study experience at National Chung Hsing University in Chinese Taipei and the contrasts I am daily exposed to, in my home country, Zimbabwe, where food and agricultural development is in a realm of its own, beyond the power of imagination to anyone with a keen interest.

I cite the late Kenyan Professor and entomologist, Professor Thomas Risley Odhiambo, who is quoted as having written that [paraphrased], "…the poverty problem is not so much one of lack of access to goods and services [including information and communication technologies] but one of a lack of will and the means to realise that will". His quote has never been truer than now when the world is in full swing with ICTs whose transformative benefits are evident. On the "technology and people/designer pendulum", there are times when it is not about the technology but rather the designers/the people of the technologies, their motifs, aspirations, their world view, and their hope for a better and food secure future. We have somewhat tended to focus more on the technology, forgetting the other end as the "technology and people/designer" pendulum swings.
One of the steps in expanding on the possibilities afforded by ICTs to world citizens should be to revisit our capabilities to spring to action in eliminating "ills" owing to the amplifying nature of ICTs. ICTs present to the human species the limits and extent of our progress, some remarkable and some, on the sidelines. This is a salient message in a recent article on "data and digital services and securing rural and food futures" focusing mainly on the economic dimension/business in the digital economy.
We should continue to explore more opportunities for improving the lives of rural folks, far and above, simply getting them connected. If this is what we have made our noble cause, then our rural folks deserve our honest response on what we can do for them, what we cannot do for them, and (or) what think we might do for them in the near future.

Thanks for your consideration.

Raymond Erick Zvavanyange

23. Boris Karpunin, Russian Federation

Original contribution in Russian

Wisdom Agriculture в виде комплексного применения информационных и коммуникационных технологий (ИКТ) в области сельского хозяйства в конечном итоге должно реализоваться в технологиях роботизированного сельского хозяйства. Возможно, для многих стран мира замена фермерского труда роботами будет не всегда положительным явлением, так как скажется в будущем на занятости сельского населения. Однако для России, где плотность населения, особенно в Сибири и на Дальнем Востоке низка, это не является проблемой. Наоборот, автоматизация и роботизация сельского хозяйства будет способствовать решению следующих проблем:

1. Вовлечение в сельское хозяйство новых территорий и более рациональное использование уже распаханных земель.

2. Реализация на практике российских технологий ландшафтного земледелия, являющихся шагом вперёд по сравнению с современным точным земледелием.

3. Стабильное обеспечение продовольствием населения России и нуждающихся в продуктах питания стран мира.

4. В перспективе – существенное снижение себестоимости продовольствия по сравнению с классическим сельским хозяйством.

Цель роботизированного агросектора можно сформулировать так: «Производство с возможно низкой себестоимостью и оптимальной урожайностью с минимальным влиянием на экологию». Такое производство должно стать производством экологически чистых продуктов.

Работа по созданию роботизированного растениеводства ведётся в первую очередь в разработке программного обеспечения (софт). Обнародованы достижения по разработке роботизированных полевых агрегатов. В настоящее время ведётся разработка софта второго уровня: логистическое обеспечение всех производственных процессов роботизированной фермы от обработки почвы до уборки урожая и его первичной переработки.

English translation

Wisdom Agriculture as an integrated application of information and communication technologies (ICTs) in the field of agriculture should ultimately be executed as robotization in agriculture. Perhaps, for many countries replacement of farm labor by robots is not always a positive thing, as it will affect rural employment in the future. However, it is not a problem for Russia, where the population density (especially in Siberia and the Far East) is low. On the other hand, automation and robotics in agriculture will help to address the following issues:

1. Engagement of new territories in agriculture and more efficient use of plowed lands.

2. Implementation of the Russian landscape-specific agriculture technologies in practice, which is a step forward as compared with modern precision agriculture.

3. Sustainable food supply for the population of Russia and those countries, that need sustenance.

4. In the long term - a significant reduction in food production costs in comparison with traditional agriculture.

The goal of a robotized agriculture can be defined as follows: "Production with the lowest possible cost and optimum yields with minimal impact on environment." Such a production should become a production of environmentally friendly products.

The work on a robotized crop production primarily consists of software design. Achievements in the design of robotic field machinery were made public. Currently the software of the second level is being developed, i.e.: logistics of all production processes of a robotized farm from soil cultivation to harvesting and primary processing.

24. Fei Gao, China

In my opinion, although China has the world's largest agricultural population and the largest area of agricultural facilities, the standard of the production, processing and circulation of agricultural

products is still far from advanced countries. But now we stand at the crossroads. Wisdom agricultural may give us the chance to catch up with advanced countries.

The main problem we faced is how to promote the wisdom agriculture in the country. In our country we don't lack research results about wisdom agriculture. But how many of the results applied to farmers?

I think we can reduce the technical difficulties at the early stage, and strengthen the construction of infrastructure. The labour efficiency of farmers can be improved.

Now we talk much of information technology in agriculture development, and we have to admit that information technology has taken a revolution to agriculture. First, it helped improved the farmer's labour efficiency. Second, it helped the agriculture production management. Third, accuracy. Through sensors all over the globe, we know much about climate, soil, diseases, we can control our behaviour, and grow high quality products.

25. Gao Lois, CAAS, China

The problems of wisdom agricultural sensor technology

Agricultural sensor technology has many technical bottlenecks which seriously restrict the rapid development of wisdom agriculture. First, kinds of China's current agricultural sensor are less than 10% of the world, the sensor price is relatively expensive at this stage, not suitable for ordinary crops. The sensor applicability and coverage are needed to be improved. Second, part of the domestic sensor performance is not stable enough, and often need regular correction. Equipment exposure in the natural environment long-term, will be short life with high maintenance costs. Third, the current sensors developed of plants, soil and gas devices, mostly single and static based on the determination, and lack of dynamic real-time monitoring equipment about growth information, pesticide residues and farmland ecological environment.

Wisdom agriculture is very lack of stable and reliable, low cost, energy saving, environmental adaptability and intelligent equipment and products.

26. Gao Lois, CAAS, China (second contribution)

Agricultural products traceability system is the embodiment of management thinking. And this kind of thought needs to be realized with information technology. Agricultural products can be traced back to the system, so that the production process of agricultural products is more controllable, we can monitor the food production process, so as to ensure the food quality.

