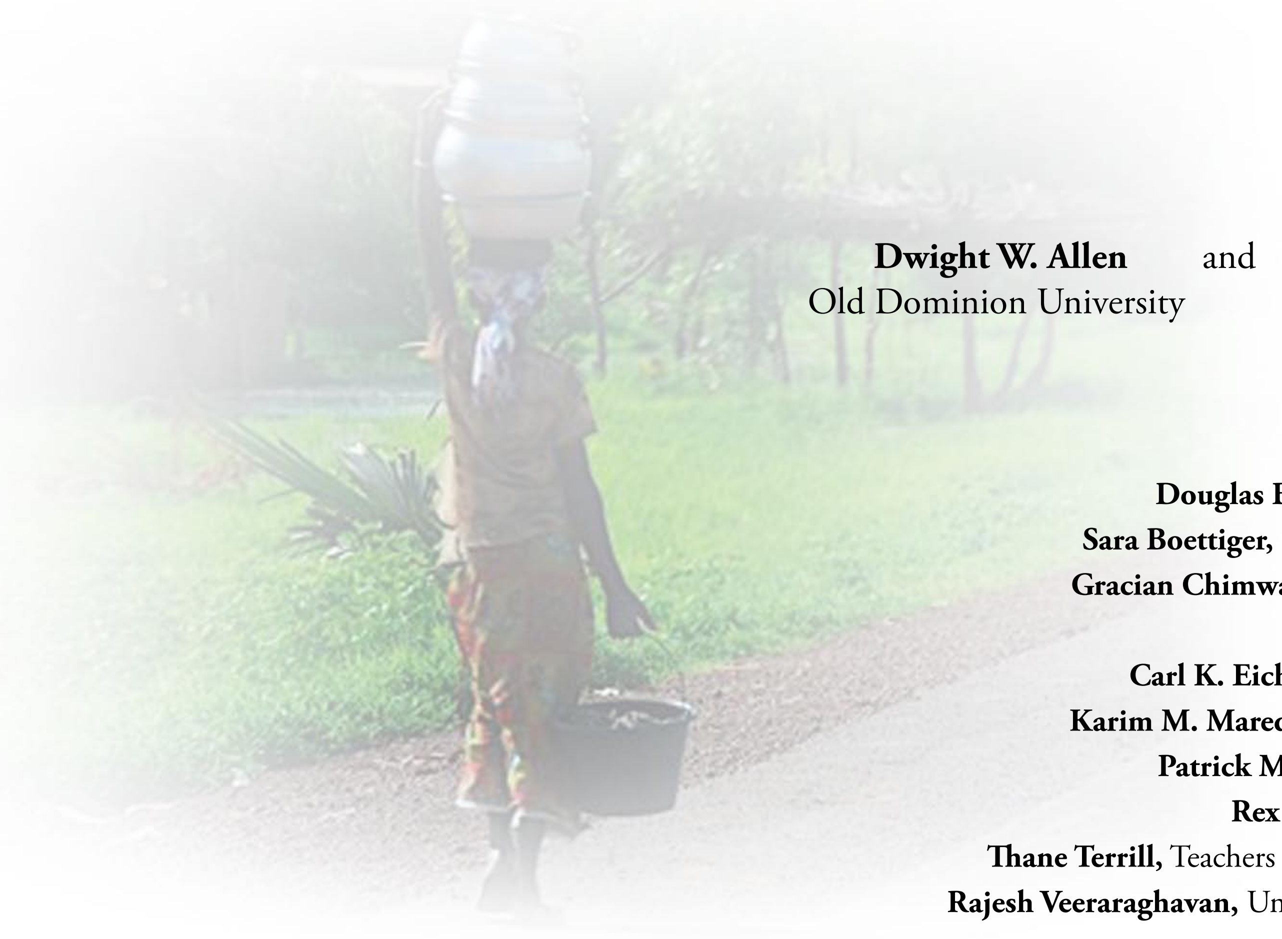
# Building Pathways out of Rural Poverty through Investments in Agricultural Information Systems

Final Report

Prepared by the WorldAgInfo Design Team
February 2008




**Dwight W. Allen** and **Mary Anderson Ochs**
Old Dominion University — Cornell University

**Douglas B. Allen,** University of Denver
**Sara Boettiger,** University of California Davis
**Gracian Chimwaza,** Information Training and Outreach Centre for Africa
**Carl K. Eicher,** Michigan State University
**Karim M. Maredia,** Michigan State University
**Patrick M. O'Shea,** Harvard University
**Rex Raimond,** Meridian Institute
**Thane Terrill,** Teachers College, Columbia University
**Rajesh Veeraraghavan,** University of California Berkeley


WorldAgInfo

# Contents

Cornell University
Albert R. Mann Library

15 February 2008

Roy Steiner
Senior Program Officer
Agricultural Development
Bill and Melinda Gates Foundation
Seattle, Washington

Dear Roy:

The following report summarizes the results of activities undertaken as part of the "21st Century Agricultural Education and Information Systems Project" (WorldAgInfo), May to December 2007, funded by the Bill and Melinda Gates Foundation and implemented by A.R. Mann Library, Cornell University.

Project activities included consultations with staff of the Bill and Melinda Gates Foundation; site visits to South Asia and Africa by members of the project's Design Team; two international workshops convened in Ithaca, New York, and Livingstone, Zambia, to bring together policy makers, scholars, instructional technology and curriculum specialists, and private sector representatives; literature reviews on topics relevant to smallholder agriculture in Africa and South Asia; and smallholder interviews conducted on-site in India, Sri Lanka, Mali and Zambia by agriculture undergraduate and graduate students.

The report offers a wealth of ideas for innovations in agricultural education and information systems, pulling together the creative thinking of the many people who participated in the project. We believe the unique composition of the project's Design Team, which included members from the fields of agriculture, information technology, and education, succeeded in facilitating outside-the-box thinking. It is not surprising that the team did not always come to a complete consensus on all aspects of the report that follows. However, the report does represent the best thinking of all members of the team.

This opportunity to be of service is much appreciated by all team members. It has been an exhilarating and productive experience for us all.

On behalf of the Design Team,

Dwight W. Allen
Old Dominion University

Mary Anderson Ochs
Mann Library, Cornell University

# Acknowledgments

The Design Team benefited from tremendous assistance from many institutions and individuals in carrying out its mission. The organization of the two workshops at Cornell University and in Livingstone, Zambia as well as the site visits to South Asia and Africa, involved extensive preparation and planning. The Team would like to acknowledge the following individuals.

Organization of the workshop in Livingstone, Zambia was facilitated by the Information Training and Outreach Centre (ITOCA), directed by Gracian Chimwaza. The Team would also like to express appreciation to the Chrismar Hotel management and staff, who went out of their way to assist our deliberations.

Our site visits to South Asia and Africa were enriched by consultations with and input from men and women farmers, university faculty and administrators, policymakers, business leaders, IT experts and others.

In India we owe special thanks to the following people. Dr. Vibha Dhavan at The Energy and Resources Institute (TERI); Dr. A. R. Kidwai, Dr. J.C. Katyal and Dr. Ram Srivastava at Haryana Agricultural University (HAU); Dr. V. Balaji, International Crop Research Institute for the Semi-arid Tropics (ICRISAT); Dr. P. Krishna Reddy, e-Sagu; Dr. Vanaja Ramprasad, Digital Green Project; Dr. Lakshmi Murthy, National Institute of Agricultural Extension Management (MANAGE), Hyderabad; Dr. David Alexander, Dr. C.R. Elsy, Ms. U.V. Deepa and Mr. Mukesh Mohan at Kerala Agricultural University/State of Kerala. In Sri Lanka: Dr. Cholani Weebadde, MSU; Mr. Adrian Mendis, U.S. Embassy, Colombo; Dr. Peter G. McCornick and Dr. Sarath Abayawardana, International Water Management Institute (IWMI); Mr. Ranjit Page and Ms. Janaki Kuruppu, Cargills (Ceylon) Company; Dr. C. Kudagamage, Department of Agriculture; Prof. Buddhi Marambe, University of Peradeniya; Mr. Prasanna Hettiarachchi, Saraketha Pvt. Ltd.

For assistance in making our visit to Mali so productive and informative, we would like to thank first and foremost, Dr. John Staatz at Michigan State University (MSU) and Dr. Nango Dembélé at the PROMISAM/MSU office in Bamako. Thanks are also due to: Hon. Gaoussou Drabo, Ministry of Communication and New Technologies; Mme. Lansry Nana Haidara, Food Security Commission; Mme Aminata Maiga, Afriklinks; Mr. Salif Diarra, Observatoire du Marché Agricole; Mr. Moustapha Amadou, Institut du Sahel; Dr. Bino Temé, National Agricultural Research Institute (IER) headquarters; and Dr. Bonny R. Ntare, ICRISAT-Mali.

Similarly in Zambia, special thanks go to Prof. Mike Weber and Dr. Jones Govereh, MSU Food Security Research Project; Permanent Secretary Richard M. Chizyuka, Ministry of Agriculture and Cooperatives; Mr. Parkie Mbozi, Panos Institute Southern Africa; Dr. David Sibalwa, Dr. Akakandelwa Akakandelwa, Mr. Collins C. Chinyama and Mr. Sikaaba Mulavu at the University of Zambia; Mr. Davy Simumba, Director, Zambia Agricultural Research Institute, Mr. Henry Khoma, Ministry of Community Development and Social Services ; Dr. James O'Rourke, QUEST Project - Ministry of Education; Dr. Stephen Muliokela, Golden Valley Research Trust; Mr. Eloi Kwete, COMESA; Ms. Christine B. Chiwala, Zambia National Farmers Union; Dr. Klaus Droppelmann, The Agricultural Consultative Forum Secretariat.

Many Mann Library staff members, especially the project's full-time conference assistant, Mary Wright, contributed to making the two workshops a success. We would like to thank, in particular, Mann Library Director Janet McCue for her unstinting support, CALS faculty member Robert Herdt, and Cornell University President David Skorton for taking the time to open the workshop and thereby draw attention to the importance of addressing the needs of smallholder farmers around the world.

# Executive Summary

New collaborative information technologies offer an exciting opportunity to transform agricultural education and information systems in Asia and Africa. To evaluate this basic premise, the WorldAgInfo Design Team was charged by the Bill and Melinda Gates Foundation with exploring the landscape of agricultural education and information systems in these regions. The outcome, as specified under the Terms of Reference, is a set of recommendations for areas of investment that have the potential to improve the lives of smallholders through better access to agricultural education, training and information. This report provides a summary of the activities undertaken under the Terms of Reference and recommendations for areas of investment.

The major components of the project included:

1. Analysis of the agricultural information landscape
2. Site visits to South Asia (India and Sri Lanka) and Africa (Mali and Zambia)
3. Literature reviews on key topics related to delivering agricultural information at the smallholder level
4. Expert consultation workshops – one focusing on knowledge systems held in Ithaca, New York in October 2007 and the second focusing on delivery systems held in Livingstone, Zambia in November 2007
5. Smallholder Survey – over 600 focused interviews with smallholders in India, Sri Lanka, Mali and Zambia

The scope of this project was vast, covering two continents, multiple stakeholders all along the agricultural information chain, and all aspects of agricultural information from soil fertility to marketing mangoes. Thus, the ideas and information presented here certainly are not comprehensive. Rather they endeavor to provide a more holistic analysis of issues involved in strengthening the smallholder sector by reflecting input and views from all the key players who have a role in achieving long-term, sustainable improvements to smallholder agriculture in Africa and South Asia.

While many factors affect the productivity and overall success of smallholder farmers, it is clear that lack of access to agricultural information presents one of the important barriers. It is also clear that there are many creative and innovative initiatives already underway, so there is ample opportunity to have impact by building on ongoing success stories as well as experimenting with new approaches.

Out of the two expert workshops, known formally as the Cornell International Symposium on Agricultural Education and Information Systems, came many ideas for innovations using new collaborative information technologies, as well as some "tried and true" technologies implemented in new ways. Twelve proposals; over 30 concept notes are included in this volume. In addition more than 50 potential project initiatives are identified for possible future development. Each proposal was developed with contributions from a multidisciplinary group of professionals who joined the WorldAgInfo team in this work, almost all of whom are considered leading experts in their field. Key issues such as feasibility, scalability, sustainability, and overall impact were given major consideration in designing each of the proposed initiatives.

Although very diverse in terms of technology, target audience, and strategy, the 12 proposed initiatives share some common themes or operational principles.

- The content, value, and quality of information and knowledge are not improved just because information is offered in multimedia or over the Internet. The importance of quality control is almost more critical the more accessible and ubiquitous information becomes.
- Building in extensive feedback mechanisms at all levels from all sources is critical. This can help address the issue of quality control and strengthen the smallholder voice.
- It is important to enable smallholder access to a wide range of support systems so that as many men and women farmers as possible are reached.
- Many of the proposals cite programs that are already making a difference, and could offer a model or potential partner for future collaboration. Investments should capitalize on existing successful programs and innovative organizations, rather then reinventing the wheel.

There is impressive momentum at all levels, from the international to local, to use new technologies to strengthen smallholder farmers and their support network. This presents an optimal environment for scaling and impact.

# List of Acronyms

| Acronym | Definition |
|---|---|
| AAAS | American Association for the Advancement of Science |
| ACCI | African Centre for Crop Improvement |
| AGORA | Access to Global Online Research in Agriculture |
| AGRA | Alliance for a Green Revolution in Africa |
| AICM | Agricultural Information and Communication Management |
| AIR | Advancement through Interactive Radio |
| AJOL | African Journals Online |
| AMARC | World Association of Community Radio Broadcasters |
| AMARC–WIN | World Association of Community Radio Broadcasters - Women's International Network |
| ARDA | Agricultural and Rural Development Authority |
| ARM | Advanced RISC Machine |
| ATMA | Agricultural Technology Management Agencies |
| BMGF | Bill and Melinda Gates Foundation |
| CBO | Community-Based Organization |
| CDD | Community-Driven Development |
| CGIAR | Consultative Group on International Agricultural Research |
| CIA | Central Intelligence Agency |
| CIAT | Centro Internacional de Agricultura Tropical |
| CKW | Community Knowledge Workers |
| CLIC | Centre Local d'Information et de Communication |
| CPU | Central Processing Unit |
| CRS | Community Radio Stations |
| CTA | Technical Centre for Agricultural and Rural Cooperation ACP-EU |
| DCFRM | Developing Countries Farm Radio Network |
| DFID | Department for International Development (UK) |
| DSH | Digital Study Hall |

| | |
|---|---|
| EDC | Education Development Center |
| EDGE | Enhanced Data rates for GSM Evolution |
| FAO | Food and Agriculture Organization |
| FARA | Forum for Agricultural Research in Africa |
| GFAR | Global Forum on Agricultural Research |
| GIS | Geographic Information System |
| GMO | Genetically Modified Organism |
| GOFAU | Global Open Food and Agriculture University |
| GPRS | General Packet Radio Service |
| GPS | Global Positioning Satellite |
| HAU | Haryana Agriculture University |
| HINARI | Health InterNetwork Access to Research Initiative |
| HIV | Human Immunodeficiency Virus |
| IAALD | International Association of Agricultural Information Specialists |
| IAMR | Institute of Applied Manpower Research |
| IARC | International Agricultural Research Center |
| ICAR | Indian Council of Agricultural Research |
| ICM | Information and Communication Management |
| ICRISAT | International Crops Research Institute for the Semi-Arid Tropics |
| ICT | Information and Communication Technologies |
| IEEE | Institute of Electronics and Electrical Engineers |
| IIAM | The Indian Institute of Agricultural Management |
| IIM | Indian Institutes of Management |
| IIT | Indian Institutes of Technology |
| IMARK | The Information Management Resource Kit |
| IMF | International Monetary Fund |
| INASP | International Network for the Availability of Scientific Publications |
| INSAH | The Institut du Sahel |
| IPR/IFRA | Rural Polytechnic Institute and Institute of Applied Research and Training (Mali) |
| IRD | Integrated Rural Development |
| IRI | Interactive Radio Instruction |
| ITOCA | Information and Training Outreach Center for Africa |
| ITU | International Telecommunication Union |
| IWMI | International Water Management Institute |
| JTAG | Joint Test Action Group |
| KACE | Kenya Agriculture Commodity Exchange |

| | |
|---|---|
| KVK | Krishi Vigyan Kendra or Farm Science Centers |
| LAN | Local Area Network |
| LARRA | Linking Agricultural Research for Rural Radio in Africa |
| LCD | Liquid Crystal Display |
| LED | Light Emitting Diode |
| MANAGE | National Institute of Agricultural Extension Management |
| M&E | Monitoring and Evaluation |
| MIS | Market Information Systems |
| MISTOWA | Regional Market Information Systems and Traders' Organizations project |
| MSU | Michigan State University |
| MVIWATA | Tanzania National Network of Farmers |
| NAADS | National Advisory Services |
| NARO | National Agricultural Research Organization |
| NARS | National Agricultural Research System |
| NGO | Non Governmental Organization |
| NIMR | National Institute for Medical Research |
| NVA | National Virtual Academy (for Rural Prosperity) |
| OARE | Online Access to Research in the Environment |
| OMA | Observatoire du Marche Agricole |
| PDA | Personal Digital Assistant |
| PGD | Post Graduate Diploma |
| PPP | Purchasing Power Parity |
| PROMISAM | Projet de Mobilisation des Initiatives en Matière de Sécurité Alimentaire au Mali |
| QUESTT | Quality Education Services Through Technology |
| RAM | Random Access Memory |
| RRDI | The Rice Research and Development Insitute |
| RUFORUM | Regional Universities Forum for Capacity Building in Agriculture |
| SAU | State Agricultural Universities |
| SDC | Swiss Agency for Development Cooperation |
| SHG | Self Help Group |
| SME | Small and Medium-sized Enterprizes |
| SMS | Short Message Service |
| SPC | Sahelian Pesticide Committee |
| SPI | Serial Peripheral Interface |
| SRO | Sub-Regional Organization |
| SSA | Sub-Saharan Africa |

| | |
|---|---|
| TEEAL | The Essential Electronic Agricultural Library |
| TERI | The Energy and Resource Institute |
| TVI | Tutored Video Instruction |
| UCAD | Universite Cheikh Anta Diop |
| UN | United Nations |
| UNESCO | United Nations Educational, Scientific, and Cultural Organization |
| USB | Universal Serial Bus |
| VFPCK | Vegetable and Fruit Promotion Council in Kerala |
| VISA | Value-chain Information System for Agriculture |
| VKC | Village Knowledge Centers |
| WACCI | Western African Centre for Crop Improvement |
| WARDA | West African Rice Development Association |
| WHO | World Health Organization |
| WIFI | Wireless Fidelity |
| WOCAN | Women Organzing for Change in Agricultural and Natural Resources |
| WREN | Water Research and Education Network |
| WSIS | World Summit on the Information Systems |
| WTO | World Trade Organization |
| ZEF | Zentrum für Entwicklungsforschung/Center for Development Research |
| ZNFU | Zambian National Farmers' Union |

# 1

# WorldAgInfo: 21st Century Agriculture Education and Information Systems Project

## Terms of Reference and Overview

The WorldAgInfo Design Team was charged with exploring the landscape of agricultural education and information systems in South Asia and Africa. The goal of the project is to recommend potential areas of investment that will improve the effectiveness of agricultural education and training and ultimately the practice of small-scale agriculture at the local level. The team was specifically charged with identifying and exploring the feasibility of using collaborative technologies, such as community-based information systems and alternative information delivery mechanisms, to improve effectiveness of agricultural information systems. The report that follows addresses these goals and these four key project objectives:

- Identify agricultural curriculum/information needs of key stakeholders all along the education/information chain, including researchers, policy-makers, faculty, students, extension personnel, private sector input providers, large growers and smallholders
- Identify promising new technologies that can be adapted to agricultural information activities to improve the livelihoods of smallholders
- Explore the feasibility of using a Wikipedia-type model to create a "WorldAgInfo" system for developing collaborative community-based knowledge systems
- Explore the socioeconomic context of smallholders, including the institutions that support them, focusing particularly on ways to empower women as contributors and end users of collaborative agricultural information systems

The primary deliverable for this project was to be a final report recommending potential areas of investment to advance agricultural knowledge and information systems. The report that follows highlights strategies and technologies that offer particular promise.

## Guiding Principles

The project operated under several guiding general principles:

1) The geographic focus areas for the project are South Asia and Sub-Saharan Africa. Because these regions are vast in size and extraordinarily heterogeneous, the team identified representative locations for closer study.

2) The primary beneficiary for potential information projects is to be the smallholder farmer. The team looked for opportunities where new technologies had the potential to significantly enhance the well-being of this group. The team coined the term "First Kilometre" to refer to the special problems in delivering agricultural education and information at the smallholder level. The team also looked for opportunities for successful intervention along the full agricultural education/information chain. This chain of multiple stakeholders, including researchers, faculty, graduate and undergraduate students, extension workers, agricultural input dealers, community knowledge workers, large commercial farmers, and smallholders, is a complex and interlinked ecosystem. The team worked under the assumption that successful interventions at any level could potentially enhance the livelihoods of smallholders.

3) The agricultural education and information needs of women were given priority during the entire project. In many parts of South Asia and Africa, women face a variety of barriers to full participation in agricultural education and information sharing. The project attempted to identify ways that new technologies could help reduce or eliminate these barriers.

The team drew many ideas and concepts from the background paper on "Agriculture for Development in Sub-Saharan Africa," prepared by John M. Staatz and Niama Nango Dembélé, at Michigan State University, for the World Bank's *2008 World Development Report.*

## Project Components

The project consisted of 5 major components, each of which informed the others and enhanced the development of the set of potential support initiatives in this report. The project components are outlined here in brief.

### *1. Landscape Analysis*

The agricultural information landscape is complex and interconnected. Traditional views of this landscape have described the triad of research, education and extension in primarily linear ways. Collaborative information technologies allow for new ways for these sectors to interact. The article following in this Section (1) redefines this landscape as a dynamic ecosystem and suggests a new set of tools for modeling the processes within the ecosystem.

