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Adoption of ICT* Enabled Information Systems for Agricultural Development and Rural Viability

(Pre-Conference workshop summary, August 2008)

E. Gelb, A. Maru, J. Brodgen, E. Dodsworth, R. Samii, V. Pesce

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*Information and Communication Technologies

Table of Contents

Abstract

Attaining sustainable agricultural development is a worldwide strategic concern. Information and Communication Technologies (ICT) have a potential to contribute to achieving significant economic, social and environmental benefits. To better understand constraints in ICT adoption for agricultural development, feasible options to reduce these constraints and contribute to developing effective policies for improving use of ICT a workshop sponsored by the Global Forum on Agricultural Research (GFAR). It was titled Adoption of Technological Innovation and Information Technology (IT) for Agricultural Development and organized as a pre-conference event of the AFITA*, IAALD** and WCCA*** joint conference in August, 2008 in Atsugi, Japan****. 35 workshop participants from 21 countries representing a complementary mix of professional competence, international insights, ICT uptake experience, research enthusiasm and political perceptiveness participated in the Workshop. The participants discussed ICT Adoption constraints and options for alleviating them. The issues discussed included policy priorities, resource allocation guidelines, integrating ICT development with end user needs and uptake details. Recommendations and guidelines that emerged from the discussions were focused on:

- policy priorities emphasizing the public sectors' role in ICT Adoption;
- imperative investments in human capital, training and research;
- matching available and innovative ICT to end user needs;
- End User involvement in planning future ICT development and uptake.

These measures were detailed in four conference theme-dedicated, sessions titled: "Extension Service/Rural Development/ICT Adoption/Policy" and were emphasized in the AFITA, IAALD and WCCA joint Conference wrap up plenary and a summary panel session.

** AFITA/EFITA – Asian/European Federation for Information Technology in Agriculture*
** IAALD – International Association of Agricultural Information Specialists*
**** WCCA – World Conference for Computers in Agriculture*
***** Links to workshop presentations are freely available at:*
http://www.egfar.org/egfar/website/new/eventpage?contentId=2533

1. Pre Conference Workshop Background

Allocation of public resources for adoption of technological innovation that contribute to development is an undisputable policy priority globally. Adoption of Technological Innovation for sustainable agricultural development is even more so, especially in countries where agriculture is a major livelihood.

Indication of the magnitude and impact of issues related to agricultural development are detailed in FAO (2008), Bruinsma (2008), Corporate IT (2008), Land Reform in China, (2008) and the following figures from the International Fund for Agricultural Development (IFAD) presented at the Atsugi conference:

- Agriculture is the source of livelihood for 86% of the rural population who in turn encompass half of humanity;
- Agriculture provides 1.3 billion jobs for small-scale farmers and landless workers
- GDP growth generated by agriculture has proven 2-4 times more effective than GDP growth in other sectors
- More than 80% of the decline in worldwide rural poverty from 1993-2002 can be attributed to agricultural results, largely due to technological innovation;
- A majority of the world's poor people will live in rural areas for at least another generation.

Adoption of ICT Enabled Information Systems for Agricultural Development and Rural Viability is a strategic concern worldwide. This has been affirmed through responses to a questionnaire circulated by Gelb between 2006 and 2008 to participants in AFITA, EFITA and other similar professional conferences. Table 1.summarizing the responses quantifies this affirmation.

Table 1. *Do you think there are problems with the uptake of ICT in Agriculture? (%)*

	Montpellier 2001 n=65	Debrecen 2003 n=51	Villa Real 2005 n=60	Glasgow 2007 n=56	AFITA 2006 n=49
Yes	53.2	78.8	96.6	94.4	100.0

(Source: Gelb, Voet, 2008. Summary of the EFITA ICT Adoption Questionnaires)

The ICT cited in the workshops included Internet, Radio, TV, Mobile phones, PDAs, Computers, RFIDs and the multitude of various information systems generated and supported by them.

NASS's 2007 survey results, (Fig. 1) provides reconfirmation that regardless of its importance, ICT Adoption for Agriculture is still far from universal - e.g. even for example in the United States of America.