In China, the rural farmers are the household contract responsibility system operation mode. It's difficult to obtain the scale efficiency. So how can they benefit from agricultural product traceability systems? I think we should make farmers aware of the importance of food security, as well as what is food security. Then, there should be pioneers to use agricultural product traceability systems. The government should also provide policy and technology support. Found an information base platform, someone may use the platform or technology first. The other people also have the opportunity to enjoy. Through the system, government can monitor the production process. When problems arise, technical personnel can be sent to help farmers solve the problem in time. If the agricultural product in high quality, the government can help farmers sell the product at a good price.

27. Olayemi Samson Sennuga, Royal Agricultural University, Cirencester, United Kingdom

Dear All,

Thank you for this great opportunity.

Please permit to share my research findings with you on the above subject matter. The potential role of ICTs in agriculture cannot be underestimated! Undoubtedly, ICT is the solution to the current economic meltdown around the globe.

I am a PhD researcher from Royal Agricultural University, Cirencester, United Kingdom. I am currently working on the use of ICT (mobile phone) among smallholder farmers and its relevance to sustainable Good Agricultural Practices (GAP) in Nigeria. The study aims is to investigate how ICT (mobile phone) could be better used to improve adoption of Good Agricultural Practices and increase the productivity of smallholders farmers.

I conducted adapted livelihood survey in two rural communities in Kaduna State, Northern Nigeria. On my second visit to the study area I trained 25 farmers per community (called lead farmers) on 16 Good Agricultural Practices (GAP) and asked them to train 3 farmers each. In a nut shell, I trained 200 smallholder farmers using lead farmers extension model and gave them action plan. Moreover, I gave them improved seeds as incentive for participating in the study and also liaise with an NGO who gave farmers fertilizers at a subsidize prices.

In the same vein, I trained 100 smallholder farmers on the effective and efficient use of mobile phone to improve adoption, unlock market prices and increase bargaining skills. Therefore, I have 100 ICT group and 100 non-ICT group. I also presented 14 free mobile phones to farmers without handset to ensure that all ICT group have access to personal mobile phone. In addition, I sent SMS text messages to ICT group every 2 weeks as a reminder to prompt them to follow the action plan.

On 15 October 2016, at the end of the growing season, I went back to the study area to evaluate the impact of the training on adoption and the effectiveness of ICT (mobile phone). To my greatest surprise the GAP intervention made a big difference in the study area. GAP technologies has created rural prosperity and increase the agricultural productivity and incomes of the farmers. Participants recorded 71.6% increase in productivity particular the ICT group. The role of ICT couple with adequate resources cannot be underrated. I also conducted market intelligence in four rural market in the study area to investigate how farmers and traders use ICT (mobile phone) to unlock markets.

I strongly believe that the purpose of any research is to make meaningful contributions to the lives of participants and body of knowledge.

Thank you.

Olayemi Samson Sennuga.
PhD Student, RAU, UK.

Attachment:

http://www.fao.org/fsnforum/sites/default/files/discussions/contributions/Fieldwork%20Photo.docx

28. Peter Steele, Independent consultant, agricultural engineer, Australia

Information and communication technologies and people making choices

Everyone wants to share in that development dream and, according to recent UNDP reporting, the majority of people worldwide are well on their way of achieving it. In the race to develop, however, previous lifestyles and the systems upon which they were once based are being abandoned. Urbanization of human society across the globe is leading change concerning everything and not simply choice of foods and traditional methods of food production.

On micro-scale, there may be value with the resilience of these earlier systems – for those who fail to develop, fail to investment, remain ill-informed and/or fall outside modern trends of socio-economic development. The next generation – living in that town or city, providing services or manufacturing, earning a salary and exploring those personal responsibilities with freedom from archaic systems – is far too busy looking forward to be concerned about the past.

Technologies in the service of people

To the layman, it must seem as if the society around them has divided into two distinct groups of people; those who have embraced the extent of new IC technologies that have become increasingly available (and affordable) during the past 30 years – as the personal computer has taken centre stage in many lives – and those who largely ignore developments of this kind and continue to remain with out-dated (i.e. non-electronic) systems – for all manner of reasons. You can't explore all the variations around this kind of statement in a brief introduction but, by default, those of you reading my contribution will probably be part of the former group; and constantly challenged by the routine updating required of modern systems (and the money needed to do so).

Look around you at the agricultural industries that you represent and, perhaps, note the growing division between those who embrace the changes that developments in IC technology provide and those who continue to ignore them. If you service industries/people in the low-income countries you will know of the need to *'move mountains'* to enable the majority people to participate.

Modern worlds have also become increasingly divided between the *'haves'* and *'have-nots'*; with Gini coefficients that continue to show the dynamics of the changes involved with minorities becoming richer at the expense of the masses. (Check out South Africa, the Seychelles, Haiti and others, for example).[1]

All of which leads to the use of technologies with which to bridge gaps, improve lives, boost efficiency and more – an approach which is accepted by most people notwithstanding the difficulties with taking part. Not for nothing are we living through a period of technical evolution that will change our working and living patterns; the opportunities eventually provided by *'artificial intelligence'* will shape the world around us.

Automated technologies will put people alongside software agents, robots and other services that were previously unimaginable; people and machines in partnership will boost productivity and enable people to work more efficiently – a step up from the machine as simply an alternative to muscle power.

The socio-economic changes that these developments will bring with employment, new industries, and new ways of thinking/investing are already visible in the changes around you – but more obvious in the industrial countries. Previously viable economic sectors have declined leaving behind, for example, the infamous *'rust-belt cities/suburbs'*as one indication of the importance of long-term planning on the part of the national authorities.

Urbanization

So what's changed during the past 50 years; and more so during the past 20 years? In a couple of words: the *'Middle classes'* have been discovered everywhere. Once a feature of the industrial countries, this particular group of people can now be found in all kinds of places where they were once least expected; meaning wherever stability has provided people with opportunities for investing their time, intellect and lives. Middle class people invest in their society; and this comes from the opportunities provided by a reasonably capable government and a buoyant economy.

Check out the report from UNDP[2] of March 2013, and their projections of around half the world's people expected to join the *'middle classes'* by 2020, and ponder the ramifications of more than one million households worldwide with an income of >US$20,000 annually (60% of which will be in Asia). Sure, this report is now more than three years old, but the trends shown remain valid.
The report lists Laos, Mongolia and Bangladesh in addition to India and China. Elsewhere Turkey, Rwanda, Ghana, Mexico and others are shown – in total >30 countries currently considered within that rather out-dated descriptor *'developing countries'* will have shifted appreciably up the socio-economic scale.