### *2. Site Visits*

Members of the WorldAgInfo team undertook 2 site visits as a first step in order to set the context for the rest of the project. A 5-member team travelled to South Asia (India and Sri Lanka) in June, 2007, and a 6-member team travelled to Africa (Mali and Zambia) in August, 2007. Each trip itinerary included visits with an extensive range of agricultural stakeholders and their related individuals and organizations, ranging from smallholder farmers to extension offices to large agricultural companies to government agricultural research facilities. Reports for each site visit are included in Section 5.

*3. Literature Reviews*

Team members and outside experts prepared literature reviews on key topics related to “First Kilometre” delivery of agricultural information. The reviews provided background for the Design Team on existing agricultural information systems for large and smallholder producers and an initial understanding of how the systems might be improved. Literature review authors surveyed the literature and described whatever issues arose in an institutional context.

In addition to informing our project, the literature reviews may offer useful summaries of key issues for Foundation staff. The literature reviews are available on the WorldAgInfo web site at www.worldaginfo.org.

*4. Expert Consultation Workshops*

Cornell International Symposium on Agricultural Education and Information Systems

- Workshop I: Knowledge Systems (Ithaca, New York, USA, October 2007)
- Workshop II: Delivery Systems (Livingstone, Zambia, November 2007)

The team organized two workshops which brought together leading experts in agricultural education in Asia and Africa to work alongside experts on emerging collaborative information technologies. The workshop agendas lead to discussion of current and optimal practices in agricultural education and information delivery in rural areas of Asia and Africa. Each workshop was divided into smaller groups which were charged with developing ideas for solving key problems in agricultural education and information systems. Ideas developed at Workshop I held at Cornell in October 2007 were used to jumpstart creative thinking at the second workshop a month later in Livingstone, Zambia. Section 3 of this report includes the short concept notes developed in the first workshop and Section 2 includes the more developed proposed initiatives that were generated by the Zambia workshop.

*5. Smallholder Surveys*

To supplement the Design Team’s observations during the site visits, an informal survey was undertaken to pull in additional anecdotal evidence regarding key problems in access to information at the smallholder level. Students from universities the Design Team visited in India, Sri Lanka, Mali and Zambia assisted us in gathering information about where smallholders get their agricultural information and what barriers they face in obtaining accurate, up-to-date information. While not a scientific study, the interviews with smallholders provide confirmation of many of the observations made during the site visits. A brief summary of the survey is presented in Section 6.

## Conclusion

As agreed in our Terms of Reference, this final report proposes a series of 12 support initiatives related to agricultural education and information systems. The ideas for these initiatives came primarily out of the November 2007 Zambia Workshop. The proposals describe the initiatives in some detail, but any attempt to implement any of these proposals requires additional decisions about partners, staffing, and budgets.

Proposals were created by individuals and small teams, and they do not always have full team consensus and unqualified support. They do, however, represent the best creative thinking of the Team and our many colleagues who contributed in one way or another to the development of these ideas.

In addition to the 12 full proposals and 30 brief concept papers Design Team members produced another 50 ideas for opportunities to improve agricultural education and information systems during the course of this project. Due to time constraints the members weren't able to develop the ideas further. These are listed in Section 4.

# The Agricultural Information Landscape—New Tools for Analyzing Dynamic Systems

Agriculture was the foundation and organizing activity of humanity's first civilizations but that does not mean that it is well understood. Analyzing agricultural processes has become increasingly difficult as the agricultural environment grows ever more complex. Among the elements that add to that complexity are the introduction of new technologies, the creation of global markets, the impact of rapid environmental changes, the pressures of population growth, the disruptive influence of urbanization, and the flood of new information sources relevant to even the smallest scale farmer.

All aspects of agriculture present challenges to analysis, but agricultural education and information systems are particularly resistant to traditional methods. These mirror the complexity of the overall agricultural environment and present similar problems of analysis, while adding some unique problems of their own. Additional methodologies are required to understand processes and relationships in agricultural information. Only with that understanding will we be able to match needs with solutions and apply effective ideas on a global scale.

Policy makers and planners have used a variety of models to analyze agricultural processes. Frequently used analytical tools such as hierarchical organizational charts and cost-effectiveness studies give the impression that agricultural systems can be described by static relationships and predictable interactions. Traditional models, particularly of information systems, are generally top down and fail to value local knowledge, nor do they facilitate sharing and transportability.

Although these tools still have value, used alone they will not prove adequate to the task of understanding modern dynamic agricultural systems, which is the first step in designing projects that will have a successful impact on complex problems such as alleviating the plight of smallholder farmers. Anyone seeking to understand agricultural systems requires more powerful analytic models, which take into account the complexity and dynamism of those systems.

Experience shows that having a better design for an irrigation canal or a seed with 30% better yield is not enough to have a lasting impact in the local agricultural environment. Only after understanding information flow and distribution can we begin to implement effective solutions.

## The Agricultural Information Ecosystem

Because information systems consist of human actors and the interactions and the interconnectedness of information resources and behaviors, we propose to conceptualize information systems as ecosystems. An ecosystem model will allow us to understand the processes of information creation, distribution, and comprehension. We can develop our analytical tools with this model in mind.

Four distinct methodologies are used to describe ecosystems. These are easily adapted to describe the special case of information ecosystems.

1. Structural Analysis: describing the mechanics of actors
2. Process Analysis: analyzing the interactions of actors

One can also describe the environmental factors (operational and structural) in which the actors and interactions reside with these methodologies:

1. Operational Principle Analysis
2. Structural Principle Analysis

These approaches can be used together to systematically analyze a complex environment:

- Use structural analysis to identify actors in an environment and their basic relationships to one another.
- Apply structural analysis to isolate a targeted project so that the individual processes can be identified.
- Analyze each process in terms of the cyclical elements that comprise it.
- Identify activities, costs, and values to each element of the process so that an overall valuation of the process can be made.
- Analyze the operational and structural principles involved in the process in order to evaluate the ability of the process to function effectively.

## Structural Analysis

The framework of the agricultural information ecosystem (Figure 1) describes agricultural information actors and their relationships to one another. For the sake of analysis the actors are assigned to major groups: farmers, frontline workers, researchers and educators. Although many of the framework's interactions have hierarchical elements, the ecosystem model encourages the user to see other possible relationships.

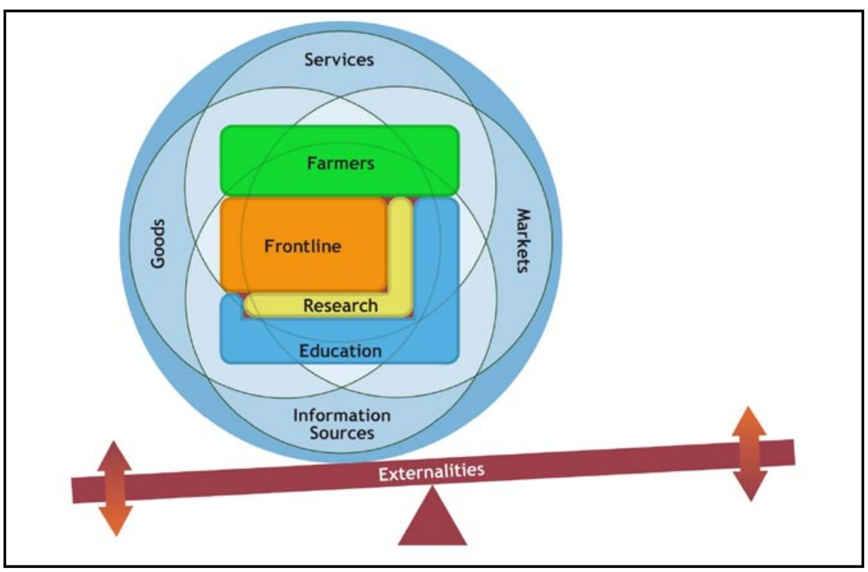



**Figure 1: Agricultural Information Ecosystems**

Another advantage of this model is that it recognizes that information may flow in multiple directions simultaneously. Although a hierarchical model might show information flowing only, or primarily, from frontline workers to farmers, in this model we have the ability to describe farmers' communication with frontline workers. Once the possibility of bidirectional flow is established a more realistic analysis of agricultural information processes is possible.

The size of each grouping of actors in Figure 1 represents very roughly the relative size of the population of each actor group, for example, there are fewer researchers than educators. The degree of contact between actors is represented by the surface contact of each block in the schematic. Researchers in this model have the greatest contact with educators, but also have some contact with farmers and frontline workers. These are, of course, generalizations. In specific cases private researchers may only contact farmers, and frontline workers may rarely interact with educational institutions, but the generalizations will help us understand the processes at work in agricultural information systems.

The second component of the framework is the set of surrounding circles. The areas of goods, services, markets, and information sources indicate resources available to the actors. The circles overlap to show that they, too, interact with each other both within the environment of the actors and outside of them.

The last major element is the constantly shifting fulcrum of external forces. These forces range from being completely uncontrollable (e.g., wars, weather) to somewhat controllable (e.g., government policy and local infrastructure). Understanding the local agricultural information system requires acknowledging that the landscape is constantly being impacted by external forces.

The Agriculture Information Ecosystem gives us a holistic perspective which will prove useful for further analysis, but as useful as it is, it does not provide us with enough information to analyze a specific information-related project, much less to take any specific action. The Agriculture Information Ecosystem is the equivalent of a high-altitude photograph, good for understanding the major features and contours but not useful for mapping specific routes.

The Applied Project Information Flow graphic (Figure 2) allows us to analyze the activities of individual projects within the Agriculture Information Ecosystem. A project, as defined here, incorporates some or all of the actors in the Agriculture Information Ecosystem, but isolates a subset of related activities from the myriad of activities possible in the ecosystem.

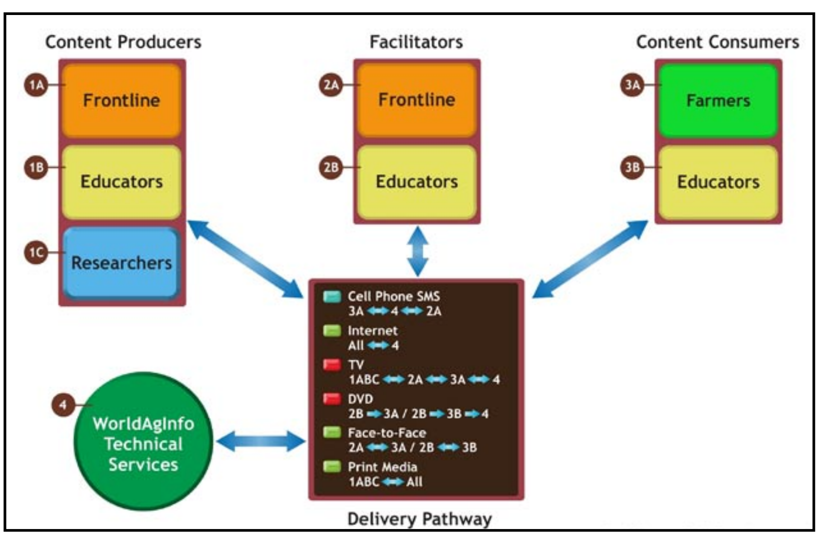



**Figure 2: Applied Project Information Flow**

Figure 2 identifies the communication flows found in the Multimedia Knowledge Exchange Systems for Smallholder Farmers proposal, a project analyzed in detail in section 2 of this report (Proposal 8). The structural elements of the Agriculture Information Ecosystem are represented in the chart. We see the actors organized according to their roles in this particular project. Now, however we have added a representation of the information flows between the structural elements (with a blue line and bidirectional arrows). These flows are the processes that are central to an analysis of the Multimedia Knowledge Exchange Systems Project.

Although the Project Information Flow Chart is useful in describing a project's structures, relationships and processes, it does not isolate each process for analysis. The chart cannot represent the difference between a working process and a malfunctioning process. Thus, another analytical tool is needed to move beyond simply representing a process to making some determination about its effectiveness.

**Applied Project Information Flow Explained**

Figure 2 arranges the actors into the specific relationships found in the project. All the communication flows are described in the Delivery Pathway box. The box is something akin to an old style telephone switchboard in that it shows a link between two points. The box describes the flows by listing the numbers of the origin and destination actors. The arrows show the direction of the communication flow. The media names indicate which medium is being used. The colored boxes to the left of the media names give a quick view of the communication flows: blue is incoming only, red is outgoing only, and green is bi-directional.

## Agriculture Ecosystem Processes

Effective analysis of information projects within the Agriculture Information Ecosystem takes place at the level of the process. Processes combine to create projects and other recognizable activities. They are inherently dynamic. Healthy information-based processes are characterized by a cycle of creation, transformation, distribution, processing and action, with a return to creation as feedback is incorporated into the next cycle. We call this dynamic and iterative cyclical process an "Infovation Cycle." The graphic of the Infovation Cycle Analysis (Figure 3) represents both the flow of information and the act of innovation.

Each element of the cycle can be assessed by using a simple table. In Figure 3, the table at the right identifies elements found at each stage of the process and characterizes their important elements, such as cost, performance, probability of success, and the application of values. All of these elements can be rigorously analyzed.

## Infovation Cycle Stages

### *Creation*

Every Infovation process starts with some act of creation. Creation can be initiated by any actor in the system. The Creation stage grows out of the Action stage as feedback generates newly created content for the next iteration of the cycle.

### *Transformation*

In most situations, the creation of information also requires its transformation into formats, styles and levels of abstraction suited for the intended audience of the project and its targeted distribution systems. When researchers create information and share that information with colleagues in the same discipline, they transform that information into formats required for journal and conference submissions. If that information is to be useful to farmers, it must be transformed, abstracted, and possibly translated into other more simplified formats.

*Distribution*

Distribution mechanisms within an Agricultural Information Ecosystem include newspapers, flyers, radio, cell phones, television, and the Internet. In a strict analysis, one would want to evaluate each distribution mechanism in detail. In the Internet age, however, the costs of many distribution systems are so low that it is desirable and cost effective to distribute information as widely and redundantly as possible.

*Processing*

Processing, which we define here as translating information into forms understandable to the recipient, is especially important in the realm of agricultural information. The high level of illiteracy among smallholder farmers, the group most in need of information, can be overcome only by re-presenting any written information in some other form.  Even when smallholders are literate, that literacy may be in local language or dialect, rather than the official language of the country and so will require translation, another form of processing.

*Action*

Once the recipient has the information, some form of action should take place. Smallholder farmers are highly motivated and usually will look for any information they believe can help them out of poverty, or merely to subsist. When inaction occurs it can be due to the inability to undertake a desired action, a lack of understanding, a disagreement with the message, or some other block. Both actions and inactions, properly analyzed, generate feedback into the cycle to improve the process.

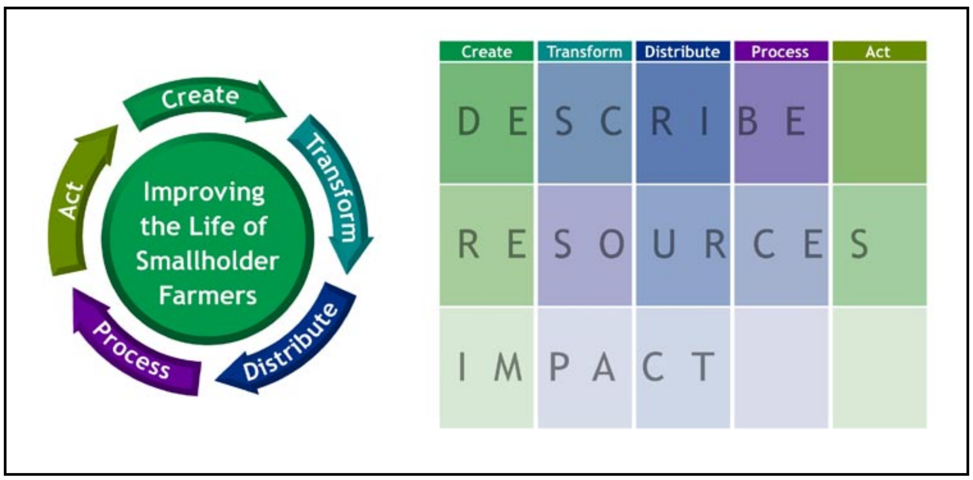



**Figure 3.  Infovation Cycle Analysis**

## Infovation Cycle Measurements

The Infovation Cycle approach states that all stages must function well for the process to function. Furthermore, a healthy system is dynamic and imbued with the ability to grow and develop.

The Infovation Cycle approach, as opposed to many traditional approaches, has the ability to incorporate and represent values. We use the term "value" to define the assumed goals of a process or actors within it. Values can be both implicit and explicit. One basic implicit value is that stated above: a healthy process cycle will be able to grow and change in order to achieve its goal. The explicit values are those of the people performing the analysis. Their values may be stated as goals: the improvement of the condition of women or the creation of content in under-represented languages.

Performing this Infovation Cycle analysis is useful for looking at an individual project, but it is equally useful in identifying intervention points within an environment (e.g., region, country, sector, technology, etc.). Because the costs, scope and values have already been applied through use of the process analysis, researchers can identify meritorious elements in a complex environment.

Additionally, a planner or project designer looking for intervention points now has a basis to analyze many projects at once for common opportunities. For example, a number of possible projects might all benefit from a common service. This perspective is the key to providing leverage and scale to future interventions.

Infovation Cycle analysis may appear only well suited to analyzing current processes but unable to be predictive due to the nearly infinite number of potential solutions for a problem. In reality, the number of potential elements is quickly reduced by what is possible in each environment, by obvious costs limitations, and by the examples of past successes and failures. And by its very nature an Infovation Cycle can survive a less than optimal solution set as long as the iterative characteristic remains.

Just as a biological ecosystem dies when its dynamic flows fail, the heart of an information ecosystem process is feedback and repeated iterations. Incorporating feedback can be challenging. Societies tend to use measurements for allocating praise or blame and not as an integral part of an analytic process. In this model, praise should be directed at actors who help the feedback process and blame reserved only for those that hinder it. The result of feedback is learning, and the information it produces is always valuable.

## Operational Principles

An information ecosystem is built from a multitude of synergistic components. Some of the operating principles of the new agricultural information ecosystem include:

- Redundancy of sources and access nodes - the availability of information from multiple sources through multiple delivery systems
- Universal, constant feedback – recording and sharing the experience and opinions of all stakeholders
- Universal "voice" - most notable is the addition of the voice of the smallholder
- Unprecedented collaboration of all participants – everyone recognizing that they are both teachers and learners
- Rapid prototyping with constant feedback and intense, real-time collaboration of all stakeholders

When these operating principles are in place the potential learning curve is compressed from decades to years to months and in some instances to near real time.

### *Operational Principles: Redundancy as a special case*

The famous line of Robert Burns's "To a Mouse," "The best laid schemes o' mice and men gang aft a-gley," applies especially well in the difficult environments of Africa and South Asia. These landscapes are littered with the literal and figurative debris of failed plans. While there are, of course, many elements that are critical to a project's success, we believe that success is far more likely if planners in the agricultural information ecosystem adopt a strategy of redundancy. In fact, redundancy should be promoted to the level of an operational principle.

Figure 4 shows one way that redundancy can be enhanced in an information system. The directional lines represent four otherwise independent projects focusing on the smallholder farmer. The center set of four circles represents the four principal areas within which each of the proposed projects fall. The areas overlap with one another in the schematic and it is along the horizontal plane of this overlap that redundancy can be enhanced. So, for example, a project involving a wiki-based knowledge system in the university environment may be supported by some of the system's content finding its way to the smallholder farmer, not only through university researchers and agricultural extension officers, but also through a radio-based agricultural educational project.

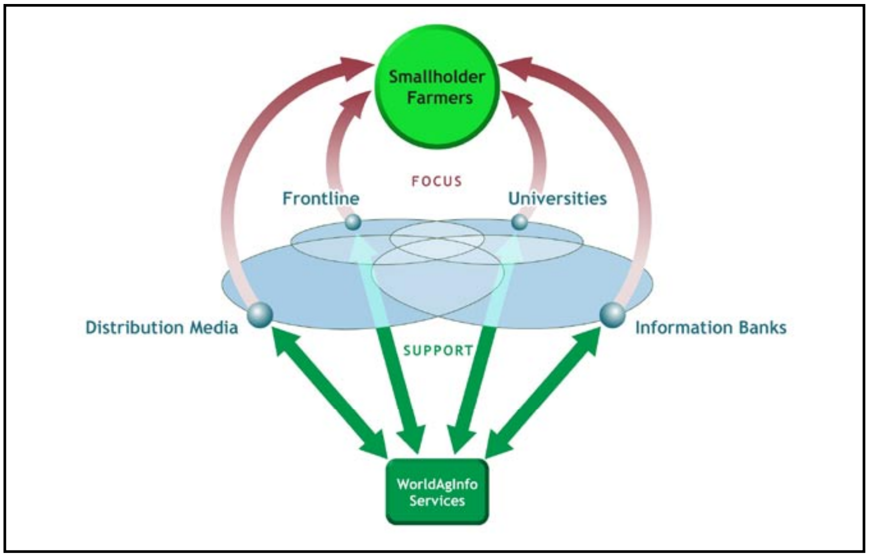



**Figure 4: Project Support Structure**

The graphic also illustrates the value of clustering related projects. One of the lessons of the Internet is that once valuable content has been created, the cost of distributing it through other information channels is usually very low. Related projects such as those shown here can easily reuse and repurpose content created for any one of them.

Projects can also be clustered by their common technological needs. In the past, a project might fail because its planners did not understand how to use an available technology in an effective way. This graphic shows how a common technology support system, in this case, WorldAgInfo Services can provide multiple technologies in support of several similarly focused projects. Projects with mutual advantages can be developed and lessons from one project may be shared with other projects. In terms of redundancy, a common support system also allows one project confronted with a technological barrier to quickly identify alternative solutions. So, in the hypothetical case of a country closing down all community radio stations for political reasons, a project based on community radio might be able to shift to cell phones or to distribution via a podcasting model.