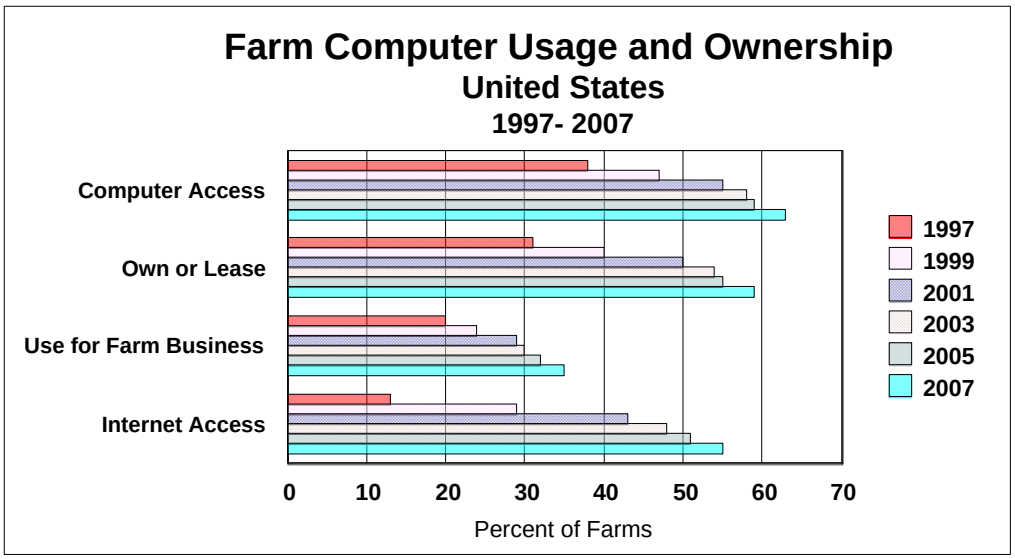

Fig. 1 *US Farm Computer Usage and Ownership. (Source: NASS 2007).*

Effective adoption of Information and Communication Technologies (ICT) now has a proven record in many parts of the world and a demonstrated potential to attain significant economic, social and environmental benefits at local, national and global levels. The past four decades have witnessed numerous attempts to understand the mechanisms of the Adoption of Technological Innovation. Rogers, (1962) provides a general framework, user acceptance of ICT is discussed by Venkatesh et.al. (2003) and the economics of specific agricultural technologies are reviewed by Grilliches, Z, (1957, 1988) and Gelb, Kislev, Voet (1996). A long sequence of studies evaluates and quantifies various aspects of past and current farmer ICT Adoption and uptake constraints - see Gelb, et.al. (1976 - 2008), International Conference (1983), NASS (2007), Taragula, et.al., (2008), van Lierde, Taragola, (2008), Warren (2004), Kuhlmann (2005) and World Bank (2008). Regardless the need for ever better understanding of the following ICT Adoption issues remains as important as ever:

- *Is ICT Adoption in Agriculture unique in its characteristics;*
- *Are there ICT Adoption commonalities between the various agricultural activities, production chains, efficiencies and various countries;*
- *Is ICT Adoption for agricultural production, development and rural viability a public concern;*
- *Do agricultural end users merit a role in ICT development and are the agricultural sector's needs unique;*
- *Is Agricultural Extension, as a public service justified?*

Understanding and alleviating these ICT Adoption constraints is a strategic concern, a public policy priority and a dilemma in allocation of research priority. All these are reviewed in detail in EU study efforts and EU FP7 Priorities by establishment of specific national and international "ICT for Agriculture" entities (e.g. AFITA, EFITA, etc), bi-national seminars, international conferences, the EFITA ICT Adoption Questionnaires Gelb et.al. (2004), development programs and more - see references below. These were

revisited at the Pre-Conference Workshop in light of the Workshop's goal i.e. to provide a venue for an exchange of experience, opinions and solutions on the core issues of Information Systems for Agricultural Development, their adoption constraints and impact.

1.1. The AFITA, IAALD and WCCA World Conference on Agricultural Information and IT

The above Joint Conference was held in August, 2008 in Atsugi, Japan. Appendix A. outlines the Conference details, goals, keywords and expectations. International follow-up activities for addressing the conference issues that are planned for the future include:

- WCCA/PanAFITA2009 with ASAEB from June 22nd-24th in Reno, Nevada, US
- EFITA2009 as JIAC from July 6th-8th, 2009 in Wageningen, Netherlands
- IAALD2010 from April 26th-29th, 2010 in Montpellier, France
- WCCA2010 with CIGR World Congress from June 13th-17th in Quebec, Canada
- AFITA2010 in October or November, 2010 in Indonesia

The Atsugi conference program incorporated a major effort to evaluate "ICT Adoption". The evaluation discussions included a pre-conference workshop titled: *Adoption of ICT Enabled Information Systems for Agricultural Development*; four sessions titled: *"Extension Service /Rural Development/ICT Adoption/Policy"* and a wrap up plenary session which hosted a panel discussion of the workshop and session reviews. The pre conference workshop's goal was to provide a venue for an exchange of experience and opinions while concentrating on core ICT Adoption issues. Subject matter was focused on Information Systems for Agriculture and Agricultural Development, their impact, adoption constraints and measures to improve adoption effectiveness. Discussions examined ICT Adoption policies and resource allocation priorities, various digital divides, rural development, government responsibilities and priorities through a plethora of perspectives, viewpoints and reports from the field. These were integrated with a follow-up review of ICT Adoption insights from the last AFITA conference held in 2006 in Bangloru. These insights were:

- ICT uptake still remains a major problem for agricultural and rural development;
- Consequences for not enabling use of ICT are recognized as serious;
- Economic benefits from ICT use are not always perceived;
- Training on "How to get an economic benefit from ICT" is paramount;
- Public funding for ICT training is justified.

The expected outcome of the pre conference workshop discussions was to take home ideas and recommendations for facilitating the ICT policy priorities for agricultural development, research and measures to alleviate ICT adoption constraints.

There were 35 participants from 21 countries in the workshop. Their combined expertise encompassed a rich mix of professional aptitude and ICT uptake experience. Experience included setting ICT research priorities, in extension and rural community development

The workshop dynamics were geared to elicit recommendations for decision makers – policy makers, research and/or end users. Technical Issues related to ICT were not

discussed in detail although ICT relevance and impact were considered in all theme discussions. In this context future technological developments were at the forefront of workshop presentations and consideration - with an eye on the future – including emerging ICT. For example, the technical specifications of mobile communications, now in the forefront of numerous ICT Adoption programs were not evaluated in the context of agricultural and rural development but their impact was – see discussion below.

2. Workshop Methodology

Subject matter presentations from Asian and European countries and international organizations were invited to achieve the workshop outcome. These presentations were focused on experience as a comprehensive, up to date background for workshop discussions. Soliciting this mixture reflected the recognition that there are significant ICT Adoption commonalities. These commonalities transpose countries with their own unique characteristics. In line with workshop expectations, the content of these presentations was focused on "*Adoption of ICT Enabled Information Systems for Agricultural Development*". Presentation insights were enriched by details of international experience, public policies, their results, country case studies, research, international organizational experience and more.