And then project forward a few more years to 2030 when estimated 80% of the world's population of middle class people will be expected to be living in those same transition countries. And it doesn't stop there – for the report suggests these same national governments will, collectively, hold more than twice the financial reserves of the industrial countries; in total close on US$7 trillion. Consider the impact that this will have on social development – healthcare, education, empowerment of women and more; and the juxtaposition that this will bring to global investment, decision-making and more.

Passion fruit production in Burundi

Abstract text is one thing, however, reality quite different. Take the example of passion fruit production in Burundi. Two years back we explored value chains in a handful of crops/enterprises including passion fruit that showed investment promise. What constraints existed, what could be done to overcome them, how to boost production and so on.

Constraints and solutions were tabulated within seven complementary sectors one of which was *'Technological/product development'*. In summary, this described the paucity of technical capabilities on the part of growers, producer organizations and those who advised them; people everywhere within the industry remained ill-informed. Change was needed with investment in hardware, training and management; and the adoption of GAPs & GMPs. People needed access to a portal with which to do so. Burundi passion fruit people were recommended to follow selected field practices in Uganda & Kenya with use of mobile phones.

That is easy to say, but hard to do quickly - given the extent of mobile phone use in Burundi. The country has been slow to embrace the use of mobile phones as a means of boosting infrastructure/facilities/information/services available to people outside the main urban areas. Unlike others in the East African Community (EAC) where there are estimated 50 million phones available representing 40 percent penetration of local markets, uptake in Burundi covers <10 percent of the national population (i.e. around 1 million people). The issues are many – high costs, inadequate power supplies, poverty, few private sector investors, etc. Recent membership of the EAC should eventually ensure that the revolution in e-services (including banking, cash-free purchasing, information exchange and more) enjoyed by people elsewhere will eventually become available to people in Burundi[3].

And, whilst Burundi is not yet a member of the 21 Pacific Rim countries that make up the Asia-Pacific Economic Cooperation (APEC) countries, it is worth pointing out that the current five-year investment plan underway (and due for completion 2017) for passion fruit production in Australia was noted -

with emphasis upon public and private sector investment, competition from cheaper fruit producers and the importance of dietary demand and climate change underway.

Timely and high quality information provides the basis for choice; then you need to communicate with people.

Peter Steele

Melbourne

[1] Gini Coefficients. At: https://www.cia.gov/library/publications/the-world-factbook/rankorder/2172rank.html.

[2] UNDP report. There is a useful summary at: http://www.mcclatchydc.com/2013/03/un-predicts-huge-expansion-of.html.

[3] Burundi mobile phones. Information available at: http://www.gesci.org/the-innovative-use-of-mobile-applications-in-east-africa1.html.

29. Yrysbek Abdurasulov, Kyrgyzstan

Original contribution in Russian

В какой степени информационные технологии в сельском хозяйстве могут способствовать снижению масштабов нищеты и повышению продовольственной безопасности, учитывая их все более широкое распространение?

Современные информационные технологии или системы, как и в любой другой отрасли экономики и в сельском хозяйстве, несомненно, будут способствовать снижению масштабов нищеты и повышению продовольственной безопасности в странах АТЭС. Роль ИКТ в сельском хозяйстве на всех уровнях и этапах производства, переработки, транспортировки, хранения и реализации продукции и услуг, в рациональном распределении ресурсов, потенциала, просто, крайне важна. Но, все это довести до Правительств, жителей сельских сообществ, что потребуется немало финансовых, материально -технических, программных средств, организационных и людских ресурсов.

Какие специфические проблемы и сдерживающие факторы стоят на пути полной реализации Wisdom Agriculture в странах-участницах АТЭС? Как создать благоприятные условия для политики?

Специфическим проблемам и сдерживающим факторам на пути полной реализации Wisdom Agriculture стоят прежде всего специфичность самой отрасли –сельского хозяйства: большая зависимость от природно –климатических факторов; технологическая отсталость отрасли; раздробленность сельского хозяйства на мелкие домашние хозяйства (натуральная форма хозяйствования); **деградированность** основных средств производства-земли, пастбищ; низкий образовательный и культурный уровень жителей сельских сообществ и невосприимчивость к новым знаниям и технологиям, то есть традиционный и сильный стереотип и консерватизм; недостаточность финансовых, организационных и людских ресурсов, целенаправленность и недостаточная почва для имплементации современных ИКТ в сферу сельского хозяйства стран АТЭС и еще многие другие проблемы..

Имеются ли примеры эффективного применения ИКТ в сельскохозяйственном секторе экономики вашей страны за последнее десятилетие, которые оказали положительное влияние на продовольственную безопасность и экономическое положение населения

сельских районов? Каков статус использования технологий, таких как «Интернет вещей» и сельскохозяйственные роботы, в вашей стране?

Как таковой, целостной системы современной ИКТ, применение которой за последние десять лет оказали бы положительное влияние на продовольственную безопасность и экономическое положение населения сельских районов в Кыргызстане, пока, нет. Но, в то же время в сельском хозяйстве Кыргызстана идут разработки и внедрение локальных информационных систем в локальные секторы отрасли. Но, они слабы и не существенны и не могут оказать ощутимое влияние на сдвиги в отрасли. Использование «Интернет вещей» в сельскохозяйственных работах еще слабая, только, на уровне оказания консультационных услуг фермерам, в прогнозе погоды и цен на сельхоз продукции на рынках страны. Можно считать очень позитивным проект правительства Норвегии, который создает информационную базу данных на уровне фермерских хозяйств Кыргызстана. По продовольственной безопасности проектом ФАО создана информационная база данных в Кыргызстане, только, проект закончился и она функционирует или нет, не известно.

Какую пользу могут извлечь мелкие фермерские хозяйства от использования сельскохозяйственных систем отслеживания продукции?

Просто, нет здесь слов, колоссальные!! Самое главное, фермеры будут иметь всю информацию, например, по ресурсам (где, что есть (семена, горючее, препараты и др.) и цены на них), спрос и цены на сельскохозяйственную продукцию, переработки и увеличение цепочки добавленной стоимости, новые технологии, обучение и оказание консультационных услуг, управление и многое другое.

English translation

With information technologies becoming more common in agriculture, to what extent can they contribute to poverty reduction and increased food security?

Modern information technologies or systems in agriculture, as well as in any other sector of the economy, will undoubtedly contribute to reducing poverty and improving food security in the APEC countries. The role of ICTs in agriculture at all levels and stages of production, processing, transportation, storage and marketing of products and services, as well as in efficient allocation of resources and capacity-building, is extremely important. But reaching out to the governments and rural people with all of these will require a lot of financial, material and technical, software, organizational and human resources.

