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Knowledge Systems: Outcome of the Workshop at Cornell University

The objective of the workshop held at Cornell University in Ithaca, NY, September 30-October 3, 2007, was to identify near-term and medium-term opportunities for strengthening the content of agricultural education/curriculum and information systems to meet the needs of smallholder farmers in areas of the developing world where agriculture lags behind needs. Traditionally called extension, teaching and research, more recently these systems are recognized as complex, interactive activities of knowledge and technology use, generation and exchange among farmers, extension workers, teachers and researchers.

Major workshop objectives were 1) to identify opportunities to give voice and access to smallholders (and their information support systems) using new social networking tools for agricultural content development; and 2) creating a new agricultural education, information and training matrix.

Participants (see list of participants and workshop program at the end of this section) included agricultural scientists with experience in South Asia and Africa, representatives of NGOs specializing in agricultural issues, senior faculty from African, South Asia, European and US universities, agriculture graduate students from Asian and African countries, private sector representatives, representatives from international agriculture organizations, and information technology experts.

The report generated after the workshop was very much a working document. It was quickly compiled so that the ideas and recommendations emerging from discussions could provide a basis for the follow-up workshop in Zambia just six weeks later in November 2007, described in Section 2. Participants at the Cornell workshop were invited to submit two-page project concepts based on the "problem space" and "solution hypotheses" identified in the workshop synthesis (which follows), for consideration at the Zambia workshop. In all, 33 project concepts or "solution scenarios" were submitted. These became the basis for work, discussions and development of full proposals at the Zambia workshop.

Cornell International Workshops on Agricultural Education and Information Systems
Workshop I: Knowledge Systems

Ithaca, New York
30 September – 3 October 2007

I. Introduction

The Design Team would like to thank the participants who came from five continents to assist in the exploration of how agricultural education and information systems could be improved for the ultimate benefit of the smallholder farmer. We were pleased that the workshop participants came from Africa, Europe, North and South America, and South Asia, with balanced male and female participation.

The workshop had a series of background presentations followed by breakout groups to discuss questions posed by the presentations. All participants were assigned to "forepointer" groups which met near the end of workshop deliberations to draft their priority recommendations, available as workshop wiki postings: http://wiki.library.cornell.edu/wiki/display/culpublic/WorldAgInfo+Workshops

At the end of the conference all 13 forepointer groups presented their recommendations to the conference, and 7 were selected for further consideration. The deliberations of these groups will also be posted to the workshop wiki as they are made available.

During the workshop the Design Team continued our own conversations of major information themes identified during site visits to India, Sri Lanka, Mali and Zambia to triangulate some of our principle observations.

The workshop structure included small groups of about 12 to 15 and forepointer groups of 4 persons to allow interaction with a wide range of conference participants. Participants were complimentary about their many opportunities for feedback and collaboration.

We deliberately did not present the participants with possible solutions to encourage their free-flowing creativity. At the end of the workshop, based on the deliberations of the participant groups, the Design Team was able to draft a problems and solutions summary document (below) which forms the basis for a series of specific concept notes being developed for consideration by the Zambia workshop. Cornell workshop participants are being invited to comment on these potential solution scenarios and to suggest others for possible consideration. This is part of what we hope will be a continuing dialogue as we explore new information options for smallholder farmers in South Asia and Africa.

II. Outline of Problem Space and Solution Hypotheses

This outline is broken down by Audience. Ultimately all of these proposed solutions benefit the smallholder farmer. However, they are divided along the lines of the agriculture information chain.

The Design Team's response to this Workshop Synthesis is to draft a series of two-page solution hypotheses. These are expected to be modified and added to in preparation for the Zambia Workshop where they will be discussed and further developed. Not all of the important problems discussed in the Cornell Workshop can be addressed in the present effort. *Issues related to credit as presented in Problem 6 are considered outside the scope of the project.*

First Kilometer Audience 1 – Smallholder farmer (direct)

1. Problem: Agriculture is devalued in primary and secondary education: poorly designed and given undesirable connotations, e.g. agriculture is sometimes used as punishment like detention.

Solution hypothesis 1.1: Enhance the education experience in primary and secondary education by building technology centers in schools where computer/information literacy training is coupled with enhanced agriculture training. Challenge One Laptop Per Child to strike a partnership with NEPAD to put one laptop loaded with agricultural information in every primary school in Africa as a learning tool for students, parents and agricultural workers. http://laptop.org/

2. Problem: Many smallholder farmers are unable to obtain accurate market information.

Solution hypothesis 2.1: Build national and regional agricultural market information systems based on such successful models as:

- **PROMISAM** model in Mali (current cost for Mali system is $250K per year) http://www.aec.msu.edu/fs2/mali_fd_strtgy/index.htm;
- **Manobi-Senegal**, a leading-edge Senegalese business that provides local farmers with up-to-the-minute market prices for their crops through their portable telephones. Manobi-Senegal was named Most Innovative Company and selected overall organizational winner at the African ICT Achievers Awards http://www.manobi.net/ ;
- **Regional Agriculture Trade Expansion Support (RATES)** program, which is designed to increase value/volume of agricultural trade within the East and Southern Africa region and between the region and the rest of the world. http://www.ratescenter.org/about.htm ;
- **tradenet** is a software platform is designed to provide the latest agricultural market information to stakeholders. Accessed via SMS, fax, web, PDAs, farmers and traders can get daily price information, download video/audio files, access research documents, post buy/sell offers to the community, and contact other market participants. Includes smallholders. Intended to make African markets more transparent and efficient, improve intra-regional trading, and provide stakeholders with enough recent and accurate information to make better decisions on bringing products to market. Partners include Technoserve, IFDC, CSIR, FoodNet in Uganda. www.tradenet.bizhttp://www.tradenet.biz/

3. Problem: Delivery of information to smallholder farmers is hampered by limited telecommunications, and related infrastructure.

Solution hypothesis 3.1: Develop radio-based curriculum for smallholders, involving partnership with agricultural universities, extension and other key stakeholders, linked to more content-rich materials at local "telecenters" with toll-free numbers for call in; collection and digitization of information generated from call in programs for use in community resource centers and in menu-driven selection of language and topics to cell phones.

Solution hypothesis 3.2: Rural Knowledge Centers or Farmer Media Centers
Village knowledge centers (telecenters) are a tested approach but need adaptation to link with social networks, farmer to farmer communication and funding for hardware capital investment. These centres will be placed at existing schools or community centres. They would be wired with PCs, photocopies, printers, cell phones, TV, radio, DVD to provide up to date relevant local language information on crop/livestock management; inputs, markets, etc. Strategy would include stakeholder assessment of rural information needs and sources of information, Train staff and SHF on how to effectively use the KCs to access information (See below).
Solution hypothesis 3.3: New Options for Extension, Real-Time and Virtual allowing for sharing of information among smallholder farmers and extension. Smallholders communicate directly with extension agents, researchers, governmental agencies, NGOs, and all other participants. These interactions allow for sharing of training, curriculum development & delivery, organization and advocacy, dissemination of market information. A great example is **aAqua** eAgriService a multilingual online question and answer forum that provides online answers to questions asked by farmers and agri-professionsals over the Internet (mostly farmers use kiosks with PCs to send questions), enabling services with people residing where they are, leveraging existing skill sets and minimizing the need of a separate team.
http://aaqua.persistent.co.in/aaqua/forum/index

4. Problem 4: Farmers do not have access to reliable information about crop production technology, e.g. use of seed, fertilizers, pest control. Information needed in local context.

Solution hypothesis 4.1: Crop specific support networks, e.g. cotton, coffee, tea, e.g. Kenya Tea Development Authority http://www.ktdateas.com/thecompany.asp?pageid=5, Colombian National Coffee Federation
Solution hypothesis 4.2: Multi-faceted capacity building, including on-farm participatory adaptive research, training, implementing field-based activities with poor farmers in partnership with other development organizations, e.g. Sustainable Agriculture Centre for Research and Development in Africa http://www.sacredafrica.org/
Solution hypothesis 4.3: Farmer-to-farmer information sharing; create system of "Tag team" farmer groups led by progressive farmers and coupled with an extension staff person, or video-tape farmers using innovative practices. Cephas Ametefe's work in Ghana, Digital Green in India http://research.microsoft.com/research/tem/dg/talks.htm
Solution hypothesis 4.4: 5,000 knowledge workers (mainly women) are trained and placed in village community to serve as the key hubs for brokering between the information sources, other stakeholders (university, government extension, private sector, and NGOs) and develop information packages to meet the need of smallholders in villages in specific geographic areas and the smallholder farmer. Each knowledge worker is placed at receptive community Farmer Media Centres (FMC) to serve 10-20 villages. The knowledge worker will be a holder of 2 year diploma from an agriculture technical training college. And will work at the centre with the help of an IT support person. Intervention: work with technical college to develop and reform the 2-year diploma curriculum to include courses in information management, dissemination; negation skills; adult literacy; communication; journalism. The IDRC/CIDA project in Nepal, Institutionalizing Gender-responsive Research and Development for Agriculture and Natural Resource Management through Women's Networks, now being replicated with extension systems in Cameroon and Ghana, is an example of how this system could be implemented.
Solution hypothesis 4.5: Expand training courses for input dealers – continuing ed, certified crop advisor programs, e.g. CNFA's work in Malawi, Kenya and Uganda http://cnfa.org/uploads/News_Resources/CNFA_AnnualReport06_web_spread.pdf, also MANAGE in India

5. Problem: Disarticulation of farmers' information sources, production advice and marketing opportunities -- the necessary knowledge to enable people to produce for markets and reach those markets is lacking

Solution hypothesis 5.1: Develop demand-driven training and field advisory services financed by and accountable to members of smallholder producer associations, supporting institutional capacity building through member-defined training and ICT development.

Cooperative approach like the NASFAM model, Maharashtra Grape Producers Association
Solution hypothesis 5.2: Private sector integrated production, credit and marketing system: Cargills' model http://www.cargillsceylon.com/home.html
Solution hypothesis 5.3: Public sector integrated rural development – public sector provides information, credit, market access and risk management
Solution hypothesis 5.4 Support network of smallholder farmer organizations at national, district and zonal levels (as a way to supplement not compete with extension system)
Scan /scope to find existing smallholder farmer groups (50-100 farmer organizations initially with approximately 100, 000 members) Recruit, train and support association-level knowledge broker/extension agent in each association to mediate information flow, access, and linkages among farmer organizations.

6. Problem: (Note: this problem was discussed at the Cornell workshop but is out of scope for further consideration at the Zambia workshop) Farmers lack access to credit, and where credit is available, landless and women often don't quality, interest rates are high, applications are hard to complete, terms are not transparent.

Solution hypothesis 6.1: *Innovative, micro-credit examples besides Grameen and Aga Khan Agency for Microfinance:* ***Warrantage****, is a credit system in which farmers stock their produce at harvest when prices are low with a local entrepreneur and receive cash on credit. Together, they sell the produce about four months later when prices are much higher and achieve up to 40% profitability. The system allows farmers to raise cash to buy farm inputs including fertilizers and improved seeds. 'Warrantage' has been practiced in Asia for many years, but was only recently introduced in the Sudano-Sahelian region of West Africa. Food and Agriculture Organization (FAO) in collaboration with ICRISAT and the International Fertilizer Development Center (IFDC) initiated warrantage to solve farmers' liquidity constraints. This credit system is being popularized with the assistance of over 330 farmers' organizations, some commercial banks, over 20 NGOs and donors.* ***Self-Employed Women's Association*** *(SEWA), Gujarat, India (focuses on illiterate women.* ***SANASA*** *Primary Thrift and Cooperative Credit Societies, Sri Lanka.*

Audience 2 – Extension Community (public, private, NGO)

7. Problem: Traditional information delivery methods have not worked well and are too top down.

Solution hypothesis 7.1: Subject-based extension programs, e.g. Extension demonstration programs based on Integrated Soil Fertility Management
Solution hypothesis 7.2: Problem-based, intensive, time-limited extension programs, e.g., Soil management farmer field schools http://www.fao.org/ag/agl/agll/farmspi/
Solution hypothesis 7.3: Reformed Public Extension Systems in Africa and South Asia (Eicher to expand)
Solution hypothesis 7.4: Competitive "transforming outreach" grants program for innovations in extension and outreach
Solution hypothesis 7.5: Learning communities for agricultural knowledge professionals and rural development practitioners fostered through small grants program to create effective regional (sub-national) networks of agricultural knowledge organizations for coordinated, mutually supporting work to advance smallholder farmer learning and innovation.

8. Problem: Extension professionals lack key skills – ICT, brokering, managerial and leadership.

Solution hypothesis 8.1 Create dynamic educational consortia able to accommodate anticipated changes in the rural sector among universities, technical colleges, vocational schools to train new generation of the extension/outreach professional community.
Solution hypothesis 8.2: Community college model; put on secondary schools, campuses
Solution hypothesis 8.3: Use AGRA as a pilot for public/private partnership in extension in plant breeding training; soils and soil fertility management: agro-dealerships.

Solution hypothesis 8.4: Train extension officers in "hard" management skills to improve their own operations and convey to farmers, e.g. MANAGE India http://www.manage.gov.in/

Audience 3 - Agricultural Universities and Research Networks

9. Problem: The universities in SS Africa are overwhelmed by demand, under-financed, isolated from other agricultural researchers and, lack public appreciation

Solution hypothesis 9.1 Reforming Agricultural Universities and Faculties of Agriculture in Africa and South Asia (Eicher to expand)

10. Problem: Inadequate access to Internet bandwidth prevents universities from gaining access to existing high quality online content.

Solution hypothesis 10.1: Establish reliable high speed Internet access at agricultural universities in Africa by funding and expanding UBUNTU-net and other similar alliances of NRENs.
Solution hypothesis 10.2: Prioritize the availability of adequate high speed Internet access in libraries and computing centers in universities in South Asia
Solution hypothesis 10.3: Agriculture libraries should be retooled and refined so that they can support the generation, organization and dissemination of local digital content relevant to smallholders and train faculty, students in ICT literacy.

11. Problem: Agriculture post-graduate students and faculty do not have access to up-to-date curriculum material, including textbooks, reference material, local and international journals, audiovisual aids, etc.

Solution hypothesis 11.1: develop online delivery systems for agricultural university/extension publications, India agricultural journals online, extension repositories.
Solution hypothesis 11.2: offline textbook/publication collections – solar powered reader?, laptop-based IADP http://www.iadpnet.org/ pilot – pilot in conjunction with MSc AERC program?
Solution hypothesis 11.3: Mirror content dense public access sites, e.g. eldis, "AgPedia" to TEEAL-like offline system
Solution hypothesis 11.4: Develop collection of open access wiki textbooks that can be downloaded or printed on demand.
Solution hypothesis 11.5: Ensure that all researchers have access to international research journals through existing programs, such as TEEAL and AGORA, and where these are not available facilitate access through development of buying consortia and development of library portals

12. Problem: SSA universities have inadequate faculty to provide quality post-graduate education.

Solution hypothesis 12.1: Support existing programs such as regional MSc program in agricultural economics http://www.agropolis.fr/pdf/iipe/bekunda.pdf
Solution hypothesis 12.2: Develop similar regional programs in additional subject areas. Share technical expertise for distance learning delivery.
Solution hypothesis 12.3: Support existing networks of faculty and post-graduate student (MSc) research programs like RUFORUM; http://www.ruforum.org/ in which grad students and faculty are trained as part of peer-reviewed research projects focused on smallholder agriculture to increase number and quality of MSc graduates.
Solution hypothesis 12. 4: Focus this model on women grad students and faculty and fund female grad students

13. Problem: Agricultural curriculum is outdated and not always locally relevant

Solution hypothesis 13.1: "The New Agricultural University" It needs to be developed in multiple configurations to take agricultural research and training, worldwide, to new levels of productivity.

Solution hypothesis 13.2: Harness the human resources and institutional capabilities of the CGIAR to work collaboratively with African partner universities to strengthen master's degree programs in agriculture through the provision of high-quality course contents for distance and traditional education. GO-FAU http://www.openaguniversity.cgiar.org/
Solution 13.3 Draw on such examples in Open Curriculum and Textbook Development: as the The OCW Consortium; The OpenLearn-UK; MIT's OCW in 2002; The BCcampus; The NPTEL Project in Engineering Education, India

Audience 4 – Undergraduate students in agriculture

14. Problem: Agriculture is considered a last choice option for newly enrolling undergraduates. There is a need to make undergraduate agriculture programs relevant and connected to potential employment opportunities.

Solution hypothesis 14.1: Link agriculture undergraduates with interesting internships with private sector like Cargills in Sri Lanka and other examples from India
Solution hypothesis 14.2: Require agriculture students (seniors) to spend 2-4 weeks in rural villages training women and men farmers in the use of appropriate ICT tools and share agricultural information. Increase village-level experiential learning opportunities for students in university agriculture programs.
Solution hypothesis 14.3: Create new colleges of agriculture in each willing African country centered around applied work patterned after EARTH http://www.earth.ac.cr/ing/index.php and the Pan-American College of Agriculture (Zamorano) http://www.zamorano.edu/ingles/index_eng.htm

Audience 5 – Agricultural researchers

15. Problem: Agricultural researchers are not closely linked with farmers, so research is not based on the needs at the farm level, and research information that is relevant to the farmer does not reach the local level.

Solution hypothesis 15.1: Develop competitive grants program for faculty to fund farmer participatory research projects. Require that a percentage of these grants go to women faculty and/or faculty working with women farmers.
Solution hypothesis 15.2: Integrated farmer-extension-research systems
Solution hypothesis 15.3: Link South Asian and African researchers with international research community, e.g. strengthen CGIAR-university linkages

Audience 6 – Multiple

16. Problem: Adequate high quality agricultural information is not readily available or is difficult to locate

Solution hypothesis 16.1: Develop an online platform for delivery of multiple types of information for multiple audiences worldwide – linking information from existing portals, e.g. eldis http://www.eldis.org/go/topics/resource-guides/agriculture This would provide a structure under which a diverse array of activities (many of which are already happening) could take place. The added value is that it would allow these activities to occur in a more systematic and organized manner, wider participation in these activities, more structured access to a corpus of agricultural information, and communication across the levels of the agricultural hierarchy.
Solution hypothesis 16.2: Add concentrated mass of high quality agricultural content to existing systems, including Wikipedia and YouTube. Could focus initially on pilot area such as soil health, IPM, etc.
Solution hypothesis 16.3: Digitize agricultural content from ag universities, research stations, extension offices, etc. and make them available online and in off-line TEEAL-like storage devices.
Solution hypothesis 16.4: Create social networking tools to facilitate communications among participants at all levels of the agricultural structure. Tools need to provide evidence of contagious content generation (diffusion); adoption of practices; content in many local languages.

Solution hypothesis 16.5: To raise the quality and consistency of country policies and strategies in the agricultural sector, ReSAKSS is a new tool that is being built for knowledge systems in Africa. ReSAKSS is a partnership between regional knowledge communities and CG centers in Africa. At country level the main activities will be creation of knowledge communities, building capacity and creating infrastructure for knowledge systems. Protocols and standards for data collection will be developed. End users include farmer associations and private sector. The program will partner with farmers in creating content. http://www.resakss-sa.org/Default.aspx?base

Solution hypothesis 16.6: Regional Technology Centers

3 Solution Scenarios Submitted for Consideration at the Zambia Workshop

1. **Policy Issues**
   a. Building African Support for Agricultural Biotechnology
   b. A Metastructure for Agricultural Research and Development Projects

2. **Agricultural Extension**
   a. Scaling Up the Farmer Field School Extension Model
   b. Creating an Integrated Network of Sub-Regional Innovation Centers
   c. Building National and Regional Agricultural Market Information Systems
   d. Generating Market-Based Systems for Integrated Soil Fertility Management
   e. Fostering Broader Use of Participatory Research
   f. Integrated Farmer-Research-Extension System for R&D Relevant to Small Farmers

3. **Developing Capacity at the Community Level**
   a. Enhancing Real Time Information Delivery to Smallholder Farmers in Africa and South Asia through Community Knowledge Workers
   b. Creating Integrated Information, Extension, Credit and Marketing Cooperatives
   c. Enhancing Agricultural Education in Primary and Secondary Schools
   d. Using Radio to Deliver K-12 Ag Education
   e. Site-Specific Agriculture Based on Farmers' Experience
   f. Enhancing Innovation Capacity and Market Access of Smallholder Farmers in East and Southern Africa

4. **Technologies and Information Exchange Systems (Part 1)**
   a. Creating and Operating a WorldAgInfo System
   b. Establishing Reliable High Speed Internet Access at Agricultural Universities in Africa: the Ubuntu-Net Model
   c. Creating and Operating National Agricultural Information Exchange Points
   d. Expanding African Access to Global Scientific Literature in Agriculture, Environment and Health
   e. Building Online Delivery Systems and Repositories for Agricultural University/Extension Publications and Journals
   f. Delivering Non-Academic Agricultural Content to Support Agricultural Extension Activities

5. **Technologies and Information Exchange Systems (Part 2)**
   a. Developing, Sharing and Delivering Smallholder RadioAgInfo Content
   b. Communicating Agricultural Information via Cell Phones (WorldAgCellPhone)
   c. Using Participatory Radio and Video to Extend Reach of Agricultural Extension Activities.
   d. Using Video to Improve Information and Knowledge Flows from and among Smallholders
   e. Community Radio 2.0
   f. Off the Grid but In the Know: Women's Advancement through Interactive Radio

6. **Gender Issues**
   a. The Economic Empowerment of Women in Agriculture in Africa and South Asia
   b. Developing the Capacity of Extension Officers and Their Organizations to Train, Work with and Support Women Farmers
   c. Five Skill Sets to Develop the Capacity of Women Farmers to Demand and Use Extension Information

7. **Preparing Universties for the New Agriculture**
   a. Market- and Technology-Led Curriculum Enhancement at Agricultural Education Institutions in Africa and South Asia
   b. Preparing Universities in Africa and Asia for the New Agriculture
   c. Developing Online and Offline Textbook Collections to Support Agricultural Curricula
   d. Water Research and Education Network

1a. Building African Support for Agricultural Biotechnology

1. Concept

In Asia smallholders are rapidly expanding the cultivation of GM (Genetically Modified) crops, while smallholders in 50 of the 51 countries in Africa are not currently growing GM crops. The "biotechnology divide" between African and Asian smallholders is attributed to fears over food safety and environmental issues and a general lack of knowledge and outreach capacity to inform African political leaders, farmers and consumers about the complex issues surrounding biotech crops.

Using biotechnology as a core issue and emerging opportunity, this project will help build biotechnology educational and outreach capacity at 25 agricultural universities and Faculties of Agriculture in Africa, and 25 in South Asia which can then be scaled up to include several hundred universities by drawing on the resource-base and experiences of these pilot universities. The full range of information technology will be used to inform smallholder farmers and urban consumers about the Asian and global experience with growing GM crops.

This project will complement a number of ongoing biotech and plant breeding projects that are being supported by the Gates foundation.

2. Rationale and evidence that the project can be successful

Agriculture in Africa and South Asia regions is in transition from production to market-driven systems to meet the goals of maintaining food security and opening new markets through value addition and trade. Along with the local traditional markets, supermarkets are emerging to serve the rapidly growing urban consumers. In addition, research institutions in South Asia and Africa are evaluating new tools of biotechnology, geographic information systems and ICTs for enhancing agricultural productivity and natural resource management. The recent trends around the world demonstrate that local governments and donors are investing to harness benefits from these new tools and technologies (World Bank 2008). Likewise, many universities in Africa are setting up research facilities and new departments of biotechnology to harness these tools.

The curricula in most faculties of agriculture in Africa and South Asia needs reform because it is narrowly focused on scientific/technical aspects of biotechnology and not embracing the legal, regulatory, economic, business, ethical and social aspects of biotechnology (Eicher, Maredia and Sithole-Niang 2006). While the private sector is playing a dominant role in commercializing new biotechnology products, the public educational system has been slow in reforming the curricula and training a large cadre of specialists in diverse areas (law, business, communication, ethics, food safety, environmental safety, trade, etc) that are required before developing countries can secure the legal authorization to launch field trials of new GM crops. The universities in Africa and South Asia are beginning to take positive steps in building their biotechnology programs. But there is a need for a long-term strategic vision on how to use the new tools of ICT for creating a climate of debate on the fears and concerns of the global community over the use of GM crops.

3. Expected benefits of the project including comments on sustainability and scale

The institutional capacity and human resources generated through this project will help revitalize the African universities in terms of their ability to provide better and comprehensive training and education for both academic and non-academic stakeholders including students, extension specialists, NGOs, policy

makers and private sector. This will help in creating greater awareness, understanding and building trust among various stakeholders on the complex regulatory, legal, ethical, and socio-economic and technology transfer issues surrounding new biotechnologies, thus creating an enabling environment for greater acceptance of these technologies by African and South Asian stakeholders.

Investments in universities are required because they are a stable platform for institutionalizing and sustaining educational programs and training beyond the life of this project. The educational programs will be sustained through fee-based short courses offered to a variety of stakeholders.

4. How the project will benefit women smallholders

The project will be implemented as follows:

1. Through a bottom-up approach, a landscape analysis of current biotechnology education, training and outreach programs/curricula and networks in Africa and South Asia will be conducted. The results will be shared with stakeholders though a regional conference in Africa and South Asia.
2. Identify 50 young "Master Trainers" from a minimum of 25 agricultural universities in Africa and 25 in South Asia. To achieve a gender balance of one male and one female trainer, two trainers per university will be identified through a merit-based competitive process.
3. Identify host institutions in Africa and South Asia to provide the required training for master trainers to equip them to offer short courses in biotechnology.
4. Implement training programs through one-year to two-year certificate programs that aim at developing comprehensive curricula and modules in various areas related to agricultural biotechnology, including regulatory, legal, economic, environmental, food safety, business, trade and communication aspects.
5. Upon completion of the program, a team of "Master Trainers" will develop and introduce revised and new courses at 50 pilot universities.
6. The Master Trainers will share their new curricula, educational resources and experiences with 200 other universities in South Asia and Africa using short courses, web-based approaches and on-lines courses targeting both academic and non-academic stakeholders.

5. Project costs of the project

It is estimated that the project will cost $5 million over a five-year period.

6. Measures of Success

- Number of young faculty trained as "Master Trainers"
- Number of public-private sector partnerships developed for biotechnology education
- Number of training modules developed
- Number of on-line courses developed
- Number of new biotechnology and related courses introduced at agricultural universities in Africa and South Asia
- Number of students, extension workers, policy makers, farmer organizations, and media and consumer organization personnel trained

7. Risks

Bureaucratic process of curriculum reforms may delay the introduction of new courses.

References

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3. World Bank. 2008. *World Development Report 2008: Agriculture for Development*. Washington, D.C.: World Bank.

1b. A Metastructure for Agricultural Research and Development Projects

1. Concept

Create an overarching framework for strategic decision-making regarding the relationship between research, experimentation and development projects on technology and social solutions to smallholder information needs. This overarching framework--or "metastructure"--would ensure ways to 1) make transparent the relationships between projects, 2) extract and share information and learning that could benefit multiple projects, and 3) coordinate activities that would create efficiencies and/or enhance the impact of projects.

2. Rationale

Metastructure refers to the overarching framework that supplies rules regarding the relationship between projects within the 'frame.' In this case, the metastructure would help create synergies between projects to enhance mutual project impacts.

The World Agricultural Information Systems (WorldAgInfo) Project was tasked to identify funding opportunities to support information exchange, enhanced decision-making and the exercise of choice as new courses of action unfold for smallholder farmers. The project's Design Team has mapped the smallholder space to identify points of leverage where improved information access could have the most impact. The entire "information supply chain" was deemed critical in this regard.

The final product of the WorldAgInfo project will include a set of proposed high leverage initiatives aimed at various "links" in the information supply chain--from researchers to extension workers to smallholder farmers themselves. These initiatives will likely bear important strategic relationships to each other. For instance, their target audiences may overlap or their technology strategies to link smallholder farmers to information may be similar or mutually enhancing.