*Operational Principles: Trust as a special case*

Billions of dollars have been spent to help the smallholder farmer with limited results. When success has been achieved, the results do not seem to be widely transferable. Many assume that the lack of progress has been due to the lack of education or an unreasonable adherence to outdated traditional practices. Our design team found that, on the contrary, smallholder farmers are sophisticated in their analysis of their environment and open to new ideas.

Smallholder farmers constantly analyze what they should grow, how it should be grown, whether they should work in the city and hire laborers, and if and when to buy and sell in the market. A wrong decision can easily result in losing their land, lowering their standard of living, or even losing their lives.

But any form of analysis requires trustworthy data. Accuracy, predictability and repeatability are a few of the factors which lead to trust. Their opposites—inaccuracy, unpredictability and unrepeatable results raise obstacles to trust. Often the smallholder does his/her analysis in information environments that are untrustworthy to varying degrees. Smallholders are frequently unsure if the price they are receiving is fair, for example, or if the product being purchased is unadulterated. Regulations may be enforced selectively and fee-based services may be difficult to negotiate.

Trust is a key element to maintaining a successful information process. Even if the immediate goal of a project has been met successfully, if trust is not maintained the result is failure over the long term. Those directly involved may be able to see a project's success, but once the face-to-face contact of trusted participants ends, they frequently will lose the confidence to influence others.

Relevance is a related issue. A smallholder may understand that the information s/he is receiving is correct and that the person presenting the information has no ulterior motives, yet the information may not be suited for local conditions.

Trust is relative to the situation and the experiences of the individuals involved. Unfortunately, because smallholder farmers cannot afford to make mistakes and because they have traditionally operated in challenging information environments where trust was absent, the level of effort required from information providers to obtain trust is very high.

Trust is most easily achieved at the level of grass-root organizations, such as farmers' cooperatives and women's groups. Agriculture information ecosystems linked to these solid foundations of established trust may become one of the best pathways out of poverty.

Additional operational principles that increase the potential for trust and success are:

- Transparency
- Formative evaluation
- Interdependence
- Diversity

Even if many elements in the environment remain untrustworthy, if an agricultural information ecosystem can be built which gains the trust of the smallholders, it will succeed in offering them new options for action and response.

## Structural Principles

As we have noted, a healthy Infovation cycle has growth and change as essential ingredients. Without them one can have a successful project that is the equivalent of a model ship in a glass bottle. It may be wonderful to point to and highly admired, but has no real utility or applicability. It will never set sail. We need to adopt a set of structural principles to insure dynamic, sustainable projects.

A successful project must include most of the following structural principles for maximum results:

- Scalability
- Replicability
- Modularity
- Multiple models

The relationship of these two sets of operational and structural principles to the Infovation cycle is illustrated by Figure 5. The graphic shows how combining the two sets of principles propels the iteration process. If the project has multiple sound structural principles, but the operational principles are poorly represented or weak, the project will be awash in resources and good ideas, but is unlikely to make progress.

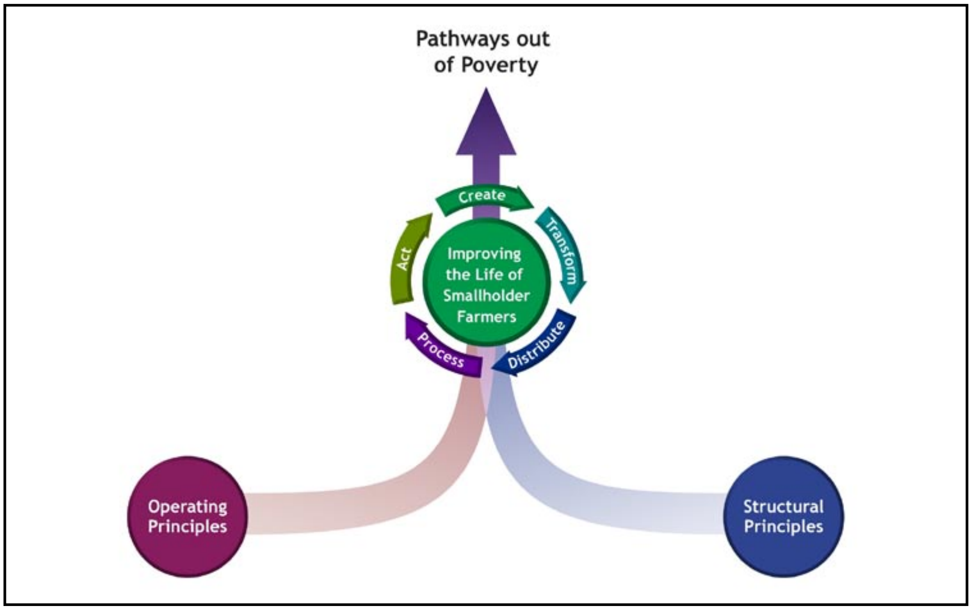



**Figure 5: Information Ecosystem Principles**

On the other hand, if the operational principles are strong, as is the case with many grass-roots organizations, but the structural principles are weak, then however successful the project is it will have difficulty sustaining itself and is unlikely to spread to other communities.

A successful project requires the optimal mix of appropriate structural and operational principles.

## Conclusion

In 1597 Sir Francis Bacon said "Knowledge is power" (Scientia potentia est). Knowledge is based on information. Today the world has generated and continues to generate even more information than the most educated person can ever use or access incrementally. Today we need an update to Sir Francis' dictum. We propose the obvious, "The management of information is power."

The world information ecosystem is reeling from information chaos. It was only 150 years ago when the soon to be founders of the Oxford English Dictionary formed an "unregistered words committee" to bring new order to the use of the English language. From that modest beginning, the publication of the first ten-volume edition of OED (really twelve volumes as volumes 9 and 10 were published as two half volumes each), took more than 75 years. Information was generated at a modest pace, and the collation of information was being transformed as well. By the time the last fascicules were published, the information was orders of magnitude more extensive, but finally under control—for that brief moment in time.

Our current education system, of which agriculture education is a part, is still organized around that 19th century compendium of knowledge and its mastery. New information has been grafted on to an old, established knowledge order. What is needed is a new information order, a new information ecosystem that is organic by its very nature and tuned to future growth.

The operational and structural principles discussed here are not the only principles of a new information ecosystem, but are among the emerging principles which, if better understood and incorporated into project development, will provide better options for new pathways out of rural poverty.

We believe that the tools discussed above may be useful for evaluating a wide range of human activities. They are essential for evaluating human activities in cultures and environments in which we are not native participants. Like biological ecosystems, the processes of information systems are fundamental but the actors and interactions vary. Many projects have failed because they attempted to reproduce the specifics of their native ecosystem and transfer it unmodified to another ecosystem. These tools help us to understand what made one ecosystem successful and then allows us to transfer those successful elements to other environments.

In the same way that many businesses fail in our culture when they appear to be destined for success and other businesses succeed against all reasonable expectations, we must allow agricultural information processes in the developing world to function in such a way that what really works can succeed and provide the building blocks for further success. At the same time processes that merely appear successful but which eventually fail should still provide us with information to design a better process.

Agricultural information is a human activity that takes place in a human environment. The key principle for success is to trust in the human process. When people can function well in a process, success will be the outcome.

# 2

# Pathways out of Rural Poverty: Proposed Information Projects Generated by the Workshop in Livingstone, Zambia

The international workshop in Livingstone, Zambia, November 11-16, 2007, was the culmination of the WorldAgInfo project's major activities to identify the critical challenges and potential solutions for improving the flow of information to and from smallholder farmers in South Asia and sub-Saharan Africa.

Whereas the Cornell workshop focused on strengthening the content of agricultural education/ curriculum and information systems to meet the needs of smallholder farmers, the workshop in Zambia focused on delivery. Drawing on the "solution scenarios" or project concepts developed at the Cornell workshop (see Section 3), participants in Zambia generated the following set of proposed information projects. We feel they represent a strong combination of feasibility, evidence of previous success and the potential for impact and scaling.

Preceding the full descriptions of the proposed initiatives are "At-a-Glance" summary versions for quick reference. The agenda and list of participants for the workshop in Zambia are provided at the end of the section.

### Proposed Support Initiatives

1. World AgInfo Systems
2. Market Information: Value-Chain Information Systems for Agriculture (VISA)
3. Real-Time Delivery of Agricultural Information to Smallholder Farmers in South Asia and Africa through Community Knowledge Workers
4. Indian Institute of Agricultural Management (IIAM)
5. Facilitated Multimedia Instruction to Support University Agriculture Curricula
6. Collaborative Content Generation: Building Digital Agricultural Content Modules
7. Improving Agriculture Literature Systems in South Asia and Africa
8. Multimedia Knowledge Exchange Systems for Smallholder Farmers
9. Mobile Phones with Bundled Agriculture Information Systems
10. Community Radio Support Systems
11. New Agriculture Skills by Radio for Smallholder Farmers
12. Soil Testing Probes for Smallholder Farmers

## 1. WorldAgInfo Systems: A Catalyst for Smallholder Agricultural Innovations

WorldAgInfo Systems is the project that provides technical and administrative support to other WorldAgInfo proposal projects. WorldAgInfo Systems will provide 1) administration and coordination of approved WorldAgInfo projects; 2) software and technology standards/processes to meet the needs of the approved projects; and 3) evaluate best practices and information sharing among projects and with the wider development community. This project will require a physical presence via a relationship with an established institution in South Asia and Africa. Central functions of WorldAgInfo Systems would be undertaken by people in roles such as program director, technical advisor and evaluation specialist. This proposal provides the mechanisms for shared learning and collaboration that will allow the individual projects to adjust to the rapidly changing agricultural information landscape.

### Problems

- Agricultural information lacks strong support networks or foundations
- Projects are implemented without oversight or built-in sustainability measures
- Regional communication about initiatives are frequently unknown and unrecognized
- Projects are difficult to scale and transport to other communities

### Solutions

- WorldAgInfo Systems will provide technical and administrative oversight to ensure all project needs are met
- Create technical and procedural standards
- Form partnerships in service areas to ensure projects do not exist in a vacuum
- Describe and distribute information on project successes for scaling purposes

### Feedback Mechanisms

- Given that most of the services provided are for specific projects, the performance of those services can be determined by the degrees to which agreed deliverables have been met
- Feedback from the specific projects can be in the forms of membership on advisory boards and through periodic surveys

### Beneficiaries

- Women's associations and networks
- Farmer's associations
- Rural chambers of commerce
- NGOs/CBOs
- Private sector service providers

### Potential Partners

- Frontline support staff
- Universities and colleges
- Private and public institutions

## 2. Market Information: Value-Chain Information System for Agriculture

WorldAgInfo

This proposal develops a Value-Chain Information System for Agriculture (VISA). VISA extends new income opportunities to smallholder farmers and other stakeholders by applying tried-and-true principles of value chains to current market information systems. VISA will provide information on new market opportunities (prices, product characteristics sought by consumers, identification of reliable trading partners), as well as information on what farmers and other actors within the value chain need to respond to these opportunities (e.g., improved crop varieties, links to research systems, links to institutional support). VISA will also distribute information to help formulate policies for value-chain development while simultaneously furnishing feedback mechanisms. VISA's vision represents a paradigm shift away from a supply to a demand-driven market information system, creating value and incentives for all stakeholders.

### Problems

- "New Agriculture" has shifted from open commodity markets
- Farmers face a lack of information about:
  - *prices;*
  - *market locations;*
  - *technical specifications required by buyers*
- Supply driven approach is antiquated because smallholder farmers are no longer exclusively dependent on conditions at the local level

### Solutions

- Establish local VISA offices in rural and urban areas and coordinated through a central office
- Demand-driven approach allows farmers to respond to new opportunites
- VISA officers would serve as information brokers for farmers
- Information disseminated to its stakeholders through multiple media such as local radio, SMS, and mobile phone

### Feedback Mechanisms

- Taskforce feedback surveys measuring participatory willingness and perceived benefits
- Production and marketing data will measure production
- Evaluate production sales and growth between VISA and non-VISA participants
- Growth in employment products and services
- Smallholder income changes

### Beneficiaries

- Smallholder farmers, especially women
- Small-scale businesses
- Agricultural extension agents
- Agricultural researchers

### Potential Partners

- Extension services
- Universities and technical training institutes
- National Agricultural Research System
- Private and public institutions
- Private sector

## 3. Real-Time Delivery of Agricultural Information to Smallholder Farmers in South Asia and Africa through Community Knowledge Workers

WorldAgInfo

This proposal outlines a project to enhance real-time delivery of agricultural information to smallholders in Africa and South Asia through village-based knowledge systems. Implemented by trained community knowledge workers (CKWs), village-based systems will operate either through existing community development platforms or by creating new village knowledge centers (VKCs) in partnership with the local community and stakeholders that support smallholders. Guided by strategies to ensure long-term sustainability and practical "on the ground" application of new information and communication technology tools, this proposal tests multiple models of VKCs and training of CKWs. Using a bottom-up and participatory approach, CKWs will provide real-time information to smallholders, focusing on women and youth members of the farm families.

### Problems

- Agricultural information does not reach villages in a timely manner
- Information is not site specific
- Smallholder feedback is rarely received and circulated among stakeholders
- Community foundations are not in place to take advantage of information communication technologies (ICTs)

### Solutions

- VKCs will serve as an information bridge between smallholders and stakeholders serving them
- Trained CKWs provide real-time information and encourage participatory information sharing
- Content informed by smallholders and site-specific needs
- CKWs will provide practical ICT application training for smallholders

### Feedback Mechanisms

- Formal evaluation measures such as VKC membership trends
- Fluctuations in smallholder productivity and income sources
- Informal farmer feedback will be gathered through the use of independent evaluations
- Community metrics will determine external resources leveraged and used by VKCs

### Beneficiaries

- Smallholder farm families, especially women and youth
- Stakeholders who support smallholder farmers
- Community knowledge workers

### Potential Partners

- Farmer's associations and other community based organizations
- Local universities and NGOs
- Private sector
- ICT providers
- Local and national governments

WorldAgInfo

## 4. The Indian Institute of Agricultural Management

This proposal focuses on a new model of higher agricultural education in South Asia with special emphasis on India. The Indian Institute of Agricultural Management (IIAM) aims to improve the quality and relevance of higher agricultural education and is to be patterned on highly successful Indian Institutes of Management (IIMs) and Indian Institutes of Technology (IITs) that have attained an international level of quality. IIAM will admit students from South Asia for undergraduate and graduate degree programs and non-degree courses, and academic staff will pursue action research that focuses on improving the lives and livelihoods of small and marginal farmers and rural women. New models of higher agricultural education are needed to foster an exchange of information, knowledge and global experience.

### Problems

- Universities are hesitant to adopt new standards
- Chronically underfunded agricultural universities
- Poor quality instruction due to lack of faculty turnover
- Curricula is out-dated
- Universities are ill-prepared to deal with "New Agriculture" issues such as food security and climate change
- Shortage of graduates, especially women, with skills to undertake "New Agriculture" challenges

### Solutions

- IIAM will be based on a successful and flexible model proven to work for other skills-based higher education curricula
- Recruit new faculty on one-year scholarships
- Incentives targeted specifically for women, such as tuition waivers, book allowances and boarding assistance
- Curricula revision based on real-world agricultural concerns

### Feedback Mechanisms

- Comparative evaluation with similar models of education, such as IIM
- Number of students trained and innovations generated to address "New Agriculture" problems
- User-generated metrics such as increases in small and marginal farmers income and employment
- In-depth project assessment every five years
- Private sector participation and external resources leveraged by the IIAM

### Beneficiaries

- Students
- Faculty and new teaching staff
- Smallholder families
- Government agriculture departments
- Agribusiness firms

### Potential Partners

- National Agricultural Research Systems of South Asia
- International and national universities
- Research foundations
- CGIAR
- Private sector
- NGOs

## 5. Facilitated Multimedia Instruction to Support University Agriculture Curricula

This program incorporates facilitated video instruction in university curricula in sub-Saharan Africa. Local universities and international partners will create and exchange video-based course materials on topics central to "New Agriculture." Many topics are currently not being addressed in the African agricultural university curricula, yet are critical for training new scientists in developing solutions to Africa's food security agricultural advancement. This program offers the possibility of enhancing the curricula in participating universities and strengthening faculty teaching skills. Beyond the university, facilitated video instruction can improve education for farmers in the field. Participatory video, in which university students, extension agents, and/or farmers create content for other farmers, creates a feedback channel from the smallholders back to the educational system.

### Problems

- Need for curriculum enhancement in agricultural universities
- Shortage of qualified instructors for key new topics in agriculture
- Current lack of feedback from smallholders to universities
- Technological and distribution challenges, such as Internet connectivity
- Lack of quality and timely information available to farmers

### Solutions

- Video facilitation encourages multi-level approach to teaching and learning
- Enhances curricula and strengthens teaching faculty at participating universities
- Video content is customized according to local conditions and crops
- Realistic technology platforms, such as VHS and DVD
- Feedback channel from farmers to universities

### Feedback Mechanisms

- User-based feedback will be built into lectures and facilitated discussions by using personal response systems, commonly known as "clicker" technology
- Standard education evaluation techniques will help determine content creation, course offerings and contributions to archive
- Independent evaluations with smallholders to determine content

### Beneficiaries

- Faculty and students
- Smallholder farmers, especially women
- Rural communities and non-farm workers

### Potential Partners

- African and South Asian agricultural universities
- American and European universities
- Faculty and students interested in "New Agriculture"
- People and institutions with experience in video specialization

## 6. Collaborative Content Generation: Building Digital Agricultural Content Modules

Agricultural students, faculty, extension staff, community knowledge workers and farmers in South Asia and Africa often do not have access to high quality, relevant educational material. This project envisions an online digital library which facilitates the collaborative production of freely licensed agricultural content. The content modules would be available for aggregation into handbooks, textbooks, extension documents, and other agricultural educational materials, as well as made available in offline versions such as PDFs, printed versions, CDs and cell phone versions. The user generated content system will involve participants from all segments of the information ecology, at both the global and local level. The content creation will occur on a wiki-type platform to allow the information to be easily developed, modified and updated.

### Problems

- Lack of affordable and up-to-date textbooks
- Inadequately stocked libraries
- Available materials are often:
  - *targeted at research audiences;*
  - *not relevant to local conditions*
  - *unavailable in local languages*
- Valuable community knowledge is not transferred back into education system

### Solutions

- Online digital library consisting of handbooks, textbooks, and other materials
- Flexible content modules focused on "New Agriculture" topics
- Collaborative production of freely licensed content
- Off-line versions address technology barriers
- Content designed specifically for and about women in agriculture

### Feedback Mechanisms

- Interactive metrics, such as a user-centric rating system to determine demand for new translations and content
- Real-time assessments, such as number of PDF downloads
- Traditional measures will account for the number of books produced and embedded in university curricula

### Beneficiaries

- University students
- Faculty
- Community information providers
- Extension staff

### Potential Partners

- Agricultural universities and consortia
- Developed/developing world partners
- CGIAR and FAO
- Textbook publishers
- Women's organizations
- E-book readers and technology partners

## 7. Improving Agriculture Literature Systems in South Asia and Africa

This proposal will improve access to information by scaling up activities which already have a track record of success and introducing some new strategies. This two-part initiative focuses on journal delivery enhancements and information seeking and technology skills training. Journal delivery enhancements would include increased distribution of TEEAL sets in Africa and South Asia; development of a cluster of interactive African-centric online journals to promote development and exchange of local content; digitization of important contributions from Indian agricultural science publications; and a current alerts pilot project in Africa that expedites and facilitates scientists' ability to learn about key new articles. Information fluency training would involve: developing a post-graduate program in Agricultural Information and Communication Management; scaling up train the-trainer workshops for TEEAL, AGORA, HINARI and OARE; and a library strengthening component.

### Problems

- Journal content is not used to its fullest extent
- Lack of ICT infrastructure
- African and South Asian research information is unavailable or only in print formats
- Lack of training for information professionals
- Many agricultural university graduates lack adequate capacity to integrate ICT in communicating agricultural knowledge

### Solutions

- Enhanced journal delivery programs will increase access to scientific literature
- *Agricultural Innovations Journal* will provide new outlets to share regional research
- Journal alerts provides opportunities for updates and real-time information sharing
- Short-term "train-the-trainers" provides continued education for information professionals

### Feedback Mechanisms

- New journal systems measures of success:
  - *Regularity of journals;*
  - *Subject coverage;*
  - *Journal citations;*
  - *PDF downloads;*
  - *Use outside region of origin*
- Short term training measures of success:
  - *Increased use of resources covered in training, i.e. AGORA PDF downloads;*
  - *Efficient use of web resources;*
  - *Implementation of training topics*

### Beneficiaries

- Agricultural university students
- Agricultural faculty and researchers
- Information professionals

### Potential Partners

- University and research center libraries
- Publishers
- FAO
- ITOCA
- Cornell University

WorldAgInfo

## 8. Multimedia Knowledge Exchange Systems for Smallholder Farmers

This proposal will integrate locally recorded video and audio, dispersed through "mediated instruction" with existing extension systems. As audio-visual formats are generally preferred by people who cannot read or write, the idea is to encourage the use of audio (radio) and video (using a combination of DVD players and TVs) to reach out to illiterate farmers. "Mediated instruction" is a particular use of video and audio in educational contexts, where a facilitator or a Village Knowledge Worker, who is not necessarily a subject matter expert, is present to pause, playback, ask questions, encourage discussion, and otherwise stimulate participation. It is known to be a very effective use of recorded media for education. The solution requires both technical and social engineering components.