What are the specific challenges and bottlenecks for the full realization of Wisdom Agriculture in APEC Economies? How can a conducive policy environment be created?

Specific problems and bottlenecks for the full realisation of Wisdom Agriculture is first of all the specificity of the sector (agriculture): high dependence on natural climatic conditions; technological backwardness of the sector; agricultural sector consists of small households (subsistence agriculture); basic means of production such as land and pastures are degraded; under-education, low cultural level of rural people and resistance to new knowledge and technologies, i.e. traditional and strong stereotype and conservatism; lack of financial, institutional and human resources, lack of focus, no ground for implementation of modern ICTs in the sphere of agriculture in APEC economies, and many other problems…

Are there any examples of effective applications of ICTs in the agriculture of your economy during the last decade that have had a positive impact on food security and rural livelihoods? What is the status of the use of technologies in your economy, such as the internet of things and agricultural robots?

In Kyrgyzstan, an integral modern ICTs system, as such, with effective application for the last decade, that have had a positive impact on food security and rural livelihoods, does not exist. But, at the same time, local ICTs systems are being designed and introduced into local industry sectors of Kyrgyzstan. However, they are weak and insignificant and are unable to materially affect major developments in the sector. The use of internet of things in agricultural work is still weak, it is only used in weather forecasts and forecasts for agricultural prices in the markets of the country. The project of the government of Norway, which is aimed at creating the information database at the smallholders' level in Kyrgyzstan, can be considered a very positive example. The database on food security in Kyrgyzstan was established by the FAO project. But the project is now completed and it's not clear whether the database is still functioning.

How can smallholder farmers benefit from agricultural product traceability systems?

I'm lost for words, colossal opportunities! The most important is that farmers will have all the information, such as in regard to resources (where and what (seeds, fuel, medicines etc.) and what are the prices), demand, and prices on agricultural products and processing, as well as the increase in value chains, new technologies, training and advisory services, management and a lot more.

30. Sinead Quealy, VirtualVet, Ireland

Dear all,

The previous contributions are fascinating and heartening. Wisdom Agriculture embracing ICTs is an exciting opportunity for everyone. A theme I would like to see further explored is the potential for rural job creation in supporting farmers in the use and adoption of ICTs. In my company we are building a knowledge & data collection service which focuses on animal health and drug usage. We want to demonstrate the power of learning from farmers about what works best in their area, gathering data on their farm to allow them to benchmark their performance or warn of nearby animal disease outbreaks etc. through a combination of phone calls, smartphone app and analysis platform. The service is rolled out in local areas using mobile phones as both a means of information exchange, but also a means of social inclusion and outreach, reducing the isolation often felt by farmers, while granting their knowledge & expereince the respect and value they deserve.

31. Cavin Mugarura, Blue Node Media, Uganda

Small holder farmers can benefit from an online marketplace, that links potential buyers and sellers of agricultural produce.

In Uganda, my home country I have seen some efforts to do this, some of these initiatives are donor funded, others are privately owned. The problem with some of the market places I have seen is that they have been poorly designed both from an archeticture aspect and the underlying technology is poorly designed and barely functional.

Some can argue that small farmers will not embrace technology as they are barely literate. This of course holds little or no water. Farmers are organized and you can easily find 1 member in the different farmer and social groups who has a smart phone and can use technologies such as whatsapp.

At Blue Node Media (an I.T. Consulting firm based in the USA and Uganda), we have developed an online marketplace that can help connect farmers find markets. Farmer groups can register and post items for sale, and buyers can reach them. We have made the platform simple, interactive and accessible using low bandwidth.

The platform is very simple to use and we expect it to grow with time. We don't expect instant success, as we in this for the long haul. Unlike other platforms which varnish when the donor funding ends, we have a robust monetization plan that will come into effect, after we start analyzing user behavior.

Cavin Mugarura
Technical Lead / Founder
Blue Node Media
Email: info@bluenodemedia.com
Website: www.bluenodemedia.com

32. Muhammad Makky, Andalas University, Indonesia

Development of small-scale wisdom agriculture for smallholder farmers in West Sumatera Indonesia.

Generally, the ownership of agricultural land in West Sumatera is less than 5000 m2. With limited land, farmers have lesser option on what crop they will produce. Furthermore, similarly to grocery principle, the same farmer will have to put higher investment per M2 compare to larger estate, due to quantity of product they purchase (either fertilizer, herbicides, or farm equipments).

Our work focused on the application of low-cost SMART-precision farming technology to reduce the production cost of these farmers, in particular the needs of seeds, fertilizer or other input components. Although the results may not be as significant as the latest advanced farming technology, it is applicable to small farmers, with some success.

Therefore, in my opinion, "Wisdom Agriculture" is a must for achieving sustainable agriculture. Saving a dollar dollar, the farmer may use their resources for other more beneficial goals, in particular education for their children.

Attachment:

http://www.fao.org/fsnforum/sites/default/files/discussions/contributions/PATPKP_english.zip

33. Salvador Peña, Sinú Verde, Colombia

Original contribution in Spanish

Las tecnologías de la información contribuyen en la planificación, preparación de terrenos, manejo y monitoreo de cultivos y predicción de cosechas. Son muy útiles en otras para realizar una aplicación muy óptima y racional de insumos agrícolas de acuerdo a las características particulares del suelo dentro de un lote y así mismo la aplicación muy racional de químicos para el control de plagas.

El cuello de botella desde mi punto de vista lo veo en el alto costo de la tecnología, tanto de los equipos como de software necesario para el procesamiento de datos. Es muy difícil o casi imposible que un pequeño agricultor tenga el músculo financiero requerido para adquirir tecnología. Has que no exista una política en el tema de incentivo en el uso de estas tecnologías con beneficios tributarios, arancelario y que sea reconocido un valor adicional por parte del consumidor final en los productos origen de agricultura inteligente, veo complicado que se amplíe el uso y aplicación por pequeños y medianos agricultores. Cómo dice un dicho en el país, “es más barato un Mercedes Benz que un tractor agrícola”. Con esa comparación se resume el cuello de botella del agro.

English translation

Information technologies contribute to planning, land preparation, crop management and monitoring, and crop forecasts. They are very helpful in optimising and rationalising the use of agricultural inputs according to the particular features of the soil and the use of chemicals for pest control.