Even though the initiatives will be designed to have positive impact on the livelihoods of smallholder farmers in and of themselves, the impacts will likely be enhanced if grantees coordinate at a strategic level to create synergies. Many different organizations and individuals, organized in ad-hoc consortia, will be involved in implementing these initiatives. The initiatives themselves will evolve over time, as they incorporate feedback and learning. In this expanding and evolving landscape, it will be critical to share information and facilitate coordination to ensure that everyone involved understands the evolving relationships between initiatives and points for strategic coordination and information sharing to enhance the impact of the initiatives.

The metastructure would provide a dynamic framework and tools for grantees, but open to other initiatives as well to create synergies between projects. The dynamic framework would help people involved in implementing WorldAgInfo and other related initiatives understand the evolving relationships between them. The tools provided by the metastructure would allow grantees to share information and discuss implications on an ongoing basis.

3. Evidence the project can be successful

There have been numerous examples of grantee conferences where lessons and information are shared and relationships are built. There is also increasing evidence that virtual communities can be effective, for

instance, if they use interactive web-based tools to allow for sharing of information and learning on an ongoing basis. Providing a systematic Metastructure for Agricultural Research and Development Projects will provide feedback and allow for cross-project synergies at relatively low cost.

4. Expected benefits of the project

- Efficient sharing of information for strategic decision-making.
- Improving the quality of the projects by sharing lessons about successes and failures.
- Creating transparency in project implementation and success.
- Sustainability and Scale

The metastructure would initially be funded by the Bill and Melinda Gates Foundation. If organizations involved in the WorldAgInfo initiatives feel that the structure continues to provide value over time, they should provide resources to support the metastructure.

The metastructure can be scaled to create synergies to other relevant initiatives--for instance, FAO's e-Agriculture project.

Providing a systematic Metastructure for Agricultural Research and Development Projects will provide ongoing, systematic opportunities for synergism. The metastructure could also be equipped with resources for additional funding for cooperative initiatives.

5. Projected costs of the project

- Staff support to facilitate dialogue and information sharing, and to develop tools
- Periodic in-person meetings, as needed
- Web development, software and server space
- Challenge grants to encourage cooperation
- Feedback, evaluation, and redirection funds

6. Measures of success

- Leaders of initiatives are fully aware of activities of other relevant initiatives and make strategic decisions to improve effectiveness and avoid duplication
- Synergies between initiatives are identified and action taken to capitalize on synergies
- Initiatives take ownership of the metastructure and provide ongoing support

7. Risks

- Incentives to devote time and effort to sharing information either on-line or in person
- Possible need to provide training, tech support and funding to staff of initiatives to ensure their ability and willingness to use tools for sharing information (related to first item)
- Who manages the structure and to whom are they accountable?
- Overcoming reluctance to share information, exposing weaknesses or to share competitive advantage

2a. Scaling Up the Farmer Field School Extension Model

1. Concept

Agricultural extension is back on the development agenda, and two recent literature reviews on extension have agreed that the performance of the Farmer Field School Model is the central "extension question" in discussions in developing countries and among donor agencies (Anderson 2007; Eicher 2007). Proponents of the FFS Model claim that the model is used in projects or national systems in 50 to 70 countries. However, skeptics report that the number is inflated because the model has been used in a number of countries and then dropped because of three reasons: limited farmer to farmer (multiplier) impact; the lack of financial sustainability, and lack of tested ICT innovations that have been useful in scaling up FFSs in different countries.

The parallels between the FFS and T&V (Training and Visit) models are instructive. After donors invested $3 billion in T&V projects in 70 countries over the 1975- 95 period, the World Bank concluded that the model was 25 percent more expensive than the traditional government extension model in Ministries of Agriculture. As a result, donors terminated their support to the T&V model. This helps explain why action research is needed now on the process of institutionalizing FFS in different countries.

2. Rationale and evidence that the project can be successful

The Farmer Field School (FFS) model emerged in East Asia in the 1980s when extension workers offered advice to farmers on using IPM (Integrated Pest Management) techniques to control pests in rice mono-cropping areas in the Philippines and Indonesia. The model was remarkably effective in reducing pesticide use on farms in these two countries. The FFS model is reported to be used in around 50 to 70 developing countries. However, there is a lack of solid information about the scope of FFS programs. For example, a recent study of extension in Vietnam reported that after 15 years of experimenting with FFS and despite convincing impact at the farmer level, the model has not been mainstreamed into the national extension system. Other studies report that farmers completing a school are reported to have limited success in spreading the new technology to their neighbors.

It is now timely to address three interrelated questions: Do farmers who have completed a school (normally farmers attend a 'school' in the same farmer's field one half day a week for 12 to 15 weeks of the growing season) use this knowledge to achieve higher crop yields and increased agricultural productivity? Do farmers who have attended the schools pass new knowledge on to their neighbors? Is the model financially sustainable?

3. Expected benefits of the project including comments on sustainability and scale

Over the past 15 years, Asia has made significant strides in reforming its public extension systems (Sulaiman et al., 2006). Despite these reforms, there has been a limited flow of knowledge about East Asia's experience to Africa because the "package " model and the FFS models were in use in East Asia one to two decades earlier than FFS projects in Africa. There are a number of complementary approaches to studying scaling up the FFS model. One lesson that has been learned is to avoid using the "returns to investments in extension or research" because of the heroic assumptions that one has to use about the diffusion process and the dubious results of this type of research on scaling up extension. Farm level surveys can answer some questions such as the impact on economic empowerment of women. Likewise, the diffusion model can be helpful in determining the farmer to farmer flow of information (Rogers)

and agricultural innovation studies by Roling and Hall. Since successful institution building involves the process of crafting a system of institutions over time, the use of economic history is critical to understanding why, how and when institutions have been modified.

This action research project will be carried out in East Asia, South Asia, and Africa (probably Uganda, Kenya and Burkina Faso). The research issues are complex and they will require three to five years of action studies. One important question that donors are asking is how to define and measure fiscal sustainability because it is often held up as the Achilles' heel of the FFS model. Sustainability can be defined as the government's willingness and ability to sustain this form of intervention over the longer term within its own budget process. An evaluation of the fiscal sustainability of FFS does not require farm level surveys. It is possible to get fairly reliable judgments by simply collecting aggregate information about the extent of field school activities in areas that had in the past had an FFS project funded by a donor for several years and where donor funding is not present any more. For example, the EU-funded Cotton (FFS) IPM project in Asia was closed in early 2005. It will be relatively simple to compare field school activity with a level of FFS activity when the project was donor funded.

Since donors play such an important role in determining the institutional models to use in agricultural development, it will be important to conduct a survey in Indonesia rice growing areas to check the level of FFS activity, now some 5-8 years since donor funding for rice has ended. The World Bank project was closed in 1999, and the FAO project was closed in 2000.

4. How the project will benefit women smallholders

The three countries in East Africa (Kenya, Uganda and Burkina Faso) could be examined by dividing the male and female households and carrying out traditional surveys to determine the ability of male and female households to acquire land, credit, markets and education.

5. Projected costs of the project

US $5 million over five years.

6. Measures of success

- A number of FFS villages pursuing FFS model over a specified period of time.
- Institutional innovations that have improved the performance of the extension.
- Data on farmer to farmer (multiplier impact).
- Fiscal sustainability.

7. Risks

Difficulties in acquiring data on the historical experience of FFS schools in East Asia in the 1990s.

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2b. Creating an Integrated Network of Sub-Regional Innovation Centers

1. Concept

Create an integrated network of "Sub-Regional Innovation Centers" (RICs) which will conduct action research and experimentation on technology and social solutions to smallholder information needs with special emphasis on the needs of women. RICs would pioneer new ways to 1) collect, digitize and assemble information from expert sources as well as smallholders themselves, 2) extract useable information from research data bases and other largely internet-based sources, and 3) disseminate information directly to smallholders and others in the smallholder information supply chain.

The RIC mission would be threefold: 1) Scan and define new socio-tech opportunities including those which would require advance funding to develop, 2) develop and support a regional network of community knowledge workers who are capable of accessing and disseminating basic agricultural support information in their community, 3) implement promising technological opportunities supported by training of the key participants in the information supply system.

2. Rationale

The smallholder information supply chain is broken and very likely in worse shape that it was decades ago. Universities in Africa and South Asia lack the funds to deliver even the most rudimentary ICT services. Research centers lack connectivity, functioning hardware, and the resident skills to tap into the wide array of knowledge bases which are available or will be soon. Extension officers are stretched, routinely relying upon outdated sources of information and lacking the resources and time to make regular visits to their constituencies.

At the same time, global technological and social innovations are occurring at an accelerating pace, requiring a real-time scanning capability for new opportunities. This includes both new ways to support existing targets of agricultural information, as well as to continuously monitor the opportunities for providing new levels (i.e., community knowledge workers and smallholders) with direct information access.

One pilot Sub-Regional Innovation Center in Africa would be established to start, and additionally, one RIC would be established in South Asia. While the RICs would be located regionally, they would serve a primary audience and network in the country in which they are located. In this sense, the initial two would serve as pilots with the intent to scale the concept to further areas in coming years. RICs in both South Asia and Africa would be networked together (themselves forming a learning community) to foster cross-border transfer of knowledge.

RICs will share a common mission, but will be empowered to experiment boldly, allowing them to undertake very different initiatives to be tested simultaneously in different regions. They might also acquire or be assigned some areas of specialty (centers of excellence) so that although they would operate under a common framework, each would develop and offer special expertise in unique areas.

Each center will meld state-of-the-art social concepts (such as learning organization principles, network organizations, empowerment, voice, collaboration, etc.) with state-of-the-art ICT (such as web 2.0, mobile phones, GIS, collaborative software) emphasizing solutions that may be hi or low tech, but always grounded in the needs and world-reality of the smallholders and their supporting information supply chain.

A regional center in Zambia, for example, could include TEEAL, AGORA etc. as basic sources of information to diffuse in Anglophone Africa. The Center could promote pilot studies of ICT innovations and channel farmers' voices to the input, marketing and research communities. The RICs would undertake the training of extension workers and farm organizations on new sources of information. They could also bring librarians together and promote an Asian/African exchange of experiences. The result will be a system of demand driven innovations to meet agricultural productivity and food security goals.

Staffing

RICs will be staffed in a variety of non-conventional ways to accomplish two objectives: 1) increase the pool of talent to which they have access, and 2) train and develop resources which will return to various agricultural sectors with new skills and talents.

Ongoing Employees - The RICs will be comprised of a combination of technical people, educators, agricultural experts, anthropological development specialists, etc. working together to help smallholders improve their livelihoods. To make these more easily saleable, RICs will rely on a new definition of "expert" who has less than expert credentials to begin with, but who goes through an intensive training program to bring him up to speed with the technical and social elements envisioned. (In most or all cases, these will NOT be expatriates, but rather local national employees.)

"**Fellows**" - will be recruited from a variety of sources as well. They might be drawn from the most outstanding applicants from all points in the smallholder information supply chain. They would at once be resources for the center and receive training while there, which would allow them to return to their institutions as resources and change agents.

Interns - Collaboration with in-region universities would result in opportunities for student internships and post-graduate job opportunities for agriculture majors. This would enhance the educational experience of the students who participate, and provide a relatively low cost source of additional human resources for the institute. It is anticipated that the internship program will improve retention of graduates in the agribusiness space by demonstrating to them the viability and excitement of an agricultural career.

Community Knowledge Workers in Residence – A select group of trainable community knowledge workers and smallholder farmers would be invited to work in the institute as well. They would serve as a voice for community level ideas and concerns, provide input into the selection and testing of new technologies, and gain skills that would allow them to return to their communities armed with new information access and dissemination skills.

3. Evidence the project can be successful

This is consistent with the business concept of socio-technical design proposed by Eric Trist and others many years ago and still very relevant. Trist (1951, 1959, 1965 and others) argued that technological innovations had to be understood in the social context in which they were implemented. The principles of socio-technical systems theory are today implemented in many of the approaches to work design.

Intense focus was placed by attendees at the Cornell Conference on the opportunity to create an empowered community knowledge workers network. Many of the proposed forepointer initiatives

emphasized this. The RICs represent an opportunity to systematically experiment with the creation and support of a CKW system.

While there are relatively few examples of sub-regional research centers which have been successful in Africa, several efforts have made a substantial impact in their respective areas. These include the Institute of the Sahel (INSAH) and others.

4. Expected benefits of the project

Identification of new ways to reach community-level players directly through a Community Knowledge Worker network as well as direct access to information networks by increasing numbers of smallholders.

Development and support of a community knowledge worker network which would provide a powerful supplement to the extension worker. These community-based individuals would receive basic training in the access to information made available through the RICs and elsewhere.

Intercontinental sharing of information, ideas and findings through the network of RICs will foster transcontinental innovation. This will enhance the breadth and speed of innovation in both continental areas.

A mutually beneficial relationship with universities. RICs offer a regional resource for universities and research centers to help them upgrade their access to information data bases and to serve as technical advisors for solving hardware and access problems. At the same time, the universities can provide expertise and a variety of resources to support the development and ongoing viability of the RIC.

Systematic identification of emerging opportunities in the agribusiness space where combinations of ICT and social solutions can be successfully applied.

Sustainability and Scale

A road to self-subsistence will be established so that seed money leads to a sustainable center that at some point becomes self supporting. A 5-10 year weaning period, where the centers are fully funded for the first five years and then receive a declining share of their budget from donors over the following five years, might be possible. In this scenario, end-users of the information would begin paying a fee for service somewhere around the 3-5th year. By the end of the funding cycle, the center could be funded by a variety of fee-based services which offered sufficient added value that smallholders and others would be willing to pay for the service. Continued governmental support could be another option as a source of full or partial funding.

5. Projected costs of the project

Physical space for the center – could be housed in an existing university or research institute, but would be accountable to a central RIC coordination system/individual.

Staffing: Permanent staff, “fellows” rotating through in 1-2 stints, student interns.

Hardware and hardware maintenance.

Operating expenses such as utilities, internet, etc.

6. Measures of success

Improved ICT skills and access at the university and research center level.

Improved access to relevant information at the smallholder level through the community knowledge worker and extension networks as well as with direct connection with smallholders themselves.

Advanced identification of ICT needs and opportunities for future funding and implementation.

7. Risks

How do RICs fit into the already existing (if broken) agricultural extension system/ministry/research center/agricultural university context?

To who are they accountable (related to previous question)?

Provision would need to be made to provide the technical support and funding to maintain and replace equipment in a timely fashion so that the RICs remain at the state of the art even as the technologies and social reality of the smallholder changes.

2c. Building National and Regional Agricultural Market Information Systems

1. Concept

Investigate and implement ways and means for linking smallholder farmers directly with up-to-date market information, supplemented with relevant technical information via multiple ICT and non-ICT formats.

2. Rationale

Most smallholder farmers are unable to obtain accurate market information. However, promising efforts are under way in a number of countries to obtain and disseminate useful market information via radio (for example: PASIDMA), mobile phone (for example: safari.com), the internet (for example: tradenet) and other high and low tech mediums.

The proposed project will capitalize upon the experience of successful market information systems to design a system which collects and disseminates useful and timely market and technical information to smallholder farmers. The information will be configured for direct access by the farmers themselves as well as others in the smallholder information supply chain (such as researchers and extension officers), who at times can facilitate the dissemination process. Emphasis on information "channel redundancy" increases the likelihood that information will get through to the smallholder via at least one channel.

Information will be delivered via multiple channels which are complementary, but free-standing. In other words, any individual can access all information via cell phone, radio, or internet. Any of these technologies will allow access to all information in the system. The program will assess which technologies hold the most long term promise in terms of user friendliness, power, cost-effectiveness, sustainability and scalability.

The project will work to foster strategic alliances between public and private entities. The combination of governmental/NGO and the private sector effort will increase the sustainability of the project overtime. However, this cannot be achieved in a vacuum. In the final analysis, success of the project depends on a predictable demand for smallholder products. Cargills of Sri Lanka offers an extremely comprehensive and successful model of this concept in action (study of their system is proposed below).

Market information is only useful for smallholders, however, if it can be acted upon. Therefore this project proposes experimenting with ways to link market information with relevant technical information which can be translated into local languages to inform decision-making. In order to act on the information received, farmers need to have actionable choices. These choices include, but are not limited to, timing issues, customer choice, location of sale, type of product produced, inputs utilized, whether the product is sold as a commodity or processed before sale, etc. While information on all of these dimensions will be provided and may prove useful, it is recognized that third party solutions will be required. Access to technology, inputs, credit – to name but a few issues – will need to be examined carefully and facilitated where possible to enable smallholders to act on sources of information. This again involves the fostering of partnerships between the smallholders and private firms as well as the strengthening of institutions including NGOs and governmental support agencies.

3. Evidence the project can be successful

We recommend funding for the following research and experimental initiatives:

Market Systems – We propose expanding ongoing national MIS experiments to deal with the "small country problem" in Sub-Saharan Africa. A need exists for national/regional market info systems to help smallholders generate "new income streams" through expanded trade and reduced price fluctuations when surpluses can be sold in regional markets. Market and technical information will target the prioritized needs of smallholders to help them engage the broader regional and global markets as an integral part of food security and income generation. Two test sites proposed for Sub-Saharan Africa (including Mali and Zambia) will compare and contrast the approaches used to build national and regional market information systems in Anglophone and Francophone Africa. These models will be scaled up in other countries in Africa.

Cargills Sri Lanka has developed and implemented a total supply chain solution to this problem. Cargills has partnered with smallholders to help provide market and technical information, credit for inputs, and access to needed inputs and technology. This supply chain provides Cargills with a reliable supply of fresh agricultural products, while guaranteeing the smallholders a market (with upfront price assurances) to reduce risk and spoilage. We propose that a case study be developed about Cargills which highlights the information supply and technical support networks which have been developed to benefit smallholders, consumers and Cargills alike. Special attention will be given to the multiplier impact that Cargills has had on the broader agricultural sector in Sri Lanka. Lessons will be drawn from this country-wide success story for the benefit of private and public sector initiatives in both South Asia and Sub-Saharan Africa.

There are multiple reports on the growing success of supermarkets and their implications for smallholders.

4. Expected benefits of the project

Sustainability and Scale

Early involvement of the private sector as partners in this program will increase the likelihood that the program can be sustainable. As the private sector develops a stake in the system, it is hoped that it will find it in its interest to support the information supply network that extends to smallholders. At the same time, smallholders will generate sufficient surplus income to help support the information supply chain, either through fee for service arrangements or cooperatives.

Expanding the two to three national African areas will set the scene for a ramping up of similar systems in multiple countries. The additional sites can either be funded through seed money in the form of grants, or ideally, private sector companies with operations in the additional countries could take the lead in implementing smallholder-oriented information supply chain projects.

5. Projected costs of the project during Phase 1 for five years:

- $7 million for Africa (2 test sites).
- $2 million for South Asia (1 test site).
- $1 million to investigate and better understand opportunities to link smallholders. with the emerging supermarket business as well as other markets representing. new or expanded demand for smallholder production.

6. Measures of success

- Reduction in losses in market/supply chain.
- New income streams realized by smallholder farmers through expanded trade in regional and global markets.
- Improved cooperation among various players in the information supply chain.
- Improved smallholder awareness of income generating opportunities resulting from improved market and technical information.
- Improved understanding on how to link different ICT instruments with market. and technical information to help smallholders increase their incomes and reduce the losses of perishable product.

7. Risks

Increasing access to information alone may not be enough to significantly impact smallholder success. Access to a variety of additional resources will be required. The success of this project depends on more than effective information flow. Credit, inputs, technology, time and trust must all be effectively addressed if the information provided by the project is leveraged for smallholder benefit.

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2d. Generating Market-Based Systems for Integrated Soil Fertility Management

1. Concept

Small farmers in Africa will have to use more commercial fertilizer if they are to increase their production and incomes. One hypothesis holds that the demand for fertilizer by these small, low-resource farmers is attenuated because most do not know how to get a profitable response to fertilizer under their local conditions. This solution would harness the power of private markets to generate a sustainable system of developing and delivering that information to individual smallholders.

2. Rationale and evidence the project can be successful

The principles of combining commercial inorganic fertilizer with organic materials or in grain-legume rotations or intercrops are well known, and researchers have demonstrated time and again that the principles can be adapted to a wide diversity of conditions. However, no widely successful method for scaling-up that knowledge to thousands of local situations has emerged, in part because there is limited opportunity to make money by adapting the principles to local situations. This note proposes a system that would be initiated with donor funds, but would be self-sustaining (or self-destructive).

3. Expected benefits of the project including comments on sustainability and scale

The program would only be made available in countries or in locations within countries where the fertilizer and output markets function relatively well and therefore would be a good complement to countries which begin a national fertilizer facility together with the envisioned Africa Fertilizer Facility.

4. How the project will benefit women smallholders

It is proposed that a farm-to-nation integrated soil fertility management system be established consisting of: a national ISFM unit, local ISFM organizations, and village-level farmer groups. The national ISFM unit would do contract-based business deals with local units and with international organizations like TSBF, IFPRI, SG2000, etc. The first responsibility of the national ISFM unit would be to do contract-based business deals with NGOs operating at the farm level to enable those NGOs to organize local ISFM units and devise ways to link those local units to village-level farmer groups. The specific nature of all three of the new organizations would have to be carefully designed to suit conditions in each country.

Foundation funds will be used to provide each unit with initial start-up capital, but the basic operating principle will be the sale and purchase of goods and services to units 'above' and 'below' each unit in the system. For example, the national ISFM unit would contract with TSBF to purchase technical integrated soil management advice, with IFPRI to purchase policy advice, with IFDC for soil testing kits, with a cell-phone company for connectivity services to its members and clients, with seed sellers to purchase seeds, and with local NGO units to sell them a program for ISFM.

The program sold by the national ISFM unit to local units might consist of:

- training of local ISFM agents in basic agronomy, soil testing, organizational methods, etc. to empower them for direct interaction with farmers
- access to a cell-phone-based market information system

- fertilizer quality and soil testing services and supplies
- design of adaptive ISFM trials in the "mother-baby" mode
- sale of improved staple food crop and legume seeds for adaptive trials
- (perhaps) a weather-based insurance opportunity
- guaranteed co-location of an agro-dealer with local ISFM units

Local units, in turn, would sell farmers a package of program elements, perhaps:

- a cell-phone-based market price information system
- a set (or sets) of mother-baby trials in their village
- access to an agro-dealer on preferred terms
- results of quality tests on fertilizer,
- results of seed variety evaluations,
- seeds of well-adapted grain and legume crops
- (perhaps) a basic weather-based insurance policy.

Initiating units would receive $50 per participating farmer, to be provided as farm vouchers directly to village level units and their participating farmers who would "spend" the vouchers purchasing the above services. A small cash amount would also be provided, say $10 per farmer. The units providing the services would either use the vouchers or redeem them for cash to purchase services from units up the line.

5. Projected costs of the project

A detailed business plan will be developed prior to implementation in a country with prices for services set at realistic levels to enable units to continue operations and farmers who make effective use of the technologies to make money. Potential partners/grantees would be consulted before the business plan and prices were finalized. The Foundation would provide 100% of the needed operating funds for a first year unit; 75% in the second year, 30% in the third year, and thereafter no funds (or some such schedule). For a program covering 100,000, Foundation investment would be $5,000,000 the first year and declining thereafter. Units unable to generate a sufficient flow of revenue to cover their costs will be allowed to go bankrupt. Where a unit proposes significant expansion Foundation funds might be made available for such expansion after the third year of a unit's successful operation.

6. Measures of success

Success would be reflected in on-going business operations, and failure would be self-evident. A system of monitoring farmer participants would gather evidence on the impact on their incomes and expenditures.

RFPs would be issued to organizations with the potential to become national ISFM units. They would have to have a functioning business presence on the ground and three years experience in at least one

country in Africa, experience with fertilizer trials or ISFM trials, and resident staff qualified to deal with ISFM. Among the organizations that might be invited to respond to the RFP are: FIPS-Africa, NASFEM in Malawi, SACRED in Kenya, ICRAF, Sasakawa Africa, Catholic Relief, and World Vision.

2e. Fostering Broader Use of Participatory Research

1. Concept

Promote the increased use of participatory research among a wide range of research organizations (NARS, South Asian and African universities, CGIAR Centres). Standardize the methodologies and the techniques needed to analyze resulting data. Ensure that participatory research data is highly accessible.

2. Rationale

Participatory research has been used to improve the effectiveness of R&D by providing a critical link to understanding drivers of demand. Feedback from small scale farmers, processors, traders, and consumers about the adoption of new technologies, for instance, can be critical to the direction and focus of R&D. In addition, participatory research often focuses on gender issues, increasing capacity in communities to support women in their access to technology and market opportunities.

If adopted more broadly, participatory research methodologies hold great potential for ensuring that investments in plant breeding, natural resource management, the development of new technologies, etc. are focused on producing goods and services that meet the needs of smallholders. Participatory research methodologies are gaining acceptance internationally and need to be integrated more widely in agricultural R&D for developing countries. As we begin to understand both their potential impact and their limitations, methodologies need to be shared and best practices developed. As multiple organizations begin to use these methodologies, there is a need for quantitative analysis of the resulting data to be standardized. Results from one organization's participatory research may have broader use and should be both standardized and made easily accessible to all.

This note proposes a four-pronged approach to improve the use of participatory research in agricultural development R&D institutions. First, curriculum is developed and made available either through an on-line course or through the provision of in-class teaching materials. It is proposed that this curriculum be developed using open curriculum development methodology (e.g. WikiBooks) that leverages the collaborative efforts of professionals already teaching participatory research methodologies in agricultural sciences. Second, an on-going series of prizes for participatory research at South Asian and African universities, NARS, and CGIAR centres is proposed to highlight and encourage excellence in this newly emerging field. Third, this note proposes sponsorship of an on-line journal of participatory research that provides publishing opportunities for researchers focused on methodologies, quantitative analysis, and research results of participatory research. Providing academic incentives for publishing will work to rapidly develop the frequency and quality of participatory research in the system. Fourth, an on-line resource is proposed that would be a centralized collection of participatory research data, analysis, etc., making it easily accessible for use by a wide audience.

3. Expected benefits of the project

Improving the frequency and quality of participatory research projects will align R&D investments with the demands of the intended beneficiaries. Participatory research has the potential to direct multi-year, significant investments in R&D that result in products and services that might otherwise have lower rates adopted or have failed to account for a critical element in consumer demand.

Participatory plant breeding, as one type of participatory research, has the potential to play a key complementary role to other investments in improving seed systems. Better understanding of farmers' needs in variety development couple with increased access to improved varieties and seeds will together work to address the currently low adoption rates.

4. Sustainability and scale

Many elements of the four-pronged approach here involve initial investment, but not significant on-going investment. Curriculum development, if done in using an "open" methodology, will be relatively inexpensive. The production of materials for teaching, or a website for on-line course offerings, will require a modest investment. Prizes for participatory research projects will take initial investment in design and publicity. Prizes typically, though, provide high profile publicity and good PR for a relatively small payout. Given this, it is likely a sponsor, or a group of sponsors, could be engaged once the initial structure has been worked out. Management of an on-line peer-reviewed journal is an investment that will be ongoing, but could be mitigated by subscriptions. Lastly, the development of a web resource for accessibility of participatory research results will require an initial investment, but not a significant on-going one.

All of the activities proposed have the ability to be easily scaled up, depending on the size of investment and the expected impact.

5. Measures of success

Measures of success for this project would ultimately be the contribution of participatory research to products and services that are more closely aligned with the needs of smallholders and show higher adoption rates. Immediate measures of success in terms of project deliverables would include: 1.) an increase in the number of participatory research projects and the number of researchers benefiting from the results; 2.) increased adoption of participatory research methodology curriculum into CGIAR, NARS and universities; 3.) submission of articles to the on-line journal and subscriptions to the journal; 4.) significant usage of the web resource sharing participatory research results.

6. Risks

There are risks that participatory research will not be adopted as widely as anticipated. The use of participatory research requires an organization to add costly elements to the research methodology, and if the incentives from donors funding the research and development are not sufficient, participatory research may not be included. Likewise, the adoption of new courses, or including on-line course training for staff requires resources that may not be available. Again, if donors investing in R&D are made aware of the benefits, they can incentivize the increased use of participatory research.