### Problems

- Farmers often lack practical information that could benefit their situation
- Content production and distribution lacks replicable and editable formats
- Technological innovations consistently lack a social interface
- Farmer illiteracy and translation barriers

### Solutions

- Captures knowledge and best practices in an easily accessible form
- Inexpensive and low-maintenance technology
- Establishes a social learning environment where discussion is a major element
- Provides a platform for farmers and facilitators to create and modify content

### Feedback Mechanisms

- Audio and video media will capture new types of content, such as audience requests and responses
- Textual media will collect general statistics on the location and attendance
- Assessment using standard techniques for agricultural extension evaluation
- Independent evaluation will be necessary to determine whether content covers smallholder needs

### Beneficiaries

- Agricultural extension system, particularly smallholder farmers
- Junior agricultural experts
- Local facilitators

### Potential Partners

- Agricultural research partners, like CGIAR, ICAR, and government-university departments of extension
- Local community-level groups
- International groups of agricultural research and extension experts

## 9. Mobile Phones with Bundled Agriculture Information Systems

This proposal builds on the success of peer-based communication. Farmers are accustomed to sharing their knowledge among one another but they are limited to those farmers with whom they come into contact. Agricultural information relevant to the smallholder farmer will be collected, organized and then made widely accessible via the mobile phone network. This includes local knowledge in local languages as well as conventional scientific information. The approach seeks to motivate farmers to participate as individuals and farmer organizations to build a knowledge bank of best farming and marketing practices. A major component of the project will be to increase mobile phone ownership and use through a negotiated discount sale of 1,500,000 mobile phones to participating farm organizations in two selected countries in Africa (Mali and Tanzania), one state in India, and a discount scheme on talk-time purchase.

### Problems

- Lack of access to timely, relevant information about inputs for crop and livestock farming and market information
- Mobile phone users are predominantly male
- Individual mobile phones are cost prohibitive
- Many smallholders lack technical skills required to take advantage of mobile phone technology

### Solutions

- Commercial mobile phone network providers will sell low-cost phones capable of delivering high-quality services as a bundle to farmer organizations
- Bundle will be financed through a structured bank plan
- Phone knowledge bank builds on peer-to-peer interaction
- Several information services for farmers delivered over the mobile phone system

### Feedback Mechanisms

- Site generated statistics such as the number of users and the amount and types of content
- Average ranking of content provides a built-in user centered metric
- External measurements such as name recognition of the system by key stake-holders, especially smallholder farmers, as well as percentage of usage, user experience and likeliness of continuing use

### Beneficiaries

- Farmers
- Farmer associations
- Agricultural universities and technical colleges
- Community extension agents
- Mobile phone operators
- Trade associations

### Potential Partners

- Commercial mobile phone and service providers
- NGOs
- Trader/ producer associations
- Private sector organizations

## 10. Community Radio Support Systems

This project will develop a set of products and support services to allow any existing or newly created community radio service to become a two-way, participatory forum. The products will provide a roadmap to involve the listening audience in the community radio experience through the inclusion of pre-packaged agricultural content and training and tutorials on how to set up call-in shows. The services are designed to complement the social and technological elements of community radio by combining interactive technologies, such as cell phones and SMS, with trained community radio specialists who can assist community radio stations. An association of participating community radio stations will be developed and maintained in order to provide users with the services to share their experiences and modify the materials to meet their needs. Providing meaningful content will encourage interaction within the community to ensure all smallholder farmers have a voice in the content.

### Problems

- Lack of flexible and ubiquitous technology
- Administrative and organizational challenges due to lack of training
- Out-of-date or irrelevant information
- Content unavailable in local languages
- Static or non-existent feedback channels available to smallholder farmers, especially women

### Solutions

- Content delivery via familiar and interactive technologies, such as radio and cell phones
- Community training will be carried out by radio specialists
- Information can be delivered in local languages through the use of aids like automated translation systems and SMS
- Interactive technology ensures opportunities for everyone to have a voice in the content

### Feedback Mechanisms

- Six-month iterative form-ative assessments performed in real-time in order to inform course corrections
- Surveys of usage and effectivenss to determine agricultural content, farmer participation, and program uptake by both new and existing community radio stations
- Growth and sustainability measured by non-directed participation

### Beneficiaries

- Smallholder farmers, especially women
- Rural communities
- Community information workers

### Potential Partners

- World Association of Community Radio Broadcasters (AMARC and AMARC-WIN)
- Advancement through Interactive Radio (A.I.R.)
- Developing Countries Farm Radio Network
- Linking Agricultural Research for Rural Radio in Africa (LARRA)

## 11. New Agriculture Skills by Radio for Smallholder Farmers

This project offers smallholder farmers basic education in agriculture, micro-entrepreneurship, literacy, numeracy, and life skills through participative radio and/or other mediated formats so that they can use and act upon new and existing sources of information. This capacity to understand and utilize information will empower smallholders to increase their productive capacity for on-farm and off-farm activity and to improve the quality of life for themselves and their families. This project will be delivered in three stages. Stage one: basic agricultural skills with literacy and numeracy training; stage two: agriculture and other skills, and stage three: advanced agriculture and other skills. As part of the radio education program, special modules will be developed for women which address gender-specific agricultural issues, and added training in related areas such as health and life skills. The radio education proposal offers innovative benefits to smallholders.

### Problems

- Many farmers lack the basic skills required to access, utilize, respond to and act on information
- Local sales of agricultural products are being augmented by new opportunities to sell to regional, national and global markets
- Smallholder success requires a two-way flow of information

### Solutions

- Radio-based methodology for teaching adults based on principles of Radio-Based Instructions for Rural Adults (IRI) education
- Agricultural and micro-entrepreneurial skills training combined with literacy education
- Radio and other multimedia instructional system will broadcast 30-minute programs four days a week
- Content informed by gender- specific smallholder job descriptions

### Feedback Mechanisms

- Ongoing interaction and feedback with participants will generate a record of deliberations for assessment of project success
- Monitor changes in smallholder income
- Annual program review
- Comparative data on radio mixed media and exclusively asynchronous program (MP3s)

### Beneficiaries

- Smallholder farmers, especially women
- Rural communities and non-farm workers

### Potential Partners

- Educational Development Center
- Universities and research institutes
- Community radio partners
- Value-Chain Agricultural Information System (VISA) *(see proposal two)*

## 12. Soil Testing Probes for Smallholder Farmers

This project creates a network of independently functioning soil testers who will provide low-cost soil-testing services to smallholder farmers. The testers will be given rudimentary training on how to perform a few simple chemical soil tests using a basic kit of a soil probe and other required devices and a simple visual guide on how to analyze the principle soil characteristics based on the results of the physical tests and from observation. The tester will send the results in real-time via cell phone SMS messages to the project's central WorldAgInfo soil/crop database. The central database will send the soil tester a set of recommendations for the optimal combination of soil preparation (e.g., fertilizer, seed variety, tilling method, etc.). The goal is for the smallholder farmer to achieve the optimal soil conditions for their upcoming crops.

### Problems

- "Trial-and-error" soil health assessment is costly and inefficient
- Lack of accessible information about soil preparation and conditions
- Laboratory soil examination is slow

### Solutions

- Soil test kit designed to perform simple chemical analysis
- Visual instructions and guides eliminate reading and language barriers
- SMS technology provides "real-time" soil preparation recommendations

### Feedback Mechanisms

- Number of soil tests
- Reference citations alluding to the soil tests
- Formative evaluation measures such as rankings and new patterns of use

### Beneficiaries

- Smallholder farmers
- Soil testers
- Researchers and educators

### Potential Partners

- Agricultural universities and research foundations
- NGOs
- Agricultural call-in centers
- FAO

# 1. WorldAgInfo Systems: A Catalyst for Smallholder Agricultural Innovations

## Executive Summary

The current system for distributing agricultural information is mired in outmoded mechanisms. Information is slow to reach the poorer regions of the world, and once there, it tends to stay in circulation for decades. The result is that the farmers who lives depend on the success of their harvests are either without information or following the advice of outdated resources and other untrustworthy sources of information. Agriculture information systems are in need of a transformation in the ways information is prepared, presented and distributed. Recent experience concludes that creating the institutional context for effective agricultural extension will require a number of decades. We believe that the availability of new technologies and new community-based knowledge systems provide exciting possibilities for addressing these entrenched problems in a shorter period of time.

We cannot over-emphasize the rate and scale of technological change in South Asia and Africa. Smallholder farmers may be using millennia-old hand hoes to cultivate their fields, yet they communicate via cell phones. The rules of slow, predictable progress generally do not apply to information systems, and we found places in these regions which exhibited rapid change in part because they do not have legacy systems to constrain progress. Also, sometimes the difficult environment in which smallholder farmers must operate forces a creativity and diversity of technological solutions not often found in more advantaged environments.

WorldAgInfo Systems is a project that is intended to support initiatives emerging from the WorldAgInfo Project both technically and administratively. It provides the mechanisms for shared learning and collaboration that will allow individual projects to adjust to the rapidly changing agricultural information landscape.

Laptops connected to car batteries transmitting market prices via ham radio-based modem (Mali)

## Project Description

WorldAgInfo Systems will require a secretariat linked with an established institution (e.g., university, UN or NGO) with a strong presence in South Asia and Africa. The staff members need not be physically located at the hosting entity or even within the same country, but the hiring of a grant administrator and coordinator to be located at the hosting site is a likely requirement. The number of people to be involved will naturally be in direct relationship to the number and scope of the approved projects. Some areas may be adequately served by a part-time consultant, whereas other areas may well be handled by several full-time staff. Most likely, the level of staffing will vary from year to year as the projects go into different periods of activity. The probable positions that would be required are as follows.

1. Program Director
2. Grants administrator/Project coordinator
3. Technical Advisor
4. Evaluation Specialist

Depending on the specific requirements, the project office may require technical and content specialists. We would also recommend establishing one central advisory board along with a number of smaller content advisory groups. These advisory groups will be as diverse as is appropriate. We will set a minimum objective of 30% women representation with a goal of reaching 50%.

Some of these tasks may be undertaken by partnering agencies. These partners may be international, regional or continental as long as they have strong expertise and/or key resources in agricultural information and education. Examples of potential partners include FAO, CGIAR centers, AGRA, GFAR, and FARA. Partners will be expected to contribute to some or all of the following areas: advocacy, promotion, development of technology tools and methodologies, organization of learning, and the maximization of synergies with related agricultural information projects and initiatives.

*Project Deliverables*

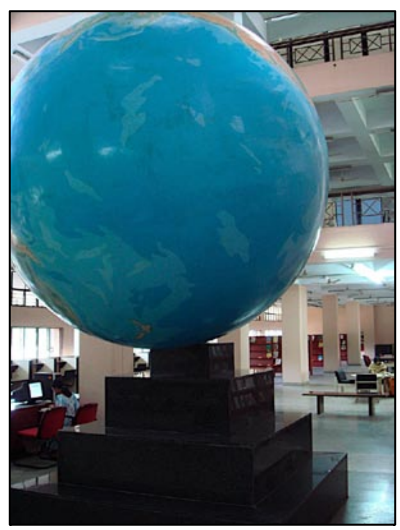
The three general categories of deliverables are as follows.

1. Administration and coordination of approved WorldAgInfo projects.
2. The creation of software and technology standards/processes to meet the needs of the approved projects.
3. The evaluation of best practices and the sharing of this information between projects and with the wider development community.

One of the central functions of WorldAgInfo Systems is to provide the software and technical services required by the approved projects. Some of these needs will be specific to an individual project while others will be shared services. There is a third set of services which are considered "seed projects" in that they indirectly support current projects or make other initiatives possible. These seed projects have been identified through a distillation of the most common technical/information shortfalls our design team observed during the sites visits. Some examples of seed projects are briefly described below.

*Agricultural Library*

Agricultural libraries in many parts of South Asia and Africa are in great need of resources. The chasm between these agricultural university libraries and their North American counterparts is vast and rapidly getting wider, as multimedia content becomes more common. A technology-based solution is the only feasible solution. We are also cognizant that truly useful and affordable digital book readers are only a matter of time. The potential positive impact on these libraries is breathtaking. In North America, these devices will offer convenience; in Africa and South Asia, they will be a matter of access.



A typical library in India: high on creativity, low on books

It is a mistake to assume that these libraries are devoid of content. Most agricultural libraries have journals, reports and dissertations on a variety of agricultural topics – frequently covering local crops and farming techniques. The first step of an agricultural library project would be to digitize relevant agricultural content.

The second step is to take this newly available content, combine it with freely available agricultural content already in digital format, and then package it into a computer appliance platform. The payment system could use a model similar to that being used currently by TEEAL. In fact, the system could potentially be designed to work in conjunction with TEEAL in those libraries that subscribed to it. The Improving Agriculture Literature Systems in South Asia and Afrrica proposal provides greater detail on enhancing libraries and online access.

*Translation Services*

Lack of printed content in local languages is one of the principal impediments to smallholder farmers and other rural stakeholders obtaining the information they need.

Our design team repeatedly found that just because a country was considered Anglophone or Francophone did not mean that the farmers spoke English or French. In fact, there was no guarantee that farmers would even speak the most common local languages (e.g., Hindi and Bemba).

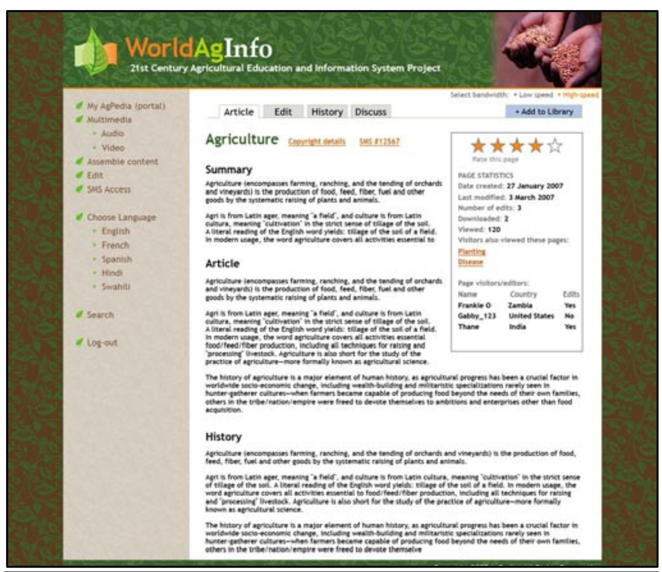
Translation software is maturing rapidly, but no automated translation system can operate without training. To train a system one normally feeds the system with a batch of paired documents (one in a source language and one in the target language). The experts we consulted at Microsoft Research in Bangalore said that approximately five thousand paired documents would be required. This project would require the help of local people fluent in both source and target languages, such as retired school teachers and former civil servants. The result would be the large scale translation of agricultural content from source languages to languages with a dearth of needed content.

*WorldAgInfo User Portal*

Data is useless if it cannot be accessed. Accessing data requires a good search tool. This system starts with a capable search facility and then adds some of the features found on a user portal. This portal serves two central purposes: customizing the user's view on the system's information and providing the system with information about the user that will then allow the system to create meaningful feedback. The WorldAgInfo portal would be the interface for the agricultural library appliance and would also be a publicly accessible system. The portal is both an interface for exploring external data sources and a container for data provided by external institutions and a location of process analysis. The user portal will build on and extend existing initiatives such as those by FAO and the CGIAR.

*Agriculture Infovation Cycle Repository*

The agricultural information space is characterized by rapid change and by fragmentary learning. Change is happening so quickly and in so many places that our design team routinely discovered projects and techniques that even people living in the area did not know existed. The result of this is that learning is not shared and is thus not




A conceptualization of a possible portal design applied or is duplicated. One of the fundamental functions of WorldAgInfo Systems is to assure that this fragmentation does not occur with the approved projects. But these projects do not operate in a vacuum. The best practices of these projects should be shared with others.

This will be done by describing the various projects both at a macro level and by examining it via the lens of Infovation Cycle analysis (see Navigating the Agricultural Information Landscape in Section 1).

*Standards and Partnerships*

One of the most important services WorldAgInfo Systems could provide is serving as a catalyst for creating technical and procedural standards. For example, a common XML agricultural format is under development but it has not been widely adopted. Such a standard being finalized and implemented is very much in the interest of the agricultural information space. Examining where blockages are and recommending possible solutions to the Foundation could potentially open the flood-gates for agricultural information. Because the WorldAgInfo projects would operate in a large service area, the potential to form partnerships is a very real opportunity, and one that could amplify the results of the individual projects.

*Implementation Strategy*

The Project will comprise a series of projects implemented at national and local levels, linked by a project framework consisting of a common set of processes and approaches, appropriate linkages between them to foster learning, and access to specialist technical and other expertise necessary to support local requirements with sustainable technologies or other tools. As soon as the project is approved by BMGF, commitment will be secured from the partners that they will participate.

*Inception Phase (month 1-9)*

This phase will comprise several elements. The project office will be established with appropriate appointments, operational and reporting procedures embedded, and institutional roles allocated to core partners. As the project office is established, an advocacy and marketing campaign for the project will be initiated for the support of the approved projects. The campaign will be most intense in the first six months as the project gears up but will continue as outputs are developed. The project will also organize specific events to engage key stakeholders and enablers at the international and regional levels. Because some of the proposed projects are easier to start than others, this inception phase will include the immediate starting of those projects that require little additional study and preparation.

Geographic areas for potential intervention will be identified. Interventions in innovation systems have been identified through the project design phase and will be clustered in distinct territories (district, provincial, state, national), with five areas each in Africa and South Asia, which will be identified using the following criteria:

1. Potential to benefit women and smallholders;
2. Potential synergies with other BMGF projects and/or with projects operated by other entities;
3. Range of agricultural production systems and agro-ecological zones; and,
4. Favorable technological and governmental environment.

*Implementation Phase (month 6-60)*

Each approved project will have appropriate strategies to ensure sustainability, and will incorporate standard project-wide monitoring and evaluation (M&E) procedures that will feed into the general project level oversight. Projects will be designed to accommodate "in flight corrections" in less than a 90-day time frame. Projects will also incorporate systematic learning opportunities that will capture experiences and acquired knowledge concerning process cases, and contribute these to the Project-level evidence base – automatically shared with other projects. The central project office will engage in parallel M&E activities and centrally cache a bank of learning resources and case examples at all levels of complexity in readily accessible formats.

Apart from the interventions as above, communities of practice for all project stakeholders will be established and strengthened to create a multi-stakeholder, people-centered, cross-sectored platform that would enhance the contribution of ICT to agriculture and rural development in a broader context. These platforms would foster focused dialogue and knowledge exchange; development of good practice guidelines; creation of opportunities to find and interact with other practitioners around the world; and share resources and build relationships that can be applied to shared projects. The communities of practice will build on and add value to the existing "e-Agriculture" community formed in 2007 in response to the World Summit on the Information (WSIS) Plan of Action. This would give the project a truly global reach, given the inclusive scope of the e-agriculture initiative, and leverage the conceptual framework and evidence base. The communities of expertise would be able to have at least two major components: (a) development and facilitation of virtual collaboration spaces (e.g., www.e-agriculture.org); and (b) face-to-face events, including conferences, meetings, and workshops, that will allow project stakeholders to share experiences and further develop the process framework, methodologies and tools.

## Primary Customers and How They Will Benefit from the Project

Local actors in the innovation systems will be strongly encouraged to take ownership and help design new initiatives. These will include institutions such as women's associations and networks, farmer associations and cooperatives, rural chambers of commerce, NGOs and CBOs, private sector service providers, public bodies, local government, and individuals such as village headmen, and progressive farmers. Universities, colleges, and frontline support staff, public and private, will be recruited as support partners.

## Project Assessment

Because this project coordinates and provides services to the WorldAgInfo projects, the successes and failures of those projects reflect back to this project. There are, however, a number of additional measurements that can be used to assess this project. Given that most of the services are being provided to the specific projects, the performance of those services can be determined by the degree to which agreed deliverables have been met. Feedback from the specific projects can both be in form of membership on an advisory board and through periodic surveys.

Assessing the market in Mali

## Force Field Analysis

The international development community has been and is intervening to enhance the role of information and knowledge exchange in support of rural livelihoods [8] [9], with varying degrees of success. This project will analyze and build on existing innovation systems in a constructed holistic way, especially those systems with a focus on smallholders and women, where poverty is greatest and lack of information is most chronic.

The critical conceptual resource will be the framework comprising: (a) the inclusive process for local process analysis and action; (b) and integrated knowledge base with multiple levels of access and complexity; (c) a collection of "process" cases; (d) an evidence base for cases that will be scaled to global level; (e) interactions with wider policy processes from local to global levels. The framework will provide structure without prescription. It will be open and transparent, allowing actors in local innovation systems to engage, contribute and learn. These linkages will ensure scalability and sustainability as the approaches are mainstreamed and the commitment to innovation is embedded.

Another critical success factor will be the communities of practice, through which the project will contribute to catalyzing development across the sector and leverage investments from sources other than BMGF in a cohesive way. This wider engagement will inform and enrich the projects.

### Timeline and Duration of Project

The project will have an initial span of five years, with performance options to extend for an additional five-year cycle. There will be a mid-term review after three years, at which time a decision will be taken on whether the project will be extended beyond five years. If extended, the project will be expanded to incorporate interventions in additional innovation systems. While the project's lifespan is connected to the specific projects it supports, the number and scale of those supported projects will change and thus this project may require periodic fundamental realignments in scale and budget.

### Potential Project Partners

There are two types of partnerships possible. The first are partners for the specific projects and the second are partners for the creation of the central services required by the approved projects. The first group will be defined by the nature of the projects that are eventually approved. The second group of partnerships will likely be with technology entities. These may include the following: technology firms; technology departments within universities; and with NGOs and other institutions involved in similar projects.

### Literature Review

Chapman, R. (2003). *Livelihoods approaches to information and communication in support of rural poverty elimination and food security*. London: Overseas Development Institute. from www.odi.org.uk/RAPID/Publications/Documents/SPISSL_WP_Complete.pdf

Food and Agriculture Organization (FAO). (2005). *Bridging the rural digital divide*. Rome: FAO. from www.fao.org/rddprocess.

Hall, A. (2006). *New insights into promoting rural innovation: Learning from civil society organizations about the effective use of innovation in development*. (Technical Report No. R 8372) Learning INnovation, Knowledge (LINK). from http://www.innovationstudies.org/docs/final_technical_report.pdf

Malone, T. W., Herman, G. A., & Crowston, K. (2003). *Organizing business knowledge: The MIT process handbook*. MIT Press.