In my opinion the bottleneck lies in the high cost of these technologies, both the equipment and the software required to process the data. For a small farmer, having the necessary financial strength to afford these technologies is very difficult or almost impossible. Until a policy that promotes their use with tax and tariff benefits is adopted and the added value of smart farming products is acknowledged by the final consumer, scaling up their use and implementation by small and medium farmers will be complicated. As the saying goes in this country, "a Mercedes Benz is cheaper than an agricultural tractor". This comparison summarises the agricultural bottleneck.

34. Alastair Marke, Climatekos, United Kingdom

The keys to addressing food security as an interconnected global problem: "sharing" and "collaborating." The digital revolution (or "new green revolution") is creating new capabilities and networks for solving an old problem. To meet ambitious food productivity targets for nine billion mouths, we need to leverage the digital revolution into agricultural innovation against the threat of climate change and the current deficiencies in the agricultural supply chain.

The digital revolution has created access to scientific and market information that was once only available to traders, academics and government officials and that information is increasingly directly available to agricultural producers, even those in remote villages. In fact, food producers are not only beneficiaries but also becoming knowledge creators—using their mobile phones and the latest Internet platforms to swap techniques, share experiences and even mobilize support from global audiences. All of these, in turn, stimulate agricultural innovation by helping spread and adopt best practices.

With open-source code the web creates new opportunities for cooperative solutions to sustainable agriculture at lower cost and higher speed. Sequencing the cassava genome, for example, was once a 13-year task. Today, it can be done in 27 hours. When linked with phenotypes and climatic data observed in the fields, breeders in developing countries can use data derived from digital technologies to predict seedling performance and produce higher-quality yields in shorter cycles.

Other examples of emerging digital initiatives that could help address some issues in the troubled global food system for smallholder farmers include:

1. Seeds4Needs
Issue addressed: Seed and technology patenting
Objective: Led by Biodiversity International since 2009, Seeds4Needs initiative researches how agricultural biodiversity can help minimize cultivation risks associated with climate change. It seeks to identify crop varieties better suited to existing or projected conditions and to strengthen local seed systems accessible for farmers.
Approach: Being piloted as a crowdsourced approach whereby farmers participate in experimentation with climate-resilient varieties of seeds in their own fields as "citizen scientists." Seeds4Needs uses GIS to identify promising seeds and planting materials for field trials by farmers. Farmers then report their observations to researchers through Internet-based technology or mobile telephony, with field weather data collected by iButton sensors.

Progress: Over 6,000 farmers in 11 countries including India, Cambodia, Honduras and Ethiopia, are involved in research on rice, wheat, barley, sweet potato, beans, etc.

2. E-Farming
Issue addressed: Seed and technology patenting
Objective: E-Farming is a text-messaging service in Kenya that has provided farmers with agronomic advice on crop management, fertilizer use and choice of maize varieties to plant since 2011.
Approach: Farmers can register via SMS and indicate their crops of interest and whether they want information on agronomy, soils, fertilizer or pesticide application. They can also choose to send a separate SMS requesting specific information regarding ways to boost food production on their individual farms, costing as little as $0.12 per message.
Progress: Farmers are able to purchase the most appropriate seed and fertilizers when they need them. Maize yields have doubled. Information can reach farmers much more quickly than an extension advisor visit, which is particularly important when heavy rains make road travel in rural areas difficult.

3. M-Farm
Issue addressed: Unfair trading condition
Objective: Against "asymmetry of information," M-Farm is a mobile app-based program developed in Kenya to provide smallholder farmers with market pricing information to help them negotiate fairer crop prices with brokers.
Approach: The service supplies wholesale market price information on 42 crops in five markets (including Nairobi, Mombasa, Kisumu, Eldoret and Nakuru) to farmers via a free mobile phone app or SMS . M-Farm offers farmers the chance to sell their crops as a collective of members in order to increase their leverage. Farmers can also create cost efficiency by pursuing group purchases of seeds and fertilizers simply by using their mobile phones or logging on to the M-Farm website.
Impact: About 5,000 farmers are using M-Farm as a virtual middleman. In some regions, farmers selling collectively more than doubled their return for their produce.

According to a 2012 World Bank report, access to market information through mobile technology has increased farmers' incomes by 16.5-36% in Uganda and 10% in Ghana. A recent Vodafone report estimates a potential $48 billion agricultural income boost in African nations by 2020.

I was the project leader of "Climate-resilient Agriculture & Food Security" at the Global Solution Networks. My white paper examined how the world can solve old food security problems for smallholder farmers in developing countries with new ICT solutions. A couple of case studies were used to illustrate the huge potential of digital innovations. The white paper is attached to this contribution or downloadable free of charge by clicking this
link: http://gsnetworks.org/research_posts/food-security/ .

Attachment:
http://www.fao.org/fsnforum/sites/default/files/discussions/contributions/White%20Paper_FoodSecurity_published.pdf

35. Ernest Bethe, International Finance Corp, Singapore

It is likely to be years (or never) before there is a sufficient, predictable, reliable monetary benefit accrusing to smallholder Farmers from traceability itself; the benefit is likely to be outside of

traceability (perhaps from information coming back from the data, perhaps from linking to a buyer, perhaps from linking to transport, etc).

Smallholder Farmers will benefit from agricultural product traceability systems when their return on the investment of time and money that they have put into the system are considered. Understanding why and how they would use a system is a first step.

36. Rick van der Kamp, Indonesia

The visual for using ICTs in agriculture is becoming increasingly granular - any farmer (in particular smallholders) can have mobile access to detailed, precise information about their farm, and receive specific advise on how to maximize yields. This has the potential to increase yields and production comparable to what the green revolution did in many parts of the world.

With that vision, the obstacles to achieving it are also starting to become known. An important part of it is how to 'chop up' services and information that needs certain agricultural scale in order to be feasible. Creating business models that allow for smaller farms to benefit from high-tech, high investment agri services is a critical part of the puzzle.

If it's relatively easy to identify this as a problem, finding solutions that actually work is a lot harder. The agri world has been working for decades on ways of grouping small farmers together. The current state of most cooperatives does not suggest that this has been cracked yet. Another clear obstacle is finding ways to motivate small farmers to pay for yield-enhancing services. While some countries have made great strides in this area, significant parts of the developing world still work on a 'minimal cash outlay' farming system.