The invited presentation titles, authors and links to the presentations are detailed in Appendix B. The presentation discussions were grouped as follows:

- *Information Systems for Agricultural Development in a Global Context,*
- *Information Systems for Agricultural Development in National Contexts.*
- *Information Systems for Agricultural Development - General Themes.*

The prerequisites for invited Workshop participation were:

a. Participants be well versed in ICT state of the art details in their country and/or their profession - noting that the workshop will <u>not</u> deal with technical ICT issues;
b. Participants will be currently involved or experienced in development, dissemination and/or implementation of ICT for agricultural production and/or rural viability issues;
c. Participants will have experience in identifying and/or solving ICT Adoption constraints;
d. Participant's purpose of participation in the workshop and the conference "ICT Adoption" summary plenary will be *to take home ideas and recommendations for ICT policy priorities for agricultural development, research and measures to alleviate ICT adoption constraints.*

For a detailed list and contact details of participants see Appendix C.

A summary of the workshop discussions and consensus recommendations are presented below. The target audience for these recommendations is the intricate mix of policy formulators, decision makers, officials, academics, farmers and rural communities. The workshop presentations are freely available see their links in Appendix B.

3. Workshop discussions and key issues

Workshop discussions were lively and enlightening. Based on them, specific comments and insights were collated under the following groupings:

1. People/Community Issues, digital divides, exclusions and interest groups
2. Training and Research
3. Political Issues
4. Adoption Barriers and their alleviation

3.1. People and Community Issues

Throughout the discussions "People/Community" emerged as the most important issue promoting and impeding ICT Adoption for Agricultural production, agricultural development and all aspects ensuring rural viability. Identification and empowering of agents of change was universally accepted as the critical adoption success factor. Rogers (1962) provided a Technological Innovation Adoption framework. NASS's 2008 survey results Fig. 1 e.g. for Internet provided a quantitative framework and guidelines for discussions and comments. Table 2 is an indicative quantification of what farmers think are the main constraints to ICT Adoption. The replies were elicited over time using the EFITA ICT Adoption Questionnaire during the German Agrocomputerage fairs.

Table 2: What are the major constraints to ICT uptake for Agriculture? (%)

	2002 n=291	2005 n=568	2006 n=388	2008 n=257
Cost of technology	*19.2*	*21.3*	*17.5*	*10.9*
Do not understand the value of ICT, awareness	*60.8*	*41.7*	*46.4*	*40.9*
Personal impediments (Illiteracy or ICT skills)	*70.8*	*63.9*	*62.3*	*67.3*

(Source: German Farmer replies from Agrocomputerage "Computers for Agriculture" Fair)

Deliberating how to incorporate "people/community" into the ICT Adoption process elicited a long list of successes and failures. Closer scrutiny brought to light the following issues and constraints:

1. We have to get the "People/community" and "Processes" involved before engaging in efforts to adopt new technologies - ICT Adoption is not an exception;
2. ICT are for Communities not just individuals. This dictates a more holistic view of the ICT Adoption processes;
3. The ICT tools themselves can do nothing. There must be effective participation of the communities as a prerequisite to identify optimal solutions, empower leaders to effectuate them and ensure relevant local content;

4. Strong leadership from the community is essential for the success of any ICT project. Understanding and taking on board the key requirements for users in terms of end user skills, motivation and their realities in terms of access must be factored into the ICT Adoption process;
5. ICT will not necessarily change the lifestyles of the rural communities. Rather they will introduce new methods of doing the same traditional activities and/or enable new activities;
6. There is a crucial need to commence ICT Adoption from a fundamental baseline understanding of the fine points of digital inclusion. This is a critical success factor. Digital divides and digital exclusion details are basic considerations in this context;
7. There is a demonstrable correlation between social and digital exclusion. A significant proportion of the digitally excluded are at risk of deepening social and eventually economic exclusion. This can be extremely disruptive for rural viability and is a major ICT Adoption consideration for agricultural development;
8. Digital exclusion is unlikely to disappear over time through demographic developments alone;
9. Digital exclusion cannot be adequately addressed in isolation from other policy issues. Consequently ICT Adoption policy priorities are a public responsibility;
10. This situation leads in turn to unavoidable lobbying and advocacy. Recognition of this eventuality led to a workshop consensus recommendation: *adopt a bottom-up participatory approach for ICT Adoption efforts;*
11. ICT penetration secured by market forces alone is unlikely to eliminate digital exclusion;
12. ICT development is dashing ahead in technological aspects, in organizational structures and models without a "people's participation" focus. For example agri-food companies now increasingly participate as networked enterprises in e.g. *"multi-dimensional, dynamic and knowledge-based networks"* – which from a "peoples" point of view can be baffling at least;
11. A long list of corrosive Digital Divide groupings was identified. Examples included unequal ICT access options, natural and acquired personal ICT skills, a deep generational divide, gender, personal impediments, tradition etc. Each unique "Divide" dictates a unique approach for solutions effectively bridging over the differences. As a prerequisite the divides must be recognized in order to overcome them. One way to overcome a divide, once identified, is to seek "champions" – agents of change - at all levels. An example would be access to ICT leaders. As articulated in the discussion: "*It is not enough to effect change, as ICT is not panacea; it is about people, about listening to them and understanding their needs*".