2f. Integrated Farmer-Research-Extension Systems for R&D Relevant to Small Farmers

1. Concept

Traditional top-down information delivery methods typically bypass poor women farmers in Africa who require novel approaches to extension if they are to engage successfully with markets and benefit from new technologies for increasing productivity. Often technologies being extended to smallholders are labor-intensive and not suited to women farmers because researchers do not understand that technologies which reduce the overall labor burden of women smallholders in Africa and provide them with more control over their labor and farm outputs will have the biggest impact on their well-being.

This innovation gap needs to be addressed by the integration of farmer-research-extension provided by the innovation systems approach to agricultural R&D. Innovation systems give high priority to networking, cross-learning and the exchange of know-how among multiple actors in private and public sectors, including farmers, business enterprises, universities, civil society organizations and state-funded research and extension providers. Effective agricultural innovation systems accompany integrated, participatory farmer-research-extension approaches with learning communities that innovate in response to producers' demand. This note proposes the creation of an international South-South learning community to exchange and apply this type of innovation systems approach to the development and dissemination of technologies designed to ameliorate women farmers' drudgery and lack of control over farm produce and income.

2. Rationale and evidence the project can be successful

The persistent low level of adoption of technological innovations in agriculture by poor farmers has catalyzed a broad international effort to restructure national innovation systems to provide a market for pro-poor research and extension services. Several countries in East Africa, notably Kenya and Uganda, have made important advances in establishing mechanisms for demand-led, pro-poor innovation similar to efforts undertaken several years ago in the Andean countries, notably Bolivia, Colombia, Ecuador and Peru. In 2006, the Andean Change Program was launched to foster a regional learning community for exchange of experience using participatory farmer-research-extension approaches among these Andean countries with the intention of expanding the program to involve outreach to East Africa at a later date.

An important opportunity exists to leverage substantial prior investment over almost a decade by DFID and other donors, as well as by the two CGIAR centers, CIP and CIAT that facilitate the program, in the development of these approaches and to contribute to the international spillover of experience with integrated farmer-research-extension approaches. Making the training materials, training courses and lessons learned from impact studies of the Andean experience available to international, English-speaking audiences is one of the Andean Change Program's objectives. The program of south-south exchange proposed here will build around common problems with respect to the feminization of agriculture and the marginalization of women smallholder producers in the tropical highland agro-ecological zone in East Africa and the Andes.

3. Expected benefits of the project including comments on sustainability and scale

There is a rich and diverse experience with the introduction of participatory approaches in east Africa with varying success in institutionalization, but at present there is no coherent picture as to the lessons learned from their application or their impact on poor producers, in particular women farmers. The processes

of methodological experimentation and adaptation, capacity building, institutional policy change and impact on producer innovation are poorly documented and have not been analyzed systematically. Innovation with these approaches is occurring in each country without the benefit of regional knowledge-sharing on ways to make market-led innovation more pro-poor.

The proposed south-south exchange will link the Andean Change Program with national research and extension institutions in East Africa, starting in Kenya and Uganda, with support from CIP, which currently provides scientific leadership to the Andean Change Program in collaboration with CIAT. South-south exchange would offer African research and extension professionals access to training and know-how on the products of the Andean Change program that provide a model for south-south knowledge sharing on a regional scale

4. How the project will benefit women smallholders

The proposed Program's strategy for improving the alignment of market-led agricultural innovation with poverty-reduction through the use of participatory methodologies will build on the prior experience of the Andean Change program to:

- Carry out an action-research-oriented inventory of experience using participatory methods and approaches in technology innovation and value chain development to benefit women farmers in East African national agricultural innovation systems (NAIS)
- Collaboratively assess the methodological gaps in experience to establish the demand for using methodologies proven successful in the Andean Change Program.
- Conduct a competitive small grant program: the program provides a procedure for proposal development that links demand for innovation with suppliers
- Assess the gender-differentiated impact of using these methods on local development and livelihoods of the poor.
- Systematize experiential learning about the process of institutionalizing participatory methods and approaches in organizations within each NAIS and with farmer groups and organizations
- Promote south-south learning among research and extension professionals about how to identify and respond to women farmers' demand for more client-responsive, demand-driven approaches to agricultural innovation that give farmers more control over the quality of research and extension services.
- Use evidence of impact and lessons learned to inform policy in the region about changes needed to expand the use of these approaches

5. Projected costs of the project

The proposed program is an opportunity to leverage a substantial investment in the development of a suite of participatory methodologies, and the training required to implement them. Additional investment to promote south-south exchange between the Andean Change Program and the proposed East African partners would amount to an estimated US$ 1.5 million annually, for a total of five years.

6. Measures of success

The program's expected impacts will include:

1. Agricultural research and extension professionals in the public sector and NGOs in East Africa are better informed about smallholders priorities for agricultural innovation and adapt their recommendations accordingly, through use of a set of gender-responsive, participatory research methodologies.

2. Up to 5,000 farmer organizations and at least one million smallholders are contributing to the content of, and receiving more relevant information from, agricultural extension, through the use of gender-responsive, participatory learning methodologies.

3. Yields, productivity, levels of successful market-engagement and incomes of smallholders participating in the program increase, through faster rates of adoption of more approriate recommendations and use of participatory market chain development methodology.

4. The productivity and income gaps between participating women and men smallholders attributed to differential access to and relevance of extension information is reduced in the first two years of the program, and thereafter becomes insignficant.

5. A practical, proven approach for South-South knowledge sharing is operating on a regional scale in East Africa about the use of gender-responsive, participatory methodologies.

7. Risks

Strong demand exists in Africa for proven participatory approaches that integrate farmers, research and extension to support the development of innovations suitable for women farmers. However, a serious risk is the institutional instability and mobility of professionals in national research and extension systems that prevents training and knowledge exchange from being put into practice. The Program's strategy to counter this risk is to first identify demand for methodologies and approaches, and then to establish partnerships between demand and supply through competitive grants before embarking on training. This helps to ensure that training is provided where there exists a prior commitment and capacity to apply the methodologies.

3a. Enhancing Real Time Information Delivery to Smallholder Farmers in Africa and South Asia through Community Knowledge Workers

1. Concept

During the site visits to Asia and Africa regions, the WorldAgInfo project Design Team members observed that the information delivered by the government-run extension system does not reach smallholders at the village level. This impacts the adoption (or non-adoption) of crop management practices by smallholder farmers such as adoption of improved seeds, pest management practices and other farm management practices, etc. The concept presented here addresses this constraint by building a large cadre of "Community Knowledge Workers" to be placed at the "Village Knowledge Centers" to effectively work with smallholders in providing real-time information on production technologies/practices through the use of both conventional methods and through the emerging tools of ICTs.

2. Rationale and evidence the project can be successful

The major producers of knowledge and information related to production agriculture for small holders in Africa and South Asia are public agricultural research systems (agricultural universities, public research institutes, public extension systems, etc.). However, the link and information flow between the producers of knowledge and smallholder farmers is often weak due to inefficient and underfunded extension systems. The private sector fills the gap only in commercial crops and regions, and the NGOs often work on specific projects and time-limited projects and activities. Evidence suggests that in the absence of an effective extension system, the prominent source of information for farmers is progressive farmers within the village community. This proposed concept is based on the premise that empowering "knowledge workers" who are part of the village community can effectively fulfill the gap in the transfer of critical knowledge/information pertaining to production agriculture to smallholders.

3. Expected benefits of the project including comments on sustainability and scale

Over the five year period, this project will create a pool of 500 well trained "community knowledge workers" (CKWs) in South Asia and 500 in Africa. These well trained CKWs will be housed at the Village Knowledge Centers (VKCs). The VKCs will be linked to various stakeholders including agricultural colleges/universities, private sector (local banks, input dealers), NGOs, government supported research and extension/outreach systems. The support from the Bill and Melinda Gates Foundation will be used to train 1,000 CKWs and as a start-up capital (endowment) of $5,000 for establishing 1,000 Village Knowledge Centers, each serving 10 villages (with a target of serving 10,000 villages in total in Africa and South Asia). Through the support provided by this proposed concept, it is expected that 1.5 million farm families in South Asia and 0.5 million farm families in Africa will benefit as a result of real time information delivery on the use of production technologies/practices such as locally adapted improved seeds, Integrated Pest Management (IPM) and other farm management practices.

The trained CKWs will be employed by VKCs through: 1) the income generated from the initial endowment, 2) contributions from local community members and fee-based services, 3) matching grants from governments and 4) voluntary contributions and support from stakeholders serving the community (i.e., private sector, NGOs, other donor agencies). For sustainability and scale purpose, the goal would be to make these VKCs operate 100 percent on the first three sources of financial support over the five year period. The specific nature of the type and size of support from all these sources would have to be carefully determined and included in the business planning and implementation documents to suit conditions in each country/region.

4. How the project will benefit women smallholders

Community Knowledge Workers to be trained by this project will be selected in consultation with the local village leaders and representatives of the village communities. A gender balance will be considered while selecting the CKWs and while designing the curriculum and training programs for CKWs. The CKWs will be trained at regional centers such as secondary/post-secondary education centers (colleges, polytechnics, etc.). The training programs will be developed in consultation with local agricultural universities, departments of agriculture and with active input from the private sector, NGOs, and extension system. Timely access and availability of good quality seeds, planting procedures, and pest management practices are important components of farm management that have significant impacts on smallholder productivity and agricultural sustainability. Thus, the initial focus of the training programs will be on two key aspects of crop production agriculture–seeds and pest management. In the long term, the skills and knowledge of these CKWs can be upgraded to include comprehensive training in other aspects of farm management (as need and opportunities arise).

In South Asia, this project will focus on all, or a sub-set of, six states that have been identified by the Gates Foundation as priority states for reducing poverty. In Africa, the countries will be selected in consultation with the assessments done by the Gates Foundation. The criteria for selecting villages within these countries/states will include: potential for buy-in of this concept from local communities and governments, community need as reflected in the size of land holdings, number of households, income levels and crop production constraints, and potential for the involvement of women as CKWs and in VKCs, etc.

The knowledge workers to be trained may include retired teachers, extension workers, part-time farmers or farm workers, with a minimum educational level of a high school certificate. A requirement will be that the CKW be a resident of one of the village clusters to be targeted. The training program will take place in both classroom and on-farm settings. The duration of the training program may vary from short-term training to season-long practical training which would cover the entire crop management cycle and will include hands-on practical approaches through experiential learning. This training curricula and project activities will build on experience and successful technologies related to seeds and IPM that are relevant to Africa and South Asia, generated by national and international research/extension systems, NGOs and the private sector (e.g., IPM CRSP, CGIAR, AGRA, FAO, etc.).

Once the appropriate training is provided, the knowledge workers will be placed at the village knowledge centers to implement the information delivery systems for smallholder farmers living in the cluster of villages targeted by the VKC. The Village Knowledge Centers will be an independent rural based organizations—run and managed by community knowledge workers with voluntary support and an advisory committee of village leaders and stakeholders (e.g., universities, extension agents, local banks, private input dealers, NGOs). The structure and organization of VKCs will have to be carefully worked out based on the legal framework of a given country/state, and with due consideration of gender balance.

At each VKC, the CKW will serve as the focal point for linking the formal research, education and extension systems with the smallholder farmers, and for generating a new set of knowledge and information to address local needs. The community knowledge workers will deliver appropriate information to smallholder farmers through on-farm demonstrations, one-on-one advice, group meetings and through local media such as rural radios, cell phones, and videos. The programs designed and implemented by VKCs will consider gender balance and incorporate feedback mechanisms to seek active input of small holder farmers. In addition, the CKWs will facilitate knowledge and information sharing by other relevant stakeholders from government, universities, NGOs and private sectors and progressive farmers.

5. Projected costs of the project

A detailed business plan will be developed for the establishment, operation and sustainability of the Village Knowledge Centers and the Training programs for CKWs. It is estimated that this project would cost U.S. $8 million as detailed below over a five-year period.

- Training program development (content, curricula, translation): $1,000,000
- Training of 1,000 CKWs: $1,000,000
- Establishment of VKCs (1,000 centers x $5,000): $5,000,000
- Project management (travel, operational support, supplies, monitoring and evaluation): $1,000,000

The activities in Africa and South Asia will be operated by an independent organization based in these regions, in collaboration with U.S. based institutions with a global network and experience in working with countries in Africa and South Asia.

6. Measures of success

Monitoring and evaluation will be an integral part of this project. The following indicators will be used to measure the success:

- Number of training modules developed for CKWs
- Number of knowledge workers trained
- Number of VKCs established and operational in 5 year period.
- Amount of external resources leveraged by the VKCs and CKWs
- Level of adoption by smallholders of new seeds and IPM practices
- Increase in farm productivity and income of smallholder farmers

7. Risks

The risks that could inhibit the success of the project include:

- Political instability may impede the operation and sustainability of VKCs.
- Retention of trained CKWs in rural areas (education may bring mobility and opportunities for these CKWs outside rural areas)
- Lack of rural infrastructure may impede the use of modern ICT tools for VKCs
- Cultural sensitivity may limit the role of female CKWs and the involvement of female community members in VKCs.

3b. Creating Integrated Information, Extension, Credit and Marketing Cooperatives

1. Concept

Provide reliable technical, price, and other information to farmers through a cooperative association owned by farmers and operated in farmers' interests.

2. Rationale

There is a disarticulation of farmers' information sources, production advice and marketing opportunities so that farmers have to get seeds and fertilizer from shops, get credit from another source, and gather various bits of market intelligence from yet other sources. Dealers generally provide information about inputs, but they may not be fully informed and may bias information to encourage excessive purchases. Generally reliable information from a public extension system may not be appropriate for the precise inputs available from dealers, often is provided at inappropriate times, is too general, or is not appropriate for particular crops in local areas.

An integrated information, extension, credit and marketing cooperative comprised from groups of village-level farmer membership organizations would overcome these limitations because it would operate in the interests of its members, the smallholder farmers. Where culturally advantageous, women farmers would have their own associations. Local farmer clubs or coops would be close to farmer-members and be the conduit for conveying their needs to a regional or national organization. They would operate village computer kiosks and cellular telephones, own and operate association radios and television sets and be engaged in producing local programs and print media for their members. The regional and national organization would have the capacity to either operate or interface with public-sector market price information systems; would interface with Universities, national and international researchers and sources of relevant technical information. Organizational governance would have to be tailored to circumstances but might consist of local, regional and national-level boards. Technical assistance could be obtained from US or European agricultural cooperatives.

Evidence the project can be successful: Such associations played an important role in Europe and in the United States in earlier days, and the National Small Farmers' Association of Malawi (NASFAM) is a contemporary successful example of the idea. NASFAM was formed in 1997 as an association of smallholder farmers associations or clubs. Currently close to 100,000, Malawian smallholder farmers are participating in its activities. NASFAM assists its members with marketing their products, and together with its member associations operates a network of shops that sell sprayers, pumps, seed and fertilizers to farmers. See: www.nasfam.org

NASFAM member associations jointly own the NASFAM Development Corporation (NASDEC), a not-for profit company, which provides them with access to resources, training and technical assistance. NASDEC, in turn, owns two subsidiaries, one for commodity marketing and one for information, policy advocacy and outreach. The commodity marketing subsidiary is a revenue-generating marketing organization. NASFAM operates through a clearly defined corporate structure, which separates the governance, commercial and developmental roles within the organization. By doing so, NASFAM ensures that it operates both as a transparent business entity serving its member-owners, and as an effective instrument for community development. NASDEC is governed by a board of twelve directors, eight being democratically elected by NASFAM associations, and four appointed on the basis of technical or commercial ability. The subsidiaries each run under advisory councils, with membership drawn from a broad cross-section of stakeholders to provide technical expertise and guidance.

3. Expected benefits of the project

The benefits of the project will come from more efficient farm production generated by better, and timelier technical information, and reliable lower cost credit. Furthermore, the reliable source of market price information would provide farmers with higher prices, on average over time. Benefits on a one hectare farm are estimated at $35 per year. Intangible benefits will come from the experience farmers get from organizing and running their own clubs and associations.

Sustainability and scale

Well-operated cooperatives reduce marketing margins, save money on inputs and generate better prices for their members, and are still able to generate enough 'profit' to be self-sustaining. As in the case of NASFAM, some activities generate revenue while others do not; a well-operated cooperative used surplus generated in the first kind of activity to support the second kind. In some countries, governments provide farm cooperatives with preferential tax advantages compared to private businesses, adding to their ability to sustain themselves. Such organizations can be scaled-up, but it is not wise to grow too rapidly. An examination of the NASFAM and similar experiences would be required before expanding this executive summary to a full RFP.

4. Projected costs of the project

Each local farm club averaging 50 members would require $250 to organize in the first year, but would be self-financing thereafter. We project one team of organizers (one man, one woman) could stimulate the creation of 100 clubs a year so 10 staff members would organize 500 clubs a year ($125,000 for club-start up cost per year). It would take one year to organize, assemble and train a staff, and in the first year they would organize at half the full time organizing rate. Organizers would be paid $10,000 per year; the Director $35,000 => $135,000. The Director and each organizing team would need a vehicle of $35,000 (start up cost => $210,000) and POL. Benefits, internal travel and other operating costs together are assumed to equal staffing cost ($135,000). At the end of the second year there would be 750 clubs, and the number would increase by 500 each year thereafter, so in five years there would be 2,250 clubs and about 112,500 farmers in clubs. One-time start up costs (vehicles) are $210,000, annual costs are $125,000 for new clubs, $135,000 for salaries and $135,000 for operations, so the total five year cost is $2.185 million, or about $20 per farmer.

5. Measures of success

In year 1: staff engagement rate, club organization rates; in year 2, club organization rate and operations of year 1 clubs; in year 3 and thereafter, activities (information received and used) and benefits (income, crop yield, child health) reported by members.

6. Risks

The success rate for government-stimulated cooperative movements in Asia is not good. India had a federal ministry and devoted considerable resources to encouraging cooperatives; the Philippines did the same. As long as government funds were available they continued to operate but even then, malfeasance and poor business practices undermined them. Success cases other than NASFAM are hard to identify.

3c. Enhancing Agricultural Education in Primary and Secondary Schools

1. Concept

To add value and competitiveness to agricultural education in primary and secondary schools so as to enhance the contribution of agricultural information and communication to the improvement of livelihoods and sustainable agricultural production.

2. Problem

Despite the agricultural technologies that have been generated through research in Africa, the impact of such technologies is yet to be felt in most households owing to inefficiency in communicating and sharing agricultural knowledge. The situation in Africa is aggravated by slow adoption of modern information and communication technologies and the shortage of information and communication management professionals. Besides the slow adoption of technologies, interest in agriculture among students at educational institutions has been on the decline. Agriculture as a subject is devalued in primary and secondary schools. The situation is made worse since agriculture is given undesirable connotations (e.g,. agricultural activities are sometimes used as punishment). In some instances, agriculture is merged with other subjects, agricultural curriculum is poorly designed, and most often students do not have access to learning aids that can enable them to learn about new technologies in agriculture.

Although efforts are being made to revolutionize agriculture education in institutions of higher learning by introducing ICT, such efforts cannot stand alone. Students entering the institutions of higher learning need to have agricultural knowledge and skills acquired from primary and secondary schools to be able to excel at the higher level of learning. In addition, young people play a significant role in agricultural production in SSA. Therefore, there is a need to have ICT integrated in primary and secondary agriculture education curriculum so as to add value and sustain the interest of students in the subject. In addition, building of agricultural information and technology centers coupled with agricultural education can contribute towards enhanced agricultural training in secondary schools and among smallholder farmers.

3. Rationale

Development of an agricultural education program that incorporates ICT at primary and secondary levels is important for sustainable agricultural development in SSA. First, children play an important role in agriculture, and there is an increase in child-headed households in SSA countries due to the HIV pandemic. Therefore, formal schooling should teach agricultural knowledge and skills based on practical tasks involving modern production technologies in primary and secondary schools to prepare the children for the agricultural tasks they perform. Incorporating ICT in agriculture education will enable students to have access to information on modern technologies, apply the knowledge, hence contribute to increased agricultural productivity. Such education will also enhance the dissemination of information on agricultural technologies from children to parents.

Secondly, the rate of scientific and agricultural information dissemination among the farming communities, especially smallholder farmers, is low. There is need to have agricultural research findings repackaged and disseminated to the farming communities so that they can have access to the information on how to improve agricultural productivity. Integrating ICT in agricultural education in primary

schools, coupled with creation of information centers, will enable local communities to have access to research findings and other scientific information that may boost their productivity.

Thirdly, few students in primary and secondary schools have access to ICT and adequate learning aids in SSA countries. Children of peasant farmers often attend public schools that have inadequate learning facilities and poor infrastructure. Providing learning ICT centers in public primary and secondary schools in rural areas will not only enhance the agricultural learning process, but will also sustain students' interest in the subject. Such information centers will also serve as learning centers for smallholder farmers.

Fourthly, programs focusing on agricultural information communication management training at primary and secondary levels do not exist, hence the need to incorporate ICT in agricultural education in the school curriculum. Lastly, given the plans to introduce information communication management in agricultural institutions of higher learning in some SSA countries, it is important that students in primary and secondary schools are equipped with the knowledge and skills, so as to minimize the difficulties in grasping the concepts when they decide to pursue agriculture at the university level.

4. Evidence that the project can be successful

The NEPAD E-schools program in Kenya was launched in September 2005 and since 2006, six schools have benefited from the pilot project in the country. So far the NEPAD e-schools initiative in Kenya has provided substantial experience and impetus on equipping of schools, including the need to determine low cost and sustainable technologies as well as the need to enhance capacity for integration of ICT to teaching and learning. The objective of the NEPAD E-Schools program is to integrate ICT in education curriculum at secondary and primary schools in order to improve access, quality and equity in provision of education within the member states and in Africa (NEPAD Kenya, 2006). Information on whether agriculture is one of the subjects where ICT is being applied is not available. There is, therefore, need to verify this from the primary and secondary schools where the program is being implemented, and from the NEPAD Kenya Secretariat. Similar programs of integrating ICT in teaching other subject areas have been successful in the UK and North America.

5. Expected benefits of the project

The benefits of the program include: an increase in the number of students acquiring agricultural knowledge and skills; smallholder farmers, including female farmers, will learn how to use IT to access agricultural information, increase in agricultural productivity, enhanced teaching of agriculture at all levels of learning; and increase in female agriculture professionals.

6. Sustainability and scale

The Agricultural Education program will be integrated into the primary and secondary school education system through the Ministry of Education. The schools will be linked to universities offering Agriculture and Information Science. The Ministry of Education, Faculties of Agriculture and Information Science, and other research institutions as well as the Ministry of Agriculture, will work together to ensure that local and region specific research findings are repackaged and distributed to schools participating in the program. The government should increase budgetary allocation for the education sector to take care of this. The project can be replicated in other schools within each country, but will require support from the government.

7. How the project will benefit women smallholders

Girls will benefit from the programme since it will be implemented in both girls and boys schools. The girls can share the agricultural information with others and translate the agricultural knowledge and skills into action, especially since they play a significant role in agricultural production. Female small holder farmers will be able to attend training sessions that will be conducted at the information centres. In addition, through the centres, they will be able to access information that will contribute to an increase in agricultural production, hence household food security. The programme is going to interest girls enabling them to pursue agriculture to higher levels of education. After completion of their studies the girls can take up jobs as agricultural extensionists, agricultural educationists, researchers and policy makers.

8. Projected costs of the project

This will be a five year project in 10 African countries. In each country, two agricultural universities and 12 schools will be involved in the project. Schools participating in the project will be located in agricultural regions. The costs related to the project are as follows:

Equipment – $100 million, supplies – $ 50 million, curriculum development and training – $25 million, travel – $ 45 million, personnel – $ 60 million, consultants – $10 million, maintenance – $50 million, Total – $ 340 million.

9. Measures of success

Year 1: Staff engagement at the Ministry of Education, universities and schools; agricultural curriculum with ICT integrated developed and disseminated to schools; increase in formation of agricultural clubs in schools; enhanced ICT content in agricultural education for primary and secondary schools;

Year 2: Increased agricultural activities in agricultural clubs; increase in SHF trained on use of information centers to access information; increase of number of students taking on agriculture as an optional subject;

Year 3: Increased agricultural production for SHF, increased access to markets and inputs; increased application of technologies on crop production, livestock production; increase in the high school graduates with interest to pursue agricultural-related courses; increased enrollment of both male and female students in agricultural tertiary education institutions.

Years 4 and 5: Increased number of women agricultural professionals, increased literacy rates among women; increased agricultural production, increase food security among SHF households.

10. Risks

The amount of land available for agricultural activities in most SSA countries is diminishing due to population pressure. The agricultural knowledge and skills acquired through the agricultural education program may not be translated into action, especially among students who come from households that do not own/have access to land.

Government involvement and ownership of the project by the local community would be important for the project sustainability. However, governments may have other priorities and hence be reluctant to allocate funds to sustain the project. The community, on the other hand, may not be willing to contribute toward the running of the project unless they see its benefits.

3d. Using Radio to Deliver K-12 Agricultural Education

1. Concept

Use radio and audio file technology to provide agricultural instruction and enhance access to agricultural information for rural farmers through delivering the content to their children in agriculturally oriented primary and secondary education.

Agricultural information will be embedded within a larger curricular framework of traditional academic information. Materials and examples will focus on agricultural situations. In this way, the students of rural farmer household, without access to a brick-and-mortar classroom, would be prepared to assist with both agricultural and non-agricultural needs of the community. Each student becomes a trusted resident knowledge worker for the farm. This project would teach pertinent agricultural skills and knowledge to those youth who are likely to become farmers upon reaching adulthood. The program will be based on the EDC model of instruction, which incorporates daily ½ hour radio broadcasts in English and untrained classroom facilitators. The initial project would develop curriculum for both primary and lower secondary levels. Upon successful completion, students would receive government recognized school completion certificates.

Strong formative feedback methodologies will allow rapid modification and improvement of instructional materials and delivery systems. Participants in the process will be able to query the system to better personalize instruction to their needs. For example, if a parent of a student indicates that the information in the fertilizer examples is inaccurate or inappropriate, he or she would be able to "feed" that information back into the system, and those materials could be altered for future iterations (if appropriate). If it is determined that the instruction actually is correct, then the information could be used for individualized interventions and instruction with the smallholder farmer.

2. Rationale

The educational needs of farmers do not begin when they become farmers. According to Kruger, et al (2006), who studied poverty issues related to farmers in South Africa, the majority of adult farmers in their study had only a fourth grade education, and farm schools provide education only to the seventh grade. The cycle of poverty will continue as children of farmers will be likely to become farmers when they reach adulthood – even though, in most cases, parents desire other options for their children.

Klauss Droppelman of the Agricultural Consultative Forum in Zambia reported the strong impact that educational level achieved has on farming income (WorldAgInfo site visit, 2007). There is a positive correlation between educational level of the farmer and the income produced by the farm.

3. Evidence the project can be successful

The Educational Development Center (EDC), working in conjunction with the Zambian Ministry of Education, the Peace Corps, and the Educational Broadcasting Services, has test results that confirm that radio education with limited non-professional community support is successful. Approximately 80,000 Zambian children (many of whom are children of smallholder farmers and would not attend school otherwise) have enrolled and participated in the program. More importantly, the EDC personnel indicate that the learning that is produced in this methodology is roughly equivalent to more traditional educational models based on end of course tests.

4. Expected benefits of the project including comments on sustainability and scale

- Current smallholder farmers will receive high quality information through their own on-site agricultural knowledge worker (AgRadioEducation students). Feedback systems incorporated into the curriculum will allow farmers and their children to access specific information for their individual needs.
- Future smallholder farmers will be better prepared to farm profitably. By continuing their education longer and having it tailored to their probable future career, their farming yields, profits and quality of life should improve. In addition, these students will also receive much of the traditional educational content that they have been missing so far, with the added benefit of learning English (or other base language).

Radio or audio device delivery of modular content offers great economies of scale in bringing the program to new populations. Instruction in English or other base language will make it much easier to scale up this effort in multiple countries. There will be less need to translate instruction into local languages. Often it can be the RadioAgEd students, themselves, who can act as translators for their families for basic agricultural information.

With a modularized curriculum design, those areas of agricultural knowledge that are generalizable can be shared widely across the system freeing resources for the creation of support content that is specific to individual regions/countries.