Malone, T. W., Crowston, K., Jintae, L., et. al. (1999). Tools for inventing organizations: Toward a handbook of organizational processes. *Management Science*, 45(3), 425-443.

Marlton, P. (2006). Closing remarks. Paper presented at the *Innovation Africa Symposium, Kampala, Uganda.* from www.innovationafrica.net/pdf/s9_closing_remarks.pdf

Waters-Bayer, A. et al. (2006). Recognizing and enhancing local innovation processes. Paper presented at the *Innovation Africa Symposium*, Kampala, Uganda. from www.innovationafrica.net/pdf/s6_waters-bayer_full.pdf

# 2. Market Information: Value-Chain Information System for Agriculture (VISA)

## Executive Summary

This proposal will develop a Value Chain Information Systems for Agriculture (VISA). VISA extends new income opportunities to smallholder farmers and other stakeholders by applying tried-and-true principles of value chains to current market information systems. VISA will provide information on new market opportunities (prices, product characteristics sought by consumers, identification of reliable trading partners), as well as information on what farmers and other actors within the value chain need to respond to these opportunities (e.g., improved crop varieties, links to research systems, links to institutional support). Initially, VISA will establish offices in four countries: Mali, Zambia, India and Sri Lanka, eventually expanding to eight to twelve additional countries over ten years. Networked among each other and to a national headquarters, VISA offices will be staffed by trained specialists who facilitate coordination among value chain participants. VISA officers will use multiple media outlets and platforms to diffuse and receive information to and from stakeholders to ensure that market information systems remain relevant and flexible. In addition, VISA will establish stable, community-based foundations while enhancing and expanding information system efforts through linkages with the private sector, agricultural research and extension services, institutional support services, and local and national policy makers.

While components of the VISA approach have existed separately in various incarnations, no initiative to date has pulled all elements together holistically and linked them to the private sector. This fact differentiates VISA sharply from previous projects, including: (a) market information and trade facilitation systems such as the Kenya Agriculture Commodity Exchange [KACE]; the ZNFU cell-phone trade brokering service in Zambia; and support to national market information systems, such as the former MISTOWA project in West Africa. Moreover, a VISA incorporates village knowledge centers and demand-driven extensions systems. Taking these various projects and approaches, coupling them with fresh ideas through communication and information flow, constitutes an entirely new information system. Such a system utilizes various components' synergies to allow smallholder farmers and other stakeholders to respond to new market opportunities. In addition, to contribute to its sustainability, VISA creates incentives among all the stakeholders by expanding market information. Previous Market Information Systems (MIS) and trade facilitation efforts have focused on helping farmers sell what they have already produced. Yet the "new agriculture" is shifting from open commodity markets that sell what is produced to more tightly coordinated value chains, where farmers are called upon to produce new products with more precise specifications for new markets. In order for farmers to respond to these opportunities, they need information on not only prices and locations of markets, but also on how to meet technical specifications required by buyers, and how to access information to undertake this production. Thus, they need to be plugged into a system that gives them access to both production and marketing extension advice, both from private and public sources. VISA represents a fundamental shift from the older supply driven approach to a demand driven market information system that allows farmers to respond to new opportunities. Furthermore, the VISA system will be rooted in regional networks to promote trust and regional trade, and provide a strong foundation for scalability to other regions and countries.

## Project Description

In contemporary agriculture, farmers need more than merely market information to take advantage of emerging market opportunities; they frequently need new technologies and practices, support services, such as credit and management training, and an enabling policy environment. Furthermore, prices and quantities traditionally produced by market information systems are not sufficient for today's smallholder.

Additional information is required, like commercial contacts, quality and delivery expectations, and information on reliability of trading partners. Today, the welfare of smallholder farmers is no longer exclusively dependent on conditions at the farm level. Bottlenecks exist in various value chains to which farmers are connected that keep farmers poor. A systems approach, improving conditions through more timely, accurate, effective and efficient information flow throughout the value chain, is critical to improving the lives of smallholder farmers. For any information system to be sustainable, it must provide value to all of its stakeholders. Such value can be in the form of higher profits for private sector participants; lower or more assured supplies for farm households who are net buyers of basic foodstuffs; better training opportunities and input for improved curricula for training and educational organizations; and more effective information for policy formulation and analysis for local and national governments. If such a system produces value for its stakeholders, they, as a consequence, have incentives to contribute to its ongoing financing. This could take place either directly, through marketing charges for trades arranged through a VISA, or indirectly, through pressuring for support through the national budget via lobbying government policy makers. Farmers themselves could participate in this process by encouraging their political representatives to support VISA. It is imperative that the entire system be customer-oriented, identifying high-priority information needs of its stakeholders, and responding to them. Such an orientation has the added benefit of creating an entrepreneurial spirit that further drives the organization to new innovation. A few additional considerations apply to the overarching principles guiding VISA.

- Central to a Gates-sponsored VISA vision is the idea of a VISA as catalyst, "getting reactions going," between actors in various value chains. Gradually, as VISA becomes self-sustaining and able to leverage other resources, donor support should be withdrawn.
- Every actor in the system, including farmers, retailers, extension agents, and researchers and more are producers and consumers of knowledge. Thus, the system is designed to facilitate two-way flows of information.
- A core value and operating principle embedded in VISA is inclusivity, including gender, farm-size, race, caste and other considerations affecting marginalized groups in society. With respect to gender, the choice of a focus on value chains will take into account those in which women are most involved. Inclusivity will also take into account that gender roles change as markets evolve and integrate, and assist stakeholders to ensure that women and other marginalized groups are not adversely affected by these changes.

*Organizational Structure*

A network of local VISA offices should be established in rural and urban areas and coordinated together through a central office in the capital city. Local VISA offices will be scaled out to other market information centers regionally and would likely housed within national farmers' organization facilities in rural areas. They could be co-hosted in Community Knowledge Centers, and help fulfill some of the functions of those centers. In urban areas, they could be housed in offices of the farmers' organization, an agri-traders' organization, or a private agribusiness firm. The national VISA headquarters would be housed within an existing market information system, assuming that system had some autonomy from government.

The whole system would be networked through both ICT and face-to-face communication between staff members. Overall staff supervision and training would take place through regular visits from central office leadership and staff. Local offices would be staffed by one or more information officers, employed by VISA, and frequently as an agent of the farmers' organization. For example, one officer might focus on gathering market intelligence (see below for details), and the other on identifying information on institutional sources of support agencies offering credit facilities and management training. Such information and support would help farmers and other local stakeholders respond to emerging opportunities. Staffing patterns would vary from region to region and country to country, and these units would also host an extension officer (public, private, or NGO) and/or an agent from the decentralized unit of the national agricultural research system, and/or a field officer from a major agribusiness firm. Salaries would be paid through host organizations with a supplement provided by VISA. The local community would be served by a local board, having a voice employment retention decisions. Both local and headquarter offices would also host student interns from local agricultural universities to encourage their education about value chain orientation and the information and economic organization/coordination challenges faced by various actors. Students and their professors could use information gathered through the VISA for their research projects, an opportunity that would to incorporate more local, applied content into the agricultural university's curriculum.

Local VISA officers would serve as information brokers, gathering and exchanging information that smallholders and other stakeholders in the value chain need to succeed. They will be in charge of gathering market intelligence on a regular basis and providing information on suppliers of institutional and technical support services. This will be accomplished through compiling and updating contact information on these suppliers. Officers also can facilitate contacts between different actors within the information chain. Thus, well-trained VISA officers will serve as key coordination agents within value chains on the local, regional and national levels. Examples of the types of information available through the VISA include:

- Current prices and market conditions
- Market analysis for various products, and their likely evolution
- New product demand, their specification requirements, contact information [trade facilitation]
- Technical report assistance from agricultural research systems
- Availability, prices, and contact information for sources of inputs, such as fertilizers or pesticides
- Transport availability, prices, and contact information
- Sources of commercial credit
- Information on other organizations providing business training, technical assistance in agriculture and agribusiness, functional literacy, and other institutional support services. VISA offices may not decide to offer these activities itself, but would serve as a source of contact information
- "Interpret" technical or scientific information into accessible vernacular

### *Organizational Communication*

The VISA offices would reach its stakeholders through multiple media: local radio (each local unit would provide contact for local radio); SMS (through arrangements coordinated by the central office with local cell providers, as is currently being developed in Mali); cell/voice (toll-free numbers); print; internet; and other appropriate media channels. The headquarters office would be staffed by employees of the MIS, the traders/private sector organization, and the national agricultural research service. This office would have links to similar organizations in neighboring countries (to help facilitate regional trade) and help also monitor conditions and develop links to international markets and clients. The national staff's functions would include trade facilitation, analysis and diffusion of information from the local units, information brokering (among various stakeholders), training local VISA officers, developing training materials, conducting market intelligence analysis at the national level, and addressing policy-related issues with the government. The headquarters staff would additionally produce an array of information products, ranging from daily/weekly market news broadcasts, weekly or monthly analyses of market conditions and outlook (of use to both the private and public sector), and custom fee-for-service reports (e.g., market feasibility studies).

A national governing board of the VISA would be established to include the following: representatives of major stakeholders, including national farmer organizations; market information systems (MIS); national agriculture research systems; private sector organizations (firms, trader associations, agriculture exchanges), and government, e.g., Ministry of Agriculture. Board meetings would take place quarterly to set major policy directions and review performance. Day-to-day operation of the VISA system, however, would be vested in an executive secretariat, housed in the MIS or farmer organization, complemented by ad hoc value chain task forces. The selection would be up to stakeholders. While VISA does not aim to directly provide contacts and partners, it can address the information needs such as: where are institutional support services available, where can information be found on new technologies and practices, and what are the likely implications of national and local policies on farmers and other stakeholders.

### Primary Customers and How They Will Benefit from the Project

Smallholder farmers as well as other value chain participants are the primary stakeholders and beneficiaries of a VISA. Table 1 shows key inputs, incentives and benefits from participation, contributions to sustainability that stakeholders will offer, and risks each face by participation in the system. Even the market information involves more than price and quantity information traditionally produced by market information systems! It involves, for example, information on commercial contacts, quality and delivery specifications, and information on reliability of trading partners. While the VISA cannot provide all of these components, it can address the information components of them. For example, where are institutional support services available; what information is available on new agricultural technologies and practices; where can smallholders get more detailed help; and what are the likely implications for national and local policies on the realities faced by various value chain stakeholders.

### A Day in the Life

The following two case studies illustrate before-and-after situations facing smallholders. Additional case illustrations are shown in Appendix 1, along with case scenarios that show how different VISA stakeholders would use and benefit from the system.

*Case Study: A Smallholder Farmer*

In the village of Tomwe, Mali, a smallholder farmer has been facing declining prices for her cotton crop. This piques her interest in planting a different crop. She has heard on the radio that there is an emerging market for tiger nuts in the region and there is a buyer in a near locality. The farmer has many questions ranging from how to procure the seeds to how to connect and appropriately respond to the buyers. She wonders if the available land, water, fertilizers and pesticides in this area are suitable for this crop. The farmer uses a cell phone from a neighbor to get in touch with VISA. The service provided some limited yet valuable information and suggests that they meet her and some of her village members for a discussion of this market opportunity. VISA did not have all the answers immediately, so it put out a request to its peers in other regions as well as some national partners. They found out that there were different buyers working with different communities in the country and that they all were experiencing supply shortages. VISA also discovered that one of the local research institutions had developed a fertilizer that improves yields with the same level of inputs, and that another partner has developed a storage container, which is essential to reduce post-harvest loss.

VISA talked with about a dozen farmers in the village about the requirements of growing tiger nuts. The farmers, all affected by low cotton prices, listened with interest and suggested that while the seed and labor intensive nature of the work were manageable –due to the high costs of the alternative fertilizer and storage technology, they would use the low cost locally available fertilizer and accept post-harvest losses. The buyers were contacted and asked about how much interest they had with working out a partnership with the smallholder farmers. Initially, they conveyed that they would be interested in purchasing any produce but it had to be dropped off at their depots. The farmers, who faced significant transport woes, saw this as a barrier and started to lose interest in the project. The buyers then were informed about these challenges: non-optimal fertilizer, lack of storage facility and transport woes. The buyers then suggested that if at least 60 farmers or 60 Ha of land was cultivated with tiger nut, they would provide the fertilizer, storage and cover the costs of transport. The farmers lobbied amongst the neighboring villages and found 130 Ha of land that could be used for tiger nut. After the first cycle, there were two challenges: 1) a new pest arose that was reducing the yield; and 2) the buyer found the tiger nuts produced created a poor final product after processing. VISA brought together research groups to investigate the pest challenges and uncovered a combination of natural methods and easily available pesticides. Researchers also discovered that the variety of tiger nut used had too much of an oil content and suggested alternative seeds.

***Case Study 2: Private Sector Demand Driven System Harnessing Smallholder Comparative Advantage***

Since liberalization of the maize market (removal of pan-territorial price controls), farmers in Zambia have started growing a lot more cassava for domestic use, especially in the cassava belt of the country. Due to other experiences throughout Africa, there are technical knowledge assets available, such as improved varieties. Commercial farmer cultivation has not been taken up, in part because smallholder farmers have demonstrated a comparative advantage in the crop. A livestock feed company has been facing increasing prices for maize, which is one of its main ingredients for its products. They wanted to find substitutes for a portion of their maize requirements and found that cassava can partly provide a high carbohydrate substitute at a lower cost than maize. The company struggled with how to tap into smallholder interest in this crop and expand the cassava supply. They contacted VISA for information on where it could find such a supply, or what ideas they had as to how to simulate more production for their requirements. VISA identified this as an opportunity for smallholder farmers to diversify and enhance their income base. VISA facilitated a discussion between the necessary market players to establish gaps, challenges, opportunities and where existing infrastructure existed. VISA also worked with the buyers to develop a proposal that was fair and afforded both farmers and buyers with some risk mitigation. They also worked with other stakeholders in the value chain to develop product standards that met the demands of the buyers (feed company) and the special form that they wanted the chips in. Another NGO in the value chain trained farmers and local traders to process cassava into the type of chips demanded by the buyer. When the buyers finally decided to offer to buy cassava, it discovered a limited supply of the type of chip thought necessary. In order to break the barrier to expanded supply, the buyer decided to experiment further with the post-harvest processing steps (chip size). Working with other participants in the value chain, the company undertook tests to retrofit its feed manufacturing equipment to use a chip more consistent with standard practices among smallholders. It resulted in finding that chips similar to farmers' current product actually led to a better end feed product. VISA then worked with other value chain participants to retrain farmers in the standards desired In previous years, there was diminished rainfall and VISA coordinated with research systems and regional seed companies to find varietals that exhibited abiotic stress tolerance mechanisms, particularly for drought and low-nutrient environments. They were able to locate one from the VISA partners in Tanzania who had linkages with the local farmers. As the smallholder farmers developed more capacity to produce more crops, they asked VISA for information on other potential markets. VISA made some inquiries to feed companies for other livestock groups.

## Evidence of Success

### *Successful Past Approaches*

While there are a number of approaches to building out value system information, they are few whose evaluation has impacted smallholder farmers. However, three critical success stories stand out that demonstrate significant benefits for smallholder farmers. Each of these successes include the following elements: a focus on two-way flow of information; a strong sense of stakeholder ownership; inclusive models; private and public sector cooperation; and a strong information focus to ensure that smallholder farmers are aware of and able to meet current and emerging demands of the market. For most developing countries, the missing element is a catalyst to undertake a value chain improvement initiative with smallholder farmers in focus. In addition, there has not been a strong market or private sector involvement, and little emphasis has been placed on horizontal replication across commodities as well as regionally through trade facilitation. In concrete terms, key success stories are Cargills, Sri Lanka; Mali's Market Information System (whose operating costs are now 100% assured through local resources); and Zambia's commercial channel expansion for cassava. Best practices and lessons learned have been digested and have informed the content contained herein.

### *Unsuccessful Past Approaches*

The Sasakawa (SG 2000) program for agriculture focused on inputs, credit, and had some positive results in increasing smallholder farmer yields. Failings of the project, nonetheless, included lack of incorporating market demand forces and other essential components of the value chain that would have prevented the emergence of barriers and bottlenecks. Another unsuccessful example occurred with the cashew nut industry in Mozambique. This program focused on mechanical processing approaches to shelling the nuts, but the shelling process damaged the attributes of the nuts themselves. As a consequence, the consumer market did not desire the quality of the output. Despite the fact that global demand existed, low prices were paid to farmers, as well as an abandonment of cashew growing by many smallholders. Numerous reports exist showing how the lack of value chain system analysis, including appropriate technology application, was critical to the demise of the cashew crop in Mozambique and the resulting impoverishment of the growers.

### *Summary Rationale for Expected Success: Sustainability, Scalability and Replicability*

Beyond the proposed funding period, VISA's approach to sustainability involves a value chain, market-based approach to improving the lives of smallholder farmers. Our expectations are that VISA will be sustainable in ten years time, serving as an on-going catalyst for successful models for all stakeholders involved. Within 3-5 years, VISA's vision is to have launched three or four successful catalysts for smallholder development. Such models will be replicable in a variety of contexts, with special attention taken to local adaptation and successful adaptability. Once shorter term successes have been achieved, these successful projects will be targets for replicability. Such an approach is inherent in VISA's design. In terms of possible regional and global levels of sustainability and replicability, local successes will provide examples and best practices to inform future opportunities. They will serve as a guide to future VISA initiatives, and to a ten-year projection of when the entire VISA initiative attains its goal of self sufficiency and on-going smallholder poverty reduction. The setup and implementation of the VISA system at a country-level will involve investments as identified in Table 2.

### Force Field Analysis

Major Barriers That Could Impede the Success of VISA

- Failure to find ways to align incentives of participants to cooperate for changing products or services in the value chain
- Lack of accurate and credible information on problems and potential solutions to value chain growth problems
- Due to market structure and/or individual participants, there may exist institutional bullies who push only their own economic interests
- Farmers and/or marketing agents may be highly risk averse or unwilling to make their own investments/contributions to solving value chain problems
- Missing infrastructure of other key public goods to complement private sector investments

Factors That May Contribute to the VISA's Success

- Private sector interest in developing practical market options as a key driving force for drawing participants' interest
- Willingness of government and donors to participate will give confidence to the private sector that key public goods and investment will be forthcoming
- Willingness to work with a range of smallholders' capabilities, drawing poorer farmers into viable economic opportunities
- Ongoing and open interaction of value chain participants is designed to provide feedback loops that identify inaccurate information or unbalanced interests.
- Third party oversight (governance board and advisory committees) mechanisms to provide objectivity and information checks/balances
- Peer-to-peer comparisons across different participants in the system

### Expected Cost Categories

Establishment and implementation of the VISA system at a country level will involve investments as identified in Table 2. The management entity costs will be entirely supported by the donor agency and will cease to exist at the end of the project. Other categories and line items will be cost shared with appropriate stakeholders involved in the VISA system. For these cost categories, VISA's sustainability plan will include a gradual devolution of donor investments, along with stakeholder requirements (government, farmer organizations, trade associations, etc.) to cover these costs within the project time frame.