3.2. Training and Research

Discussion of "People/Community" inevitably led to evaluation of extension, training, education and research. Specifically the discussion focused on how to link people with available ICT (training), how to customize ICT to be user friendly (research) and how to link all these together. Appendix D reports feedback from the four conference sessions

devoted to these specific issues in detail - namely “Extension Service/Rural Development/ICT Adoption/Policy”. The workshop discussions focused on the following issues:

1. Research has not devoted sufficient time and resources to identify solutions for effective adoption of technological innovation including ICT. This from a theoretical point of view and prioritizing practical solutions for uptake. Discussion recognition of this situation elicited a consensus recommendation: I*nvolve research in specific programs with ICT Adoption as a core issue*.
2. To a large extent there was note of a general feeling of complacency among all actors and Institutions in regard to ICT Adoption in rural areas. A workshop example suggested that “the uptake of ICT has to some extent plateaued in Europe and UK” this despite the fact that comments from the field indicate that “we are still learning”;
3. Such complacency in addition to an acceptance of inadequate “computer literacy” emphasizes the urgency to enhance ICT proficiency of Researchers, Extension, relevant officials and the public at large. The urgency and importance is crucial especially rural communities as a unique entity;
4. In this context allocation of sufficient resources to develop practical and more efficient training programs is essential. ICT adoption by diffusion and spontaneity is pervasive and powerful but insufficient and in many cases counterproductive, A point to consider is that sharing of lessons is not enough, there needs to be willingness to learn from each other;
5. Use of simpler technologies may get better results, can take projects forward and trigger learning that leads to adopting more advanced ICT.
6. ICT is a tool which manages information as well as delivering information – on request and/or unsolicited. In any case the quality and reliability of the information is a definite critical success factor for ICT uptake.
7. Fundamental research elaborating local and global digital divides is crucial. At this early evolutionary stage of the Information Society ICT there are dangers yet to be recognized with measures to counter them yet to be evaluated. A Report on Corporate IT (2008) explores some of the dangers which may have specific impact on rural communities and their economics.
8. There seems to be a lack of cost/benefit evaluation in ICT adoption research. This is especially important considering that there is need to identify measurable benefits, the benefits (and costs) are not always the benefits you expect, there are derived community and stakeholder benefits, financial spill-over and as always the risk of failure;
9. Research into new ways of providing support for farmers is paramount: proposals are missing as is evaluation of the impact of various training incentives for ICT Adoption; too many activities are “Internet biased”; there is excessive “talking” but too little discussion on how to move forward and how to involve end users; there are few if any attempts to formulate and share training and adoption models.
10. In general there is a lack of recognition that Adoption complexity increases with the increased sophistication of ICT development and content. These issues must be significant research priorities – all within the public interest.

11. Exploration and support of the connectivity details of the "next" ICT generation were singled out as an area of significant research priority. The importance of connectivity was focused on the following mobile communications pointers:
    - Digital divides can be addressed through wireless connectivity;
    - Mobile telephony revolution has picked up because it has brought:
        - Ownership enhancement;
        - Adoption and Adaptation of relevant information;
        - Business interest to go to rural areas, as there is money to be made at the "Bottom of the pyramid" – Prahalad (2004);
        - A service to virgin areas – e.g. Africa as a growing market;
        - Convergence between mobile telephony, laptops and PDAs;
    - Mobile telephony provides access to markets. This has strengthened farmers bargaining power, as they now have access to real time information and marketing alternatives;
    - Partnerships - for example public-private partnerships where governments enforce enabling regulations, provide e.g. funding for seed and encourage the private sector to provide ICT infrastructure and technological know-how;
    - Provision of tools that enhance the use of open-source technology.

3.3. ICT Adoption barriers and their alleviation

There were continued references to the multitude of barriers to ICT Adoption throughout the Workshop discussions. The following lists several – not necessarily specific to Agriculture or rural communities. They include

1. The lack of physical and human resource Infrastructure which was repeatedly cited as a major impediment. Comments identifying wireless connectivity as an alleviating factor for example did not contribute to the understanding of this issue since wireless facilities need infrastructure as well. Infrastructure was related to technology in general. Examples included issues such as using simpler, less "infrastructure intensive" technologies which *"…can take projects forward and trigger learning that leads to advanced innovation"*; building ICT infrastructure sustainability into programs from their beginning and ensuring the interests of partners who will, in turn guarantee such sustainability, innovation adoption and environmental issues,
2. Too much innovation can be an obstacle by blocking the use of older technologies which can often be more effective and/or by imposing an unacceptable cost;
3. A few of the barriers were identified explicitly: lack of leadership and/or agents of change, the need to support effective and successful traditions concurrent with adoption of innovations (for example sharing traditional knowledge with ICT supported automatic decision making in green houses), lack of end user and community involvement, lack of political will, conflicting interests, fragmented coordination among donors and failure to adopt participatory measures, uncoordinated strategy and policies, lack of funding, resources and start-up support and more.

4. ICT Adoption based on working within communities takes longer in many cases because of the lack of understanding and awareness of the needs and challenges of small-scale farmers, the lack of understanding what ICT can do including unexpected deviations from initial farmer and community expectations;
5. Numerous other obstacles were mentioned and discussed along with options and ideas to overcome these barriers. They included lack of local and/or suitable information – for example ICT incompatibility with local needs, lack of ICT awareness and training, misguided choice of partners, outdated legal systems, the effort involved in collecting, converting and exchanging necessary data, the administrative burdens required by computerized services (e.g. reporting for the EU subsidy requirements), the inherent possibility for making errors (typos and "wrong" information), decision-support is sub-optimal, lack of transparency, minimal or absence of accountability ("*the computer said...!?!.*"), time consuming data input, and many more.