5. Projected costs of the project

Costs will depend on initial size of project and projected scaling to new populations, countries, and language groups. Major costing categories are:

- Curriculum Design and Development
- Instructional Support Materials
- Radio/MP3 Transmission Costs
- Support Staff
- Field Personnel
- Formative & Summative Evaluation

6. Measures of success

The number of students served who complete the process will be an indication of success. There are already standardized academic tests used in many countries to summatively assess traditional student learning, supplemented with measures to evaluate the specialized content. The use of the formative assessment tools will provide qualitative and quantitative data to determine the engagement of the participants (both students and current smallholder farmers).

New measures will be developed to assess comprehension of agricultural information and its dissemination and use on students' households farms.

Long-term comparisons of relative crop production, farm income, and standard of living for the families of students involved with the project will provide data to determine the ultimate success of the project, if longitudinal studies are funded.

7. Risks

The results of radio education to date may not be replicated with agricultural content. It may be difficult to obtain Ministry of Education support for a modified curriculum offering parallel school completion certificates. There is need to assure that the content is delivered appropriately. Careful effort will be required to assure that generalizable information actually is appropriate for the settings where it is taught. Poor agricultural information can have adverse production, ecological and environmental impacts.

References

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3e. Site-Specific Agriculture Based on Farmers' Experience

1. Concept

The basic premises we work from are that: (a) as the conditions under which farmers operate are highly heterogeneous and farmers are always trying out something new, every time a farmer plants and harvests a crop it is an experiment, and (b) if it were possible to compile the information on what the farmer did and characterize the conditions of a large number of these experiments, it would be possible to deduce optimum practices for specific conditions. This approach is actually as old as agriculture itself, with farmers constantly experimenting, observing and innovating. What is new is the power of modern information technology available to us to exploit to the full this approach. It is now feasible to bring together multiple experiences, and through network effects, obtain vastly more valuable knowledge than that gleaned from a limited number of cases.

2. Rationale and evidence the project can be successful

The yield and quality of produce from farmers raising crops under similar conditions varies tremendously: this variation must be principally due to management. The variation in yield and quality is particularly large in the case of small farms with low input agriculture when farmers are not able to use costly amendments to provide uniform growing conditions over a wide area. Identification of those practices that produce good yields and quality for specific conditions could improve food availability and farm income.

Three brief examples show why we are so excited about the Site Specific Agriculture based on Farmers' Experience (SSAFE) approach. The examples indicate how the approach was first developed for a highly organized sub-sector, and then has been successfully adapted and adopted by small farmers, first in the highly organized coffee sector and later in the traditionally less well organized tropical fruit sub-sector. Small scale producers with lower levels of formal social organization can use the SSAFE approach due to two principle factors: firstly they avidly accept the idea of sharing their own experiences as a guide to innovation, and secondly modern information technology makes it possible to characterize growing conditions and handle the large data sets required to make sense of crop response to variation in management practices and natural conditions.

Sugarcane. For over 10 years the Colombian Sugarcane Research Centre (Cenicaña) has compiled data on more than 15,000 cane lots harvested each year and characterized them. The data was processed to make it comprehensible to the farmers who can access it on line and currently use it to decide on the best management for their specific conditions. Colombia now leads the world in sugar produced per ha per year. Previous leaders, who use a traditional research approach, face stagnant productivity or even worse the syndrome of yield decline.

Coffee. In 2005, small-scale coffee growers provided information on management practices and samples of coffee for cupping from geo-referenced "management units". Information from publicly available databases was used to describe climate and terrain. The two sets of information were combined and are available on line so that users can identify sites suitable for production of high quality coffee with apt management.

Tropical fruits. Guanábana (sour sop) producers normally have no idea what variety to plant under their particular conditions which considering the length of the investment, is a risky business. Farmers

identified the best trees on a series of farms which were characterized in terms of climate and soils, and software linked to available data bases determined which of the selected varieties is appropriate for any particular geo-referenced site. Using classical research approaches, this process would have taken decades, whereas with the SSAFE approach it took three years.

3. Expected benefits of the project including comments on sustainability and scale

Farmers tend to believe in results which they know come from real experiences of their peers as opposed to those from well manicured plots on experimental stations far removed from their world. The project will provide farmers with improved management practices apt for their particular social and environmental circumstances. The beauty of the SSAFE approach is that practices can readily be transferred from one site or region to another: the detailed characterization of sites and the access to data bases that can identify other similar sites means that experiences with practices and crop response can be shared by farmers from sites with similar or homologous social and environmental conditions even when they are geographically distant.

The project will work largely through existing organizations, including farmers groups which are a central feature of the approach of sharing of experiences. This contrasts strongly with the traditional linear model of agricultural research, and empowers farmers to make their own decisions, not only with respect to managing their crops but also in their relations with other actors in the product supply chain. In the particular case of specialty products, farmers rather than being at the mercy of the specific characteristics of a site can exploit natural variability to differentiate their product and obtain added value.

The improved management practices and empowerment of farmers groups will lead to greater productivity and higher quality produce, which will in turn increase food availability and rural incomes. The number of farmers who benefit will be determined by the products to which local agencies choose to apply the SSAFE approach. It is expected that as farmer groups see the value of the SSAFE approach, they will be prepared to pay directly a small fee for the services. In addition, as the SSAFE approach becomes more widespread, suppliers of agricultural inputs will likely use it for publicity thus providing income to support the system.

4. How the project will benefit women smallholders

The project is based on the sharing of data and knowledge by multiple entities including, and of paramount importance, the farmers. To the extent that women smallholders are farming, they will be direct beneficiaries of the project: as women in general communicate more freely and share more readily than men, it is likely that they will be primary providers of information and thus also be the principle beneficiaries.

5. Project development

The development of a SSAFE program comprises four key components in a continuous feedback cycle: (i) farmer group interpretation of shared information for decision-making (ii) information capture on the production process by farmers themselves (iii) compiling of data (iv) processing of the data to make it comprehensible and (v) sharing of information with the farmers groups and the cycle once again continues. The project will plug into existing priority crops selected by farmers and local agencies, taking into account their potential for development and the particular traits of the products.

The non-crop or product specific databases that characterize sites in time and space according to climate, weather, soils, infra-structure and socio-economic factors will be established by the project and made available to the particular product groups that are selected. The project will be executed by a consortium to be established specifically for this project that will include members with specific expertise and a successful track record in their particular fields with emphasis on developing capacity of local agencies.

6. Projected costs of the project

The projected costs of the project are US $5 million per year for five years. Of this, US $3 million per year will be (i) for local agencies and farmers to develop on farm data capture systems and systems for farmer groups to access the processed information and share the multiple experiences of many of their colleagues, and (ii) to train farmers and other local agencies in their use. It is expected that much of the training will be by farmers themselves. Furthermore, part of the sharing of knowledge will include visits by farmers to homologous sites which may be geographically distant.

The establishment of the databases, capture of data from other sources (e.g., satellite imagery, TRMM, WorldClim), processing of data, establishment of on-line or other systems of access and overall coordination of the project will have an annual cost of US $2 million.

7. Measures of Success

Success will be measured by increased incomes and improved welfare of those farmers who adopt and become an integral part of the SSAFE approach.

8. Risks

We are well aware that the approach we are proposing is not a panacea: classical research and participatory research are still required and complement the SSAFE approach. The greatest risk we see is the latent period that exists between farmers deciding to get together to adopt the approach and getting sufficient processed data back in the hands of the farmers: farmer interest has to be maintained in this period. A further risk is the development of payment mechanisms (either directly for services or through publicity) to maintain the data bases, processing capacity and information access systems. Finally, we have seen that the approach is often opposed, condemned and rejected by classical researchers for lack of scientific rigor.

3f. Enhancing Innovation Capacity and Market Access of Smallholder Farmers in East and Southern Africa

1. Concept

The purpose of the project is to improve the market access by smallholder potato and sweet potato farmers and vegetable growers by fostering market chain innovation to improve competitiveness of market chains in ways that benefit small farmers, as well as other market chain actors in East and Southern Africa. The project intends to achieve this by producing the following four outputs: (1) new market opportunities for potatoes, sweet potatoes and other vegetables benefiting small farmers identified and taken up; (2) improved entrepreneurial, organizational and technical capacity of groups of farmers to identify and respond to new business opportunities; (3) strengthened capacity of service providers to respond dynamically to farmers' needs in a market chain context; and (4) enhanced social capital to support market chains, build trust between actors, share knowledge and promote South-South learning.

2. Rationale and evidence the project can be successful

A lack of trust and opportunities for coordination between farmers and other market chain actors limits the capacity of farmers to innovate and make use of emerging market opportunities. The Participatory Market Chain Approach (PMCA) has proven useful in Uganda and in the Andes, both to strengthen innovation capacity and to develop pro-poor market chain innovation. The proposed project provides an opportunity to build on the body of knowledge and experience of PMCA gained in the Andes as well as recently in Uganda, where the approach was successfully applied in collaboration with the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) and with national partners supported by CIP's Papa Andina Initiative and the Impact Enhancement Division. The project will help consolidate ongoing PMCA applications in potato, sweet potato and vegetable market chains, and validate the approach in other commodity chains through human and institutional capacity building. Based on the assessment of the Uganda experience with the PMCA, it seems clear that other countries in Sub-Saharan Africa could benefit from the PMCA with the support of experienced Uganda facilitators.

3. Expected benefits of the project including comments on sustainability and scale

The project intends to investigate incentives and constraints when promoting innovation along the potato, sweet potato and vegetable market chains to enhance competitiveness and reduce poverty in East and Southern Africa. The project will achieve this through capacity development, and the application and validation of two linked methodologies: the participatory market chain approach (PMCA) and participatory agribusiness development (PAD). Several organizations in Uganda (for example, NARO, Competitiveness and Investments Climate Secretariat (CICS), Federation of Associations of Ugandan exporters-FAUEX) are already committed to institutionalize and support PMCA work with traditional commodities and high value exports. The hypotheses of this project are that PMCA and PAD can: (1) stimulate trust between market actors; (2) generate innovations among market chain actors; (3) stimulate the emergence of new business opportunities; (4) create dynamic and innovative groups of entrepreneurial smallholders; and (5) improve the livelihoods of resource poor farmers in Uganda and in other countries of the region. The hypotheses will be tested by employing an innovation systems approach following an opportunity-driven trajectory by analyzing market chain actors, their attitudes and practices, patterns of interaction, and the enabling environment, including incentives and resources for research, training and private sector involvement. The project will contribute to understanding how the agricultural sector can make better use of CIP's knowledge and technologies and design alternative interventions (that is,

PMCA and PAD) to strengthen value chains by more effectively linking supply and demand in selected commodities, including potatoes, sweet potatoes as well as (African indigenous) vegetables.

Like Uganda, other countries of the region could benefit from use of the PMCA. Introducing the approach elsewhere could be achieved more quickly by building on the considerable capacity that Uganda has developed for application of the PMCA.

4. How the project will benefit women smallholders

Farmers will be empowered to play a leading role in innovation process. Linkages will be developed with a range of market chain actors (micro, small and medium enterprises) who can play a key role in innovation and the development of new market opportunities. Service providers in the areas of agribusiness development and agricultural research and extension will also be actively engaged in the project. Stakeholders will be brought together through multi-stakeholder platforms to promote mutual understanding, the development of a shared vision, and to sustain collective action across the market chain in a way that favors smallholders. The project will be gender-responsive and gender-focused in all its activities in order to address gender inequalities, for example, in Uganda where women lag behind men in terms of education, income level and limited economic opportunities (GoU, 2000a). The project will monitor the contribution to the reduction of gender inequalities and assess their economic gains from the project's interventions.

5. Projected costs of the project

In Uganda where the PMCA has been piloted in commodity chains for potato, sweet potato and vegetables, the project will concentrate on PADs to develop complementary capacity amongst farmers and local service providers to respond to the new market opportunities.

The project will also target three market chains in Kenya, Tanzania and Malawi. The project will work through local organizations with capacity to facilitate innovation processes in these market chains. The central element of capacity development in PMCA is a set of four workshops which are linked to the three stages of the PMCA process. The project will provide complementary funding to support the application of a PMCA application in each of these market chains. Follow up in years two and three will concentrate on PAD.

Implementation of the PMCA will cost around US $350,000 per country for three market chains for a period of about 15 months. Follow up activities and support to strengthen innovations for at least two years can be estimated at US $100,000 per market chain. Total costs for three countries would be around $2,000,000 for a three-year project in East Africa, and an additional $2,000,000 to include three more countries in Southern Africa.

6. Measures of Success

The results of the project will be assessed first in terms of the commercial, technological, and institutional innovations generated, and then in terms of the capacities developed that can support future innovation processes. Both these types of results are important. Tangible, visible innovations that benefit poor farmers and other market chain actors – particularly new products – will be the ultimate goal of the project. Hence success will be measured by the number of innovations generated within market chains, the number of farmers who benefit, and the additional income generated for each farmer involved.

It should be mentioned that in the longer term, however, the capacities to innovate that have been built up – the social capital, knowledge, and skills –are likely to have greater social and economic impacts.

7. Risks

Two factors that may inhibit the success of the project are: (1) the lack of sustained commitment of local organizations and individuals to implement the PCMA, and (2) the lack of economic policies that support market chain innovation and development

4a. Creating and Operating a WorldAgInfo System (WAgIS)

1. Concept

Create and operate an Internet-based multimedia agricultural database designed to support user-created content and feedback. The system, called "WorldAgInfo System" or "WAgIS," will incorporate features found in Wikipedia, FaceBook, YouTube, and eBay. WAgIS will be extended beyond all of these systems in that it will accommodate interfaces for illiterate users and incorporate content delivery options oriented to the conditions found in South Asia and Africa.

2. Rationale

Though many agricultural databases are already in place, they are fragmented and often inaccessible to smallholders. Furthermore, almost none of these databases have mechanisms for recording and sharing user feedback. Feedback is essential for helping the content providers know which information has been found useful and what additional sources of information are in demand.

When user feedback can be seen by other users of the system, it has the ability to provide content and credibility for the contents being commented on. Our trips indicated that smallholders have strong concerns regarding the credibility of the information they are receiving either because they do not know the trustworthiness of the source or they are not sure if the information applies to their specific conditions. In Africa we frequently heard that middlemen would provide inaccurate information so as to get a better deal from the farmer. Indian smallholder farmers frequently mentioned fertilizer salesmen would tell them that far more fertilizer was required than was actually true. Fortunately, farmers do trust one another and thus their feedback is the surest foundation for creating trust in the database's content.

3. Evidence the project can be successful

The examples of Wikipedia, Facebook and eBay demonstrate the power of user participation. That participation may be in the form of direct content creation or it may be reviews of content created by others. eBay may be the closest model to the issues faced by smallholder farmers in that participants are often dealing with highly specific conditions. Agriculture information is much closer to diversity found on eBay than it is to a general department store; even with fairly general topics, the information may depend greatly on local conditions. Essentially, agriculture is a vast collection of niche information.

The Design Team site visits routinely found smallholder farmers interested in obtaining information that we knew to be available. Sometimes the farmers did not know of the information but in many more situations they knew of the information but did not trust the information source. Once again, eBay is a good model in that it uses the feedback of the community to create trust relationships between unacquainted participants. While the first few users are taking a chance, the users who follow have a good basis for establishing the creditability of the information source and of the specific information to their individual needs.

4. Expected benefits of the project

The nature of the benefits will be in increased access to information, the better matching of information to specific requirements, and the creation of trust and creditability in the information. Access to timely and credible information has the potential to dramatically impact the farmers. Just the awareness of new

farming techniques and new seed variants could transform the agricultural environment in South Asia and Africa. If successful, it directly addresses the most oppressive poverty--the poverty of information and knowledge.

The scope of the benefits will naturally depend on the amount of the information in the system and the number of users who can interact with the system. Digital resources can grow at exponential rates with little increase in financial outlays. A successful system creates a cycle of content growth and user growth.

Feedback will make the information valuable but multiple access methods is critical for making WAgIS feasible. The system will augment Internet access by adding cell phone SMS messaging, voice, and easy transfer to CD-ROM and to paper. The key to WAgIS is that it will use every possible communication system to connect with the smallholder farmer, via either direct communication or through intermediary media.

Direct access by smallholder farmers is just one way to improve the condition of smallholder farms. Improving the information sources for agricultural universities, research institutes, agricultural extension workers, and policy maker are all ways to help the smallholder farmer. WAgIS both serves the information needs of these groups and provides a library of appropriate content which can be used by their entities in their interactions with smallholder farmers.

Sustainability and scale

Scaling a computer-based operation is relatively easy because of the well-known scaling methods of computing infrastructure. The per-unit cost goes down as the system scales. As WAgIS becomes more popular, advertising and various usage fees could be collected. Initial hardware and software might reasonably be expected as a donation. As the size goes up it is quite possible that the costs per use will go down, and it may actually turn profitable.

The major impediments to scaling are local languages and poor communication systems. If content were all in English and the Internet was ubiquitous and high-speed, scaling would primarily be an issue of processor/storage capacity and bandwidth to some central facility. The best course of action is to focus on national centers. This also has the advantage of allowing for close interaction with local government and research entities. Scaling in this case would therefore be a system of replicating the best practices from current national systems to new national systems. The first three national centers would be in Bamako, Mali, Harie, Zambia, and Bangalore, India. Given the size and complexity of India, each state will be considered the equivalent of a nation. These three areas have been selected because they were considered important representatives of agriculture in their region when planning our design team's site visits. The project would continue to apply for locations suitable for prototyping and development.

Whereas an international structure for WAgIS is currently not feasible, a national only approach is equally untenable. WAgIS will require a center someplace in North America or Europe. This center would build relationships with centers of agricultural information and technology providers. In order to offer the user the friendliest and more flexible interface, WAgIS will need to employ some of the most cutting edge technologies in GIS, automated language translation, text-to-voice, and data-mining strategies. The center will also help coordinate national efforts and create mechanisms where data and experiences can be shared. The international center will not have to scale at the same rate as that of the national entities because its role is more that of coordination and development. The labor and technological efforts will primarily be at the national level.

5. Projected costs of the project

The initial cost for building each national system and running it during its first year will be approximately $1.5 million USD. Given three development sites, that would entail $4.5 million. The international center would be additional $2 million for a total first year expenditure of $6.5 million.

- $150,000 for computer hardware
- $ 50,000 for modifying WAgIS technical system for local conditions
- $250,000 for content conversion: data format and translation
- $350,000 for staff salaries: One director, one executive assistant, one graphic designer, one editor, one driver, travel and consulting fees
- $350,000 for office rent, supplies, insurance, attorney and other fees
- $150,000 for Internet and telephone lines
- $200,000 for promotion of WAgIS's availability

Computer and development costs will decrease in subsequent years and content translators and other labor associated with the increases in size and use will increase. Additional content editors might be required as languages are added. The approximate yearly operational cost will be $1.2 million per national center.

The international center will require a small office with sophisticated technology. The international center needs to be able to replicate the technologies of the national centers so that it can help develop new features. The approximate costs are provided below.

- $250,000 for WAgIS software development
- $100,000 for staff travel
- $50,000 for computer equipment
- $300,000 for office rent, insurance, fees, etc.
- $500,000 for staff and consulting. Staff will entail a project manager, accountant, office manager/• executive secretary, systems architect, project evaluator, and part-time intellectual property attorney
- $850,000 for content acquisition and licensing, data conversion, and translation

6. Measures of success

There are many internal measurements that can be used to determine success. Some possible site generated statistics are the number of users, the amount and types of content, and the average ranking of content. Some external measurements could be the name recognition of the system by key stakeholders, especially that of smallholder farmers. In addition to name recognition can be percentage of usage, user experience and the likeliness of using the same again.

7. Risks

The most significant risk is the cost and availability of Internet access. The use of cell phones to access a text-to-speech system may not be well received for a variety of reasons ranging from voice quality to the cost of the calls.

Getting content current on agricultural databases may be difficult for IP and/or territorial reasons. While much of the content will be user generated, there has to be a significant amount of currently existing content. Content holders may be concerned that WAgIS will reduce the interest and thus funding of their work. They may be concerned that IP rights might be infringed or that remote information may get out of synch with their master database.

Some information providers may not be comfortable with the concept that any user can leave feedback related to their information.

4b. Establishing Reliable High Speed Internet Access at Agricultural Universities in Africa: the Ubuntu-Net Model

1. Concept

Inadequate access to Internet bandwidth prevents universities and technical training institutions from gaining access to existing high quality online content. Many universities and training institutions in developing countries cannot afford the cost of Internet bandwidth. Bandwidth is too little, too expensive, and ineffectively managed for many developing country institutions. To date, several initiatives have proved the power of consortia in bringing down bandwidth costs and delivering affordable internet in developing countries. The UbuntuNet Alliance www.ubuntunet.net is a recent initiative to establish national inter-institutional collaborative platforms in the education and research community in Sub-Sahara Africa (SSA). UbuntuNet Alliance was established to capitalize on the emergence of optical fibre and other terrestrial infrastructure opportunities and thus become the Research and Education Network (REN) backbone of Africa. Country level initiatives called National Research and Education Networks (NRENs) in South and East Africa have drastically improved internet connectivity for the research and education community in the region through the 'bandwidth buying consortia' and effective management of the available bandwidth opening access to high quality online content to the sector. This proposal is to further fund the building of this model in SSA and South Asia in order to provide high speed internet connectivity to researchers, faculty and students.

2. Rationale and evidence the project can be successful

The formation of bandwidth buying consortia, which are effectively buying-clubs, leverage on their large membership to negotiate better pricing structure with suppliers bringing down the unit cost per Megabyte. The recent availability of cheaper bandwidth via the optical fiber accessed through undersea cable implemented on Africa's coastal shores, compared to the expensive terrestrial infrastructure access, has spurred on the UbuntuNet initiative. Fiber optics brings down internet bandwidth costs by at least 80% compared to terrestrial infrastructure services. The Eastern Africa Submarine Cable System (EASSy) is an initiative to connect countries of East and South Africa via a high bandwidth fiber optic cable system, completing the loop around the continent and connecting Africa to the rest of the world. It is considered a milestone in the development of information infrastructure in the region. EASSy is planned to run from Mtunzini in South Africa, to Port Sudan in Sudan, with landing points in six countries, and connected to at least five landlocked countries – which will no longer have to rely on expensive satellite systems to carry voice and data services and is set for completion in 2008.

The NRENs are vehicles to facilitate inter-institutional collaboration and bandwidth procurement and act as bandwidth consortia to secure general internet access. The UbuntuNet Alliance, established in 2005, has been one of the successful ventures in Africa on the bandwidth arena. Tertiary education and research institutions throughout the rest of the world are connected to the Internet using fast low-cost fiber. Currently the Alliance comprises MAREN (Malawi), MoRENet (Mozambique), KENET (Kenya), RwEdNet (Rwanda), and TENET (South Africa). The Alliance is expected to expand during 2007-2008 as new NRENs are formed and become members. The activities of the UbuntuNet Alliance have so far been funded through several funders including the International Development Research Centre (IDRC), Canada, Open Society Institute (OSI) and OSI Southern Africa (OSISA), BMZ and SIDA. The funds have been invested in building the alliance, NRENs and technology infrastructure.

The connection of the rest of SSA countries institutions to the undersea submarine cable and commissioning of the project in each of the countries would change the Africa's education agriculture education and provide a window for development not only in the sector, but across all fields and disciplines at tertiary level. Each participating institution would have to source its funding for the last-mile fiber connection to 'its door' and internal internet infrastructure based on national ICT policies (which most of SSA has now put in place) and the motivation for this investment would be very high given the potential benefits to each of the institutions.

3. Expected benefits of the project including comments on sustainability and scale

Reliable and affordable internet access facilitates strengthening of faculty, delivery of online course material, and general communication is set to improve. Access to up-to-date scholarly literature, research and collaboration with overseas communities of practice and institutions will help improve research and education in the region.

National governments set regulatory policy on the use and license fees for the use of the available bandwidth by institutions. The revenue is used for the maintenance of the cable network ensuring sustainability of the investment. Precedence set in Southern Africa shows the viability of the model and the nature of public-private sector support and collaboration on the project and potential long-term benefits to education and research on the investment.

Key to the success of the model is the establishment of fair tariffs the enable investment recouping particularly on the inland connections to the undersea cable that governments or quasi government arms have to take lead on or at least coordinate timely to ensure maximum benefit on the infrastructure. High capacity on the undersea cable accommodating multitudes of connections linking all the region's countries will provide for up scaling of the project as the demand of the service increases.

4. How the project will benefit women smallholders

Enrollments at institutions of higher education and research institutions for women are gradually increasing depending on selection and institutional enrolment policies and reliable internet connectivity will create more communication channels for communities of practice and gender sensitive networks available internationally that female students, faculty and research can then easily link with.

Strong faculty and research institutions would deliver output and support the information chain to extension and small holder farmers who are the ultimate beneficiaries of the initiative.

5. Projected costs of the project

Estimate figures show expenditure of $3 in the initial alliance building and terrestrial infrastructure implementation by UbuntuNet in the last three years and this estimate of $1m per year can be projected into the future over a 10 year period to establish a stable base for the organization . Whilst estimates of over $300m required for the completion of the remaining stages for EASSY and for the investment to connect 16 countries to the submarine cable over a five year period starting 2008, the cost estimate for the rest of SSA countries may need further investigation with a project specialist to accurately budget for the project.

6. Measures of success

The establishment of NRENs in all the SSA countries and the building of inland links led by public-private collaborations to connect to the submarine cable would be a tangible milestone on the project whilst the rate of agriculture educational institution's connecting rate to the backbone in each of the countries will provide the project's worth over a short period. Online content access and use by the institutions would be measurable to indicate the benefits to the research and education community in the region.

7. Risks

Policy set by governments supporting the establishment of the NRENs and fair landing and pricing structure for the bandwidth use and access by institutions are crucial success factors for the project as well the willingness of governments to collaborate with private sector on the project. Hence the biggest risk on the project is if the governments fail to see the value of the initiative and do not set appropriate regulatory policies that support and promote the use and maintenance of the submarine cable aimed at developing research and education in Africa and further benefiting the needy on the continent.

4c. Creating and Operating National Agricultural Information Exchange Points

1. Concept

Create and operate a national information exchange point (NIXP). This service would collect currently existing domestic agricultural information and help in the production of additional agricultural content suited for the national audience. In countries where an IXP (Internet Exchange Point) exists, a hosting site connected to this national backbone would be created. In less advantaged nations, the content would be hosted at all the significant ISPs (Internet Service Providers).

2. Rationale

Last year, 2007, the International Telecommunications Union (ITU) called for the creation of IXPs as a means to strengthen national and regional Internet traffic. A 2003 Probe Research Report found that in 2001, 71% of all European traffic stayed in Europe; whereas only 8% of African traffic stayed in Africa. Ironically, African ISPs pay up to 100 times more for international Internet connectivity than do their counterparts in North America and Europe.

The ITU notes that it may be a long time before Internet costs equalize. Firstly, some national governments and some international bandwidth providers believe it is in their economic interest to use their monopoly powers. Secondly, the heavy use of satellite-based connectivity disaggregates Internet traffic and thus reduces the volume of traffic that would either go through fiber optic sea cables or through satellites. This makes the African Internet user population appear even smaller than it already is, and thus reduces the incentive for other firms to provide much needed competition.

The idea of creating IXPs in Africa is not a new one, but what has been lacking has been the local content. The consolidation and increase in agricultural content on this national infrastructure helps to support the country's Internet efforts, while it synergistically helps in the creation of a mechanism for the efficient distribution of badly needed agricultural information. Naturally, once this system is in place, nationally oriented content for education and health would also be candidates for national hosting.

3. Evidence the project can be successful

The norm for the world outside of Africa is that there is a natural progression to a more localized Internet. In this regard, this project would be helping with a natural progression that should be taking place normally.

As important as it is to create a comprehensive database of locally relevant agricultural information, the full benefit of collecting this information only comes when the smallholder farmer can access it. Digital Green's peer-created videos and Mali's market information system are two examples of agricultural information that smallholder farmers find valuable.