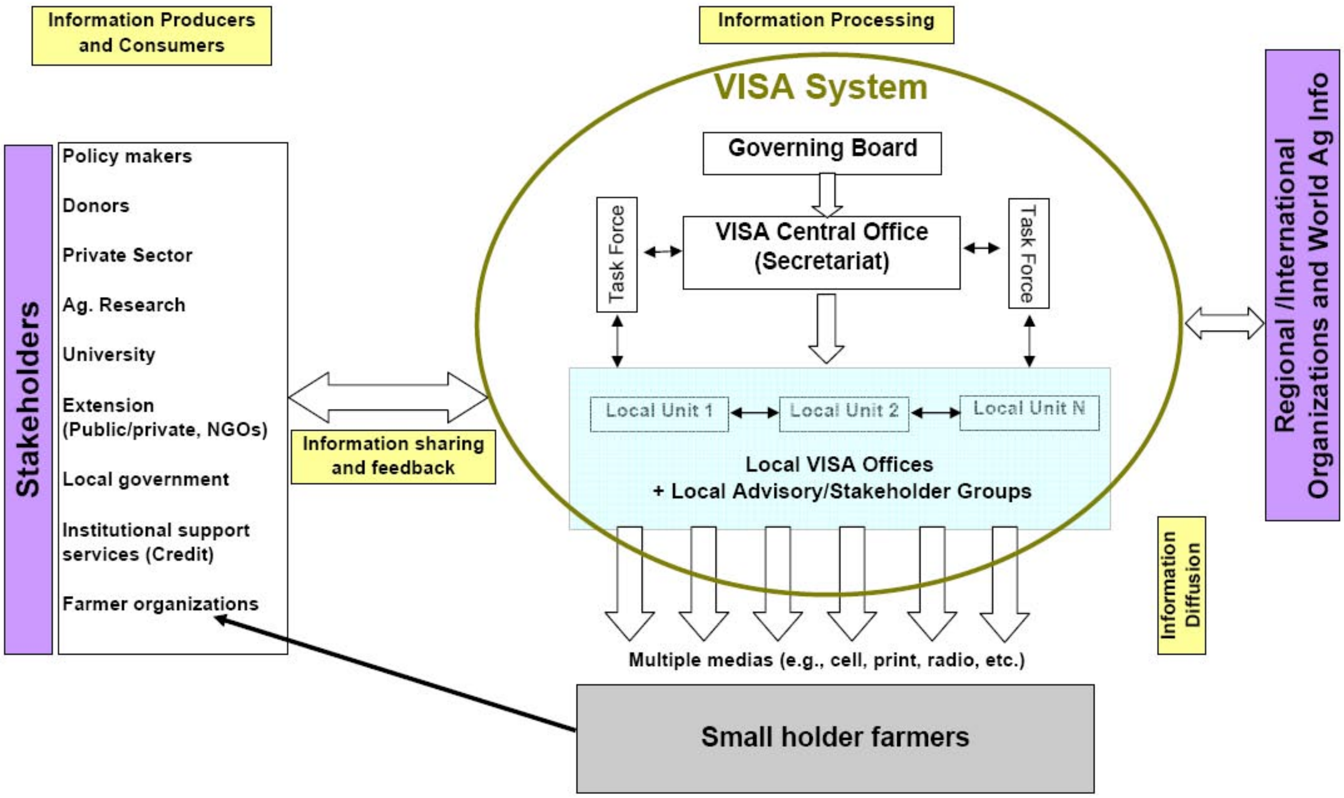

Information Producers and Consumers
Information Processing
VISA System
Governing Board
Task Force
VISA Central Office (Secretariat)
Task Force
Stakeholders
Policy makers
Donors
Private Sector
Ag. Research
University
Extension (Public/private, NGOs)
Local government
Institutional support services (Credit)
Farmer organizations
Information sharing and feedback
Local Unit 1
Local Unit 2
Local Unit N
Local VISA Offices
+ Local Advisory/Stakeholder Groups
Regional /International Organizations and World Ag Info
Information Diffusion
Multiple medias (e.g., cell, print, radio, etc.)
Small holder farmers

**Figure 1.**

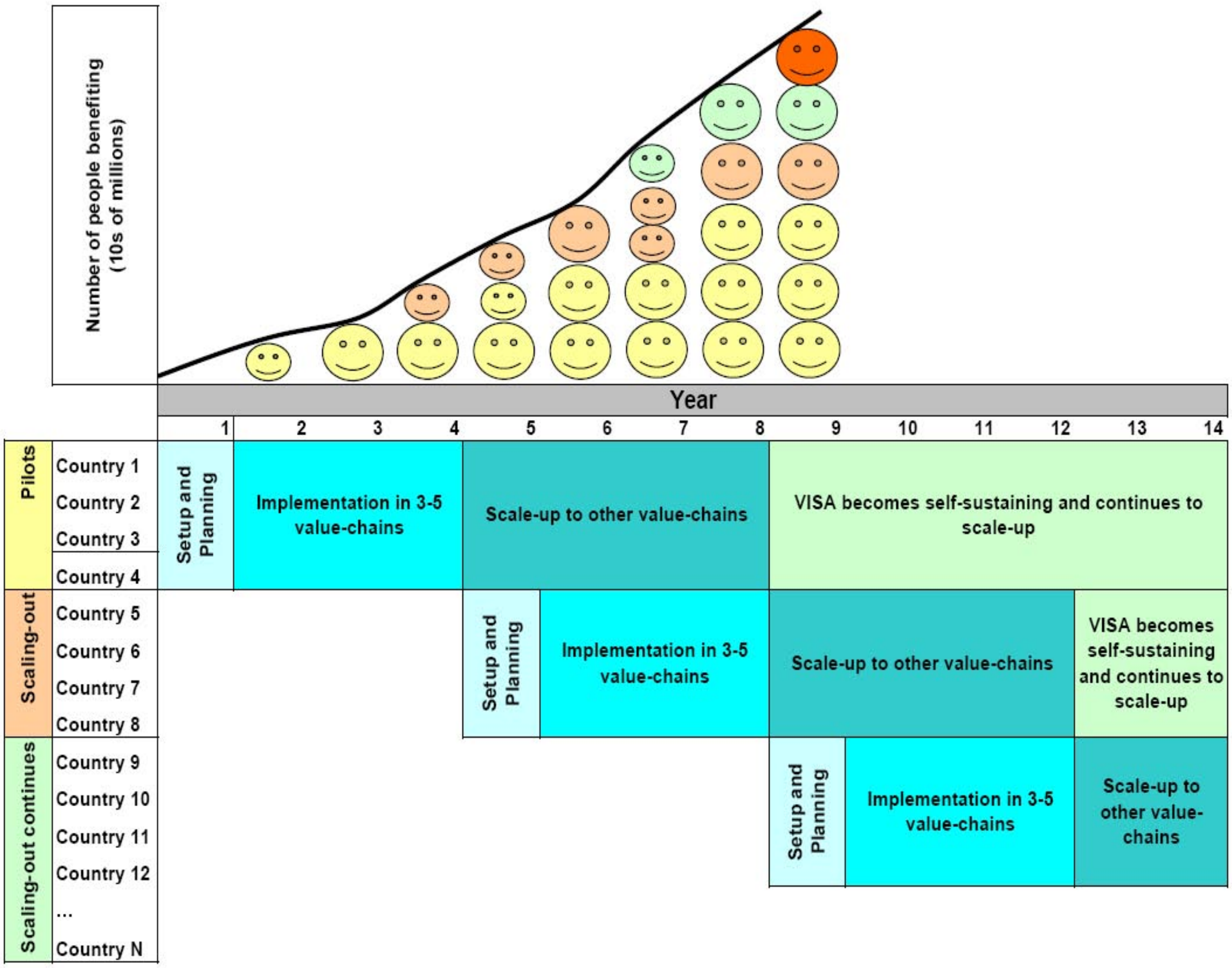



**Figure 2. VISA Timeline**

**Table 1. VISA Stakeholders: Inputs, Incentives, Contributions to Sustainability, & Risks Involved in Participation**

| Stakeholders | Inputs | Incentives/Benefits | Contributions to Sustainability | Risks |
|---|---|---|---|---|
| Farmers and farmer group | Staff commitment, lobbying government, contract enforcement, governance (code of conduct) | Expanded and diversified markets for net sellers; more economical and secure sources of supply for net buyers; more reliable and economical input supply sources; ability to articulate and feed back problems to other stakeholders; sharing of best practices; increased economic stability and improved quality of life | Dues, marketing fees, lobbying for budgetary support of the system | Lack of trust between farmer groups and other organizations. Mindset of reliance on subsidy system |
| Private sector firms (both input and output markets) – includes a wide range of firm sizes, including SMEs | Provide information on the evolving demand for different products (articulation of demand; information on consumers) | Better/lower cost/better quality sourcing of products; expanded and better targeted markets for products; ability to address system-wide problems beyond the scope of any one firm to address; sharing of best practices; increased economic stability and improved quality of life | Training; marketing fees on trades arranged through VISA total resources to system grow | Inability to achieve necessary quality/ quantity to meet demand needs |
| Private Trade Associations | Information on prices and commercial contacts. Lobbying government for better policies, contract enforcement , governance (code of conduct) | Expanded set of commercial contacts; new markets; forum to interact with other stakeholders | Dues, marketing fees, lobbying for budgetary support of the system | Lack of interlocutor between associations and farmers |
| Financial institutions | Information on financial products and means to access them | Expansion of quality and quality of loan portfolio; lower costs of developing and screening loans; greater savings mobilization | User fees and lobbying for public-sector support of VISA | Non-sustainable, loan defaults. |

**Table 1. VISA Stakeholders: Inputs, Incentives, Contributions to Sustainability, & Risks Involved in Participation**

| Stakeholders | Inputs | Incentives/Benefits | Contributions to Sustainability | Risks |
|---|---|---|---|---|
| Government/ policy makers (both national and local) | Staff, better policies, infrastructure; tax concessions; infrastructure | Better information to formulate and evaluate policy. Non-confrontational forum to interact with other stakeholders. As economic activity expands, so does the tax base | Budgetary support | Too short term demand for results. Failures lead to lack of public support for agricultural programs |
| National Ag Research System | Information on new technologies, processes, and management practices | Better diffusion of results; better feedback on results; better identification of research needs | Supply of demand driven technologies; responsiveness to real-world problems builds political support for system | Isolation from practical farmer problems; possible incompatibility with professional reward structure. |
| Diffusion media (radio, TV, cell phone, print, internet, etc.) | Diffusion of messages; Discounted rates for lower income areas | Free or low-cost content development from the VISA; Content more attuned to customers' needs; increase business volume/reach broader audience; attraction of private-sector sponsorship | Creation of awareness of success stories; Availability of improved services; provision of space/ airtime | Diffusion media succeeds technologically, but common meaning fails to be constituted between sender and receiver. |
| Extension services (public, private and NGO) | Technical and commercial advice, information, training services | Better access to technology information; location for upgrading of skills; opportunity for staff development | Supply of demand driven extension services | Failure to grasp complexity of problems. Lack of trust. |
| NGOs | Institutional support services (e.g., learning materials, technical assistance, equipment, organizational development support) | Better targeting of activities to client needs, building more successful NGO projects | Supply of demand driven support | Poor project picks. Lack of demonstrable impact. |

**Table 1. VISA Stakeholders: Inputs, Incentives, Contributions to Sustainability, & Risks Involved in Participation**

| Stakeholders | Inputs | Incentives/Benefits | Contributions to Sustainability | Risks |
|---|---|---|---|---|
| Universities & technical training institutes | Student interns & time of the professors who supervise them; research results and training materials (esp. from applied agriculture/ agribusiness programs) | Location for research and training of students; material from VISA feeds into development of more relevant curricula with local content | In kind staff and student time contributions | Lack of awards with professional system. Non peer review. |
| Donors | Resources from other donor projects may co-finance either parts of VISA of the support services to which it relates | Better knowledge of emerging issues in key subsectors; better coordination of their activities with those of others | Possible co-financing of complementary resources | Underfinanced or lack of co-financing complementary resources |

| **Table 2. Major Cost of Categories** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Structure** | **Function** | **Staff salary** | **Operating Costs** | | | | **Training** | **Consul-tancy** | **Over-heads** |
| | | | **Equip.** | **Travel** | **Communication** | **Supplies** | | | |
| Board | Gover-nance<br>Technical Direction | | | x | x | x | | | |
| Exec. Secretariat (Central office) | Day-to-day operation<br>Content develop-ment<br>Network-ing | x | x | x | x | x | x | | |
| Local units | Outreach<br>Informa-tion collec-tion | x | x | x | x | x | x | | |
| Ad hoc Task Force | Conduct assessment studies<br>External evaluation | | | | | | | x | |
| Manage-ment Entity | Project setup and manage-ment<br>M&E | x | x | x | x | x | x | x | x |

## Literature Review

Binswanger, H. (2004). Empowering rural people for their own development. Seminar at the International Food Policy Research Institute (IFPRI).

Kuruppu, J. (2007). Role of private sector in improving information for smallholders: The Cargill's way. *Cornell International Workshop on Agriculture Education and Information Systems,* Livingstone, Zambia.

Lundy, M., Carlos, F. O., Rubert, B. (2002). Value adding, agroenterprise and poverty reduction: A territorial approach for rural business development. Paper presented at the *First Henry A. Wallace Inter-American Scientific Conference, "Globalization of Agricultural Research."* Turrialba, Costa Rica.

Michigan State University, Department of Agricultural Economics. (2008). *Food and agriculture market information system development website.* http://www.aec.msu.edu/fs2/mis_dev/index.htm.

Roduner, D. (2007). *Community of practice on value chains in rural development* (Working paper. Switzerland: Swiss Agency for Development and Cooperation (SDC). From http://www.sdc-valuechains.ch/resources/resource_en_131.pdf.

van der Meer, C. (Kees) L. J. (2004). Exclusion of small-scale farmers from coordinated supply chains: Market failure, policy failure or just economies of scale? Paper presented at the World Bank Conference, *"Is there a Place for Smallholder Producers in Coordinated Supply Chains?"* Washington, DC.

# 3. Real-Time Delivery of Agricultural Information to Smallholder Farmers in South Asia and Africa through Community Knowledge Workers

## Executive Summary

With the emergence of 'new agriculture', which is demand/market-driven, agriculture globally is becoming information-intensive. But the agricultural information is not reaching villages in a timely and reliable manner. To benefit from the emerging opportunities of the 'new agriculture,' farmers are searching for site-specific information related to farm management, agricultural inputs, new technologies, credit, markets, and non-farm opportunities in order to diversify and expand their income streams. While much information is generated through the research, education and outreach programs of public and private organizations, often it does not reach the smallholders at the village level. Thus, there is a critical need for new models of rural-based information and knowledge systems for smallholders.

Within the overall framework of the WorldAgInfo program, this proposal outlines a 10-year project for building village-based information and knowledge systems. Building on the past successes and failures, new models of village knowledge centers (VKCs) will be piloted in two countries in South Asia (India and Sri Lanka) and two countries in Africa (Tanzania, Senegal or Mali). A cadre of community knowledge workers (CKWs) will be identified and employed by existing or new village-based knowledge centers serving a cluster of 10-20 villages. The CKWs will be selected and trained based on criteria set forth by the VKC's governing body that is composed of multiple stakeholders. This project will test multiple models for building sustainable village knowledge centers in partnership with local communities. Five different VKCs models will be tested using affiliation and operation by farmer groups/ cooperatives, government, agricultural universities, NGOs, and private firms.

Using a bottom-up and participatory approach, the CKWs will provide real-time information and education on various aspects of agricultural development directly based on the needs identified by the farm families, with a special focus on women. In addition, the CKWs will develop active links with various stakeholders to bring new knowledge and services to local farm families using both conventional and new tools of ICTs. The project views smallholders as valuable collaborators and sources of knowledge and wisdom - not as empty vessels to be filled. The project will respect socio-cultural and village governance aspects of rural communities, and will ensure that from the onset, there is buy-in from local government and local communities.

The VKCs will be guided by a long-term strategic plan. Since the ultimate impact of the ICT tools is targeted at the village level, this project will serve as an excellent rural platform for testing practical applications of ICT tools such as radios, cell phones, videos, etc. It will help integrate proposed ICT projects of the WorldAgInfo Program with 'on-the-ground' realities of rural people and their families, especially issues facing women. Additionally, the project will help increase the information and intellectual base for how community knowledge workers can utilize ICT tools to fulfill information needs of smallholders.

## Project Description

The recent site visits to South Asia and Africa by the WorldAgInfo Project Design Team identified a serious gap in information and knowledge delivery systems at the village level. The design team also observed that there is a serious lack of trusted local platforms to provide their voice, feedback and input to their support systems. Interactions with the smallholders during the site visits indicated that agricultural knowledge and information generated by research and extension systems in Africa and South Asia does not reach smallholder farm families in a timely and reliable manner. There are sporadic visits to villages by extension workers, but there is no reliable informant on the ground to help meet the real time information needs of smallholders.

Since the ‘new agriculture’ is demand and market-driven, the agricultural sector globally is becoming information-intensive (World Bank, 2007). But millions of smallholders remain outside the information flow. To benefit from the emerging opportunities of the ‘new agriculture’, farmers are searching for site specific information related to farm management, agricultural inputs, new technologies, credit, markets and non-farm opportunities to diversify and enhance their sources of income. Information generated through research, education and outreach programs by public and private organizations does not reach the smallholders at the village level. Thus there is a critical need for effective rural-based information and knowledge systems for smallholder farm families.

Some efforts have been made to bring information and knowledge to the village level, but there have been many ICT false starts. The reasons are numerous including inadequate resources, unrealistic time frame, lack of focus, top-down approach, and no clear strategy for sustainability (Kuriyan and Toyama, 2007). Many lessons have been learned from the past sixty years of historical experience. This experience points out the need for village communities to acquire knowledge and real-time information and building village based systems for feedback, active input, and connectivity of smallholders to public and private sources of information.

With the emerging trends of new global agriculture and rapid uptake of ICT tools, there is a new momentum for establishing and strengthening rural-based information and knowledge systems. The priorities of governments in South Asia and Africa are shifting towards building village-based knowledge systems (Swaminathan, 2005). For example, Dr. A.P.J. Abdul Kalam, former President of India, has stressed that India should be empowered to pursue the development of knowledge villages. A well-respected economist has also recently emphasized the importance of empowering rural people for their own development (Binswanger, 2007). To this end, the World Bank is now contributing 9% of its total lending to community-driven development to give the rural people a voice in setting their priorities and providing them with multiple sources of information using the new tools of ICTs. The government of India recently announced a program that aims at setting up 100,000 village knowledge centers (VKCs) across India (Dr. J.C.Katyal, Personal Communication, 2007).

Building on the experiences and lessons learned from the successes and failures of the community-based development programs, a 10-year project is proposed to develop pilot village-based knowledge systems in South Asia and Africa. This project will supplement the current extension system by building village-based agricultural information and knowledge systems implemented by community knowledge workers (CKWs). This village-based system will serve as an interface between smallholders and stakeholders serving them by providing a special focus on women and youth members of the farm

Box 1. Criteria for Identifying VKC Locations

- Possibility of partnering with existing programs to add Ag Info value
- Political will and support
- Smallholder population, size of landholding and income levels
- Under served areas
- Willingness of community participation
- Involvement of women
- Local government buy-in

families. The CKWs will operate either through existing community-development platforms or by creating new village knowledge centers (VKCs) in partnership with the local community and the stakeholders that support smallholders.

This project will be initiated in 2 countries in South Asia (India and Sri Lanka) and 2 countries in Africa (Tanzania, Mali or Senegal). Using appropriate criteria, in each country, 2-3 sites will be selected for these pilot projects for developing VKCs (see Box 1, previous page). Each VKC would cover a cluster of 10-20 villages served through CKWs. The CKWs will be housed in either existing or new VKCs.

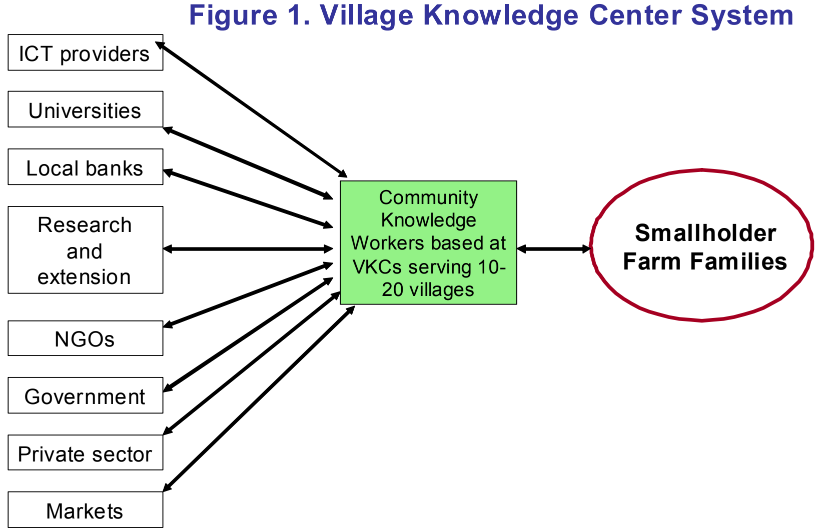
<u>Box 2. Skill Set Requirement of Community Knowledge Workers</u>

In recruiting CKWs, the following qualifications will be considered:

- Education – Primary school education (at least $6^{th}$ grade)
- People skills – communication skills
- Knowledge of community culture and language
- Acceptability in community
- Community organization skills
- Liaison with other community programs
- Gender sensitivity
- Training and retraining for communication skills

The skill sets required for CKWs are described in Box 2 (right). Using a bottom-up, participatory approach, the CKWs are expected to access and provide real-time information and education on various aspects of agricultural development directly based on the needs identified by the local farm families, with a special focus on women and youth. In addition, the CKWs will maintain active links with various stakeholders to bring new knowledge and services to the local farm families using both conventional and new approaches/tools of ICTs. Further, they will also explore mutually beneficial strategic alliances with the private sector (local banks, input dealers, buyers) NGOs, and government supported research and extension outreach systems to develop new skills, identify off-farm jobs in rural and urban areas, facilitate credit, and educational opportunities for youth and women in rural communities. In addition, close attention will be given to opportunities for farm families for agri-based entrepreneurship (e.g., value added products, local processing). The CKWs will thus serve as an interface between the smallholders and their support systems and will provide a means for bringing traditional and new knowledge together for real and lasting benefits in the lives of farm families by bridging the gap in the transfer and exchange of information (Figure 1).

**Figure 1. Village Knowledge Center System**



***Approach to building VKCs and CKWs***

Multiple approaches will be utilized for initiating VKCs, including VKCs affiliated and operated by: 1) farmer groups/farmer cooperatives, 2) local agricultural universities, 3) private sector, 4) local entrepreneurs, and 5) NGOs. The VKCs will be developed in full partnership with the local communities with an ownership and governance structure that includes local village/community leaders and stakeholders that serve smallholders including the representation of women (Box 3, right).

Box 3. VKCs' Organizational Structure

Listed below is the organizational structure envisioned for the VKCs:

- Independent, legally recognized entity, affiliated with public, private sector institutions or NGOs.
- VKC membership of local farm households
- VKC governed by a council of stakeholders in the area (farmers, local government, private sector, NGOs, University) – with smallholder and women voices
- Community Knowledge Workers (at least two – one man and one woman) operate under the mandate approved by the governing body
- Community Volunteers/Contact Point in each village
- Partners (links to stakeholders serving the communities)

While setting up the governance structure of the VKCs, this project will consider the socio-economic and village governance dynamics in different regions of Africa and South Asia. The project will respect the traditional hierarchical and social networks that may exist in local communities. VKCs will leverage the contributions of existing social networks. Villages in South Asia and Africa have village head, chiefs, hakims, sarpanch, etc. who play an important role in providing leadership on community development issues. VKCs will leverage on the existing systems to ensure buy-in from the community.

Efforts will be made to create partnership with existing on-going village based programs that need agricultural information capacity. For example, as indicated earlier, the government of India is building 100,000 multi-purpose village knowledge centers. This pilot project can partner with this initiative to enhance the agricultural information delivery capacity in these VKCs by training and supporting CKWs that will be housed in these VKCs.

Depending on the socio-cultural situation of the project sites, multiple approaches and local dynamics will be used for selecting and training CKWs. The pool of CKWs will include retired school/college teachers, civil servants, young entrepreneurs, part-time farmers who are selected from the immediate area, with the approval of the community. The CKWs will be full-time employees of the VKCs and will be trained using multiple avenues/approaches in subject areas directly relevant to the community they will serve. To increase the retention rates of the trained CKWs, efforts will be made to recruit CKWs from the same area so that they are more likely to stay with the job.

The CKWs will identify and liaise with agricultural training institutions, private sector (input dealers, banks, ICT companies), government-supported research and extension services, NGOs. The formation of these links will enable the CKWs to address the site-specific agricultural problems and questions that arise within their communities. Each VKC will employ two CKWs (one male, one female) so that the project will be assured of direct contact with women in the rural areas.