Discussions indicated options and ideas to overcome these barriers. They included:

6. Ensuring leadership within the political and governmental environment;
7. Developing leadership and agents of change at all levels including communities;
8. Sharing details of successful projects including business opportunities and their benefits;
9. Securing ICT Adoption funding including public/private partnerships.

3.4. Political Issues

Discussions were immediate in understanding that ICT Adoption issues cannot be isolated from the wide range of issues and considerations involved in Agricultural development and rural viability. Workshop discussions also recognized that governments today have no choice but to prioritize agriculture and rural viability as the only sustainable solution to the current, explosive rural migration, the need for ensured food security, food quality and the urgency to minimize environmental abuse. With that noted the following were outlined for consideration and action:

1. ICT Infrastructure for rural areas must be part and parcel of all national infrastructure planning and programs;
2. Utilization of ICT for strengthening the linkages between agricultural policy, research and extension institutions, communities and individuals is a political issue as well as an organizational option. Different types of stakeholders in this context include private and public agricultural service suppliers, small-farmer and other non-governmental organizations, the media and a wide range of other entities involved with agricultural production and all aspects of the rural sector;
3. By the same token digital inclusion must be addressed as an infrastructure policy priority with the understanding that ICT penetration based solely on market forces is unlikely to eliminate digital exclusion;
4. Encompassing digital inclusion can have tangible benefits including a favourable ICT impact on productivity, GDP and quality of life. This is especially important for rural communities during the current generational and technological transition;

5. The need for Public Private Partnerships (PPP) to alleviate funding and resource scarcities for investments in physical and human capital;
6. The need to ensure ICT Adoption Bottom-up and Top-down compatibility;
7. It is a governmental responsibility to ensure embedding of ICT Adoption in
    a. national policies, long term strategies and universal involvement;
    b. mainstream thinking concerning digital inclusion;
    c. professional bodies, NGOs, private initiatives, international collaboration, community responsibilities influencing thinking;
    d. regulations enhancing ICT benefits to business and the public;
    e. the collaboration between the IT sector, government, project managers, rural communities, end users and research;
    f. encouragement and promotion of ICT Adoption partnerships.

4. Workshop Recommendations

The recommendations of the Adoption of ICT Enabled Information Systems for Agricultural Development and Rural Viability Pre-Conference Workshop discussions were a straightforward follow up of the 2006 AFITA Bangloru Conference recommendations. They were concentrated mainly on the need to

- Focus and consolidate all National and public ICT policies, budgets and investments for agriculture and the rural sector;
- Involve all ICT stakeholders in setting of the ICT R&D priorities and the measures needed to attain the successful transfer of these technologies;
- Strengthen the "Agricultural ICT" curriculums in the formal and informal educational and training programs;
- Focus ICT training for teachers/researchers/extension and farmers on practical implementation;
- Link Village Knowledge Centers and agri-clinics to farmer needs. Where possible involve unemployed university graduates in this activity.

The Bangloru conference further singled out specific priorities for future AFITA ICT Adoption activities. The following concerns were emphasized:

- Development of relevant human capital;
- Food production – quantity, quality, sustainability and marketing;
- Water management – at national, regional and farmer levels;
- Dissemination of ICT Innovations as reflected by farmer and rural needs;
- Ensure the compatibility of ICT R&D priorities and end user needs;
- Incorporate rural community viability concerns in strategic ICT Development and Adoption;
- Ensure the coherence of ICT policies at national and regional levels.

These 2006 AFITA insights were reviewed and discussed in detail as background resource material during the 2008 workshop deliberations. The 2008 recommendations accordingly not only reflect these insights but elaborate and expanded them. They were:

1. The planning and implementation of ICT Infrastructure for rural areas must be an integral part of all national infrastructure planning and programs. These to include the integration of ICT implementation as an enabling factor for national polices for sustainable rural viability;
2. ICT Adoption activities as a priority must encompass intimate participation and collaboration of policy makers, ICT research professionals and developers, end users/stakeholders and their respective communities;
3. Public involvement in promoting the uptake of ICT for agricultural development and rural viability must be recognized and prioritized as an additional critical success factor for national policies and their implementation;
4. Digital inclusion must be addressed as a policy priority within all ICT infrastructure issues. There is a clear understanding that ICT penetration based solely on market forces is unlikely to eliminate digital exclusion and in turn impeded the success of the relevant agricultural and rural policies;
5. Traditional "Top down" ICT Adoption dictates are at best partially successful. Coupled with a bottom-up participatory approach for ICT Adoption efforts is highly recommended based as a potential critical success factor;
6. Successful ICT Adoption is conditional on human capital development. This includes more than a comprehensive education curriculum effort. It should involve prioritizing extension and end user involvement in policy formulation, meticulous planning of resource allocation and ultimately assessment of the results based on feedback and evaluation of results;
7. Involve research in prioritizing practical solutions for ICT uptake. Some research pointers for example include:
    - How to construct sector-specific ICT architectures and cross-industry standards;
    - How to use best practice models for specific processes integrations;
    - How to develop sustainable program commitment to rural viability;
    - Involve research in specific programs with ICT Adoption as a major core issue.
8. Identify and focus all ICT Adoption Public Priorities together in a unified effort even if this concept is not part of national routine planning. It is essential to avoid the high cost of diffusion of development and implementation efforts and in turn the excessive waste of scarce human capital and funds;
9. Maintain an ongoing feedback mechanism to help in identifying and focus all ICT development programs. Sharing commonalties and including uptake measures such as incentives, training and involvement of the private sector services can go a long way to secure ICT Adoption success;
10. All agricultural and rural development programs must ensure that ICT compatibility with end user needs and national policies are prominent in their considerations;
11. Increase support for solution-generating collaboration between various national ICT entities (the (country)FITAs), international collaborations such as AFITA, EFITA, etc and the relevant international agencies and organizations including e.g. FAO, GFAR, ISNAR, CIGR, IAALD, IFAD, WFP, INFAD, IBRD, etc.