African nations often have untapped Internet connectivity. Urban areas frequently have wireless Internet providers, and cell phone providers frequently have nationwide data networks as supplemental features to their voice services. In both cases, the average person cannot utilize these services due to the high costs. As mentioned before, these high costs are primarily the result of the abnormally high charges for international Internet connectivity. If one were to remove this fee by creating a domestic Internet

rate, much like a local and long-distance call, users may well find appealing the currently underutilized connectivity options.

In short, we know that a move to local content is a normal development process. We know that smallholder farmers, not to mention government agencies and universities, want agricultural information in digital format. Finally, the opportunity to access a national repository of agricultural information is currently available.

4. Expected benefits of the project

This project has the potential to dramatically increase access to agricultural information. In Mali, the design team heard farmers and wholesalers describe the improvement in market efficiency and product pricing for the products being monitored. The creation of a national Internet provides avenues by which other projects can transform the agricultural environment.

Sustainability and Scale

The technical aspects of this project are easy to scale because the addition of processing and storage capacity is easy and inexpensive. The main issue will be to bring local content into this hosted site. The majority of the work will be to get the first large collection of content online. As the site contains more information, providers of agricultural information will be eager to pay for their content to be developed and hosted. At some point, this site could be sold to a commercial vendor or to a consortium of stakeholders. The ultimate goal is for this service not to be necessary due to the proper functioning of Internet dynamics within African countries.

4. Projected costs of the project

The initial project would involve three African countries: Mali, Zambia, and Kenya. Each center would require two million dollars for the first year. Approximately one million would be for hardware and facilities, and the second million would be for staff, legal and governmental fees, and for content accumulation.

5. Measures of success

There are many internal measurements that can be used to determine success. Some possible site generated statistics are the number of users, the amount and types of content, and the average ranking of content. Some external measurements could be the name recognition of the system by key stakeholders, especially that of smallholder farmers. In addition to name recognition can be percentage of usage, user experience and the likeliness of using the same again.

6. Risks

The most significant risk is that of governmental interference. IXPs in Africa have had problems in the past because the government telecommunications entities have felt threatened. While this appears less true today than it once did, anything that appears to create a new system of communications with a nation has to be concerned with how it is viewed by the government. While this project is not intended to create IXPs,it may have to be linked to the development of such a center so that the content may be made available.

The second major risk is that local data providers may either be unwilling or unable to create a domestic pricing tier for users of the national agricultural database. This would greatly restrict the ability of smallholder farmers to access the information. This risk should be fairly remote in that Internet providers have to pay so much for international connectivity that they cannot add a significant profit margin. Domestic traffic, while priced far lower, will be based on their cost of operations and thus they may actually enjoy higher profit margins.

4d. Expanding African Access to Global Scientific Literature in Agriculture, Environment and Health

1. Concept

Since 1999, several free or low-cost electronic scientific journal delivery programs have been implemented to close the serious information gap in food, agriculture, health and medicine. They make available to teaching and research institutions in 114 of the world's poorest nations the equivalent of a research library with the highest quality journal content. These inter-related programs include: 1) TEEAL (The Essential Electronic Agricultural Library) [www.teeal.org]; 2) AGORA (Access to Global Online Research in Agriculture) [www.aginternetwork.org]; 3) HINARI (Health Internetwork Access to Research Initiative) [www.who.int/hinari]; and 4) OARE (Online Access to Research in the Environment) [www.oaresciences.org]; aka (T/A/H/O). Where scientists have access, these programs are having a transformative impact on research and education. However, in most African countries, lack of Internet connectivity, inadequate bandwidth, no or reduced library budgets, and low information literacy skills among librarians, faculty and students limit full use. To increase access to and use of these powerful research and education tools, the current successful inter-agency model of T/A/H/O capacity building, coordinated by the South Africa-based Information Training and Outreach Centre for Africa (ITOCA), will be scaled up over five years with existing and new partners. Existing partners include FAO, WHO, UNEP, Cornell, Yale and Michigan State universities, CTA, INASP, ILRI and the publishers who provide the content. All training is carried out in partnership with local universities or institution. Major components would include: 1) Distribution of LanTEEAL sets (200-400 depending on funding) with necessary backstopping and peripherals; 2) Eight 3-day national Train-the-Trainers workshops per year in English, French and Portuguese depending on the country; 4) Equipping Regional Training Hubs in East and West Africa to carry out more tailored and advanced institutional training; 5) Higher level Agricultural Information Literacy training to expand the core of African library professionals able to teach digital literacy skills in agricultural sciences and assist in integrating information literacy into university curricula, with special reference to such initiatives as e-Agriculture, AGRIS, etc.

2. Rationale and evidence the project can be successful

Access to up-to-date, peer-reviewed research is a key driver of both short-term and long-term development in Africa. It contributes to institutional capacity building, curriculum enhancement, research and extension quality, and evidence-based policies, all of which have an impact on smallholders' welfare. As of October 2007, 721 institutions in 43 Sub-Saharan African countries had registered for AGORA. Collectively, these institutions represent the major actors in agricultural research and teaching in Africa. They are producing the next generation of agricultural scientists, teachers and field practitioners. The five African countries with the most institutions registered are: Nigeria (100), Tanzania (69), Ethiopia (61), Kenya (56) and Ghana (41). They are followed by: Zimbabwe (39), Uganda (36), Mozambique (29), Sudan (27) and Mali (23). An average of almost 20,000 PDF articles are downloaded from AGORA monthly, with 12-14,000 PDF articles downloaded by institutions in Sub-Saharan Africa. This compares with the average monthly download rate of 100,000 for HINARI users in countries that have relatively good Internet access and IT literacy. These figures demonstrate both the demand and potential for improvement. In 2006, over 220 agriculture information professionals launching the Africa Chapter of the International Association of Agricultural Information Specialists (IAALD) urged renewed efforts to mobilize agricultural information to improve food security and enhance rural livelihoods across the continent, underscoring the critical importance of such programs as TEEAL and AGORA. Since its establishment in 1999, ITOCA has trained almost 2,000 librarians, information specialists

and researchers how to use these resources. Since April 2004, it has conducted 25 three-day intensive T/A/H/O Train-the-Trainer workshops in 18 African countries, with over 600 trainers from agriculture and health sectors representing 250 institutions. This has led to significant increases in registrations and use of AGORA and HINARI, and more rapid roll out for LanTEEAL. The 2006 external evaluation of AGORA and HINARI found a direct link between training and increased use of the programs.

3. Expected benefits of the project including comments on sustainability and scale

Follow-on training from ITOCA's training over the last several years has reached some 5,000 users, enabling them to find, search, browse and cite journals and articles and identify other important electronic resources. It is estimated that some 20,000 end users could be reached over a 5-year period. Training information professionals on T/A/H/O has led to increased visibility and status of librarians and libraries and significantly increased library patronage. Specific target audiences for training include CTA-funded Q&A service staff, IAALD Africa chapter members, among many others. Greater use of the literature will lead to more articles submitted from African researchers and accepted by refereed journals and thus more exposure of African agricultural research issues internationally. African researchers, likewise, will be better able to compete for grant funds and collaborate with peers at advanced research institutions around the world. All of these benefits will improve the quality of research and teaching directed at smallholders in Africa. As training on T/A/H/O and other electronic resources become integrated into curricula, greater emphasis can be placed on more advanced skill development of the institutions' information and knowledge managers.

4. How the project will benefit women smallholders

Access to research affects smallholders (including women) at multiple levels. Examples abound where literature reviews on T/A/H have led to policy recommendations that have major impact on smallholders. As John Willinsky notes in his article on "Research in international policymaking," in the Summer 2006 Harvard International Review, the case Chad and Benin made to the WTO against US cotton subsidies, which affected millions of women cotton farmers in West Africa, was based on access to research and data on open sources, such as AGORA. He writes, "This ability to access research has become part of the struggle to create sustainable and fair markets for the developing world." Tanzania's National Institute for Medical Research (NIMR) attributes access to research findings on HINARI for the government's national policy on malaria bed-nets, which affects the well-being of all rural families.

5. Projected costs of the project

$10 million over 5 years, with $5 million in personnel (mostly Africans, in Africa), $2.5 million in workshop expenses and $2.5 for equipment, training materials, backstopping and evaluation.

6. Measures of success

Numbers of information professionals completing courses, number of end users reached, increased numbers of articles in international journals authored by African scientists, university curricula integrating T/A/H/O training, numbers of articles downloaded by AGORA-registered institutions.

7. Risks

The AGORA, TEEAL, HINARI and OARE programs can only operate with the authorization of the participating publishers. However, they have agreed to align AGORA, HINARI and OARE with the Millennium Development Goals, and thus have agreed to continue the programs through 2015.

4e. Building Online Delivery Systems and Repositories for Agricultural University/ Extension Publications and Journals

1. Concept

Most newly published material is in electronic format in much of N. America and Europe. Even when a print version is available, the original is electronic. This is common even for small publishers, academic society publications, and extension material. However, print is often still the norm for much of the rest of the world, limiting access to materials. Access to extension materials, agricultural journals, and historical agricultural material of relevance to African and Asian agriculture will be improved by conversion to electronic format. To further support wide usage, a delivery platform that supports multiple languages will be chosen.

2. Rationale and evidence the project can be successful

The solution to the problem is to convert to electronic format extension materials appearing only in print. The principles of digital imaging have been used in a variety of projects, such as the Making of America Project at the University of Michigan (http://moa.umdl.umich.edu) and Cornell University (http://moa.cit.cornell.edu), the Core Historical Literature of Agriculture (http://chla.library.cornell.edu) and the Home Economics Archive: Research, Tradition, and History (http://hearth.library.cornell.edu) at Cornell University. These digital imaging technologies and principles have also been applied more recently by large-scale projects, such as Google Books, Microsoft's Windows Live Book Search, the Million Book Project, and the Open Content Alliance.

3. Expected benefits of the project including comments on sustainability and scale

Text pages, color plates, complex illustrations, and black and white photographs scanned as high quality digital images that are then made available to agricultural university and extension communities will significantly improve access over what is currently possible. Text should be scanned as 600 dpi bitonal (1 bit) images; color plates as 300-400 dpi color (24 bit) images; and complex illustrations and black/white photographs as 300-400 dpi gray-scale (8 bit) images. This approach, along with images in a standardized format, such as TIFF or JPEG200, and lossless compression schemes allows images to continue to be useful as bandwidth increases and high definition monitors are developed.

Page image files processed to generate optical character recognition (OCR) and XML will enable searching and browsing for quick and targeted retrieval of information. Content will be displayed to the user through page images, ensuring that the user sees the most accurate representation of the original print material. Navigation will be eased by noting pagination and highlighting document structures. Digital masters will meet the functionality requirements of the Benchmark for the Faithful Reproductions of Monographs and Serials (www.diglib.org/standards/bmarkfin.htm).

Delivery systems will be developed using free or low-cost open-source software, such as Greenstone (http://www.greenstone.org) or D-Space (http://www.dspace.org). Both packages require a relatively low investment of IT professional time and are customizable to some degree. Both are also able to handle a variety of materials, such as digital images, digital audio, and digital video. Greenstone may be especially useful for this project's purposes since it supports many languages.

Preservation of electronic materials is a challenge to all libraries and institutions that have a large corpus of digital materials. Thus, it is necessary to plan from the beginning for the long-term preservation of the electronic material created for the project. While the website(s) created for this project should be mirrored at a remote location, simple back-up systems could also be employed. For instance, while the electronic collections are small they could be burned to CD or DVD for storage purposes, as long as the media is refreshed annually. Long-term preservation requires the development of a preservation repository or the use of a commercial repository.

4. How the project will benefit women smallholders

Digitization of a wide range of agricultural and related materials will greatly improve the amount and type of information currently available to extension personnel, equipping them to better address the needs of women smallholder farmers.

5. Projected costs of the project

Materials can be digitized and made available in an online environment in the US for approximately $1 (USD) per page. The scanning itself costs $.20 to $.25 per page (USD). Other costs come from the pre-scanning and post-scanning work described above. Costs in India or Africa, for instance, would be lower due to the difference in labor costs. Funds would also be used for staff training and for the purchase and maintenance of servers at each participating institution and for back-up servers. A detailed business plan would be developed prior to implementation.

6. Measures of success

The number of pages digitized would be the first measure of success. Once the material is available electronically the number and types of searches and pages viewed would demonstrate the amount and efficiency of use of the materials. User surveys would indicate information needs, allowing for the addition of further content and enhancing the website's tool set.

7. Risks

Preservation of electronic materials is a challenge to all libraries and institutions. Solutions to this problem are beginning to emerge, especially from some research libraries in the US and Europe. However, it will take time for the establishment of a reliable system, and is likely to be expensive to implement.

4f. Delivering Non-Academic Agricultural Content to Support Agricultural Extension Activities

1. Concept

Extension agents and NGO workers need access to reliable agricultural information if rural livelihoods of smallholder farmers in Africa and Asia are to improve. Information does exist, but it is typically in English-language scientific publications that are inaccessible to non-English speakers, and those who are not highly trained scientists. Further, these as well as extension publications, are not easily or widely available. Thus, even trained personnel who might bridge the gap between knowledge creation and its local application by smallholder farmers do not have the information to effectively do this.

A model is proposed that involves personnel with agricultural expertise working with agricultural program graduates to make scientific knowledge more accessible to such "bridge workers" in the agricultural sector. In addition, community-based findings of local significance and applicability would also be included for dissemination by extension and other agricultural sector workers. Such information would be organized on a website, but would also be available in a variety of formats, including other, non-internet formats (CD-ROM or hard drives), video/audio (via TV, radio, phone), and paper. The information needs to be regularly updated material that is location and need-specific, multi-lingual, and visual to accommodate the varying literacy levels of farmers. In particular, it needs to be accessible and relevant to women who are the majority of small-holder farmers in Africa and Asia.

2. Rationale and evidence the project can be successful

Several resources exist to deliver published literature and reports to agricultural scientists, among them the FAO's WAICENT and e-agriculture portals, Eldis, the CGIAR's CGVirtual Library, and Mann Library's TEEAL and AGORA (which supports English, Arabic, French, and Spanish) initiatives. However, the materials in these collections are generally not location and need-specific, and target highly trained, English-literate users, rather than the average extension agent. Digital Green uses participatory videos to disseminate targeted agricultural information directly to smallholder farmers in South India. This approach is accessible and relevant to farmers who see their peers in videos, but is not linked to knowledge generated by institutionalized research and development (both academic and commercial or market-based). An innovative approach to information dissemination is needed that marries the relevancy of Digital Green with knowledge generated by formal institutions, but made accessible through the interpretation of published literature—such as that found at Virginia Tech's Virginia Cooperative Extension website.

3. Expected benefits of the project including comments on sustainability and scale

Multi-media content will be categorized by subject within three broad areas: agriculture and natural resource management; agribusiness and marketing (including post-harvest processing and off-farm income generation activities such as handicrafts); and human and livestock health and nutrition. Knowledge in all three is critical to improving agricultural productivity, environmental sustainability, and human well-being. Foundation funds will be used to recruit and train personnel for content creation, and to leverage existing agricultural networks such as public and private agricultural education and extension systems, agro-business dealers, and NGOs for delivering information and gathering feedback in pilot-scale implementations.

The pilot phase will cover 100 villages each in Kenya and Mali, and two Indian states to assess the influence of varying infrastructures, cropping systems, and cultural norms—particularly those governing the rights to resources of women. In 3 years, implementation will be scaled up to broaden institutional arrangements to sustain information creation and delivery, and to include other regions. Content, material, and hardware maintenance is envisioned to continue after the funding period through the recognition of mutual benefits for farmers and information deliverers. Innovative arrangements such as the formation of farmer cooperatives paying small fees to ensure timely and relevant information delivery could also play a role in sustaining this model.

4. How the project will benefit women smallholders

Location-specific and need-based agricultural information targeted to smallholder farmers and delivered via women-centered examples and visuals will improve livelihoods of women and entire families. It will also acknowledge and formalize the contribution of women within their societal structures. Access to information on activities that tend to be female and family-centered—such as handicrafts and human and livestock health—directly benefits women and children as well.

5. Projected costs of the project

Pilot scale implementation over the first 3 years of the project will cost about USD 1,000,000 annually, with funding decreasing to 750,000 and 500,000 annually over the next 2 years. Much of the initial costs will cover software, hardware, content creation, facilitating participation by personnel in existing agricultural networks, staff recruitment and training, and survey creation, administration, and analysis. Costs over the last 2 years will primarily cover staff recruitment and training, content creation and maintenance, and survey administration and analysis.

6. Measures of success

Project effectiveness will be measured quantitatively and qualitatively through surveys to determine success. Indicators of success will include assessments of: most popular delivery formats/media; whether the type of content needed is being delivered; who is using what material and how—to help address gender, socio-economic status, cropping system, and other biases; changes in "livelihood" as measured by income, children's education level, family health and nutrition (food choices and accessibility).

7. Risks

Context-based content, flexibility in mode of delivery, and personnel responsive to local and gender-based issues and feedback are critical determinants of this project's success. Scaling up from pilot phase implementation and maintaining effective service after the funding period are likely to be challenging, but not insurmountable obstacles, given effective initial deployment and innovative arrangements.

5a. Developing, Sharing and Delivering Smallholder RadioAgInfo Content

1. Concept

Programming partnerships will be developed with existing community radio systems. Agricultural personnel from nearby agricultural institutions (e.g. higher education, governmental agencies, extension models, etc.), both faculty and students, will be recruited to participate in the development of content in a variety of formats, and lengths from 30 seconds to one hour radio programs focused on community agricultural needs. The program content will be archived in English or other base languages in addition to being presented in the dominant local languages. This RadioAgInfo bank will be available to share across countries and regions. Programs will use a variety of formats including story-telling and "call-in" radio, to allow local smallholder farmers to interact with the information using a variety of technologies and survey techniques and to request specific program content. Archived programs will become part of the larger agricultural information system.

RadioAgInfo typically will not build or operate community radio stations, but it will be a content provider which also offers evaluative support for its delivery and use.

Audio brochures or flyers will be a major product. These topical brochures, audio versions of extension materials, can be delivered by radio, MP3 audio device, cell phone, or podcast. One program thrust will be the semi-automated translation of audio brochures into local languages, possibly using machine translation, augmented by edits of agricultural students recruited as radio readers in local languages.

In addition, agricultural content, based on a modularized curriculum, will also be used to feed multi-media content into the formal agricultural training system.

2. Rationale and evidence the project can be successful

There are many successful community radio stations in South Asia and Africa. Many smallholder farmers in our WorldAgInfo Village Surveys reported radio as their prime source of information. Experimental efforts are already underway in the use of MP3 audio and video devices.

3. Expected benefits of the project

As the RadioAgInfo content bank becomes well developed it will be easier for community radio stations to access up to date agricultural content which will be open source, and easily adaptable to use as individual stations see fit. The development of audio brochures will provide agricultural faculty and students with ready made opportunities for clinical practice. Extensive formative evaluation efforts will allow for the rapid improvement of both content and delivery support systems.

Sustainability and scale

RadioAgInfo content banks may be housed in Agricultural Universities and become a standard feature of their training and clinical practice. Corporate support may be available in the sponsorship of audio brochures with promotional "tags" to advertise their products. User fees may become an option with call-in audio data banks.

4. Projected costs of the project

- RadioAgInfo infrastructure development for program content generation, institutional relationships, feasibility studies, translation, and university and extension interface.
- Translation protocols
- Experimentation with alternative delivery systems
- Exploration of synergies with other institutions and systems
- Extensive formative evaluation efforts, including the development of evaluation protocols and instrumentation and longitudinal analysis

5. Measures of success

Measures could include the extent of use of content materials generated and usership "ratings" (RadioAgInfo may develop a proxy for "Nielson-like" ratings of community radio listenership. Analysis of macro agricultural production and environmental health data for areas served and not served by extensive RadioAgInfo programming.

7. Risks

It may be difficult to get the cooperation of agricultural universities in making RadioAgInfo content development a regular part of their curriculum. Community radio stations are often expecting to be paid for airing of content and the idea of brief, agriculture public service announcements may be a difficult concept to "sell." Developing a social networking mentality for community radio stations across regions and national boundaries may not succeed.

5b. Communicating Agricultural Information via Cell Phones (WorldAgCellPhone)

1. Concept

Communicate agricultural information via cell phones. Content would be collected from a variety of agricultural information sources and then distributed through local cell phone networks. Some of the possible services that could be offered are: soil testing system, market information via SMS, automated agricultural answering system, and agricultural information audio and video downloads.

2. Rationale

The cell phone is the most pervasive form of bi-directional communications in the hands of the smallholder farmer. The recent explosion of cell phone access has left agricultural information systems behind. The move to cell phone based systems is a natural and potentially very beneficial.

Cell phones have recently started being used in Africa for sending SMS-based information. These simple systems have already had a major impact. If data and voice services could be added to SMS, the possible uses would increase greatly. The WAgCell center could help local government agencies, agricultural NGOs and farmer cooperatives to take advantage of this exciting new tool.

Cell phones could also be used to transmit data, even video files, to cell phones with sufficient memory capacity via the cell phone's data service. The video could be watched on the cell phone's small screen or projected to a common TV set. The system could work along the lines of a podcasting system or on-demand system. A user would have requested information delivered at night when the cell phone company is not otherwise using its infrastructure. If the cell phone company could be convinced to transfer data files at off-peak times for a very low cost, that could transform information delivery to smallholder farmers.

Evidence the project can be successful: SMS messaging has already shown great potential. The FAO is using SMS messaging as a data transmission system for field workers wishing to send in agricultural reports. The Zambian farmers' union uses SMS message to distribute market prices.

Both South Asia and Africa have a large percentage of illiterate farmers. Call-in help centers have become quite popular, both because of their immediacy and because one does not need to be literate to access information. This project could help smallholder farmers by creating an automated answering system which would funnel callers to the right language and content area. If, after listening to the most common answers to their question, the farmer still has questions, the automated system could direct the call to the person most able to answer the call based on language, content expertise, length in queue and cost per minute. This project would first look to current efforts to provide call-in centers and offer technical and strategic coordination.

Another service could be the creation of a soil-testing network comprised of local women. Like the Grameen Telcom's pay-cell-phone system, local women could charge for the use of an automated soil-testing device to be sold by the project. This model has worked well for cell phones and it should be an attractive service for smallholder farmers given the significant impact fertilizers and other agricultural inputs can have on crop yields and on soil health.

3. Expected benefits of the project

This project has the potential to dramatically increase the access to the agricultural information. The cell phone is uniquely positioned to provide sophisticated, two-way communications. This may be the first time the smallholder farmer has had the ability to use technology to communicate with sources of agricultural information.

While it is difficult to measure the impact of a new type of technology, we can say that the smallholder farmer is very interested in obtaining reliable agricultural information, and that the cell phone realistically provides this potential.

Sustainability and scale: This project has the benefit in that the use of cell phones is projected to grow rapidly in Africa and South Asia. This project can ride on the coattails of that growth. Scaling the technical aspects, such as broadcast of agriculture-related SMS messages, is trivial. The scaling of systems that utilize people will clearly be more difficult to accommodate. Fortunately, the use of a central system will allow for the sophisticated analysis of calling patterns so as to allow for the optimal deployment of human resources.

This project may be able to become self-sustaining based on user fees and fees applied to content providers. For example, the project could arrange to receive a small percentage of the normal fees applied by the cell phone company. If a normal SMS message costs ten cents, one cent could be allocated to the project by the cell phone provider.

One possible use of this system is to use a SMS based system to transfer information from automated soil testers. A local soil tester could be provided an automated soil tester with a GPS capacity. The soil tester could transfer its information via Bluetooth (a short-range wireless system) to the cell phone. The cell phone could send the results and GPS coordinates to a central server at the project. This type of system is currently being operated as described by the FAO. The system could then send back recommendations to the person running the test via SMS. If needed, it could ask for additional information. Because this server would be run as a business, the uploading of data could include a small charge. For an additional small charge, the results could be sent to the farmer whose soil is being tested. Market prices and suppliers could also be sent to the farmer. On the server side, fees could be charged to entities wanting to see the resulting soil map of the country. As this system becomes more widely used and includes historical perspectives, the value for accessing its content would increase. This system could become profitable enough to support other services of this project.

The distribution of audio and video via the cell phone could allow for the insertion of advertising. This could be a significant revenue source for the project. Clearly, there would have to be strict standards for advertisers so that the project's content does not appear biased.

4. Projected costs of the project

The initial project would involve three countries: Mali, Zambia, and India. The main costs will be creating the content collection in local languages and converting to audio format. Two million dollars should be allocated for each center. In some countries, such as Zambia and India, finding automated voice systems and third-party SMS providers should be possible. In Mali, the project might have to purchase its own equipment.

5. Measures of success

There are many internal measurements that can be used to determine success. Some possible site generated statistics are the number of users, the amount and types of content, and the average ranking of content. Some external measurements could be the name recognition of the system by key stakeholders, especially that of smallholder farmers. In addition to name recognition can be percentage of usage, user experience and the likeliness of using the same again.

6. Risks

Cell phone providers may not be interested in providing these services or they may want to price these services beyond the budget of the smallholder farmer.

5c. Using Participatory Radio and Video to Extend Reach of Agricultural Extension Activities

1. Background

Small and marginal farmers often lack knowledge that could immediately improve their livelihoods. However, to educate such a vast, scattered population, two key areas need to be developed: content production and distribution. Classic extension programs typically have followed either a push-based approach in which information is broadcast to farmers, or a pull-based approach in which farmers pose questions to experts. These systems have shown some success in the field; however, the programs are either too general because they aim to be highly scalable (push-based) or too costly because they require experts to provide advice on an individual basis (pull-based).

Nevertheless, extension remains the focus of many government programs; India, for example, has the second largest number of extension workers in the world at over 100,000. However, these programs have challenges. Many farmers have been frequented by extension officers in the past and have become apathetic to the advice they receive. The programs are typically produced by experts of a different socioeconomic status in model conditions. Thus, farmers who seek information from people similar to themselves, may not necessarily identify with the content in such programs.

Most existing technology solutions also fall short. There are rural PC/Internet kiosks that have sought to give farmers access to "expert systems", but these programs have not sustained due to the prohibitive total cost of ownership, and they rarely result in absorbed knowledge by farmers. Other projects have attempted to allow farmers to interact with experts through more cost-effective mobile/SMS-based systems, but even these place an overemphasis on delivering static information rather than on building human capacities. Information does not equal absorbed knowledge or true education.

Our hope is to encourage building on the existing infrastructure and capacity through the construction of an agricultural extension ecosystem that includes not only technology but also new protocols. Many programs expect information or communication technology, such as PCs and mobiles phones, alone to deliver useful knowledge. Instead, these technologies must be placed in the context of existing efforts of governments, universities, and NGOs to build a collaborative platform that delivers end-to-end services to farming communities. The platform must not only address this issue technologically, but more importantly, socially.

2. Concept

Our concept is to advocate the use of locally recorded video and audio, dispersed through "mediated instruction", integrated with existing extension systems. Because audio-visual formats are likely preferred to mostly illiterate, visually-oriented groups, the idea is to encourage the use of audio (radio) and video (using the combination of DVD players and TVs) to reach out to farmers.

"Mediated instruction" is a particular use of video and audio in educational contexts, where a facilitator, who is not necessarily a subject matter expert, is present to pause playback, ask questions, encourage discussion, and otherwise provoke participation. It is known to be a very effective use of recorded media for education.

Finally, by building on extension systems, we take advantage of existing social networks that farmers

already have. It is a known sociological phenomenon, that uptake of new ideas happens through social networks, traveling between social connections. Thus, the idea is to use content generated with local farmers as subjects as a means of advocacy. Such a system could serve as a collaborative platform for exchanging locally relevant media using a digital pipeline comprised of cost-realistic technologies. Radio and video then become mechanisms to capitalize on natural social dynamics to amplify a single extension worker's ability to evangelize agricultural practices.

There are several possible ways to make progress in this idea:

Working with NGOs: An NGO's agricultural expert can record best practices in audio or video. The NGO hires a local facilitator in the village to facilitate the screenings (audio and TV) of these shows. The facilitator is there to facilitate the meeting, record questions and to hand out materials that are talked about in the show. The facilitator then communicates with the NGO expert to better inform him of the needs of the local village. The expert, when he visits the village, can now use his visit to better target feedback.