Box 4. Examples of Services to be Provided by CKWs

- Active outreach to farm families - Interact with farm families to identify their agriculture related needs
- Facilitate feedback process – (two way flow)
- Disseminate information on crop/livestock management
- Information about local market prices and demand
- Facilitate bulk purchase of agricultural inputs, and bulk selling of agricultural produce

Box 4 presents examples of the range of activities that CKWs will implement based on smallholder information needs. Different approaches will be used to identify, select and train CKWs. Depending on the educational level of the CKWs, they will be trained at a local institute or a university or by providing training programs locally through mobile educational vans or distance education programs. The training program will take place in both formal classroom settings (agricultural universities, technical training schools, private sector) and on-farm sites. The duration of training may cover short-term and an entire crop cycle, including hands-on practical approaches to local problems through experiential learning. Given the dynamic nature of both agriculture and ICT and the value of lifelong education, the CKW will receive additional subject specific training on an ad hoc basis. This will reinforce the links between the CKWs and their training institutions. Moreover, the CKWs will maintain an ongoing relationship with institutions in order to gain new knowledge and assistance from specialists to address location-specific problems. Conversely, the institutions will be appraised of research opportunities based on farmer's feedback to the CKW.

This project will serve as a reality-based rural platform for testing practical applications of ICTs tools such as radios, cell phones, videos, etc. that are proposed by the WorldAgInfo Program. Additionally, the project will help expand the information and intellectual basis for integrating ICT tools with community knowledge workers to fulfill the information needs of smallholders. It will help integrate proposed ICT projects with the on-the-ground realities of rural people and their families, especially issues facing the women.

### Primary Customers and How They Will Benefit from the Project

The primary beneficiaries of this project are the smallholder farm families and the stakeholders that support smallholders. The smallholders will benefit from the information delivered by the CKWs to help them make timely decisions on farming practices, marketing, and non-farm opportunities.

The stakeholders will benefit from receiving feedback from farmers through Community Knowledge Workers. This will help them to better serve the smallholders and meet their needs. The new approach to the Village Knowledge Centers will especially favor women's participation in agriculture programs. The centers will serve as repositories of knowledge from the community, which they will transmit to the key community stakeholders.

### Day in the Life: Pre/Post

Pre: Due to lack of effective extension systems at the village level, smallholder farmers are not receiving real time information on various aspects of agriculture and non-farm opportunities in rural areas. This impacts their decision-making on farm management practices, marketing etc. Women are marginalized in the present system. Information is often given to male members of the community and not shared with women.

Post: The village based knowledge systems implemented through community knowledge workers will help bring location-specific agricultural information and educational programs in a timely manner using both conventional approaches and ICT tools. The VKCs will endow farmers with a voice and provide feedback about their needs to stakeholders serving them through the CKWs. The real time information delivery through village knowledge centers will help farm families to make timely and informed decisions leading to higher agricultural productivity and increased incomes. The proposed approach of village based knowledge systems will facilitate testing of ICT tools for their practical applications in rural areas.

*Evidence of Success*

The following indicators will be used to measure the success of this project:

- Number of training modules developed and offered for CKWs
- Number of knowledge workers trained
- Number of VKCs established and become operational
- External resources leveraged by the VKCs and CKWs
- Level of commitment and buy-in by local communities and local government and other stakeholders to sustain the VKCs.
- Level of adoption by smallholders of new farming practices and market opportunities
- Increase in farm productivity and income of smallholder farmers
- Level of participation of women in programs

## Project Assessment

The progress of this project will be monitored and evaluated using both informal and formal methods. Continued feedback will be sought from the community members through CKWs. In addition, periodic reviews, corrections, and evaluation will be an ongoing process. At the end of year two, an external program evaluation will be conducted at which time there will be an opportunity for midcourse corrections.

Examples of feedback mechanisms and indicators may include:

- Farmer feedback through independent surveys
- Evaluation of membership trends in the VKCs
- Number of training programs offered, with special attention to the number of women participating in these programs
- Adoption of new technologies and farm practices
- Increase in farm productivity and increase in income of smallholders
- Increase in household surpluses
- Amount of external funds leveraged for the VKCs

## Force Field Analysis

Factors that could inhibit the success of this project include:

- Retention of trained CKWs in rural areas (training may bring mobility and opportunities for these CKWs outside rural areas, unless attractive remuneration package is offered)
- Lack of rural infrastructure may impede the use of modern ICT tools for VKCs and CKWs
- Political instability may impede the operation and sustainability of VKCs.
- Lack of sustained support from the local community and the government.
- Cultural sensitivity may limit the role of female CKWs and the involvement of female community members in VKCs.

Major factors that will contribute to the success of this project include:

- Mutual benefits to both—smallholders and stakeholders serving them
- VKCs serving as local platform and CKWs serving as trusted human face for the smallholders and the stakeholders
- Emerging favorable government policies and support for village based knowledge systems.
- Emergence of new tools of ICTs providing easy access to information for rural areas (e.g.,, cell phones)

Design features of this project that reflect this analysis and will increase the likelihood of success are as follows:

- Testing of multiple approaches/models
- Buy-in from the local government, community and stakeholders
- Affiliation with credible partners such as government, local university, NGO and private sector.
- Community ownership and commitment
- Participation of women (at least one CKW at the village level is expected to be a female)

## Expected Cost Categories

The following categories should be taken into consideration when developing a detailed budget for this program:

- Landscape analysis and assessment of village based knowledge centers
- Personnel (Community Knowledge Workers-CKWs)
- Operating costs of Village Knowledge Centers; office rental and supplies; local transportation costs

- Training costs of CKWs
- Training costs of programs for farmers, women, and youth
- Communication, computer, Internet, phone, fax, interactive radio, LCD projector, TV/VCR
- Monitoring and Evaluation
- Advisory body meeting costs
- Community database development

***Sustainability of VKCs***

We envision the VKCs to be self supporting after a 10-year period. The following examples are indicative of the kind of support that will be required by the VKCs:

- Initial start-up and operating funds from Gates Foundation and governments
- Government commitment/support
- Voluntary Donations from Community
- Membership fees
- Training and Service fees
- Support from the stakeholders serving the community (private sector, banks, ICT companies)
- Facilitation fee for bulk purchase of agricultural inputs and bulk marketing
- Fee-based cell phone usage
- Donation of time and knowledge
- Initial endowment funds (start-up); run some centers as profit centers as an experiment

## Timeline and Duration of Project

This 10-year project will be implemented in two phases of 5 years each. The first phase will be a pilot scale that will conduct a landscape analysis of village-based knowledge systems and establish pilot sites and training programs for village knowledge centers and community knowledge workers.

- Year 1: VKC landscape analysis; Site selections, alliance-building, and development of training programs for CKWs
- Year 2-3: Establishment of first 10 VKCs (5 in Africa and 5 in South Asia) using multiple approaches/models and affiliations with key stakeholders.
- Major evaluation at the end of year two; mid- course correction
- Year 4-5: Scale up to 25 VKCs serving 500 villages
- Year 6-10: Scale up to 100 VKCs serving 1,000 villages.

### Potential Project Partners and Possible Existing Sites for Locating VKCs

*South Asia*

- Major agribusinesses (ICT eChaupal, Reliance Fresh, Cargills Ceylon, etc.)
- Government of India Village Knowledge Centers (Initiative implemented through states)
- The Energy and Resources Institute (TERI), Village Knowledge Centers, India
- M.S. Swaminathan Research Foundation, Chennai, India
- Agricultural Universities
- NGOs (e.g.,, Aga Khan Rural Support Program)
- National initiative to create ICT access to rural communities (Nenasala), Sri Lanka
- Community based Agroforestry program in Matale District, Sri Lanka

*Africa*

- MVIWATA – National Network of Farmers Group, Tanzania
- Millennium Villages in Africa
- Rural-UCAD model farm project, Senegal
- Agricultural Universities
- NGOs and private agribusinesses

### Literature Review

The literature on community development (CD) and rural reconstruction is voluminous and spans six decades. During the 1950s the United States launched community development programs in some 60 nations around the world, mainly in Asia and Latin America. These projects recruited civil servants known as "multi-purpose village-level workers" and placed them in villages to help meet what were perceived to be the "felt needs" of the village people (Holdcroft, 1984).

Community development programs blossomed in the 1950s, but in the early sixties, the specter of a looming Asian food shortage shifted the attention of developing countries and donors from CD to food production programs (Ford Foundation, 1959). As a result, many Ministries and Departments of Community Development in developing countries were shunted aside in the late fifties and Ministries of Agriculture became the lead agency to deal with food production and rural problems. Agricultural development was given primary attention by developing countries and most donors during the 1960s (Eicher and Witt, 1964). But agricultural growth with an emphasis on increasing food production did not solve many deep-seated rural problems.

In the early seventies, the World Bank launched integrated rural development (IRD) programs with a commitment to smallholder production and an overarching goal of reducing rural poverty. But Binswanger (1988) points out that many of the IRD projects failed because they were introduced into an adverse macro-economic environment, and they suffered from a lack of government commitment, lack of profitable technology, neglect of service institutions, lack of beneficiary participation and an inability to solve complex coordination problems. Binswanger sums up the IRD experience as "painful lessons" that helped many donors prepare new types of community projects over the past decade that are known as community-driven development (CDD). Broadly defined, CDD gives community groups and local governments control over planning decisions and investment resources (World Bank, 2008). The CDD model has attracted the attention of many donors and developing countries. In fact the World Bank reports that currently more than 9 percent of Bank lending uses this form of development model. The government of India has just announced a new goal of placing a village knowledge worker in every village in India (National Knowledge Commission, 2007). For a summary of the literature on CD, IRD and CDD see Binswanger's timely survey article on empowering the rural poor (2007).

With the emergence of the 'new agriculture' and the availability and rapid uptake of ICT tools, the governments are refocusing development resources in rural areas. Excellent recent reviews and studies provide information on the vision and momentum towards bringing information and knowledge to the village level (Arunachalam 2004, Kuriyan and Toyama 2007, Dossani et al., 2005). The following list of publications and web links serves as a useful literature resource for this project. It includes references that are cited in this proposal:

Arunachalam, S. (2004). Information and communication technologies and poverty alleviation. *Current Science*, 87(7), 960-966.

Binswanger, H. (1998). Agricultural and rural development: Painful lessons. In C. K. Eicher and J. M. Staatz (Eds.), *International agricultural development* (287-299). Third Edition. Baltimore, MD: The Johns Hopkins University Press.

Binswanger, H. (2007). Empowering rural people for their own development. In K. Otsuka and K. Kalirajan (Eds.), *Contributions of agricultural economics to critical policy issues* (13-27). Malden, MA.: Blackwell Synergy.

Dossani, R., Misra D., Jhaveri, R. (2005). *Enabling ICT for rural India.*Stanford University, CA: Asia-Pacific Research Center.

Dutz, M. A. (Ed.) (2007). *Unleashing India's innovation: Toward sustainable and inclusive growth*. Washington, DC: World Bank.

Ford Foundation. (1959). *Report on India's food crisis and steps to meet it.* New Delhi: Ministry of Food and Agriculture and Ministry of Community Development.

Eicher, C. K. & Witt, L. W. (Eds.) (1964). *Agriculture in economic development*. New York: McGraw-Hill.

Holdcroft, L. (1984). The rise and fall of community development, 1950-65. In C. K. Eicher and J. M. Staatz (Eds.), *Agricultural development in the Third World* (pp. 46-58). Baltimore, MD: The Johns Hopkins University Press.

Katyal, J.C. (2007). State of technology transfer: Proposal for a new extension model. Hisar, India: CCS Haryana Agricultural University.

Kuriyan, R. & Toyama K. (Eds.) (2007). Review of research on rural PC kiosks. Microsoft Research India. http://research.microsoft.com/research/tem/kiosks/.

National Knowledge Commission. (2007). *National Knowledge Commission: Report to the Nation 2006.* New Delhi: National Knowledge Commission.

Swaminathan, M. S. (2005, November 25). Mission 2007: Every village a knowledge center. *The Hindu*.

The Energy and Resource Institute (TERI). (2007). TERI Knowledge Center brochure. New Delhi: TERI. www.teri.org.

World Bank. (2007). *World Development Report 2008: Agriculture for Development.* Washington, DC: World Bank.

***Web links***

Kalam, AJP Abdul, President of India. (2004). Village Panchayat Knowledge Centers for Rural Prosperity. India-US Million Book Digital Library Project http://www.new.dli.ernet.in/UDL-Talks-May2004/President.pdf.

Indian women for community development through village knowledge centers. (2007). http://www.telecentre.org/en/news.detail/38111

Rural knowledge telecentres of Sri Lanka. (2007). http://nanasala.org

Jamsetji Tata National Virtual Academy for Rural Prosperity (NVA). M. S. Swaminathan Research Foundation, Chennai: http://www.mssrf-nva.org

Grameen Gyaan Abhiyan. (Mission 2007). Indian Telecentre Network. http://www.telecentre.org/en/community.detail/101450/

Research on rural PC kiosks: Technology for emerging markets. Microsoft Research India. http://research.microsoft.com/research/tem/kiosks/

Strengthening of services deliveries through knowledge kentres for realization of Mission 2007: Every village a knowledge centre. http://www.apdip.net/projects/undp/in05/view

# 4. Indian Institute of Agricultural Management (IIAM)

## Executive Summary

This project proposal focuses on improving the quality and relevance of higher agricultural education in South Asia with special emphasis on India. Because of many historical reasons, the quality of higher agricultural education has declined in many universities in South Asia. Government and private employers argue that graduates do not have the knowledge and skills to provide solutions to problems faced by the New Agriculture. Spurred by the boom in demand for agricultural science graduates, the Indian Council of Agricultural Research (ICAR) has earmarked funds to implement curriculum reforms in the State Agricultural Universities (SAUs) over a three-year period. India's universities are slated for a major upgrading with state-of-the-art equipment, stringent norms for faculty and a new market-driven curriculum. The ICAR is India's apex body for agriculture education and research. However, because of the erosion of autonomy, undue pressure from students and teachers unions, persistence of wide-scale inbreeding and ICAR having no statutory authority to influence agricultural education, this proposal contends that the State Agricultural Universities will have difficulty undertaking the necessary reforms to improve the quality and relevance of agricultural education in the near future. Therefore, we propose setting up a new model of higher agricultural education: The Indian Institute of Agricultural Management (IIAM). The IIAM is to be patterned on highly successful Indian Institutes of Management (IIMs) and Indian Institutes of Technology (IITs) that have attained an international level of quality. One of the innovations of the IIAM model of higher agricultural education is the recruitment of approximately 100 young faculty members who will be awarded one-year global scholarships to help build a global understanding and knowledge base on issues related to the New Agriculture and incorporating these global issues into the curriculum, research, education and outreach mission of the IIAM. Thus, one of the important dimensions of this project is to build a cadre of well-trained faculty teams that can build bridges with multiple stakeholders, including academic staff members in the SAUs as well as members of the emerging private sector, nationally and globally.

Although the IIAM is proposed to be established in India, the model includes a number of educational innovations that could be introduced in other universities in South Asia and Africa. The IIAM will admit students from South Asia for undergraduate and graduate degree programs and non-degree courses. The model will include preferential admission of female students and offer special incentives such as the waiver of fees, travel grants, scholarships, book allowances and hostels for women. Members of academic staff will pursue action research which focuses on improving the lives and livelihoods of small and marginal farmers and rural women. One of the key challenges is to get the government of India to buy into the concept and support it over a long period of time.

## Project Description

On recent visits to South Asia and Africa, the WorldAgInfo Project Design Team observed that virtually all agricultural universities were under-funded, suffering from poor quality and in urgent need of curriculum reform. However, universities worldwide are noted for their slowness to address agreed-upon reforms. In addition, universities in both Asia and Africa are ill-prepared to address a new set of problems under the rubric the "New Agriculture" that is dominated by climate change, bio-fuels, rising global food prices and food insecurity.

Without question, institutional and public/private sector partnerships are needed to generate human capital and institutional reforms to increase and sustain agricultural productivity and meet the emerging 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. New models of higher agricultural education are needed to foster an exchange of information, knowledge and global experience. However, because of historical, administrative, political and institutional constraints, we believe that it will be slow and difficult to reform the existing agricultural universities in South Asia (India alone has 41 State Agricultural Universities). Therefore, we recommend the establishment of a new higher agricultural education model that draws on the successful record of the Indian Institutes of Management and Indian Institutes of Technology.

To address these emerging opportunities, one needs to examine them in historical perspective. In South Asia, systematic agricultural education began at the beginning of the 20th century. The first State Agricultural University in India was established in 1960. The curriculum was structured to produce graduates who became technology transfer agents of government-sponsored campaigns to grow more food. The principal focus of the research efforts of the post graduate students and university faculty was to increase agricultural productivity as rapidly as possible. This approach paid dividends. Dramatic increases in productivity in response to high yielding varieties, irrigation, fertilizer and other agro-inputs made India self-sufficient in food in the mid-1980s. However, sustaining agricultural productivity has now become a political and economic challenge. Peak agricultural growth rates that were reached during the VIII Five Year Plan (1992-97) have started declining. During the X Five Year Plan (2002-07) the growth rate in agricultural productivity has plummeted to about 2% compared to a 4% target set by India's National Policy on Agriculture. This has happened in the face of falling efficiency of inputs and rising degradation of native soil, water and climatic resources. In this changing scenario, the market relevance of agricultural graduates and postgraduates has become increasingly a subject of serious questioning and scrutiny (IAMR, 2000). Now graduates need to possess qualifications that meet market demands and many sectors of the economy. University graduates need to have professional capabilities to deal with the existing and emerging problems of the New Agriculture such as:

- Stagnating/declining productivity and profitability
- Degradation and depletion of natural resources,
- Increased risk in the face of changing climate,
- Insecure livelihoods for millions of small and marginal farmers,
- Deplorable state of women in agriculture,
- High postharvest losses and fragmented processing industry
- Regional imbalances in agricultural productivity,
- Globalization of trade and commerce (Katyal, 2004).

In order to address the challenges of the New Agriculture, there is a need to produce appropriate knowledge and skills by rebuilding excellence and relevance in education, research and technology transfer. To participate in the agenda of the New Agriculture, agricultural universities need to develop and strengthen appropriate educational programs and bring academic excellence in education to bear on the agricultural problems of South Asia. But this shift requires agricultural universities to introduce institutional and systemic reforms.

The first step is to address persistent deficiencies such as:

- Excessive focus of graduates on public sector jobs and postgraduate research on routine topics rather than on farming systems and diversification strategies of small and marginal farmers
- Lack of commitment in introducing courses that develop new skill areas such as agribusiness and entrepreneurship, value chain organization and operation, natural resource management, international trade and treaties, biotechnology and information and communication technology
- Inadequate investment in training and retraining of faculty through sabbatical leaves at home, in the region and in advanced research institutes,
- Excessive inbreeding makes it difficult to hire academic staff from outside the State of a university's jurisdiction, and
- Too much emphasis on classroom teaching and too little on learning from real life situations.

The requisite paradigm shifts in agricultural education necessitate:

- Granting real and operational autonomy to the agricultural universities
- The introduction of a new curriculum leading to formal degree and non-formal certificate courses
- Availability of and accessibility to modern teaching and learning materials
- Training and retraining of existing faculty
- Fresh employment of highly competent faculty through a national search and selection on the basis of academic excellence and professional competence
- Creation of infrastructure
- Linkages with development departments to learn the realities of agriculture in farmers' fields
- Private industry to support hands-on experiential learning situations.

Without question, the Agricultural Education System must institutionalize appropriate reforms to address concerns and issues relevant to real life conditions. Equally urgent is the need to introduce the envisaged reforms and 'right-track education' and sustain its quality with purpose and consequence (Ramarao et al., 2000). However, the big question is with the limited functional autonomy that state agricultural universities (SAUs) enjoy today, will it be possible for the SAUs to introduce and implement a comprehensive set of reforms in agricultural education? Presently students-, teachers- and non-teachers-unions are blocking reforms. Since agricultural education is a State subject, the SAUs are receiving around 90% of their funding from State Governments. As a result, agricultural universities are left with few options except to obey their dictates. By contrast, institutions such as the Indian Institutes of Management (IIMs) and the Indian Institutes of Technology (IITs) are less dependent (40%) on public funds and enjoy functional autonomy. These harsh facts explain why the present State Agriculture Universities are unable to function independently of the micro-level management by the State governments and solve the problem of inbreeding of students and staff.It is with this background that we propose the establishment of an Indian Institute of Agricultural Management (IIAM) with the following structure, objectives and functions:

- Enjoys autonomy in all aspects of functioning with clear accountability on the value of output and contribution
- Cultivates excellence by excluding inbreeding. Employs outstanding core faculty without local or regional bias and admits students from all over South Asia.
- Provides a mix of undergraduate and graduate degree and non-degree courses. Creates enabling environment for admission of female students
- Makes agricultural science and scientists responsive and responsible to the unique needs of small and marginal farmers and farm women and other stakeholders
- Utilizes action research as a problem-solving approach to alleviate poverty by raising on- and off-farm incomes and tackling the stubborn problems of hunger and malnutrition
- Emphasizes and harnesses the power of interdisciplinary cooperation and networking with agricultural universities, development departments, private sector and farmer groups
- Educational design and research will follow a utilitarian approach and a flexible pattern, but the problems of small and marginal farmers and rural women will remain at the core of new activities and programs
- Integrates conventional and technology-mediated delivery of course curricula
- Harnesses the infinite reach and time neutral potential of open and distance learning
- Promotes the use of online scientific information, journals and textbooks and other teaching materials and learning aids
- Develops linkages between agricultural universities and agricultural service programs such as extension
- The IIAM will develop the corporate culture of a business house and scientific culture of a CGIAR centre; it should act as a model for restructuring existing agricultural universities
- Serves the needs of the South Asian region. Although the IIAM is recommended to be based in India, its core functions can be incorporated in the development of similar models in other countries of South Asia.
- Serves as a learning center for African Universities that are currently introducing new M.Sc. and Ph.D. programs.