The following pointers were emphasized in addition to the above workshop recommendations. They were highlighted during the conference plenary wrap-up:

12. Ensure ICT supported Connectivity between individuals, communities and all involved as a top priority for rural and agricultural sector acitivities;
13. Create ICT Adoption Partnerships throughout the agricultural sector, rural communities, stakeholders, service providers and policy makers;
14. Maintain Individuality – including facilitating and supporting ICT agents of change – wherever they may be – in public, private, national and local environments;
15. There is a need for focus in ICT innovation programs – this to avoid an investment and/or oversupply of unnecessary information, investment in the latest rather than the most relevant ICT, adoption of ostentatious/fashionable ICT and more;
16. Ensure ICT benefit sustainability by incorporating proven ICT in innovative ICT Adoption programs for agricultural production and facilitation of rural viability;
17. Enhance ICT Adoption as a priority in sustainable Rural viability development programs;
18. Management of information and its quality are as important as are the measures to assure the uptake of the various ICT providing it to farmers and rural communities;
19. Facilitate End-User Involvement in all ICT development and uptake programs from their earliest possible stages ;
20. ICT should be: Affordable, Scalable, Sensible and Appropriate.

Summary

Adoption of ICT Enabled Information Systems for Agricultural Development and Rural Viability is a strategic issue - part and parcel of agricultural and rural policies. The pre-conference workshop attempted to try and better understand the ICT Adoption issues involved and the barriers to effective ICT uptake for agriculture, agricultural development and rural viability. The composition of participant proficiencies provided a successful mix of competencies for this task. These enabled attainment of the professed workshop goal namely to provide participants with take home ideas and recommendations. The recommendations focused on ICT policy priorities for agricultural and rural development including the research specifically necessary to support them. The results of the workshop deliberations, though ambitious, produced feasible priorities and measures to alleviate ICT adoption constraints and contribute to ensuring sustainable rural viability.

In conclusion the following were considered the core issues for effective ICT Adoption for Agricultural Development and Rural Viability:

- Increased and improved investment in ICT infrastructure and capacity development;
- ICT Training and content development;
- Involvement of end users in ICT development;

- ICT compatibility with stakeholder needs;
- Public involvement in providing ICT services for farmers;
- Collaboration between relevant entities in sharing ICT Adoption experience.

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Appendix A.

The AFITA, IAALD and WCCA August 2008 Conference in Atsugi Japan

http://iaald-afita-wcca2008.org/

6th Conference of the Asian Federation of Information Technology in Agriculture (AFITA)
12th World Congress of the International Association of Agricultural Information Specialists (IAALD)
6th World Congress on Computers in Agriculture (WCCA)

Co-organized by

Conference theme

We believe that advancements in information and communication management, knowledge creation and sharing, and information technologies can contribute to the Agriculture and Rural development and viability. Topics of the conference include but are not limited to:
Information technologies, Information, knowledge and communication activities related to the applied life sciences, including: agriculture, food from production to marketing, natural resources, fish and wildlife, environment, extension, communication, and education.

Introduction

Though the population on the earth has not yet been really exploded, we can see clues of food crisis; that is, the lack of food in some of the developing countries is chronic and even major powers are facing the difficulties to balance the productivity and the environmental requirement. As the balance of the food supply and demand is now inevitably under the strategy of the world trading mechanism and the control of the power, it is almost meaningless to solve the crisis within a country. Only the international sharing and cooperation for sustainable food productivity on the basis of information sharing and mutual understanding could bring the solution.

The Conference will provide an effective forum for agriculture related researchers and information specialists to share and discuss latest development on applications and developments in the use of Information Technologies. These include new applications of well established and understood technologies to innovative and entrepreneurial applications of emerging technologies, in addition to issues related to policy and knowledge dissemination. The Conference will also provide an appropriate forum for agricultural information specialists for information dissemination, exchange and knowledge sharing. It will cover a wide array of topics. The Conference preparations have shown a significant impact in Asian countries and world wide.

First, the information communication technology such as the Internet that is now dynamically changing our life style and social consciousness will provide us a best tool

for the information sharing and mutual communication. Second, we should not forget the possible contribution of information science to effective and stable production by several models such as crop growth prediction and decision support. Thus, the importance of the studies on agro bioscience information and agroinformatics is undoubtedly increasing.

The Asian countries are keeping the highest growth rate in the world and the requirement on food is abruptly changing from quantity to quality. In addition, the Asian countries have their individual agricultural features that are not common in the USA or EU countries. The rice-dependency and the farming scale are the typical examples. In this conference, sharing such common features, researchers, engineers, administrators and farmers who are interested in the informatization of the Asian and world agriculture, will join together, exchange information and discuss about agbioscience information and agroinformatics which will help us to find some key points to solve the world-wide food problems.

The Conference is a precious chance for participants from all over the world to meet and share knowledge on all aspects of agrobioscience information and agroinformatics development. Participants are from diverse background, including practitioners, researchers, educators and policy makers from various disciplines such as computer science, information technology, library and information science, archives, knowledge management, etc.