Working with the government: Government extension systems have widespread coverage, and can be revamped by training them on video/audio based delivery of their extension messages. A workflow as described in the previous paragraph could be followed, except the content in this case is produced by the governmental agricultural expert at the local level by visiting farmer fields. Local facilitators are still key to guarantee success of the program. The hope is that the burdened government extension system officer now finds an amplification channel to deliver relevant agricultural messages to farmers.

Encouraging content from the farmer: Although rare, there are farmers who are real experts in their profession. However, these experts are few in number and dispersed geographically; reliable traditions are often lost. Training the local farmers in the use of audio/video equipment and entrusting the equipment at the local farmers based organization as a public good and have a way for them to post the recorded cassettes to a city center for processing would help in getting information that is lost in the farmers minds.

Having agricultural universities produce content: The real experts are often at universities, with content locked up in a library. The idea here is to stimulate creation of audio/video tapes grouped by area by simply encouraging them to record their innovations offers a tangible way to encourage collaboration with the faculty and the NGO or the government extension staff through the medium of audio/video.

3. Rationale

Using videos as a means of communication has been in vogue for many years, but it is only recently that the costs of video production have become so low as to be affordable for smallholder agriculture extension.

For example, the Food and Agriculture Organization (FAO) of the United Nations supported a farmer-training project in Peru between 1975 and 1986 that recorded 1,000 videos of about 20 minutes in duration that reached more than 150,000 small farmers [2]. These projects and others, such as that of the Deccan Development Society in Hyderabad, India, successfully demonstrated the potential of using participatory video. However, at the time, audio-visual technologies were cost prohibitive. These costs have fallen dramatically in the last decade, and a 1996 FAO study suggested that audio-visual training activities would cost one-third to one-fifth of classical extension training [2].

A recent project called Digital Green, run by Microsoft Research India, has compared the use of video and "mediated instruction" (in which a facilitator is present at video playback to encourage discussion and answer questions among farmers) in an NGO to find that the adoption rates of good farming practices increased seven-fold by using participatory video [3].

Farm radio has pioneered the use of radio to reach out to many farmers in Africa [4].

4. Expected benefits of the project including comments on sustainability and scale

The project benefits are to extend the reach of the extension system by capturing knowledge and best practices in an easily accessible form (video/audio). It allows local facilitators to become trainers without necessarily being experts of agriculture. It encourages farmers to produce content in a format that that is best suited for them to produce (audio/video). It helps in training of junior agricultural experts as they can review the content periodically to update their knowledge.

As there are nearly 800 million smallholder farming households in the world, a system that can enhance their knowledge and skills could benefit a large portion of the poorest populations in the world.

5. How the project will benefit women smallholders

Radio/TV is a very accessible medium that allows participation by men and women. However, in places where TVs and radios are not widespread, a shared TV/radio would be used, and facilitators would need to exercise care to have special screenings with women present. In many cultures, having screenings at night or with mixed-gender audiences would not work due to cultural taboos; these constraints would have to be worked around. Another potential idea is to use existing social group structures, such as Self Help Group (SHGs), to involve women.

6. Projected costs of the project

In each village, the system has two primary types of expenditures: fixed equipment costs for TV and DVD players and recurring honorariums of the facilitators. The equipment costs about US$250 and the facilitators would be paid a maximum performance-based honorarium of US$20-50 per month, depending on location. By working with departments of extension in state governments and NGOs, the system could be integrated into their existing operations at minimal incremental cost. For example, a government extension officer who is only able to visit villages on a periodic basis could be supported by a more regular, local presence of a village facilitator and "virtual" experts in the video-based content.

In some cases, a village's existing infrastructure of TVs and DVD players and local village cable could be employed, but an individual's willingness to share her private TV and DVD player with her community would diminish over time. Local village cable networks could be used for a narrowcast distribution scheme; however, this latter method lacks the personal connection provided by the presence of a local facilitator.

The community might also contribute to the costs of the local facilitator to instill a sense of ownership.

7. Measures of success

Productivity: The end goal of any agriculture extension system is ultimately increased economic production for the farmer (note that this does not necessarily equal farm productivity, as oversupply can result in lower prices, with little economic benefit to the farmer).

Adoption: Productivity is difficult to measure in the short-term. One proxy for productivity is adoption of new practices by farming households, based on the premise that if good practices are being adopted, they will lead to greater productivity.

Capacity: One of the proximal aims is to build the capacities of farmers to improve the sustainability of their livelihoods. At the same time, we can measure the capacities of local organizations to produce and disseminate content. This solution provides a platform for organizations to share the triumphs and the pitfalls of their experiences. As farmers are motivated to adopt a better farming practice by observing the experiences of their peers, organizations can see that reaching the last-mile is possible through the system.

Localization of content: Another metric for success is the degree to which localized content is generated. Since the most effective content is intensively localized to geography and language, the more the overall extension ecosystem can produce localized content, the better.

8. Risks

Content synergy: The objective of improving the sustainability of a farmer's livelihood may be shared; however, partners may have differing viewpoints on how this may be accomplished (e.g., through intensive use of modern chemicals, or through natural sustainable practices). Partners should be encouraged to validate practices through participatory research. Such feedback needs to be incorporated into the system.

Accountability: Accountability is an issue that affects nearly every extension system. It is difficult to ensure that extension officers and field staff are visiting farmers and conducting demonstrations when the locations are often remote and difficult to access. Any solution must therefore provide a framework for an extension staff to be able to structure its activities.

Cost and scalability: Producing locally relevant content and distributing this content through locally-hired facilitators introduce costs that multiply with scale. These costs must be analyzed with respect to alternative models of agricultural extension. Community contributions could be used to provide farmers a sense of ownership for the shared success of the system.

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5d. Using Video to Improve Information and Knowledge Flows From and Among Smallholders

1. Concept

Use the medium of video to convey local information, knowledge, experiences, and needs from small-scale farmers to a broad audience of extension workers, researchers, NGOs, policy makers, and other farmers. The model outlined here provides a way to scale up the local use of video made by farmers as an effective tool for giving "voice" to smallholders.

2. Rationale

Agricultural information and knowledge systems are often focused on a one-directional model -- experts create informational content intended for delivery to smallholders. The merits of expanding that model to enable information to flow from farmers and among farmers are well-recognized. This would enable researchers' work to be better targeted and more effective in meeting smallholders' needs. In addition, policies and extension services could be better designed. Enabling better and broader information flow among farmers would have a different, but also substantial impact; studies have repeatedly shown that farmers cite other farmers as their primary source of information and that trust is a major determinant in farmers' effective use of information. A variety of technologies have been discussed to facilitate the information and knowledge flow from and among farmers (such as PDAs, mobile phones, and the use of telecentres), but video has been shown to be one of the easiest and most powerful media for farmers to use.

Local farmers conveying information in local languages to other farmers can come closer to addressing these issues than other forms of media. Despite the potential impact of using video with smallholders, finding a way to implement this concept in a scalable way -- traversing language, social, economic, and cultural barriers -- has proved elusive. This note proposes a project where a large number of village-level "farmer-reporters" generate video essays/films on local agricultural topics. The videos are edited, translated, and tagged; and text summaries are created, resulting in a library of video and text information that is highly accessible and searchable. Regionally the videos in local languages can be used to convey information to other farmers. In aggregate, videos and text summaries that are well-tagged provide a resource that supports further analysis and the conveyance of critical information to NARs, CGIAR Centres, extension workers, universities, policymakers, and others.

The project is designed to leverage the local knowledge of NGOs and their ability to identify women farmers in surrounding communities that are most likely to succeed as a "reporters." NGOs are used as centers for training the reporters, as well as for video editing, translating, tagging, and producing text summaries.

The project begins with an RFP allowing NGOs to provide documentation as to their suitability for inclusion in the project. Each NGO is granted funding for three years to support the hiring of one staff person skilled in video production, reporting, leadership training, etc. The staff person will train and supervise the village level "reporters" as well as edit and produce the final product video essays. Additionally, each NGO is given necessary equipment, including video cameras which can be "checked out" from the NGO for use by the identified reporters in local villages.

The NGO staff person sponsored by the initial grant has clear deliverables on which continued funding is dependent. As well as delivering a specified number of final product educational video articles each month, the staff person is responsible for the training of local village-level "reporters" in leadership skills, equipment operations, and reporting skills. In order to allow for targeted research questions from a variety of sources, some percentage of the video articles would be on subjects generated by the researchers, policymakers, etc. For example, a request from a CGIAR centre on post-harvest processing and storage of a particular crop may result in information that is useful in selecting traits for plant breeding research. Or the requested feedback in video essays could be coordinated with testing the adoption of a new crop variety or new technology in the same villages. Other video essay topics would be chosen by the reporter, reflecting agricultural topics of local importance.

3. Expected benefits of the project

This project will train a large number of rural women in leadership skills and provide them with the means to document and share local agricultural knowledge, both with other rural communities and with other stakeholders in the information system important to smallholder farmers. A searchable library of videos and text summaries will allow research, policy, and donor investments to be better targeted and more effective. The project design allows for critical, directed feedback on questions that may be relevant to other stakeholders in the information system.

Scalability and sustainability

The project is scalable because it leverages local NGOs and provides incentives for them to participate in a proscribed way. The NGO benefits from gaining the capacity to make videos, as their own work can be promoted through the newly enabled medium. The collection of knowledge from smallholders and allowing for its use by an international community is unlikely to lend itself to a business model and may need continued sponsorship for the production of a public good. There are some possibilities for dual use of the video equipment. In India, for instance, where this model has been tried on a small scale, the equipment and expertise was hired to produce wedding videos.

4. Measures of success

The outcomes of the project would be evaluated. The skills of village-level video "reporters" will, in part, reflect whether the NGO was effective in training. The quantity and quality of the films and text summaries produced can be ascertained by ratings from viewers/readers as to their relevancy, their ability to convey knowledge, etc.

5. Risks

There are implementation risks in terms of dependence on NGOs for success. The project requires coordination among many NGOs that is best achieved by an oversight organization. This organization will face complexities in dealing with so many local organizations and may face a number of defaults as the performance requirements are enforced. Anticipating the incentives of the NGOs and aligning the project with them may be difficult. There will be challenges with equipment – maintenance issues, theft, etc. In addition, there are risks as to whether the locally contextualized knowledge from farmers can be made relevant to a broader audience (whether it is other villages within the region, or research centers half way across the world). Perhaps the largest risk lies in the fact that the information gathered is, by its nature, ad hoc. Basing a video on one lead farmer in a community who describes his experience with a

new technology, for instance, is not the same quality of information as a carefully constructed survey that can provide a much more in depth understanding over many farmers of the context in which the new technology is being used. Unless the information produced is used carefully, there is the potential that decisions based on this body of information may not be optimal.

5e. Community Radio 2.0

1. Concept

Extend the Web 2.0 paradigm to the use of Community Radio for the acquisition and dissemination of agricultural related information and education. The basic concept is to provide "user generated content" (UCG) mechanisms to enhance the use of community radio as a social network. The establishment of new community radio stations and enhancement of existing stations such that smallholder farmers will be able to:

- Send a request using a mobile phone for specific program topics for broadcast
- Vote on a list of programs to select specific topics of interest
- Rate broadcasted programs using simple SMS messages (a la American Idol voting)
- Provide real time feedback or questions regarding broadcasts through the use of interactive voice response (IVR) or a conference call number
- Upload agriculture information via IVR that can be processed and turned into future radio broadcasts and transformed to text (with images) on a web site

The new community radio stations would be set up such that audio feeds could be streamed off a local web site. Content that is currently only available as text can be transformed to audio with text-to-speech tools (i.e. TextAloud). The audio content would be tagged such that it could be harvested from other community radio sites. Community Radio stations would be staffed by extension workers, interns from a "new agriculture university", and local community members after sufficient training.

This solution scenario integrates well with the Radio Agriculture Education scenario.

2. Rationale and evidence the project can be successful

In the many rural Sub-Saharan African communities, the community radio is still the most reliable means to disseminate information. For the most part, radio has always been a "push" technology, such that listeners cannot guide what is broadcasted, nor can they comment effectively on broadcasts. Additionally, the station can only broadcast what it has available and rarely is it obtained from the local community, thus it may not be as relevant as it could be to the local community. Technology, language, literacy, and gender barriers exist which can limit access and sharing of digitized agricultural information. This solution directly addresses those barriers.

Web sites which provide user generated content make up six (YouTube, MySpace, Facebook, Wikipedia, Orkut, hi5) of the 10 most popular web sites in the world today. Clearly, participatory web has been a significant success.

3. Expected benefits of the project including comments on sustainability and scale

User generated content media, whether it is a web site or delivered through radio broadcasts, is somewhat self sustaining. Radio or audio device delivery of content offers great economies of scale in bringing the program to new populations. Instruction in English or other base language will make it much easier to

scale up this effort in multiple countries. As each community radio station would be configured similarly, and use the same set of tools, scaling the project to many stations would not be an impediment.

4. How the project will benefit women smallholders

Current smallholder farmers will receive high quality information using existing communications technologies (radio), thus overcoming the internet infrastructure barriers that still exist in many rural areas. Feedback systems incorporated into project will allow farmers and their families (regardless of gender) to access specific information for their individual needs.

5. Projected costs of the project

Costs will depend on initial size of the project and projected scaling to new populations, countries, and language groups. Major costing categories are:

- Station staff training materials
- Radio/MP3 Transmission Costs
- Support Staff

6. Measures of success

Productivity

The end goal of any agriculture extension system is ultimately increased economic production for the farmer (note that this does not necessarily equal farm productivity, as oversupply can result in lower prices, with little economic benefit to the farmer).

Adoption

Productivity is difficult to measure in the short-term. One proxy for productivity is adoption of new practices by farming households, based on the premise that if good practices are being adopted, they will lead to greater productivity.

Capacity

One of the proximal aims is to build the capacities of farmers to improve the sustainability of their livelihoods. At the same time, we can measure the capacities of local organizations to produce and disseminate content. This solution provides a platform for organizations to share the triumphs and the pitfalls of their experiences. As farmers are motivated to adopt a better farming practice by observing the experiences of their peers, organizations can see that reaching the last-mile is possible through the system.

Localization of content

Another metric for success is the degree to which localized content is generated. Since the most effective content is intensively localized to geography and language, the more the overall extension ecosystem can produce localized content, the better.

5f. Off the Grid but In the Know: Women's Advancement through Interactive Radio

1. Concept

Many rural communities in Africa still do not have reliable cellular or electrical service, thus members of these communities cannot meaningfully use Information and Communication Technologies (ICTs) to aid advancement. In addition, women in rural communities face gender barriers to the access and use of ICT-based development initiatives. The AIR (Advancement through Interactive Radio) project seeks to advance women in rural agricultural communities by adding interactivity to community radio. AIR gives community radio listeners, especially women, a voice with which to respond to development programming (such as agricultural extension programs), as well as a mechanism to participate in the creation of programming content. The AIR project is based upon the premise, grounded in development communications theory, that enabling women to publically articulate what they know, and what they wish to know, will advance community development strategies and increase the stature of women in the community. This objective is widely acknowledged as a key component to sustainable development.

2. Rationale and evidence the project can be successful

While Sub-Saharan Africa is the fastest-growing mobile market in the world, more than 50 percent of Sub-Saharan Africa does not have cellular phone coverage. Community radio is still the most accessible and popular ICT in the region. For example, Zambian agricultural communities benefit from community radio networks that air the Radio Farm Forum (RFF), a program (started in the 1960's) that is produced by the National Agricultural Information Services; and the successful "Development Through Radio" programs, where women's listening groups meet to discuss agricultural extension, health information, educational material and poverty reduction strategies that have aired previously. While community radio's popularity and reach has caused it to be named "the Internet of the Poor" and "Africa's Internet," Community radio's inherent unidirectionality limits its potential usefulness to connect essential development information to those who would most benefit from it – the women who are responsible for agricultural production, management and marketing. Radio also needs to make itself relevant to the growing numbers of technologists who focus on ICT for development; else it will be overlooked as a "serious" ICT by those who do not appreciate fully its potential and audience base. Adding incremental interactivity to radio provides a platform for idea exchange, rather than the more common information "push," for the communities that employ it.

3. Expected benefits of the project including comments on sustainability and scale/How the project will benefit women smallholders

(This development project is directly intended for use by women, thus sustainability and appropriateness for women's use has been our top priority. Thus, we are combining our response.) Radio Mang'elete reaches approximately 500,000 people in a 75km radius around the station tower in southeast Kenya. Broadcasting eight hours a day in the local tribal language, Ki-Kamba, Radio Mang'elete is the definitive source of news and information for the Kamba, a rural society currently undergoing major agricultural shifts due to climate change, the associated loss of both of the typical rainy seasons, and unexpected flash floods. Almost all agricultural work in the region is conducted under the purview of a number of mwethya, or women's work collectives, who divide agricultural and community improvement by locality and interest. Mwethya members take their radios everywhere – it is impossible not to hear Radio Mang'elete when the station is operating. Interviews with mwethya members have shown that these women have a strong and nearly universal desire to communicate with the station. They are full of

ideas and feedback about the programs that arrive at the station each month on CD; they have criticism regarding agricultural content that seems irrelevant or goes against the common wisdom; they have questions about myriad development initiatives that are aired without the option of face-to-face follow up to clarify the data or position in a local context. However, given their workload and social factors, women in general are not able to visit the radio station, nor do they have other means to communicate their feedback. AIR is designed to provide women a mechanism to communicate with the station from their work and home locations, and influence programming to make it more relevant to their livelihoods.

Cell phones have been suggested as an alternative to the custom AIR device. We rejected this approach, at least in the near term, for several reasons. Many communities served by Radio Mang'elete simply do not have cellular service. Further, several women in areas with partial cellular service were adamant that anything resembling a cell phone would likely be taken by their husband and sold. In contrast to the successes of cell-phone-based initiatives such as the GrameenPhone, this observation highlights the non-universal nature of developing communities. However, by designing a free, voice-based system, optimized for female voice ranges, AIR reduces some of the unique barriers to ICT access that women encounter – at least in terms of literacy, cost and mobility. Along this discussion of scale, we are conducting exploratory conversations with health and microfinance NGOs who are investigating the use of AIR in scenarios where it is as necessary to receive information from the community as it is to deliver information to the community, especially in areas where the infrastructure or culture challenges more sophisticated technologies. We are also monitoring the growing use and convergence of community radio and Internet Radio. While expanding into different development areas is not a primary goal of AIR, we intend to make the source code and hardware design freely available for ICTD purposes.

4. Projected costs of the project

System costs

While our current cost per device is in the $150-200 USD range, due to our manual construction of a small number of AIR devices, increased demand could reduce the price per unit to about five dollars. This would require collaboration with a larger development initiative or agency, such as the network of AMARC community radio stations or a wide-scale education/health program. Our current cost is in the hardware components; the design requirements are based upon information collected from community radio listeners, station managers, station operating personnel, and community radio NGO leadership. We met with mwethya representatives to iterate on design decisions and discuss deployment and evaluation strategies. The prototype consists of 3 parts – the handset, a solar-powered charging station, and the equipment required at the radio station. The handset is designed to enable users to simply push a button and talk into the device, in order to support non- or semi-literate populations. Inside the ruggedized enclosure, the device architecture consists of a low-power ARM processor, and 802.11 and Flash RAM USB devices for networking and storage, respectively. When a woman presses the push-to-talk button and speaks into the device, her voice is filtered (in hardware) and compressed for storage using codec software, and then stored in the Flash RAM. AIR devices in a given area form an ad-hoc mesh network; thus, voices are asynchronously routed through a Delay Tolerant Network (DTN) architecture to the terminus device at the station, where incoming voice messages are made available on the existing station PC for post-production and broadcast use. Once the radio station has received and stored a particular voice message, an acknowledgement packet is routed back to the original transmitting AIR device, so that users have confirmation that the transmission was successful – a requirement added by mwethya members on our last field visit. Currently, the AIR project is funded by two Microsoft Research grants; we are actively looking for partners who wish to iterate on our current design and goals at a larger scale.

Community costs

AIR requires community adoption and station commitment. While this will vary across communities, such pre-deployment activities as feasibility studies, search conferences, and station training must be conducted to gauge community interest.

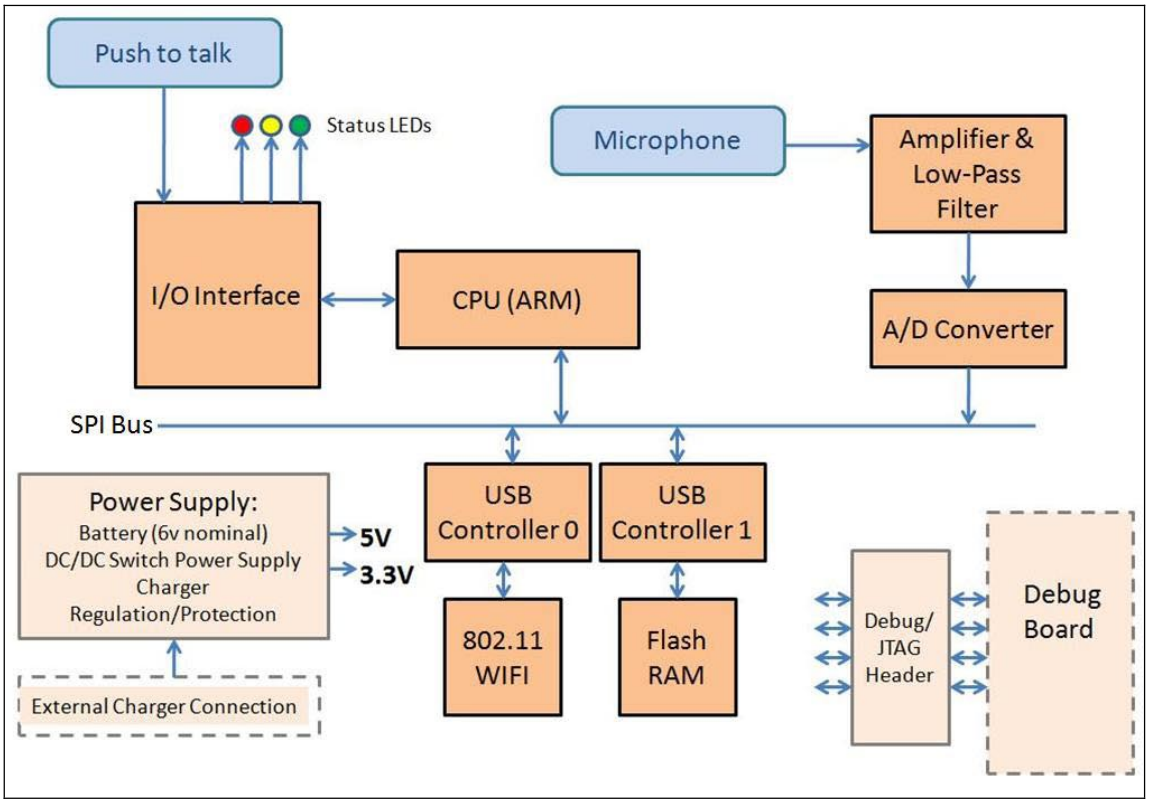
5. Measures of success

We are preparing to deploy an AIR device to each of the thirty-four mwethya served by Radio Mang'elete. Following deployment, we will study the impact that AIR has on broadcast content and audience response, especially as listeners become more active participants in the broadcast/response cycle. Does better content lead to better practices? Does a two-way communications model increase women's perceived empowerment? Our metrics of success will include a comparison between a baseline and post-project survey data on the impact of Radio Mang'elete before and after the introduction of AIR devices, tracking the number of "calls" made by women (per mwethya), station receptivity to women's feedback, as well as other qualitative and qualitative methods to determine if the AIR devices have a positive effect on both radio programming for development, as well as women's agency.

6. Risks

Risks to the successful deployment and evaluation of the AIR project include user adoption and uptake, station willingness to produce radio programming per women's feedback, device malfunction or theft of system components, lack of interest in Community Radio in favor of "higher-tech" ICTD solutions.

7. Appendix: AIR device diagram



6a. The Economic Empowerment of Women in Agriculture in Africa and South Asia

1. Concept

The male bias in the gender mix in Africa's agricultural institutions is sobering. In ten countries in Africa, 90 percent or more of the agricultural scientists are male (Figure 1). Moreover, the research and knowledge base on how to help increase the economic empowerment of women in Africa is patchy, even though women are major producers of food crops, important traders in local markets and diligent workers in non-farm employment. Part of this reason for the gender gap is a carryover from early gender research that focused on whether women worked longer hours than men and whether they gained or lost in the commercialization of farming. For example, when Ester Boserup published her path–breaking book Woman's Role in Economic Development (1970), she charged that women "lose in the development process" because agricultural development projects can lead to an increase in women's workload and a reduction in the workload of men. But Boserup's assertion was not supported by rigorous empirical research. To test the Boserup hypothesis, Spencer (1976) carried out a study of an agricultural development project in Sierra Leone and found that the new technology increased women's workload slightly but the increase was much less than the increase in the workload of adult males and children. Spencer rejected Boserup's emphasis on the number of hours worked and called for research on the returns per hour of work and the profitability of farming. But after decades of research, there is a lack of understanding on how to help rural women gain economic empowerment through three pathways out of poverty: farming, rural nonfarm employment and migration to market towns and cities.

2. Rationale and evidence the project can be successful

There is currently a lack of information about policies and strategies on how to address gender issues within Africa and between Africa and South Asia. This project is a study of the three economic empowerment pathways for women (farming, rural non farm employment and migration) in two countries in Asia and two in Africa. It is complex and time consuming because, as Boettiger has pointed out, there is an array of subtle and complex questions that have to be addressed in studies of female farmers, etc. The four country studies will take two to four years to complete, but we believe that the payoff would be high. Agriculture is the most important pathway out of poverty and it will be the centerpiece of the four country study. We now turn to some of the issues to be studied in the agricultural pathway option:

- The economic empowerment of rural women in farming hinges on their ability to garner access to resources (e.g. land, credit, education) and timely information about prices and markets. The task is to study the ability of female farmers to generate new income streams from higher yielding food crops and higher value export crops through the use of improved varieties and agronomic and market information diets, higher value foods and export crops and access to global supply chains. For example, a study in southern Ghana found that because women had lower soil fertility on their food plots (food grown around their compounds for their families) and less access to credit, they were less likely to plant pineapples, a profitable export crop. But as Boettiger points out, farm management and marketing studies of female farmers are far more complex than those for male farmers because in studies of female pathways out of poverty, special attention in rural surveys must be given to local knowledge, and how to make content relevant locally.
  Finally content must be studied in depth because research has shown that different types of content varies in value when it is created in a global setting (e.g., CGIAR research), or in a sub region or an

individual country or a village. Other issues to study are why do males often fail to pass on new extension advice to female farmers.

- The second pathway is non farm employment that accounts for about 25 percent of the hours worked by women in rural areas in Africa. Here the emphasis is on the need for skill training for local off farm firms.
- the thirds pathways is migration and the critical role of education in teaching new skills for more complex markets.

Clearly the most promising pathway out of poverty for women is wage labor and high value agriculture (vegetable, fruit and flowers) because these jobs provide about twice as much labor input per hectare of cereal production and additional off farm jobs in processing, packaging and marketing (World Bank 2008).

3. Expected benefits of the project including comments on sustainability and scale/How the project will benefit women smallholders

Concentrating on designing and executing a four country comparative study of the economic empowerment of women in agriculture can pay large dividends because the current research and donor funded action programs for women are poorly designed and poorly evaluated. For example, the World Bank issued an Operational Policy on Gender dimensions in 1994 and cranked out a string of recent books on mainstreaming women, but they rely heavily on secondary data.