It goes too far - and is probably too early - to start promoting definitive solutions in this area. IFC is working on a number of topics in ICT for agri, which cover traceability, farmer extension, benchmarking and GIS/precision ag. As so often, the real question of success may be shaped more by who is most successful in getting their services adopted, rather than who has the technically most elegant solution.

37. Xiuming Guo, Agricultural Information Institute of CAAS, China

The "APEC Wisdom Agriculture development and application workshop" was held successfully from Nov. 23 to 25 in Yinchuan, Ningxia (China). The workshop invited more than 120 experts and scholars from 8 APEC economies, 5 observing countries, 5 international organization and different provinces in China. Experts from Greece, Korea, Spain, and Canada gave wonderful speeches on wisdom agriculture, precision agriculture, internet & agriculture, and agricultural product traceability. Chinese experts gave speeches on wisdom plants, precision forest, wisdom animal husbandry, crop modelling and wisdom orchard respectively. Experts from different economies showed the research and application progress in their economies and exchanged information on the advanced technologies and achievements.

The workshop has yielded a series of achievements, mainly along four points.

1. Create an APEC wisdom agriculture cooperation network, build a communication and exchange platform for experts.
The information and technologies have already been commonly applied in agriculture, and wisdom agriculture has received more attention from APEC and other regions in the world. The economies and regions faced some common problems regarding wisdom agriculture and there exist also some

differences in wisdom agriculture development and application due to regional variations. The creation of an APEC wisdom agriculture network can help share information, integrate and optimize resources, and promote cooperation and communication.

2. Strengthen long-term cooperation in wisdom agriculture for APEC regions.
The APEC wisdom agriculture workshop can build bridges for researchers and organizations in APEC and other regions in the world and strengthen related cooperation. It also can help apply funds and projects for wisdom agriculture in APEC regions, collectively carry out research in wisdom agriculture, and push the development and application of wisdom agriculture in APEC and other regions.

3. Create an expert database, and promote multilateral cooperation.
An expert database in wisdom agriculture can collect the related information of agricultural experts to support the researchers in wisdom agriculture while strengthening multilateral cooperation in different APEC regions.

4. Promote the research level and application ability of related researchers in wisdom agriculture.
The workshop invited international leading experts in wisdom agriculture to give presentations on the internet of things, big data, intelligent agents, the agricultural product traceability system, the plant growth model, digital orchard, and presented good international application cases of wisdom agriculture in different APEC economies. The workshop supplied advanced knowledge on technologies, helped share good cases, and promoted the research level and application ability of related researchers.

In order to expand the influence of the workshop, this online discussion was held to allow experts from across the world to exchange on wisdom agriculture. This discussion has been very successful in debating some crucial questions and for collecting examples from around the world.

On behalf of agriculture information institute of CAAS, I thank the staff from FAO responsible for the online discussion, my colleague Dr. Bi for her support, YPARD for joining the discussion actively and the colleagues from the Agriculture Information Institute of CAAS for their help. I also thank our partners from the Ningxia Foreign Affairs Office and finally and especially thank Mr. Max Blanck from FAO for his hard and careful work. I appreciate you all for what you have done for the online discussion, without which it would not have been as successful.

38. Pradip Rey, ICAR-AICRP (STCR), Indian Institute of Soil Science, Bhopal, India

Crop cultivation is a complex process and involves a set of activities like land preparation, planting, pest control, irrigation, nutrient management, harvesting, marketing, etc. The entire cycle of crop production requires multitude of information by the farmers. Despite many efforts over the years to disseminate and transfer agriculture knowledge to the stakeholders, large amounts of expertise and knowledge are still out of reach to most of them. Agriculture knowledge may be contained in the corporate database, or it may reside undocumented inside the brain of the researchers or even stored in locations unknown to the majority of the people in the organization. Large sections of the farming community, particularly the rural folk, do not have access to the huge knowledge base acquired by agricultural universities, extension-centers and businesses. In this respect the main challenge is to find this knowledge and apply it to the decision making process involved in agriculture development. The main issue now is for organizations to recognize, locate and utilize this specialized knowledge; currently embedded in organizational databases, processes and routines as a distinct factor of production to increase productivity and competitiveness. Knowledge management is one of the tools

for organizations to achieve the capabilities mentioned above to enable them to remain competitive in this fast changing world.

Knowledge Management Requirements in Agriculture

While formulating Third National Agricultural Policy in 1999, Ministry of Agriculture of Malaysia opined that knowledge is a fluid mix of contextual information, values, experience and rules. Knowledge Management (KM) is a term applied to techniques used for the systematic collection, transfer, security and management of information within organizations [Gerhard, 2006]. Process consists of collecting, organizing, classifying and disseminating information throughout an organization, so as to make it purposeful to those who need it [Albert, 1998]. Knowledge management in general tries to organize and make available important know-how, wherever and whenever it's needed. This includes processes, procedures, patents, reference works, formulas, best practices, forecasts and fixes. Function of knowledge management is to allow an organization to leverage the information resources it has and to support purposeful activity with positive definable outcomes.

To apply these strategies in agriculture domain, there is need to have idea about what are information requirements of the grower, which are not handy and requires application of knowledge management. Information need of farmers during entire cycle of crop production may be broadly categorized [Hasan and Isaac, 2008] into Input procurement and marketing, Strategic Information, Past Trends, and Government Policies.

Input Procurement and Marketing

Farmers frequently seek information regarding various inputs needed in their field such as seed, fertilizers, pesticides, labour, transport, etc in terms of cost, quality, availability and possible sources. Once crop gets ready for harvesting, need arises for its marketing. The questions like; where to sale, when to sale, how to sale and whom to sale mesmerizes the farmers. At this point of time, information provision related to marketing and transportation is must, which may help farmers in decision-making of agriculture product marketing.

Strategic Information

There are several stages where farmer requires information to strengthen the planning and minimizing risk of cultivation. Information related to cultivation practices such as varietal characters, fertigation schedule, pest control methods, irrigation schedule, mechanization, planting and harvesting schedule, inter-cropping, crop rotation, etc may be classified under strategic information. Information about most suitable production and protection technologies is required for optimum and sustainable crop production.

Past Trends

Information on past trends regarding area, production, productivity, consumption, utilization, pest attack, climatic conditions, environmental concerns, fertigation, etc are of immense use in making decision in crop production. For example, past trends in climatic conditions may help growers in scheduling cultivation activities for optimum production and control of stresses.