Conference key words:

ICT policies for rural development; ICT adoption in rural community; e-government; agricultural resources data banks and databases; agricultural information systems; extension service; e-agribusiness, traceability and virtual agri-markets; GAP; digital library, education, training, pedagogical issues and e-learning; intellectual property, security and privacy; social, institutional, and policy issues; decision support systems; remote sensing, GIS, precision farming, sensors; grid, web and communication systems; modeling, pattern recognition, information retrieval, and extraction, data/text/Web mining; social media/Web 2.0 technologies, metadata, standards and cataloging, taxonomy, ontology, the semantic Web; digital preservation, knowledge management; open source tools and frameworks for agricultural information; mobile services; human-computer interaction.

Conference workshops

http://afita.ac.affrc.go.jp/wcca2008/workshops.htm

Appendix B.

Pre Conference Workshop Program – Presentation Titles, Authors and links to presentations

See http://www.egfar.org/egfar/website/new/eventpage?contentId=2533

Workshop First Session – Global aspects

Workshop outline – A.Maru, E. Gelb
Robert W. Fairlie (US) - The Global Digital Divide and the Effects of Technology Use on Educational Outcomes
[Available at http://www.fao.org/docs/eims/upload//257344/Fairlie_presentation.pdf]
Ajit Maru (GFAR) - Adoption of Information and Communications Technologies in Agricultural Research for Development
[Available at http://www.fao.org/docs/eims/upload//257345/Maru_presentation.pdf]
Stephen Rudgard (FAO) - Rural information and communication systems: lessons learned through linking research to extension
[Available at http://www.fao.org/docs/eims/upload//257367/Rudgard_presentation.pdf]

Workshop Second Session – National Aspects

Karl Charvat (**Czech Republic**) – The role of EFITA as an International ICT Organization
[Available at http://www.fao.org/docs/eims/upload//257361/Charvat_presentation.pdf]
Nori Nakamura (Japan) - Review ICT Adoption for Agriculture of surveys in Japan
[Available at]
Virupakshagouda Patil (INSAIT, India) - Web Based Agricultural Extension In India
[Available at http://www.fao.org/docs/eims/upload//257364/Patil_presentation.pdf]
Iraj Namdarian, **(INEA, Italy)** - Italian rural ICT (computer and Internet): deployment and availability at farm and e-government level
[Available at http://www.fao.org/docs/eims/upload//257362/Namdarian_presentation.pdf]
Jenny Brogden (UK) - Government Priorities in Closing Rural Digital Divides
[Available at http://www.fao.org/docs/eims/upload//257360/Brogden_GovprioritiesinDD.pdf]

Workshop Third Session – ICT Adoption Thematic Issues

Sjaak Wolfert (EFITA) Information Sharing in Agri-Food Supply Chain Networks
[Available at http://www.fao.org/docs/eims/upload//257370/Wolfert_presentation.ppt]
Divine Njie (FAO) - The Case of Traceability Systems
[Available at http://www.fao.org/docs/eims/upload//257363/Njie_presentation.pdf]
Roxanna Samii - (IFAD) Role of ICTs as enablers for agriculture and small-scale farmers
[Available at http://www.fao.org/docs/eims/upload//257368/Samii_presentation.pdf]

Workshop and Conference plenary rapporteurs

J. Brodgen, E. Dodsworth, R. Samii and V. Pesce

Appendix C.
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Appendix D

Feedback from the four sessions on Extension Service / Rural Development / ICT Adoption / Policy

Reported by E. Dodsworth

The sessions' presentations covered regional, national, local situations, issues and activities, seen through social, political technical and infrastructure view points. The technologies ranged form the highly specific, for example precision agriculture to adaptation of increasingly common technologies, such as mobile phones.

Overall the use of ICT illustrated that they were valuable in providing information and facts, increasing knowledge sharing and exchanges, facilitating communication; disseminating key messages, informing decision making, all in order to achieve food security and economic growth.

A range of technologies and approaches were described and their type and use was selected on the basis of appropriateness to the needs and expectations of the end user. Literacy levels, gender, language, culture and social norms were considered in choosing the appropriate ICT. Text-based, audio and video communications were channeled through the internet and World Wide Web, radio, TV, mobile phones, PDAs, GPS, GIS, and Radio frequency identification.

The wide ranging use of ICT was seen as a driver of change, especially at the policy level, but questions on whether this is disruptive, and can this be anticipated were raised. Involvement of communities is important, not just as targeted groups but as people who need to trust services and technologies. Thus planning the use and dissemination of ICT and exchange of knowledge should assess what other programs should be integrated. Examples in rural communities illustrated how adoption of ICT was successful when innovation systems approaches had been factored into analysis of the impact of ICT in those communities. For example all relevant stakeholders within the community should be involved. Situation analyses should help identify current behaviors by matching appropriateness of ICT to knowledge needs and must be inclusive. Age of farmers, service providers and policy makers may determine openness to adoption of ICT, whereas disabilities such as blindness and deafness may exclude these sections of communities.

The political issues on adoption use and value of ICT in knowledge exchange, characterised by rapid development are well documented. Consequently investment, capacity and training will continue to be identified as constraints. Calls were made for strengthening national policy environment including clarity on the role of public financing and government responsibilities. Increased investment and prioritization of ICT as part of national curricula will reap benefits by embedding new skills and attitudes in the next generation, the global born digital generation. This can only be achieved by strengthening ICT training for teachers and trainers.

As always knowledge exchange using ICT depends on access to a reliable power supply, Internet access, technical support when necessary, affordability of equipment and of

access to knowledge provider, ability to choose cost effective ICT solutions, and acceptable payment arrangements.

Trust in the content, the knowledge/information, that professionals and communities access and use is paramount. The reliability of the source of information on which decisions are based will be the test of the long term investment in ICT. Ultimately the adoption of ICT will depend on who provides the service, its reliability, objectivity, and can it be trusted?