4. Measures of success

Generation of primary data sets on the economic empowerment of women in agriculture will help the governments of developing countries and donor agencies have access to more accurate information on a range of issues that are crucial to the success of women's projects:

- inventory of information needs
- localization and ensuring content, by, for, and about women's' issues
- gender
- farmers' voice
- credibility
- technology adoption
- accreditation
- time sensitivity
- value of networks
- integration of ICT with existing information systems

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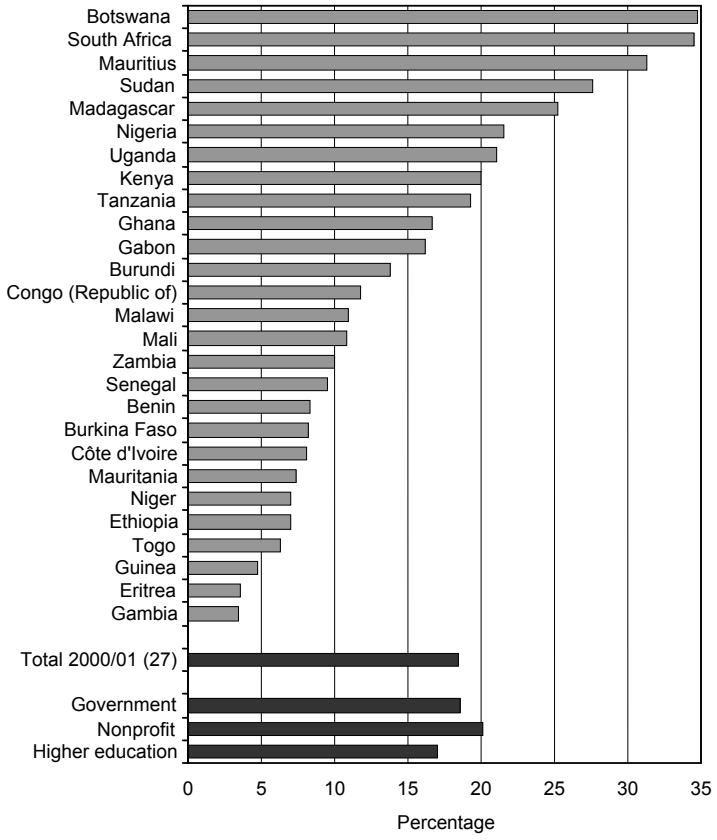
Figure 1—Africa: Share of female agricultural research staff by country, 2000



Source: Beintema and Gert-Jan Stads (2006)
Compiled by authors from datasets underlying the ASTI Country Briefs.

6b. Developing the Capacity of Extension Officers and their Organizations to Train, Work with and Support Women Farmers

1. Concept

Extension systems' widespread neglect of women farmers can be reversed through changes in attitudes of extension personnel and the structures and processes within agricultural institutions to assist them to become accountable to women farmers. While there is ample evidence that women extension professionals are more effective than male professionals in communicating and servicing women farmers, the small numbers of women extension agents (a global average of 15% according to FAO) require a strategy that enables male agents to service women farmers as well. This requires a two pronged approach that:

- Builds the skills and changes attitudes of the professionals
- Facilitates a process of organizational change to create an enabling environment that supports gender equity and is responsive to the needs of women farmers.

Skill building for female and male extension officers on gender, leadership, negotiation, adult literacy, information management, communication and training can develop their abilities to train, work with and support women farmers, while simultaneously acting as internal change agents to facilitate processes of change within their organizations.

Our hypothesis is that both men and women extension professionals, if provided with suitable, gender-sensitive organizational support, skills and ICT resources, and made accountable for reaching women farmers, will deliver better services to women farmers and groups. This solution would transform existing extension systems to be accountable to women farmers.

2. Rationale and evidence the project can be successful

Despite women's major role in the economy (comprising over 70% of total African agricultural labor and up to 90% of the labor engaged in food production) (Blackden and Bhanu 1999), women farmers have been by and large neglected by existing extension systems, receiving but 5-7% of extension services due to their limited control over assets and decisions, and systemic gender biases that are evident in agricultural institutions throughout Africa, South Asia and much of the world. A recent FAO survey showed that only 15% of the world's extension agents are women. Only in very few countries have women field staff been deployed in sufficient numbers and with sufficient resources to become effective agents of change among women farmers.

Experience has also shown that complementary strategies to bring about changes in attitude and behavior within institutions are required. Gender sensitization training has been developed to initiate the task of attitude change within male-dominated extension and research bureaucracies and donor agencies; training materials and methods for gender analysis in agriculture have also been developed and are now in widespread use. Specialist material for training of trainers has been developed and are beginning to spread through agriculture training institutes, colleges, and universities.

However, training needs to be complemented by other strategies to bring about change in organizational behaviors. Spring (1986) demonstrated in Malawi the range of often minor but critical, adjustments

which can increase women's access to and the relevance of extension significantly, even where most field agents are male. For example, male extension agents were encouraged to ask their male farmer contacts to include their wives during visits, demonstrations, or farmers' meetings. Field agents were required by their organizations to devote a greater percentage of their time to working with women's groups. Women farmers' seminars were organized for women to share with researchers and field staff their solutions to the technical problems specific to women farmers' production systems, and women's field days were organized to celebrate and legitimate women farmers' successes and to promote farmer-to-farmer exchange among women in Tanzania.

Extension programs that target women farmers as an integral part of the target audience have produced considerable benefits. In Kenya, following a nationwide campaign targeted at women under a national extension project, yields of corn increased by 28%, beans by 80%, and potatoes by 84% (FAO, 1997).

3. Expected benefits of the project including comments on sustainability and scale

Agriculture extension institutions that have already demonstrated interest in improving their capacities to address the needs of women farmers in Africa and South Asia would be selected to benefit directly from this capacity building program. The process of selecting and preparing extension professionals to be trainers in successive waves will continue until the proposed target number for achieving a critical mass of extension agents/trainers has been created for each country or region.

The trainers of these extension professionals will be prepared to provide both the initial training course and the structured mentoring that accompanies trainees in the first year of field practice. The program's strategy includes institutionalization of this training/mentoring service to extension professionals in suitable organizations with responsibilities for technical training of extension agents, such as agricultural universities or training institutes. By building the capacities of extension staff and their organizations (including extension training institutes) to train and mentor others through a Training of Trainers, these benefits would scale out to women farmers groups and other extension officers, and would continue beyond the life of the grant supported project.

Cadres of women and men extension professionals and the organizations supporting them will be linked to their team of trainers by a range of information media, adapted to local needs and possibilities, but including radio, phone and where feasible, rural telecenters with internet access where the program's on-line training materials and mentoring will be provided. The program's use of communications media will be flexible but includes technical training in media literacy and financial support for the provision of basic, locally appropriate communication resources such as a radio or cell-phone for use by women farmers or groups.

The WOCAN project in South Asia (currently being replicated with Heifer International extension systems in West and Central Africa), Institutionalizing Gender-responsive Research and Development for Agriculture and Natural Resource Management through Women's Networks provides an example of how this approach could be implemented.

4. How the project will benefit women smallholders

This approach that puts women at the center of supply and demand for agricultural knowledge is required to transform existing systems of extension. From the trained extension professionals, women farmers will develop the capacity to lead, to negotiate, to communicate and to organize so that they are able to

demand agricultural services and market access. The process through which women farmers demand services, in tandem with processes inside the agricultural organizations that create opportunities for them to play a role in planning and decision making, result in a strategic shift in power for women farmers.

5. Projected costs of the project

To be effective, the organizational change to create an enabling environment as described in the proposal should be implemented at the scale of a national innovation system (this includes the key actors both public and private who provide extension services). The goal is to create a "tipping point" in the institutional environment that shifts the perception and the practice defining women farmers as clients, what their needs are and how to work with them. An indicative budget for a one country pilot that aims at training at least 2,000 extension professionals in the public sector and another 2,000 from NGO extension providers, adapting the training package to national and local cultural and linguistic needs and providing field staff with basic communications technology, is US $4 million per year for a total of three years.

6. Measures of success

Organizations that have experience in capacity building for organizational change and gender equity at the institutional level, women's leadership at the community and professional levels, and extensive experience working in the agriculture and natural resource management and marketing sectors, are best able to lead the implementation of this initiative.

Among the organizations that might be invited to respond to the RFP are: Women Organizing for Change in Agriculture and Natural Resource Management (WOCAN); Heifer International; African Women Leaders in Agriculture and Environment-Net AWLAE-Net).

7. Risks

The selection of suitable partner organizations is critical to the success of this initiative. Time and money are wasted when the top management of agriculture organizations do not wholeheartedly believe in or support a shift to putting women farmers at the center.

6c. Five Skill Sets to Develop the Capacity of Women Farmers to Demand and Use Extension Information

1. Concept

Women smallholders in developing countries produce an estimated 70% of food from semi-subsistence farms, own 1% of land and receive 5 to7% of extension services. Including women as a minimum number of beneficiaries in extension services will not redress gender inequities in access to reliable information because women farmers' needs are so different from the needs of men farmers. Men and women often grow different crops, have different responsibilities in production and marketing, apply different cultivation technologies, and have different objectives for using their produce. Moreover, women play different roles along the marketing chain, as producers, consumers, traders, laborers and retailers of agricultural supplies and their needs for extension information are not uniform. The hypothesis of this note is that meeting women smallholders' diverse needs for agricultural information requires extension services to establish an on-farm, participatory adaptive research service that generates recommendations developed with and validated by, women in all these different capacities. This solution will harness the proven power of women's self-help groups as a foundation for woman-centered agricultural extension.

2. Rationale and evidence the project can be successful

The principles and practice of participatory extension are well known. Research shows there are broad spill-overs from using participatory approaches with women's groups that include developing members' self-esteem, solidarity, managerial and leadership skills. Participatory extension approaches such as farmer field schools and farmer research committees have been successfully implemented on a large scale in Africa, Asia and Latin America, but never with an explicit woman-centered focus or with the goal of reaching poor women farmers in large numbers. This brief proposes an approach to do just this.

In participatory extension, extension agents act as facilitators, assisting farmers to develop skills in problem analysis, problem solving, and management. Farmers set the agenda, test technologies under their own conditions, formulate conclusions and make recommendations to each other, This is essential for women farmers because their traditional crops and practices are typically neglected and overlooked by research as well as extension, and when they grow the same crops as men do, the constraints they face are usually quite distinct. Skill building must be a feature of any extension initiative that aims to benefit poor women because typically, even when poor women access extension information, they lack the "action resources" to translate information into good choices and actions. Skills are one component of the action resources that women farmers must aquire for extension information to have any real impact on their welfare.

Skill building is best done with poor women in self-help groups. In Andra Pradesh, for example, small group organization and self management within rural communities, with a particular focus on women, has successfully organized over 8 million poor women in approximately 700,000 self-help groups that have proved a powerful engine for getting information and services to this numerous but marginal sector of the rural population.

A recent study of self-help groups in three continents found that all groups studied were proactively seeking to acquire five basic skill sets, even in the absence of any assistance from outsiders. The five skill sets were: group organization skills; financial skills; marketing skills; experimentation skills and sustainable production. Skill development designed for women farmers is seldom included in extension programs

but when it is, a remarkable increase in women's participation in extension programs can be achieved, for example, women-centered extension in the Gambia that includes skill development achieved a dramatic increase of women participants from 5 percent to over 60 percent in under five years.

The proposed approach to participatory extension will identify rural women in need of extension all along the marketing chain from farm to kitchen, and work with them through women's self help groups where these already exist, and will form new ones where more are needed. Participatory adaptive technology testing and farmer-to-farmer extension will be combined with development of the five skill sets.

3. Expected benefits of the project including comments on sustainability and scale

The proposed program is expected to:

(a) improve the relevance and credibility of extension information for poor women farmers by testing alternatives with groups under local conditions

(b) increase women farmers' participation in and access to extension services from a low base (typically around 5 percent) to at least 55 percent of women

(c) increase the application of extension information by poor women

(d) improve five key skill sets that women farmers need to be able to use extension information

(e) contribute to higher productivity and incomes for women farmers in Africa.

This program will work on a pilot scale initially in two countries, but will work from the outset with at least 5,000 women's self-help groups in each country. Starting at significant scale is important for a definitive demonstration of the principle of focusing the service on women farmers.

Willingness to pay for information and extension services--even among the very poor--is a proven principle and it is reasonable to expect self-help groups to eventually cover about 20% of costs in this way. The program will aim to institutionalize women-centered participatory extension with public sector agencies. Participatory extension programs are being implemented in several countries on the basis of competitive funds through which part of the state (federal) budget for extension is assigned to farmer organizations (e.g. Kenya, Bolivia). For example, the Kenyan National Agricultural Research Institute (KARI) makes grants available to farmer groups for testing technologies, exchange visits to other farmers who have already adopted the technology, visits by KARI staff, and other costs of observing, learning, and adopting technologies. KARI maintains a small network of farmer research committees around its experiment stations to conduct participatory technology testing. Smaller grants are given preference over larger ones to expand the number of beneficiaries. The average grant is about US $3,000. The initiative is now working with 178 community-based groups cover 11,835 farm families. One women's group in this program multiplied members' assets four times in 18 months.

4. How the project will benefit women smallholders

The program will work with womens'self-help groups on a large scale. Woman-centered, participatory extension will add value to self-help group activities, which in most cases start with internal savings and loans and then graduate to looking for ways to invest savings. The participatory extension approach, which will include skill development, will include a training module that assists groups to use

participatory approaches to evaluate alternative productive investments and marketing alternatives. For an example from this author's experience see the World Bank AgInvestment Sourcebook at http://web.worldbank.org.

A regional training-of-trainers program on the approach will be conducted for NGO and public sector development and/or extension professionals. Training will be supplied in a variety of modes, including in-country short courses and e-learning by accredited University or other suitable extension training institutions. Trainers will obtain a credential enabling them to teach the course and draw on continued mentoring and advice from the program. The program will include experienced advisers in gender, participatory extension and adaptive on-farm testing who will support and mentor trainers.

Organizations invited to submit an RPF should have the following strengths and experience, singly or in partnership: gender-sensitive programming; participatory adaptive research and extension, women's self-help groups; skill formation for low-levels of literacy; training of trainers, mentoring. By the end of the three year pilot, two regional networks of experienced trainers will have been prepared and will be in place to scale out the approach to additional countries.

5. Projected costs of the project

An indicative budget is US $2 million per year for a pilot in two countries involving

8-10,000 women farmers and the preparation of approximately 1,000 trainers and 5,000 development professionals trained, over a total of three years.

6. Measures of success

The program will include a participatory monitoring and evaluation component

(a) Women farmers in self-help groups participate in adaptive testing and develop extension information that other women framers find relevant and apply

(b) The number of women participating in extension services in the pilot areas increased from a low base (typically around 5%) to at least 55% of women farmers

(c) Women farmers' self –help groups are willing to generate some means to pay a small proportion of the costs of the service

(d) Trainers are able to market the training course in women-centered participatory extension to meet an expanding demand

7. Risks

(a) Participating institutions claim that increasing gender quotas –increasing the number of women who receive the (male-oriented) supply of existing extension information --are a substitute for generating demand-driven content through participatory extension with women farmers

(b) Bad (or worst) participatory practice is used – if those responsible are not trained in techniques of authentic participation, then participatory extension will be counter-productive

7a. Market- and Technology-Led Curriculum Enhancement at Agricultural Education Institutions in Africa and South Asia

1. Concept

Fund partnerships between selected US and overseas universities to support the transformation of existing undergraduate curriculum in Africa and South Asia through: 1) developing a series of curricular modules to address the business, market and supply chain information needs of 21st century smallholders,

2) fostering the introduction and expansion of experiential learning as part of the educational experience of undergraduate students, and 3) training master trainers to assist in the deployment of these new curricular features. Modules and strategies would be developed to focus on three key areas currently lacking in most programs:

- Market and technology led curriculum focusing on business management skills for smallholders as entrepreneurs as well as for the various players in the agricultural supply chain
- ICT and information access skills with emphasis on extraction of relevant information via multiple channel access to information databases and web 2.0 technologies
- Preparation for 21st century career opportunities in agribusiness which extend beyond the traditionally limited focus on farming, to processing, supply chain management, and emerging agribusiness market opportunities such as supermarkets and regional and global sales activity. Linkages between the university and the private sector would create internship and long term employment opportunities for students.

2. Rationale

Agriculture in the African and South Asian regions is in transition from production to market-driven systems to meet the dual goals of maintaining food security and opening new markets for local agricultural products through value addition and trade. Along with the local traditional markets, new supermarkets are emerging to serve the rapidly growing urban consumers. In addition, the research institutions in South Asia and Africa regions are accessing and applying the new tools of biotechnology, geographic information systems and ICTs for enhancing agricultural productivity and natural resource management. In this environment, smallholder farmers require new levels of business skill which will allow them to make better business-based decisions regarding product and input choices and at the same time, allow them to better take advantage of market opportunities – both locally and globally.

In this new environment, the private sector is expected to play an increasing role in building the technology and ICT base, requiring a greater cooperation and collaboration among various stakeholders and public-private sector partnerships. These emerging trends have important implications for improving the quality and relevance of higher education in the African and South Asian regions in the coming decades. The current curriculum largely focuses on the production aspects of agriculture. These new trends, however, are demanding curriculum reforms/enhancement for developing human resources with training and skills in market and technology driven agriculture.

A large pool of human resources will be required in the areas of food processing, food packaging, food safety, food marketing, agri-biotechnology, environmental biosafety, intellectual property management,

bio-entrepreneurship, technology commercialization, and agribusiness. As a result, careers in agribusiness require skills in business management and entrepreneurship as well as the more traditional skill sets addressed in the traditional agricultural curriculum. At the same time, experiential learning is gaining increased attention and is being embedded in the new curriculum to provide practical real-world experiences to the graduates of tomorrow.

Partnerships could be funded between select US universities and universities in Africa and South Asia which would be configured to develop and deliver market and technology led curriculum intended to prepare students for a career in large or small, public or private agribusiness institutions. Through dialogue and discussions with educational institutions, this Partnership will conduct a landscape analysis of current curriculum, proposed reforms, and opportunities and challenges.

As a result, five to ten 21st century agribusiness career profiles will be developed which represent viable career options in the developing world agribusiness space. A gap analysis will identify where the current agricultural curriculum is failing to prepare their graduates for these careers. These gaps will be addressed with specific new curriculum modules which supplement, and in some cases replace, the traditional agricultural training already in place.

Master trainers (selected primarily from existing host university faculty) will travel to the US for one year where they will go through an intensive training program on the new modules and experiential learning practice. The capstone of their training will be a three-month internship in a US company related to agricultural business. This will be achieved through the establishment of close partnerships between the US university partner and surrounding agribusiness-related firms. This internship will provide master trainers with practical experience and model the value of experiential learning. Having participated in the experiential learning opportunity, the master trainers will return to their respective institutions serving as resources to facilitate the integration and implementation of the new curriculum modules and the service learning component.

3. Evidence the project can be successful

Many universities and higher education institutions around the world are attempting to reform their curriculum in order to prepare their students for work and life in the context of globalization, rapidly growing industry, as well as the blending of local, regional and international food markets.

Experience suggests that universities are some of the most stable institutional platforms for sustaining programs beyond the life of a proposed project. The proposed project idea is a demand driven activity and a direct response to the stakeholders and potential job providers with whom the WorldAgInfo Design Team met during the site visits to Asia and Africa.

4. Expected benefits of the project

A new generation of graduates will be prepared to take leadership roles in meeting increasingly complex and market-driven demands in the agribusiness space of developing countries. In addition to traditional agricultural training, graduates will acquire a basic set of technical and business skills which will prepare them for specific career tracks reflecting the changing face of global agriculture.

This program is at once a response to a specific information need in the smallholder information supply chain and an effort to lay the groundwork for increased demand for smallholder goods by improving the

human resource capability of future employees/leaders in agribusiness. Meeting both objectives will be of immediate and mid-term benefit to smallholders.

Sustainability and Scale

The train the trainer model is designed to allow scaling. As the original wave of trainers return to their home countries, they represent the primary resource for assisting their university in the implementation of the new curriculum. After these individuals have successfully launched the new curriculum in their own institutions, a "stage two" funding could be made available to facilitate their travel to assist additional universities implement similar projects. The train the trainer classroom sessions could be video-taped and made available as podcasts worldwide over the web.

In addition to current college students, it is possible that former graduates of the university system (i.e. extension officers, researchers, and a few smallholder farmers) could return for a one year "tune up" to upgrade their skills and capabilities as well relying on the same new curriculum modules.

5. Projected costs of the project

It is estimated that this project would cost about $7 Million over a 5–year period.

- 100 trainers in the US for one year ($30,000/trainer): $3,000,000
- Curriculum development
- Supplementary support (with milestones) for trainers back in the field which would serve as incentive for continued participation in the program

6. Measures of success

- Retention of agriculture studies majors in the agriculture supply chain.
- Employer assessment of skills of graduates
- Satisfaction of students with curriculum
- Measurable impact at the smallholder level

7. Risks

- Bureaucracies in universities may resist curriculum reform
- Lack of desire on the part of students to remain in the agricultural sector
- Substantial curriculum reform will not alone be able to overcome lack of jobs and career opportunity in the agricultural sector

7b. Preparing Universities in Africa and Asia for the New Agriculture

1. Concept

The recent visits by the WorldAgInfo project Design Team to Africa and South Asia observed that agricultural universities are underfunded, suffering from poor quality and in urgent need of curriculum reform. But universities worldwide are noted for their slowness to address and implement reform. In addition to the internal reforms of universities, a new set of problems such as climate change, biofuels, rising global food prices and food insecurity has emerged. These problems are referred to as the "New Agriculture," but food prices and the share of consumer spending on food will always be at the core of the old and the new agriculture. For example, the critical role of food prices in reducing poverty in poor countries is illustrated by a recent IMF report that consumers in Africa spend 60 percent of their budget on food as compared with 30 percent in China and 10 percent in the United States. Without question, institutional innovations and public-private sector partnerships are needed to generate human capital and institutional reforms to drive down real food prices as well as addressing the challenges of the New Agriculture. This will require changes in a wide range of incentives for innovation and new types of public, private and university partnerships that foster an exchange of information, knowledge, and global experience (IAASTD 2007).

But instead of the Ag Info Design team preparing a supply side approach of assuming that they know what should be done to identify and solve the problems of universities in other continents, this project focuses on incentives for bottom up debates among scholars and stakeholders in South Asia and Africa on their problems and pathways to reforming their institutions.

This project has four interconnected components: the first is helping universities and consortia of universities in Africa and South Asia prepare a landscape analysis of the magnitude and country-specific challenges and funding levels to address the issues surrounding the New Agriculture. The second component is to lay out the types of Business Education training that is needed at different levels of the educational ladder for extension workers, and smallholder farmers and input and marketing agencies. The third is to lay out the types of ICT training modules about the New Agriculture that are needed to train extension workers, smallholders, private firms and the Third Sector. The fourth objective is to request bottom up proposals of how public and private universities in Africa plan to respond to the New Agriculture and to increase their emphasis on graduate training within Africa because of the rising cost of overseas graduate education.

2. Rationale and evidence that the project can be successful

The first three objectives of this proposal will be developed jointly by Dwight and CKE. We shall now comment on the fourth objectives of building Africa's science base to address the New Agriculture by fostering graduate education in Africa by expanding graduate training in Africa. In many developing countries, the reliance on overseas training to develop qualified staff for agricultural teaching, research and extension is no longer feasible because of donor reluctance to pay the rising cost of overseas graduate education and the number of graduates who do not return home.The cost of graduate training in agricultural economics in 2006 in various universities around the world is displayed in Table 1.The cost in the United States was about $30,000 per year or $60,000 for a two-year M.S. degree. The cost of an additional three years for a Ph.D. is $90,000 for a total of $150,000 for the two degrees. These comparative cost estimate why it is time to shift the center of gravity of post graduate training in agriculture from overseas to Africa. Africa has much to learn from the global experience (Eicher 1996)

as well as that of its own experience. For example, the collaborative Master of Science Program in Agricultural Economics in Eastern and Southern Africa (CMAAE) is now in its third year of operation. The success of this innovative program raises two questions: first, should CMAAE expand its geographical coverage from Eastern and Central Africa to include West Africa? Second, should the CMAAE model be cloned and set up as a separate organization with a base in West Africa similar to the Ph.D program in plant science/biotechnology that is being set up by the Alliance for a Green Revolution with a January 2008 start-up at the University of Ghana at Accra? The new model in Ghana will cover West Africa and it is based on the success of the first five years of a plant breeding/biotech Ph.D program at the University of Kwa Zulu at Natal in South Africa.

3. Expected benefits of the project including comments on sustainability and scale

The "coat rack" for reforming agricultural universities is combining the research, training and outreach agendas for the New Agriculture with shifting MSc.graduate education from overseas to African universities in an orderly manner. During this transition period, new high priority Ph.D. programs (e.g. food processing, horticulture, etc.) can be added in a few universities in South Asia. This coat rack requires funding for scholars in South Asia between ages 30 to 45 to pursue one-year sabbatical leaves in the region or in overseas universities. The decline in the number of African students being trained in overseas universities will be offset by a pent-up demand for scholars from South Asia and Africa who have expressed a strong desire for sabbatical leaves, both in the region and overseas.

4. Measures of success

- Number and quality of landscape proposals addressing the "New Agriculture"
- Number of students trained in African graduate programs in agriculture
- Number of sabbatical leaves for academic staff members in South Asia and Africa
- Number of field trails of innovations in ICT
- Number of new degree programs in information technology
- Number of short courses for trainers of trainers of agricultural biotechnology

5. Risks

This project could be captured by university debaters who are more interested in debates than reforms.

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Table 1—Estimated total cost of MSc and PhD Degrees in agricultural economics in various countries in 2006

Degree	Years	University/Country	Estimated Total US$ Cost	Year
MSc	2	U.S. Sandwich*	30,000	2006
MSc	2	U.S. Universities with USAID Fellowships	60,000	2006 (incl. out-of-state tuition)
MSc (Econ)	2	Africa/AERC/ Economics**	30,000	2006
MSc	2	CMAAE (Collaborative Masters Program in Agricultural Economics in Eastern, Central and Southern Africa)	20,000	2006
MSc	2	Imperial College, London Distance Learning Program	15,200	2006
MSc	2	Kwa Zulu Natal, South Afric	32,700	2006
MSc	2	Norwegian University of Life Science (UMB)	45,000	2006
PhD	3	U.S. Universities with USAID Fellowships	90,000	2006 (incl. out-of-state tuition)
PhD	3	India Agriculture Research Institution	22,500	2006
PhD	3	University of Agriculture Bangalore (India)	25,000	2006
PhD	3	Belgium (Sandwich degree)***	42,500	2006

Source: Eicher (2007)

*One year in a U.S. university and research at home in year two. Home University awards degree (Eric Crawford).

**The African Economic Research Consortium (AERC) was established in 1988. Currently 21 universities in 17 African countries collaborate and award MSc and PhD degrees in Economics

*** Eric Tollens.

7c. Developing Online and Offline Textbook Collections to Support Agricultural Curricula

1. Concept

In many agricultural universities and colleges in the developing world, students do not have adequate access to textbooks for their courses, and often have to wait in long lines at library reserve desks to borrow the few available copies of the textbook. In some cases even the professor must use the library's copy to prepare his or her lectures, although the available copies are often seriously out of date. Indian universities have addressed this problem to some extent through textbook "rental" centers, which collect a small fee from students for the use of a text for the semester. Applying this model in the electronic environment offers the potential to create digital collections of textbooks which could be made available for a small fee per student. Two types of texts could be added to this collection: 1) textbooks owned and distributed by publishers in electronic form where rights and fees have been negotiated; and 2) open access wikibook content developed by agricultural faculty, students and extension staff. Textbooks in these collections would be distributed to students either on inexpensive laptops (note: partnering with the One Laptop per Child program is one possible model), or content and delivery developed in conjunction with one of the new e-book reader development efforts, e.g. SONY Reader.

2. Rationale and evidence that the project can be successful

The International Association for Digital Publications www.iadpnet.org currently has several pilot programs to test the viability of an offline textbook delivery model. They are working with four universities in South Africa, and between two and four of the Universities of Botswana, Namibia, Zambia, and Malawi, in conjunction with the South African Institute for Distance Education. They have successfully negotiated rights with a number of key scientific publishers, and expect to reach about 1,000 and 3,000 students in phases I and II of the program, respectively. A similar model, applied on a pilot scale to consortia of resource-rich and resource-poor universities in India and in other parts of Africa, could go a long way towards removing a basic constraint of access to educational material in agriculture and development.