Government Policy decisions

Government decisions related to agriculture and its products marketing, labour laws, land holdings, rural development etc is also important factors while taking decision. All such information must reach to the farmers at the earliest, so that one may take right decision for high production and maximum return. Many IT tools are available to record and disseminate information for decision support. Making available the information about government policies and support facilities to the farmers in time will empower the farmers in the way to their prosperity.

Harnessing the indigenous technical knowledge

Farmers in different parts of the world especially in poor and marginal indigenous groups of south Asia and Africa are experimenting with the agricultural adaptation measures in response to climatic variability for centuries. There is a wealth of knowledge for a range of measures that can help in developing agri-technologies to overcome climate vulnerabilities. Research works from plateau region clearly demonstrate that indigenous people and their knowledge are central to the adaptive changes for sustainable agriculture using available natural resources essential to face the world's changing climate (Dey and Sarkar, 2011). There is a need to harness and manage such knowledge and fine-tune them to suit the modern needs.

ICT Tools and Techniques for Knowledge Management

Information and communications technologies are an important ingredient of virtually every successful knowledge management program. Sadaan [2001] has identified five essential categories of technology requirement in agricultural research and development for knowledge management viz. business intelligence, collaboration, knowledge transfer, knowledge discovery and expertise location. A variety of ICT tools are available for knowledge management in agriculture. An effective knowledge management in crop production and protection will involve an integrated approach of various ICT tools and techniques. Here we discuss some of key ICT technologies considered for knowledge management in crop cultivation.

Database & Data Warehouse

Database and data warehouse technologies [Chaudhari et al. 2001; Hipsley, 1996; Humpshires, 1999; Ralph, 1998] are used to store and retrieve large amount of data (both text and image) efficiently at affordable cost. Temporal / historical data on crop production, protection and utilization statistics, meteorological facts and pest / disease survey data and other useful data may be managed using these repositories for further analysis and decision support.

Data Mining, OLAP and analytical techniques

Data Mining and OLAP techniques [Ganti et al. 1999; Humpshires, 1999; Monte, 2001; Ralph, 1998] make it possible to extract new finding and meaningful patterns from large historical database. Based on these analytical techniques useful advices can be developed for farmers.

Expert System

An Expert System is an intelligent computer program that uses knowledge and inference procedures to solve problems that are difficult enough to require significant human expertise for their solution. Expert in crop production and protection are the modern extension tools for decision support at farmer level. It can suggest suitable variety, method of field preparation & sowing, irrigation, fertilizer application, etc. Disorder diagnosis and treatment are one of oldest application of expert system.

GIS / GPS

A geographic information system (GIS) integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information. GIS allows us to view, understand, question, interpret, and visualize data in many ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts. Major application of GIS in agriculture includes land use analysis, thematic mapping, demographic analysis, socio-economic studies and environment management.

Internet / Intranet

Internet technology [Agarwal, 1999; Bennett, 1996] has revolutionized the world of information communication. With this the information dissemination to farming community can be made instantaneously in parallel. Further this technology provides a powerful collaboration mechanism for knowledge sharing using WWW, Email, Chatting, News Group, etc.

Simulation and Modeling

Modeling and simulation technology can be used to model an ideal crop situation and predict its growth through extrapolation and other techniques by considering a specific crop environment. Crop Simulation Models [Singh, 1994] can be developed for environmental characterization, optimizing crop management, pest / disease management, impact study of climate change, yield forecasting, effective crop scheduling, etc.

Multimedia Tools
Multimedia means many media – text, video, narrated sound, music, graphics, animations, special effects, etc. which are controlled, coordinated and integrated by a computer. Multimedia is simply multiple forms of media integrated together. Multimedia based Instructional Tools, Encyclopedia, Tutorials, Videos, etc not only give enhancement over text only messages but also improves understanding and retention of information.

Knowledge management initiatives in agriculture domain
The USDA Forest Service and Environmental Protection Agency have cooperatively developed a knowledge base for assessment and monitoring of ecological states and processes in sixth-code watersheds. The knowledge base provides a formal logical specification for evaluating watershed processes, patterns, general effects of human influence, and specific effects on salmon habitat. The system integrates geographic information system and knowledge base system technologies to provide an analytical tool for environmental assessment and monitoring. The basic objective is to improve the quality and completeness of environmental assessments and the efficiency with which they are performed [Reynolds et al. 2000].

FarmNet is a network of rural people and supporting intermediary organizations, such as extension services, using ICTs and conventional communication media to facilitate the generating, gathering and exchanging of knowledge and information. Operated by farmers and their organizations, FarmNet (h*ttp://ftp.fao.org/sd/farmnet.pdf*) links farmers to each other and to the resources and services that they need to improve their livelihoods through agricultural productivity, profitability and food security.

aAQUA is an online multilingual, multimedia Agricultural portal for disseminating information from and to the grassroots of the Indian agricultural community. aAQUA simultaneously addresses two major challenges in farmer outreach programs - geographic reach and customized delivery. It answers farmers queries based on the location, season, crop and other information provided by farmers. Agricultural content repositories (Digital Library), Agri-price information (Bhav Puchiye), farmer schemes and various operations support databases (aAQUA-QoS) have also emerged from the experience of aAQUA deployments. aAQUA's large scale deployment provides avenues for researchers to contribute in the areas of knowledge management, cross-lingual information retrieval, and providing accessible content for rural populations [Ramamritham, 2006].

Wen [2007] presents a knowledge-based intelligent e-commerce system for selling agricultural products. The KIES system not only provides agricultural products sales, financial analysis and sales forecasting, but also provides feasible solutions or actions based on the results of rule-based reasoning. The intelligent system integrates a database, a rule base and a model base to create a tool of which managers can use to deal with decision-making problems via the Internet. For offering convenient delivery and user-friendly services to customers, an e-map combined with a GPS is used.

LPCUBE Wise Agri KM™ is an innovative knowledge management solution designed for the agriculture industry. It enriches research and helps researchers to share knowledge and reuse the lessons learned. The collective knowledge base built using this platform can be used to disseminate right knowledge to the farmers at the right time. It enriches farming and ultimately improves agriculture productivity.

Agricultural Information Management Standards (AIMS), website http://www.fao.org/aims/index.jsp, is a portal whose main objectives are: to facilitate collaboration, partnership and networking among partners by promoting information exchange and knowledge sharing; and to harmonize the decentralized efforts currently taking place in the development of methodologies, standards and applications for management of agricultural information systems; consequently, providing a 'one-stop' access to system designers and implementers.