The challenges facing ICT Adoption include

- Financial sustainability
- Skills development and retention
- Making ICT more intuitive and conversational
- Enriching and diversifying the knowledge base
- Validating local language communications
- Gaining and maintaining trust in the system
- Local information for local use
- The trustworthiness of the content

Comments from the four session's summary session

Reported by R. Samii

- There are weaknesses at global, national, regional and local levels. Although the ICT infrastructure is available and accessible we are missing regulatory and policy frameworks at all these levels;
- ICT can be used as tools to achieve food security and increase economic growth;
- ICT can drive change

The following discussion concluded the four sessions:

Reported by V. Pesce

***C:** Chair moderator- E. Gelb; **Q:** Questions brought up during the discussion,*
***A:** Answers and opinions expressed during the discussion*

Q: Which (ICT) technology do you think will have the best impact on ICT Adoption?
A: Education and communication among people. It is better if Universities educate external people, e.g. extension, rather than the farmers (one external person will then work with several farmers). This is the best way to make information flow.

C: So perhaps the best ICT technology is "Extension" (individuals and/or service).

C: The four previous sessions reviewed Extension and ICT policies focusing on:

- specific technologies
- applications of specific technologies
- comments on policies

Points for discussion include evaluation of "Change", "Farmers" and "ICT Uptake"; ICT Adoption in the context of "Change"; who exactly is going to do what? If it is the responsibility of Extension what is the framework for extension agents?

A: ICT Adoption has got to be at all levels of agricultural production and rural communities. ICT are tools: unless we understand what the tools are for, they are useless. Adoption is closely related to economic growth: what is there for a farmer to use? The farmer has to gain something out of ICT Adoption (improved production, improved income). ICT must be delivering a specific solution for a specific problem, the question about adopting an ICT must be: is it helping a farmer to achieve "something"?

C: Regarding Extension agents as “agents of change”: is there a commonly accepted framework for their activities? Is there a coordinating agency or body? Who is going to synchronize the needs for extension and solutions provided by them?

A: Yes, there is a framework: “Extension agents” are a well established feature - while various ICT are transient.

A: Extension agents and ICT: some Extension agents adapt very well to ICT, some don't want to use them, so sometimes it is even at the agents’ level that ICT are not adopted and the agents themselves are an impediment.

C: We are assuming that if a farmer sees the benefits of ICT adoption they will be adopted but this also depends on the effort required to obtain these benefits.

A: It depends also on the way you communicate the ICT to the farmers; extension agents must be dedicated in these efforts.

A: If a farmer is satisfied with the results of his work, it is hard to make him adopt new technologies even though the farmers’ income can be very variable. While in the former Eastern block countries farmers looked for new technologies, the Western farmers didn't move much because they had already reached a stable situation (an ICT Adoption plateau).

A: People interact at different levels: technologies that connect at low levels of proficiency are “better”. People who work at the same level understand each other: platforms that connect people at the same level are more effective; lack of common language e.g. computer literacy, is one problem.

C: we are talking about the farmer as though this was a unique, well defined identity. In fact, a farmer could be a member of a cooperative, have a university degree etc. Who is this ICT Adopting farmer?

A: It is difficult to talk about the individual: you have to take into account the effect of and on the community. E.g. one person having a telephone may change the community structures and conventions – for example hierarchies and importance of community services and activities.

C: In introducing ICT Adoption to Social order: do ICT flatten out a community hierarchy?

A: They disrupt the hierarchy rather than flatten it. Maybe they flatten out a current pattern, but new hierarchies and power relations would establish themselves in the future.

C: Disruption (or flattening) may be an external driver specifically with ICT Adoption changing an ongoing social evolution pattern.

Q: Younger generations are essentially more ICT literate, but the younger generations might not stay in the rural environment and/or be involved with traditional occupations – e.g. agriculture.

C: Rural communities include non farming individuals and farmers involved in other than farming activities - economic and others - sometimes ICT supported. What opportunities do ICT offer to those who stay in the rural environment?

A: Several. For example the same person can grow a crop and at the same time engage in a non farming or activity, serve another farmer's needs or contribute to the community.

C: Are ICT extension issues a factor for women empowerment in rural areas; is it a mistake to ignore this as a special issue, is gender an important issue.

There were no comments on this point from the participants.

C: One of the problems in slow adoption of ICT is the existence of alternatives. ICT in this case might be marginal.

A: ICT encompasses traditional communication: the best technology has to be the most appropriate means of communication. It is not that ICT can be marginal it is rather that we have to include traditional means of communication in our definition of ICT even at low technology levels.

A: ICT and information skills now are considered one entity, but may be different in the future. An Extension goal should be to elevate farmers who are at different levels to the same level.

A: There is no need to fear rejection of an unsuitable technology if it doesn't work.

A: Many women use Internet successfully. In some cases Internet functions as an Extension service. Maybe there is no need for a local Extension agent in the areas where Extension is done by Internet.

A: Paper may be enough to manage one or two hectares, but if you have to make 10-50 decisions per day you need supporting tools – for example cellular phones, calculators and or computers/services.

A: ICT are required to provide fast solutions in urgent cases

A: Regarding the issue of “magnitude”: ICT might not be needed in small scale production units or markets

C: In all the responses and comments during the sessions there were very few, if any elements of doubt in responses from participants. We seem to have a lot of certainties – with minor reflections mentioning “not knowing what to do”.

A: If we focus only on electronic means we would have doubts, but if we are inclusive, do not put barriers to what ICT is and deal with generalities then I/we are more comfortable with professed certainties!!