3. Expected benefits of the project including comments on sustainability and scale

This project has the potential to improve teaching and learning in the undergraduate and graduate programs in agriculture and other subject areas, and could be scaled up to include universities throughout Africa and South Asia. Curricula which are currently outdated can be significantly enhanced with better access to textbooks. In addition, students leaving university programs would have a reference collection to use in their future work–of particular value to those going into public or private agricultural extension. This e- book and reference material model might also be viable for extension agents since portable devices with extension publications and other helpful material can be easily taken into the field. Lastly, digital readers have the benefit of continuing to deliver information even when electricity and/or connectivity are limiting, as they often are in much of Africa and Asia.

4. How the project will benefit women smallholders

Many university agriculture students are female, as are most small-holder farmers in Africa and Asia. Providing students with a strong information core on a reader or laptop would contribute to improved understanding and implementation of their curriculum, and greater confidence of women educators or extension agents. The benefits would ultimately accrue to women farmers. These e-texts would serve as a

reference library for students when they graduate, allowing them to obtain updates as the material ages, particularly if an open access wikibook collection is created.

5. Projected costs of the project

- Budget items:
- Staff costs:
- Additional Local level costs:
- Purchasing content (at discounted prices)
- "Book Downloading Center"
- Developing Wikibook content (Separate project?)
- Additional Central level costs:
- Negotiating publisher content/prices on consortial basis
- Repository for storing Wikibook content

6. Measures of success

Project effectiveness will be measured quantitatively and qualitatively at least three times over the period of funding to determine trends in adoption and success. Some indicators of success will include but not be restricted to: number of students participating in e- book and material subscriptions by gender and academic level; number of graduated students by gender continuing in agriculture-related activities; number of extension agents using e- material by gender, and number of stakeholders served by gender, holding size, and income and education level.

7. Risks

Publishers may be unwilling to expand this program into countries where students are unable to pay full price for published material. The delivery model requires each student to have an e-book reader or inexpensive laptop, which may not be viable; however, it may be possible to implement innovative arrangements (mini-cooperatives) that allow small groups of students to share resources. It is still unclear which e-book reader, if any, will be widely accepted. Current e-book readers do not support color, which would be necessary for effective delivery of scientific texts and visuals.

7d. Water Research & Education Network (WREN)

1. Problem

Inadequate, unpredictable and contaminated water supplies for agricultural and non-agricultural uses currently rank among the most serious problems in eastern and southern Africa today, a crisis destined to become more serious if climate change predictions are correct. The magnitude of the problem is huge: global water use was projected to increase by 50% between 1995 and 2025 (Rosegrant, Cai, and Cline 2002), while rainfall is predicted to decline appreciably in some of the most densely populated parts of the African continent according to the recent IPCC reports. Not only must water issues be addressed at local, regional, national and international scales, but also proposed solutions must be integrated to avoid unintended consequences whereby water availability might be improved in one locale while creating scarcity elsewhere.

A combination of research, education, community action and effective policies is needed to develop short- and long-term responses. The breadth and extent of the water crisis make solutions difficult especially in developing countries with relatively weak educational and government institutions, miniscule research budgets and limited interdisciplinary and organizational collaboration (often due to budget constraints). The capacity to use the social, natural and engineering sciences to develop effective and acceptable solutions must be enhanced and university graduates must be able to talk to community members, politicians, citizens and to each other. The instructional programs at the universities need to be revamped to include aspects of water management ranging from quantitative engineering skills to effective social interactions with rural residents to the ability to detect water-born pathogens like Cryptosporidium parvum. Participants at all levels will require access to computers for communication and information access accompanied by the skills to use these technologies.

The international dimensions of water problems magnify the complexity of the water problem: increased use of water from the Blue Nile in Ethiopia creates shortfalls for farmers in the Sudan and Egypt and poor farming practices in Kenya affect the fish catch in Lake Victoria by Tanzanians, Ugandans and other Kenyans. However, trans-boundary and regional water disputes are very real and merit consideration.

Although the scope of the water problem is daunting, water scarcity and contamination cannot be ignored. We are proposing to develop an integrated Water Research and Education Network (WREN) that will include African universities, NGOs and government ministries in eastern and southern Africa, the region where the predictions for drought are most dire.

2. Proposed Solution

WREN's goal is to develop the scientific and social capacity and will to develop African solutions to one of the continent's most pressing problems. If we can create a community of informed local resource managers/educators, hydrologists with appreciation for farmers' concerns, policy makers able to understand the complexities of water dynamics and farmers able to change their water use patterns, the project will have been a success. To accomplish these goals, the following are necessary: 1) develop university research and outreach/development capacity [8b], 2) develop and implement community solutions to water management [3b and 2e], and 3) promote dialogue to foster local, national and regional policies that promote water efficiency for sustainable development [1b].

WREN will be an integrated research, development and education program to address complex water issues. A consortium of 8-10 African universities in eastern and southern Africa will be formed with partner development institutions (community organizations, NGOs and government ministries) and developed country universities to provide educational and research backstopping.

An integral part of WREN will be a competitive grants program for water research and conservation programs. The annual calls for proposals will mandate the following: 1) support for graduate student research and undergraduate internships, 2) direct involvement of universities in community water management activities with their development colleagues, and 3) creation and strengthening of university or multi-university water management programs at the graduate and undergraduate levels. No project will be funded that does not include graduate and undergraduate training, community involvement and demonstrable benefits, and rigorous, interdisciplinary science related to water management. Each project will be managed by a team that includes a community coordinator from an NGO or local organization and by a research director from a university. An interdisciplinary panel with representation from the academic, development and business communities and with people from within and outside the region will review the proposals to ensure that these goals are met.

The competitive grants program will provide incentives for faculty to become more involved in urgent water issues while simultaneously strengthening the research, teaching and outreach capacities of the universities. Those involved in local water management initiatives will benefit by having access to expertise need to improve water use efficiency and to evaluate the effectiveness of their efforts. By providing support for internships and community-based research, we will address the concerns that today's graduates are long on theory, but short on practical experience. Few competitive grants programs are available for African scientists leaving them too often to play "second fiddle" to their OECD colleagues who have access to better funding alternatives. This program will permit equal partnerships and ensure the capacity to develop sound, science-based water management policies. By explicitly combining research with development, our goal is to ensure that the results directly affect those whose water supplies are threatened.

Some funds will be set aside for multi-national programs similar to the National Science Foundation's Long-Term Environmental Research (LTER) sites to stimulate collaboration on critical watersheds such as Lake Victoria, the Limpopo basin, and the Blue Nile basin. Unlike the LTER sites, development as well as research activities will be expected. An important part of the on-going monitoring inherent in the LTER-like program will be how water use patterns at the household and community levels have changed. One of the difficulties in assessing the effectiveness of environmental programs in Africa is that the term for most projects is 2-3 years so there are few assessments of the long-term results of a project.

3. Projected costs of the project

The budget will depend on the magnitude and scope of the grants programs, but the costs of implementing community management activities in 8–10 sites, university program revision and development, student support and research costs likely will be in the vicinity of $ 10 million over 5 years. An additional $ 1 million should be placed in an escrow account to permit evaluation of the long-term effects of the interventions 10 years after the project is complete.

4. Measures of success

The following criteria should be used to evaluate the program:

1) Efficiency with which water is harvested and used at the household or watershed scale.
2) Community knowledge of options to improve water access and quality.
3) Ability of university graduates to function at the community level and scientifically (based on perceptions of community members, government officials and scientific peers).

5. Risks

This is an ambitious project that strives to increase the impact of universities and their graduates on development while improving the efficiency with which water is used at the community level. It is likely that resistance will be encountered at both the community and university levels by those with a stake in the status quo.

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Cornell International Workshops on Agricultural Education and Information Systems
Workshop I: Knowledge Systems

Cornell University, September 30-October 3, 2007

The Bill and Melinda Gates Foundation requested a small group to consider the best ways that smallholder farmers and their support institutions might share, develop and gain access to new information about agricultural practices and technology that would improve their lives. In response, a "core team" planned a number of activities, including the workshop reflected in this document, and a companion workshop in Zambia.

The Objective of this workshop is to identify near-term and medium-term opportunities for strengthening the **content** of agricultural education/curriculum and information *systems* to meet the needs of smallholder farmers in areas of the developing world. Traditionally called extension, teaching and research, more recently these systems are recognized as complex, interactive activities of knowledge and technology use, generation and exchange among farmers, extension workers, teachers and researchers.

In achieving the workshop objective, discussions will specifically focus on identifying the opportunity to give voice and access to smallholders and their information support systems, using a range of tools, including new social networking tools for agricultural content development and creating a new agricultural education, information and training matrix.

While this workshop focuses on the **content** of agricultural education/curriculum and information systems, a follow-up workshop in Zambia will focus on identifying the most promising mechanisms to improve the **exchange** of agricultural information among smallholder farmers and between smallholder farmers and the people and organizations that support them.

Some overlap between the two workshops is expected and participants in the workshop at Cornell university are encouraged to identify issues that need to be discussed in more detail at the follow-up workshop.

Processes the workshop will use:

Individual Participant Preparation: Participants are asked to prepare for the workshop by reflecting on and answering the following questions in advance of the workshop.

1. What are the priority issues you see as needing to be addressed?
2. Are you aware of activities already underway that address these priority issues?
3. What is your relevant expertise?
4. Do you have an example of a success story or a failure from which the workshop participants can learn?
5. What do you expect to gain from this workshop?
6. Are there any topics that are not on the agenda that you feel need to be addressed?

Forepointer Groups: (Forepointer, one who points out beforehand). Each Forepointer Group will have four members and will incorporate "the wisdom of the workshop" with representatives from each of the breakout sessions.

Breakout Groups: Participants will be divided into groups of 10-12 people. They will focus on the topics identified in the program using the questions provided. Each breakout group will have a Facilitator and Reporter. Facilitators will be identified in advance. Each breakout will be guided by the set of questions or a discussion scenario may be substituted for the questions.

Plenary Discussions: Following each breakout session there will be opportunities for the entire group to discuss the ideas developed in the small discussion groups.

Presentations: Most work will be done in the groups but there will be a number of 15-minute presentations designed to share some key ideas among participants. These will highlight the presenter's most important ideas and challenge the participants to use them in the breakout groups that form the main part of the workshop.

Additional Resources: The core planning team identified a number of areas for which knowledge was particularly uneven and asked various persons to write literature reviews that survey the successes, failures, scalability, incentives, sustainability and replicability of various initiatives for improving the lives of smallholder farmers. The reviews will be posted on the workshop website - http://www.worldaginfo.org.

For more information, contact:
Dwight Allen (dwallen@odu.edu) or Mary Ochs (mao4@cornell.edu)

Cornell International Workshops on Agricultural Education and Information Systems
Workshop I: Knowledge Systems

A Workshop Organized by Cornell University
on behalf of the Bill and Melinda Gates Foundation
30 September–3 October, 2007
Statler Hotel, Cornell University

SUNDAY, SEPTEMBER 30, 2007

16:00-19:30 **Registration (STATLER HOTEL LOBBY)**

18:00 **Welcome Reception (TERRACE LOUNGE)**

18:30 **Welcoming Remarks**
Janet McCue, Director, Mann Library
David Wippman, Cornell University Vice-Provost for International Affairs

18:45 **Introduction of the WorldAgInfo Design Team and Tasking of Forepointer Groups**
Project co-leaders Mary Ochs and Dwight Allen

19:00 **Dinner and Introductions (TERRACE LOUNGE)**

MONDAY, OCTOBER 1, 2007

7:45 **Breakfast (CONFERENCE FOYER)**

7:45-17:00 **Registration and Information Desk Open (CONFERENCE FOYER)**

Moderator: *Janet McCue, Director, Mann Library*

8:45-9:00 **Welcome (AMPHITHEATRE)**
David Skorton, President, Cornell University

9:00–9:15 **Introductory Remarks**
Roy Steiner, Senior Program Officer, Bill and Melinda Gates Foundation
Overview of workshop objectives

9:15–9:30 **Administrative Remarks and Explanation of the Workshop Structure**
Mary Ochs, Head, Services and Collections, Mann Library

Session 1: First Kilometer Challenges and Opportunities (AMPHITHEATRE)
This session is designed to develop a common understanding of First Kilometer Challenges by sharing experiences and understandings of the variety of ways different smallholder farmers currently develop, obtain, accept, reject, use, modify, ignore, and improve information related to their agricultural activities.

Moderator: *Thane Terrill, Adjunct Associate Professor of Computing and Education, Teachers College, Columbia University*

9:30–9:45 **"Setting the Stage: Why First Kilometre Challenges?"**
Dwight Allen, Eminent Scholar of Educational Reform, Old Dominion University

PERSPECTIVES FROM SOUTH ASIA (AMPHITHEATRE)

9:45–10:00 **"Key Findings from Field Visit to India and Sri Lanka"**
Karim Maredia, Professor and Program Director, World Technology Access Program (WorldTAP), Michigan State University

10:00–10:15 **"Smallholder Challenges and Opportunities in South Asia**
Vanaja Ramprasad, Director, Green Foundation

10:15–10:30 **Discussion**

10:30–11:00 **Morning Break (CONFERENCE FOYER)**

PERSPECTIVES FROM AFRICA (AMPHITHEATRE)

11:00–11:15 **"Key findings from field visit to Mali and Zambia"**
Gracian Chimwaza, Director, ITOCA (Information Training and Outreach Centre for Africa)

11:15–11:30 **"A Smallholder View from West Africa"**
Cephas Ametefe, Ghanaian Smallholder Farmer

11:30–11:45 **"Smallholder Challenges and Opportunities in Southern Africa"**
Henry Kalomba, Regional Manager – North, National Smallholder Farmers' Association of Malawi

11:45–12:00 **Discussion**

TOPICAL PERSPECTIVE

12:00–12:15 **"Gender-Based Constraints and Opportunities for Agricultural Information"**
Jeannette Gurung, WOCAN (Women Organizing for Change in Agriculture & NRM)

12:15–12:30 **Discussion**

Session 2: Agricultural Education/Information/Training Content Needs along the Stakeholder Chain

Smallholder farmers and the range of stakeholders that support these farmers require many types of information, including: market information, farm management information, information on government, private sector, and other services, and information to support education or training. Smallholder farmers and others in Africa and Asia may experience different sets of challenges associated with ensuring the quality, relevance, credibility, and timeliness of information. For instance, much of the information of value to farmers differs across regions and countries, that is, it is local in applicability. In some cases what is good extension advice for one farmer may actually be detrimental advice to another.

Participants are asked to elaborate on the range of agricultural information content needs of smallholder farmers and other stakeholders engaged in education, information, and training development and delivery, and to identify the key challenges associated with these information needs.

Facilitators: *Rex Raimond, Meridian Institute and Robert Herdt, Cornell University*

12:30–12:45 Organization of Breakout Groups (AMPHITHEATRE)

Working Buffet Lunch in Groups (YALE/PRINCETON ROOM, THEN MOVE TO BREAKOUT ROOMS)

12:45–14:00 Breakout Groups – Elaborate on Agricultural Education, Information, and Training Content Needs Matrix – See notebook for group assignments

Breakout Group 2.1 Columbia Room

Breakout Group 2.2 Dartmouth Room

Breakout Group 2.3 Harvard Room

Breakout Group 2.4 Pennsylvania Room

Participants in the Breakout Groups will receive a matrix of information types and types of challenges as a starting point for the discussions. Based on their experience and the realities of the issues and challenges they face, participants will be asked to answer the following questions:

- What other types of agricultural information are needed by male and female smallholder farmers and the people that support them?
- What are the top challenges for smallholder farmers or people supporting those farmers associated with information content?

14:00–15:00 Breakout Groups Report to Plenary (AMPHITHEATRE)
Facilitators: Rex Raimond, Meridian Institute and Robert Herdt, Cornell University

15:00–15:30 Afternoon Break (CONFERENCE FOYER)

Session 3: Defining Challenges and Identifying Possible Solutions

Facilitators: *Rex Raimond, Meridian Institute and Robert Herdt, Cornell University*

Participants will receive a revised and expanded matrix based on the outcomes of Session 2. Building on the range of information types and challenges identified, participants will be asked to develop a more detailed understanding of specific challenges and to begin identifying opportunities to address those challenges. The workshop is particularly concerned with reaching women and men smallholder farmers

15:30–17:00 Breakout Groups – Defining Challenges and Identifying Possible Solutions

Four groups**, each group starting with a different type of information** (i.e., market information, farm management information, information on services, and agricultural education curricula), will discuss the following questions. The groups can use the categories listed across the top of the matrix to catalyze their discussions.

- What are the key challenges associated with this type of information?
- For each challenge, is it different depending on the user group (e.g., male farmers, female farmers, youth, extension workers, researchers, educators, policy-makers)?
- Is the challenge different in different regions?
- What is happening already to address these types of challenges?
- Which approaches seem particularly successful, and what can be learned from failures?
- What evidence does past experience provide for new scalable and sustainable solutions?

Breakout Group 3.1 (Markets)	**Columbia Room**
Breakout Group 3.2 (Farm Management)	**Dartmouth Room**
Breakout Group 3.3 (Services)	**Harvard Room**
Breakout Group 3.4 (Education/Curriculum)	**Pennsylvania Room**

17:00–18:00 **Breakout Groups Report to Plenary (AMPHITHEATRE)**
Facilitators: Rex Raimond, Meridian Institute and Robert Herdt, Cornell University

19:00 **Dinner (BALLROOM A – 2nd FLOOR)**

Dinner Remarks "Smallholders' Access to Information: Policy Issues and Promising Initiatives"
Dr. Ousmane Badiane, Senior Research Advisor to NEPAD, Introduced by Carl Eicher, Michigan State University

TUESDAY, OCTOBER 2, 2007

8:00-9:00 **Breakfast (CONFERENCE FOYER)**

8:00-17:00 **Registration and Information Desk open (CONFERENCE FOYER)**

9:00–9:15 **Announcements**
Mary Ochs, Mann Library

Session 4: Knowledge Creation through Collaborative Processes (AMPHITHEATRE)
To familiarize participants with cutting-edge developments in information technology to enhance information for smallholder farmers, a few presentations will share ideas about the potential of new technologies to support sharing and creation of content, and report on some important existing international agricultural ICT initiatives of relevance to the workshop.

***Moderator**: Douglas Allen, Director Global Business Programs, Daniels College of Business, University of Denver*

9:15–9:30 **"Selected International Agriculture Information Initiatives"**
Barbara Hutchinson, College of Agriculture and Life Sciences, University of Arizona

9:30–9:45 **"Digital Green**: **Locally Recorded and Screened Video for Disseminating Good Agricultural Practices"**
Rajesh Veeraraghavan, PhD Student, Information School, University of California, Berkeley.

9:45–10:00 **"UbuntuNet Alliance for Research and Education Networking"**
Margaret Ngwira, College Librarian, University of Malawi, and Secretary, UbuntuNet

10:00–10:15 **"Open Curriculum"**
V. Balaji, Head, Knowledge Management and Sharing, ICRISAT, India

10:15–10:45 **Discussion**

10:45–11:15 Morning Break (CONFERENCE FOYER)

Session 5: Reform, Revamp, Revitalize Agricultural Extension, information, and Education Systems

Participants continue the process of identifying new strategies and solutions to facilitate knowledge development and information flows: farmer-to-farmer, researcher-to-farmer, and farmer-to-researcher. Each potential solution should be measured against the following criteria:

- Relevance – Is it likely to meet smallholder needs
- Past successes – Has it been successful under tough conditions?
- Scalability – Does it have the potential to reach 1, 5 or 10 million smallholders?
- Sustainability – Is it likely to continue without massive donor funding?
- Replicability – Can it be replicated to reach 200 million smallholders?

Moderator: *Patrick O'Shea, Director, Handheld Augmented Reality Project, Graduate School of Education, Harvard University*

11:15–12:15 Breakout Groups – Opportunities to Reform, Revamp, Revitalize Agricultural Extension, Information and Education Systems

Four breakout groups, each group focusing on a different topic, will explore potential solutions in more detail. Based on information and ideas generated during the workshop thus far, participants will identify strategies and potential solutions to facilitate knowledge development and information flows.

5.1 New Extension Models to Address the First Kilometer Challenges (COLUMBIA ROOM)

- Which extension models could most successfully address the challenges and implement the ideas identified during Session 3?
- What are some of the alternative mechanisms to integrate smallholder farmers, in particular women, in these models?
- What are mechanisms to better connect smallholders to extension models, ensuring that smallholders' information needs are integrated into the models and feedback on information quality, transfer, relevance, credibility, and timeliness is used to improve the models?
- What are mechanisms to help smallholder farmers assess the credibility and quality of information they access?

5.2 Agricultural Curriculum, Quality, Accreditation, Credentialing (DARTMOUTH ROOM)

- How can smallholder farmer information needs be better integrated in agricultural curricula?
- Can agricultural content be effectively modularized to make dynamic curriculum changes more likely to be incorporated into various levels of university and extension instructional programs?
- What approaches could be used to ensure that modular curricula meet the standards and criteria of credentialing systems?
- How can feedback systems be designed which are simple to use, credible, and accessible to all users of agricultural curricula?

5.3 ICT for Agriculture and Implications for Content (HARVARD ROOM)

- What are the various means of information and communication tools that smallholders have access to (radio, TV, mobile phones)?
- How necessary is interactive communication?
- How sophisticated are existing tools for localizing information?
- Assuming that the technology exists to automate translation of information and extract data, will it be useful?

- What are the costs associated with various technologies?

5.4 Role of the Private Sector in Agricultural Information, Education (Penn Room)
- Where have public-private partnerships effectively contributed to the AEITS, in your personal experience?
- List the primary ways such activities might be encouraged.
- List the primary barriers to increasing the level of such activities.
- What kinds of incentives might encourage private sector or partnership extension services to "play fair" and protect smallholder farmers entering the market?

12:15–13:15 Lunch (BALLROOM FOYER–2nd floor)

13:15–14:00 Breakout Groups Report to Plenary
Facilitators: Rex Raimond, Meridian Institute and Robert Herdt, Cornell University

Session 6: The Future of Information (AMPHITHEATRE)
A range of tools exist or are in development that could become part of strategies to change information exchange in the future. In four parallel breakout groups, participants will explore the implications of those tools focusing in particular on the implications for information types and content.

***Moderator**: Sara Boettiger, Director, Strategic Planning and Development, Public Intellectual Property Resource for Agriculture (PIPRA)*

14:00–14:15 Presentation: The Future of Information
Chris Pal, Assistant Professor, University of Rochester

14:15–14:30 Discussion

14:30–15:30 Breakout Groups: The Future of Information

Four breakout groups, each group focusing on a different topic, will explore how new tools can contribute to solutions. The discussions continue to focus on identifying strategies and potential solutions to facilitate knowledge development and information flows.

6.1 Libraries of the Future (COLUMBIA ROOM)
- Given developments in digitization, electronic publishing, information syndication, and integration, what new opportunities are now available for disseminating agricultural information?
- What are the infrastructure needs for libraries to optimize these opportunities, as facilitators of both production and consumption of new information?
- What are the human resource/training needs for libraries in order to realize the full benefit of these new technologies? Are there other barriers?
- Agriculture is local in scope, yet much information has value across geographic boundaries. What are some of the existing and potential roles of agricultural libraries in helping to store, organize and deliver locally-relevant information for the smallholder?
- Is there a need for building a culture of information use and sharing among various groups of users, e.g. researchers and faculty? smallholders? extension workers? If so, are there user training needs, awareness needs, etc.?
- What are the funding challenges libraries face?

6.2 Distance Education (DARTMOUTH ROOM)
- How do we reach the unreached populations with distance education? What has been the experience in using such approaches?
- How do we incorporate interactive elements across language and literacy barriers?

- What are opportunities to incorporate new elements in the teaching and learning process?
- What are preconditions for successful distance education?
- What are new opportunities for feedback?

6.3 Language Translations (HARVARD ROOM)
- Given that technology for automated translations is in advanced stages of development, what are the new opportunities to utilize this technology?
- What could be done to make these technologies available and deploy them in agricultural information systems in developing countries?
- Given the limited extent of literacy among smallholder farmers, how much priority should be given to automated translation for languages written by few people?

6.4 Data Extraction for Localization (PENNSYLVANIA ROOM)
- Given that technology for automated extraction of information is in advanced stages of development, what are the new opportunities to utilize this technology?
- What could be done to make these technologies available and deploy them in agricultural information systems in developing countries?
- Given the limited connectivity in focus locations, how much priority should be given to extraction technology over the next five years?

15:30–15:45 Afternoon Break (CONFERENCE FOYER)

Session 7: Developing an Action Plan to Address First Kilometer Challenges
Facilitators: Rex Raimond, Meridian Institute and Robert Herdt, Cornell University

Participants will work together in Forepointer Groups, following Steps 1 – 3 below to identify and rank practical action programs to strengthen the **content** of agricultural education/curriculum and information systems to meet the needs of small farmers (particularly women) in areas of the developing world.

15:45–17:30 Forepointer Groups Develop Specific Action Items

(Columbia, Penn, Harvard, Dartmouth Rooms and Amphitheatre are all available for Forepointer group meetings – Rooms are not specifically assigned to groups, but more than one group will need to meet in each room.)

Note: We have been asked by the hotel not to use the small tables in the Conference Foyer for our Forepointer Group meetings, since other concurrent conferences must be able to share that space.

Procedure:

Step 1: Develop a detailed list of action programs.
Step 2: Craft a one-sentence description of each.
Step 3: Rank order your list of action programs based on: relevance, scalability, sustainability, replicability.

18:30 Tours of the Newly Renovated Mann Library (OPTIONAL—MEET IN MANN LIBRARY LOBBY)

19:00 Dinner (DEAN'S ROOM, 2nd FLOOR, MANN LIBRARY)

Dinner Remarks "The Role of the Private Sector in Improving Information for Smallholders"
Ranjit Page, CEO, Cargills (Ceylon) Limited, Sri Lanka, introduced by Douglas Allen, Director Global Business Programs, Daniels College of Business, University of Denver

21:00 **Forepointer group discussions continued as necessary**

Columbia, Penn, Harvard, Dartmouth Rooms and Amphitheatre are all available for Forepointer group meetings through 22:00

WEDNESDAY, OCTOBER 3, 2007

7:30 **Breakfast (BALLROOM FOYER-2nd FLOOR)**

7:30-12:30 **Registration and Information Desk open (BALLROOM FOYER)**

8:30-8:45 **Announcements (BALLROOM-2nd FLOOR)**
Mary Ochs, Mann Library

8:45–10:00 **Forepointer Groups Report to the Plenary (participants can add to the list of action items)**
Facilitators: Rex Raimond, Meridian Institute, Robert Herdt, Cornell University and Dwight Allen, Old Dominion University

10:00–10:15 **Morning Break (BALLROOM FOYER)**

Session 8: Prioritizing Action Items

10:15–11:15 **Breakout Groups Prioritize Action Items**

Breakout Group 8.1 **Ballroom A**

Breakout Group 8.2 **Harvard Room**

Breakout Group 8.3 **Dartmouth Room**

Breakout Group 8.4 **Columbia Room**

Taking the action items developed by the forepointer groups, four breakout groups work in parallel to prioritize action items based on the following criteria.

- Relevant – Is it likely to meet smallholder needs
- Past successes – has it been successful under tough conditions?
- Scalability – does it have the potential to reach 1, 5 or 10 million smallholders?
- Sustainability – is it likely to continue without massive donor funding?
- Replicability – can it be replicated to reach 200 million smallholders?

Participants will also be asked to distinguish action items that are critical to implement and which are less critical.

11:15–12:15 **Breakout Groups Report to the Plenary (BALLROOM–2ndFLOOR)**
Facilitators: Rex Raimond, Meridian Institute, Robert Herdt, Cornell University and Dwight Allen, Old Dominion University

12:15–12:30 **Wrap Up**
Project co-leads Mary Ochs and Dwight Allen

12:30-1:30 **Lunch (ROWE ROOM)**

1:30- **Departures**

Thank you for your participation!

Cornell International Workshop on Agricultural Education and Information Systems
Part I: Knowledge Systems
Ithaca, New York, 30 September - 3 October, 2007

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