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39. Thierry Palata, IITA, Democratic Republic of the Congo

Original contribution in French

Les technologies de l'information et de la communication permettent un contact direct rapide entre producteurs et consommateurs dans le secteur agricole.

Elles facilitent l'accès au marché et permet aux agriculteurs d'évacuer rapidement leurs productions en ce sens les nouvelles technologies de l'information et de la communication sont un outil que les agriculteurs peuvent utiliser pour avoir en temps réels toutes les informations sur le marché et adapter leurs produits aux exigences du marché ou des consommateurs.

Les technologies de l'information permettent aussi aux agriculteurs de détecter tôt les maladies des plantes ou autres, d'entrer en contact rapidement avec des spécialistes pour traiter de leurs problèmes ; elles leurs permettent aussi de faire la promotion de leurs produits, de moderniser leurs activités.

Les nouvelles technologies de l'information sont en train de transformer le monde et l'agriculture ne devrait pas rester en dehors de ce changement!

English translation

Information and communication technologies allow a fast direct contact between producers and consumers in the agricultural sector.

These technologies facilitate access to the market and allow farmers to send off their harvests quickly, in this sense the new information and communication technologies are a tool that the farmers can use to have, in real time, all the market data and adapt their products to the demands of the market or the consumers.

Information technologies also enable farmers to detect early plant or other diseases, and to make quick contact with specialists to treat their problems; these technologies also allow users to promote their products and modernize their activities.

These new information technologies are transforming the world and, agriculture should not be excluded from this change.

40. Hamisi Mtimbuka, Sokoine University of Agriculture, United Republic of Tanzania

Based on the African context especially in rural areas whereby there are no internet infrastructures, IT immediately can not have a contribution in agriculture development. Therefore, a certain country must invest in IT technology in rural areas to enable development of agriculture.

41. Djouma Sadou, Program for smallholder competitiveness improvement, Cameroon

The case study of introducing a new ICT technology through cell phone seems to improve efficiency in agricultural marketing in Mali. In fact,first generation of market information systems did not meet the expectations of their promoters. The information produced and made available to users was not reliable enough and reduces its usefulness. It is disseminated without sufficient knowledge of the actors' request

for information. The beneficiaries consider that conventional broadcast channels (radio, television, and paper) provide generic and often inadequate information. The USSD platform of the Sénèkela project tries to remedy this problem by giving access to quasi-personalized market information. At this stage, it registers between 50 and 60 000 monthly subscribers, following its launch in April 2014. However, despite pricing, which is below actual costs, the service carries a risk of excluding low-income users. This pricing principle also threatens the sustainability of the platform.

https://www.google.cm/url?sa=t&rct=j&q=&esrc=s&source=web&cd=5&cad=rja&uact=8&ved=0ahUKEwj2_Ne5otDQAhXjI8AKHTesCcQQtwIIOjAE&url=https%3A%2F%2Fwww.youtube.com%2Fwatch%3Fv%3DlGVM55SWxHU&usg=AFQjCNE8F-pAbXhxtQ_Cc39K1qb3GyFRDQ&sig2=ERvvx2hxdCCQ8bnqvqi5hw&bvm=bv.139782543,d.bGs

Attachment:

http://www.fao.org/fsnforum/sites/default/files/discussions/contributions/actes_jipad_web.pdf

42. Andrea Sánchez Enciso, FAO, Italy

Thank you for sharing all these interesting insights! My name is Andrea and I work as part of the Dimitra Team at FAO: http://www.fao.org/dimitra/dimitra-clubs/en/
I have read with great attention other comments and I would like to add an important perspective to this conversation which is gender and people's empowerment in the design and implementation of development initiatives that focus on ICTs.

The agenda 2030 focuses on "leaving no one behind", including in the area of ICTs. Unfortunately the gender gap in ICTs is still a major concern worldwide. Constraints such as high costs, social norms and illiteracy hinder women's chances to take full advantage of these enablers.

In Sub-Saharan Africa, for example, 64% of women, representing over 300 million, do not own a mobile phone. Even when women have access to mobile phones, their devices tend to be less sophisticated than those of men and their usage is less frequent as most of the time women tend to borrow mobile phones rather than owning them for self-use.

ICTs are great enablers for prosperity and economic growth but should not be considered as a development objective in itself. This means their usage in development initiatives should be accompanied by empowering processes of change that are inclusive and gender-responsive.

I just wanted to make sure this gender dimension is not forgotten when addressing ICTs in rural development. And also mention another geographical context (sub-Saharan Africa) in which FAO has been promoting a gender-transformative participatory communication approach called the Dimitra Clubs. These clubs are groups of rural women and men who meet, discuss their daily challenges and identify solutions together to overcome them. Access to information and networking is facilitated by the use of solar powered radios paired with mobile phones connected into a fleet. Thanks to these clubs, rural women and men and entire rural communities take their own development in hands by identifying their own priorities and implementing local solutions to improve their livelihoods.

An important element of this approach, worth sharing here, is that by combining capacity development processes with the use of ICTs the Dimitra Clubs greatly contribute to people's empowerment, women's leadership, collective action, social cohesion and gender equality.

Today, there are over 45,000 members (two thirds being women) in the 1,530 existing Dimitra Clubs in six countries of Sub-Saharan Africa (Burundi, DR Congo, Ghana, Mali, Niger and Senegal). It is estimated that over one million rural people benefit from the activities of the clubs.

I would like to share a link to some Dimitra videos (in French and English) showcasing the impact of this approach in different areas. http://www.fao.org/dimitra/dimitra-clubs/en/

43. Kien Nguyen Van, Plant Resources Center (PRC), Viet Nam

Dear All,

It is an interesting topic. Basically, ICT is not cheap for the poor and agriculture sector. But it will reduce risk and loss of agriculture sector as well as save resources.

Please imagine that: ICT will provide connection between farmers, distributor and consumer in APEC, provide services of agriculture production and processing including insurance, R@D, value chains, marketing as well as custom, etc

Best regards,

KIEN

Mr. Nguyen Van Kien

Plant Genebank Management Division
Plant Resources Center (PRC)
Address: An Khanh, Hoai Duc, Hanoi, Vietnam

44. Stella Kimambo, FAO, United Republic of Tanzania

Dear FSN Forum members,

Please find in attachment my contribution.

Kind regards

Stella

Attachment:

http://www.fao.org/fsnforum/sites/default/files/discussions/contributions/ICT%20APPLICATION%20IN%20AGRICULTURE_1%20%28002%29.docx