### Primary Customers and How They Will Benefit from the Project

The primary customers of this new type of university are the cadre of IIAM students and young graduates, and the faculty and administrators in the 41 SAUs who will be able to cooperate with IIAM academic staff in developing new courses and carrying out joint research programs. Additional customers include members of the government departments, including the apex body the Indian Council of Agricultural Research and state agricultural departments. Additional customers include agribusiness firms who are clamoring for graduates with real life work experience through the IIAM's mandatory year of work experience. Ultimately the main beneficiaries will be Indian smallholders and their families and village people, in particular female workforce.

## Day in the Life: Pre/Post

The proposed institutions innovation – The IIAM – is designed to increase India's capacity to develop a national agricultural innovation system and help interlink the current 41 SAUs and form a national system of human capital improvement. The key indicator of success of the new IIAM model is its ability to speed educational reforms in the SAUs and spur innovations such as public-private partnerships to encourage women to plan on careers in teaching, research and extension in agriculture and special attention to action research on the problems of smallholders.

## Evidence of Success

The establishment of the proposed IIAM enshrines complete functional autonomy that is inherent in the of IIMs and IITs model. Since these models have sparked reforms in other institutions of higher education both in the public and private sector, we anticipate that the IIAM will also generate favorable multiplier impacts on higher agricultural education in South Asia. Evidence of success includes the following:

- IIAM established and funding assured from a variety of national and international sources
- Number of students trained and research support mobilized to address the problems of the New Agriculture
- Number of innovations generated to address specifically the problems of small and marginal farmers and their impact on raising income, employment and nutrition status
- Number of programs having multiplier impacts on the quality of higher agricultural education
- Number of joint projects with agricultural universities and institutes, private agencies and NGOs
- Number of collaborative projects with foreign universities, CGIAR Centers and other international organizations
- Number of consultancies, awards and recognitions earned
- Private sector participation to help finance scholarships, travel grants and sponsored research, and Endowed Chairs.

Government buy-in and commitment are essential for the success of this project, including land allocation and basic infrastructure for IIAM building. Foundation support is important for training 100 new faculty members to develop market-driven courses and also carry out action outreach at the village level on bio-technology to increase smallholder food production and to develop new export commodities such as horticultural products, spices and livestock.

## Project Assessment

This 20 year project will be difficult to evaluate. However, much can be learned by comparing the implementation of the IIMs with the IIAM in terms of moving through the stages of planning, implementation and evaluation. In -depth evaluation is needed every five years.

### Force Field Analysis

This project is complex, difficult and expensive. It can flounder if the government is unwilling to acquire land and construct the necessary buildings and infrastructure. There is a possibility that the State Agricultural Universities will view the IIAM as a competitor rather than a partner in research and development of new courses and sabbatical leave programs. With the boom in demand for science graduates in the private sector, there will be an abundant crop of students applying for admission. The mandatory year of work experience will generate skills that will be of great benefit to NGOs and the private sector. The positive and negative experience of the pathways of the State Agricultural Universities from 1960 to 2007 can be used to develop the IIAM.

### Expected Cost Categories

Government support will be required to provide the land and underwrite the cost of buildings and infrastructure. Private support will be needed to develop special projects for women by hiring some experienced female faculty members who will serve as role models and mentors for young female academic staff members. Without question both male and female faculty members are needed to set the direction, priorities and academic quality of research on such problems as food insecurity. Foundation support will be needed to provide a planning grant, and program support will be required for a period of at least 5 to 10 years.

### Timeline

A minimum planning and implementation period of one decade is the appropriate timeline for the planning, development and implementation of the IIAM. This timeline represents an incremental period of planning, studying the strengths and weaknesses of the SAU and IIM models of higher education, and building academic partnerships within and beyond India. African Vice Chancellors and leading African faculty members should be invited to examine first hand the IIAM model of higher education and determine if the model or components of the model can be scaled up in African Universities.

### Duration of Project

This is proposed as a 20 year project with a one year planning period (requiring foundation support), four years devoted to acquiring land, construction of buildings, hiring staff, admitting students and developing new courses and working with the private sector, NGO community and the development departments in order to recruit academic staff from national and global labor markets. Years 6 to 10 will focus on developing partnerships with many of the present 41 state agricultural universities and private firms in order to exchange ideas on ICT and new types of learning models. Years 10 to 20 will be focused on implementing new courses, new graduate degree programs and new lines of action research to solve problems of smallholders and determining whether to set up IIAM centers in different locations in India.

### Potential Project Partners

The IIAM will maintain a close relationship with the National Agricultural Research Systems of South Asia, CGIAR Centers, overseas universities, private firms and NGOs. The IIAM will develop the following linkages:

- The teaching faculty from nearby agricultural universities and institutes will be invited to supplement IIAM core faculty for teaching undergraduate courses. This will spur cooperation in building excellence in teaching and developing a new curriculum.
- Existing research facilities and faculty of the nearby university and research institutes will be invited to act as co-supervisors of theses of postgraduate students.
- Undergraduate students and those pursuing non-degree courses will be seconded to development departments, NGOs and various extension programs to gain field experience in real life situations of farmers' fields. Likewise, students will be nominated to work in business firms for hands on training and developing entrepreneurship.
- In pursuance of the goals of action research, besides collaboration with the universities, development departments, NGOs and private sector, IIAM will work closely with the farmer organizations and cooperatives.

### Literature Review

There is a growing body of literature on the importance of policies, human capital and institutions as the prime movers of agricultural development (Eicher, 2006). For example, two institutional innovations were crucial to the success of India's Green Revolution of the late sixties and seventies. The first was the development of a new model of agricultural higher education that was called the State Agricultural University (SAU) (Katyal, 2004 and Katyal and Nainawatee 2005)). Nobel Laureate T.W. Schultz has called the SAU's a"brilliant institutional innovation" because the SAUs were decentralized and administratively and financially responsible to the state rather than to the Ministry of Education in New Delhi.

The second prime mover that played a critical role in India's Green Revolution was investment in human capital and building the scientific capacity for a modern agriculture. During the Green Revolution era of the sixties and seventies, the donor community invested heavily in scholarships to enable countries such as India and Brazil to each train 1000 agricultural scientists in industrial countries. But starting in the mid-1980s, donors cut back on overseas training because of increased university capacity in developing countries, low returnee rates, and the lack of relevance of research by international graduate students on agricultural problems in industrial countries. But the first generation of Indian agriculturalists who worked in the Green Revolution era has or will soon be retired. And with India's private sector clamoring for science graduates, there is a convergence of opinion that substantial Indian investments are needed to producing a new generation of agricultural teachers and researchers to address the problems in the New Agriculture. Likewise a number of donors (World Bank 2008) and foundations are rethinking the need for investments in agricultural higher education in Asia through scientific partnerships with other developing countries. China is important because it is now the third largest investor in R&D following the U.S. and Japan. Scientific partnerships are also being sought with private research labs and universities in industrial countries.

Without question, the State Agricultural Universities are facing a serious crisis (Katyal and Naianawatee 2005). The apex organization, the Indian Council of Agricultural Research (ICAR) has spearheaded a drive to revamp the SAU curriculum and introduce new courses on renewable energy, post harvest technology, remote sensing, organic farming agri-business and bio-technology (Eicher, Maredia and Niang 2006). India is about three to five years ahead of Africa in terms of facing up to the problems embodied in the New Agriculture. African nations should study the success and shortcomings of the SAU model. Several landscaping studies of higher agricultural education are underway in Africa.

Eicher, C. K. (2006). The evolution of agricultural education and training: Global insights of relevance for Africa. *Staff Paper 2006 (26)*. East Lansing, Michigan: Department of Agricultural Economics, Michigan State University.

Eicher, C. K., Maredia, K., Sithole-Niang, I. (2006). Crop biotechnology and the African farmer. *Food Policy,* 31(2006), 504-527.

Katyal, J. C. (2004). Status of agricultural education in India. Paper presented to the Governing Body of the ICAR on 10 March 2004, Krishi Bhawan New Delhi.

Katyal, J.C. & Nainawatee, H. S. (2005). *Agricultural education: Historical perspective.* New Delhi: Education Division, ICAR.

Ramarao, D., Kumari, R. V., Haribabu, E. (2000). Agricultural education in India: a sociological perspective. *Outlook*, *29,* 177-184

IAMR. (2000). *Assessment of national manpower needs in agriculture and allied sectors*. New Delhi: Institute of Applied Manpower Research.

World Bank. (2008). *World development report 2008: Agriculture for development.* Washington DC: World Bank.

National Knowledge Commission. (2007). *National Knowledge Commission: Report to the Nation 2006.* New Delhi: National Knowledge Commission.

# 5. Facilitated Multimedia Instruction to Support University Agriculture Curricula

## Executive Summary

This novel program incorporates facilitated video instruction into university curriculums in sub-Saharan Africa. Local universities and international partners will create and exchange video-based course materials on topics central to the "New Agriculture" and work together to train instructors in the use of innovative education techniques and technologies. Many of these new topics are currently not being addressed in the African agricultural university curriculum, yet are critical for training new scientists in developing solutions to Africa's food security issues. This program offers the possibility of enhancing the curriculum in participating universities and strengthening faculty teaching skills. Beyond the university, facilitated video instruction can improve education for farmers in the field, as well as inform the institutional curriculums. Participatory video, in which university students, extension agents, and/or farmers create content for other farmers, creates a vital feedback channel from the smallholders back to the educational system, helping to ensure that instructors at the university level understand the on-the-ground needs of smallholders.

Improvements in education will play a crucial role if Africa and South Asia are to throw off the yoke of poverty. At the university level, there is need for a "New Agriculture" curriculum that addresses topics such as climate change, biofuels, biotechnology, rising global food prices and food insecurity. There is also a need to educate Africa's university students in practical, locally relevant subject matter including technical expertise and managerial skills that can be applied in the local agricultural economy, as well as a need for educational content that is useful and accessible (directly or indirectly) to smallholders. Importantly, there is an additional need for agricultural curriculum that addresses women's educational needs and encourages their increased access to information and participation in training. Farmers must learn how to increase yields, use resources efficiently, and conserve soil and water. Unfortunately, the education system in Africa is chronically underfunded, which greatly complicates the task of rolling out a new curriculum. A major problem in particular, is dispersed expertise: no single African university has the knowledge or resources to build a new curriculum on its own.

To address these educational needs, a novel program based on facilitated video instruction is proposed. In this model, universities create and exchange video-based course materials. Research on facilitated video instruction suggests that students in video-mediated classes can perform as well as students in conventional courses. Beyond the university, facilitated video instruction can improve education for farmers in the field.

An intriguing model for this is participatory video, in which farmers create content for other farmers. Creating content in this manner creates a feedback channel from the smallholders back to the educational system. This feedback loop and bi-directional flow of information is crucial for both the universities and the smallholders. For the universities, feedback from farmers works toward ensuring that university curriculum includes local knowledge and focuses on problems that are relevant to the agricultural economy of the country. For smallholders, gaining access to up-to-date educational materials can improve farming incomes. Other media formats can also be used as appropriate. Audio files, PowerPoint presentations, and other resources may offer supplemental content.

Particularly important is that video content be adapted to local conditions and crops and to give smallholders a voice in describing their agricultural conditions. The project must include content that is relevant to women and ensures high levels of participation by women. Courses focused on building women's leadership skills may be considered. See "Day in the Life" section below for an example.

The desired outcomes of the project include a digital collection of course materials to support a curriculum in "New Agriculture," an archive of farmer-to-farmer video, improved ties between institutions, diversified faculty teaching repertoires, and a strengthened agricultural education system. If the project is successful, new agricultural specialty programs that could not have been created by any one individual institution will be available across multiple institutions. Evaluation and feedback must be built into the project to measure progress and to support the adjustments required to achieve success.

### Project Description

The core of the project is the development and video recording of courses and the offering of courses through the facilitated instruction. In addition, there will be significant support activities to ensure that participants understand both the concepts of New Agriculture and the approach to education. Regional workshops will be held for the agriculture faculty on topics of "New Agriculture" and also on pedagogy. To ensure that the recorded materials are suitable for facilitation, it is important the faculty adopt an active teaching style and modern pedagogy. Special attention will be paid to training the facilitators.

The overall goal of the model project is to improve agricultural education by sharing expertise across multiple institutions through facilitated video instruction and conferencing. The work rests on a number of key principles:

- Facilitation: Videotaped lectures are not a complete educational solution because they lack the interactivity that is the hallmark of good pedagogy. This model relies on training of local facilitators, whose role is to engage the audience in discussion and in-class exercises focused on the lecture video. Videoconferencing, where available, could be used to enable direct interactions between students and the lecturers. Faculty delivering lectures must also receive additional training in the use of active learning techniques in order to structure courses appropriately for this model of instruction.

- Digital video: The key technology for the project is digital video, although other digital formats should be accommodated. The decrease in video camera prices and the availability of powerful PC video editing software make this project model feasible. Appropriate distribution of material must be considered given the realities of network bandwidth in Africa, including a sort of Netflix model for distributing DVDs. These advances greatly lower the overall project cost, as well as allowing for local development of video content.

- Multiple audiences for instruction: The project includes inter-university, university outreach, and farmer-to-farmer instruction. There will be synergies between the levels and opportunities for sharing content and infrastructure. One of the strengths of the multi-level approach is that it will help link smallholder issues into broader agricultural education.

- Content localization: It is important that educational materials are relevant to local conditions (crops, climates, soils, farming practices). The use of video provides the opportunity for local customization of materials.

- Partnerships: The emphasis of the project is on the development and delivery of educational materials. These are to be used by partners who have existing educational programs, and who have considerable autonomy on how materials are used. The goal is to strengthen existing educational institutions and groups – not to create new ones.

- Community-based educational archive: The project will have an open model for dissemination of course materials so that they are freely available.

- Cost realism: To be successful and sustainable, this program must function in environments with limited infrastructure and financial resources. This means paying attention to costs at all levels, and limiting the requirement for investing in expensive equipment. High bandwidth Internet connections will not be necessary for participation in the project, since instead it is envisioned that video content will be disseminated through alternate modes, such as DVD, where necessary.

The model for course creation employs faculty from the various partner institutions who will consult with members of an oversight body to identify relevant courses and topics. Course design will be iterative with appropriate involvement of additional experts. The courses will leverage modern pedagogical techniques such as active learning. When the course is offered at the instructor's home institution, it will be video recorded, and the resulting video and support materials will be stored in a database accessible to other institutions. Each individual course lecture should be created in a modular fashion such that individual sessions can also be used independently in a "mix and match" mode for instructors who want to use individual lectures in a guest lecture model. Note again that high bandwidth Internet connectivity is not required as materials can be distributed by DVD.

A key aspect of the project design will be the use of facilitators (or teaching assistants) at the partner institutions. The facilitators will actively engage the students in the material by asking questions, elaborating on the instructor's explanation, or conducting active learning activities. The facilitators will receive training in the methodology, but need not be subject matter experts (and need not be prepared to teach the course on their own). Facilitators may be other faculty in different areas or possibly students. Facilitators offering the videotaped lectures will also be given training in active learning techniques, so that for example, there are logical breaks in the lecture for the incorporation of exercises and discussion.

Beyond merely consuming content, students in the courses can also become active content producers. Using cameras or video recorders (provided by the project), they will capture supplemental local agricultural content, which can be used to enrich the course archive. For example, they might be asked to interview a farmer about a particular issue, or videotape the planting of variety field trials. The ability to record material from different places will help adapt the course materials to local conditions. In addition to supporting courses offered at the universities, the video materials will be used to support outreach activities by the universities. These will include both short courses, for example short courses for agricultural input dealers or women farmers, as well as courses offered at agriculture technical colleges.

The project should emphasize the role of women in agriculture and take concrete steps to ensure participation of women at all levels. Topics of relevance to women should be included in the curriculum, especially topics related to crops that are grown by women. One aspect of the "New Agriculture" curriculum is its emphasis on real world problems. Broadly speaking, experience in North America and Europe has shown that female enrollments improve as the curriculum is more closely tied to societal problems.

### Primary Customers and How They Will Benefit from the Project

The direct customers are students and faculty of the agricultural education system. Students will benefit from a more relevant curriculum to address agricultural problems. The use of facilitated video instruction will allow course offerings at institutions that could not otherwise do so. Another benefit of the methodology is that facilitators often are able to improve their teaching abilities and in some cases even learn to teach courses they previously were not trained to teach.

The creation of video-based courses (which will be made freely available) will create educational opportunities for institutions beyond the schools that are initial members of the consortium. The project should include the offering of short courses to farmers so that they can also directly benefit from the program. Video content will be created and archived in modular format so that lectures can be incorporated into short courses as well as standard university courses.

Institutional beneficiaries are participating universities in sub-Saharan Africa. If successful, the project could be replicated in other regions of Africa and in South Asia. For example, a group of State Agricultural Universities in India working with similar agricultural conditions and crops could potentially share course content.

### Day in the Life

Smallholders will benefit in the long run by having agriculturalists that are better trained in new areas of agriculture as well as local growing conditions. Involving students with the smallholders will also create feedback channels, allowing the farmers to impact the curriculum and give information back to the university.

Short courses can have tremendous benefit for underserved communities. For example, public education in most Muslim countries is segregated on the basis of gender and generally preference in schooling is granted to boys. Culturally girls are not encouraged to travel alone so if the girls' middle or high schools are located far from the village most families will decide not to send their daughters to school because it will involve incurring more transportation costs. Because of this, rural women and girls in Muslim countries generally lack access to agricultural information even though they conduct most of the agricultural work and can benefit from more education. There is an urgent need to identify strategic actions to overcome institutional, cultural, and other barriers to access for rural girls' and women's agricultural education in Muslim countries. Short courses offered through a female-led facilitated video teaching model offer the opportunity to train these girls and women in basic agricultural practices.

### Evidence of Success

The value of facilitated video instruction is that it allows instructors to teach classes that they would not otherwise have the background to teach. This strategy allows for a rapid ramping up of a broad new agricultural curriculum by sharing expertise across multiple institutions, when no single institution would be able to build multiple areas of the curriculum singlehandedly. Facilitated video instruction can also succeed in making more classes interactive, even with student populations who traditionally are not active in the classroom. There is a significant record of facilitated video experience to build on from both the developed world and the developing world. E-clips http://eclips.cornell.edu/ is just one successful example of an archive of short video clips used to supplement traditional instruction in Cornell's Department of Applied Economics and Management.

Replication of the project to multiple regions in Africa should be straightforward. New courses will be developed for different regions, although access to courses recorded in all parts of Africa will also be available. Site selection will take into account factors such as geography and instructional language (English or French). The project could also be replicated in South Asia. Much of the content will have cross program value, although language issues must be taken into account.

### Force Field Analysis

There are a number of risks to consider, some of which can be evaluated during a startup/planning phase of the project, with appropriate adjustments made. Many of the targets are easy to quantify – such as creation and offering of courses – so it is possible to build metrics into the project from the beginning. Potential risks include:

- Lack of demand. We hope that during preparation of a full proposal, or during selection of the partners, project partners will be able to establish that there is adequate demand for the facilitated video based courses. Adjustments to the program will be necessary if demand is not as high as anticipated. Initial pilot offerings of courses will help assess this. It will be important to have various targets for course offerings and take action if they are not met.
- Conflict with existing institutions. The desire is to make this program complementary to existing programs. It is entirely possible that this project could be done under the aegis of an existing regional consortium.
- Failure of international consortia. International educational collaboration in Africa has a mixed record. This project aims to create courses that may be used by different programs in different ways. Crucially, it is not necessary for different institutions to share degrees or align programs. Giving institutions autonomy on how they use the courses avoids some of the challenging political issues in linking academic programs.
- Failure of the facilitated video instruction model. Factors that lead to the success of facilitated video instruction have been identified from other projects; including training facilitators and ensuring that students at the remote site view their own site as the locus of the course. This model project will follow the existing best practices.

### Expected Cost Categories

- Coordination and Administration
- Faculty, Facilitator and Video Technician Training
- System Design and Development
- Equipment and supplies (e.g., video cameras, video editing software, video conferencing and projection equipment)

### Timeline and Duration

The project should involve a start-up phase followed by the launch of the regional consortia. Initial funding must include funding for the development of the digital repository of course video material and the infrastructure for delivering offline video content to partner institutions. Funding for each consortium will last for six years. The first three years of funding will support the creation of the video courses, the training of facilitators, and the adoption of the curriculum. The second three years will be at a lower level of funding to support the permanent inclusions of the new materials in the curriculum and to allow the innovations to be sustained. New partners could potentially join after the original start-up phase.

The first year of the project could be done as a planning grant, with the scale, duration and funding levels of the full project influenced by the outcome of the planning phase. The total number of consortia, and the duration and level of funding at each site is variable, and would be dependent on meeting various milestones. One first step for the project may be to create an oversight group to coordinate administration and provide guidance in setting priorities for development of the curriculum. The next step would be to build the initial partnerships of the universities, and develop some pilot offerings of courses.

The project should actively involve sites for three years. After three years, there should be a significant collection of courses to continue using, as well as the available expertise to continue making additional course videos and offering them with facilitated instruction. The equipment required for replay and lecture capture is not too expensive – laptops, video cameras, and possibly data projectors so continued maintenance (and replacement) should be within the financial resources of most sites (providing that the program is providing value). At the end of three years, the project should continue for another three years, helping to support offering of courses, to provide continuity as the institutions support the courses on their own.

### Project Assessment

The project will need a set of benchmarks on content creation, course offerings, and contributions to the course archive, which will give a measure of progress. The deeper question is about quality of materials and facilitated video offerings. Assessment will be done using standard techniques for educational evaluation. Independent evaluation is necessary to determine whether the content covers student, faculty and smallholder needs. Feedback mechanisms should be built into the lectures and facilitated discussions themselves. Use of clicker technology could be adapted for interactive learning assessment and student input on lecture content and delivery if feasible at the various institutions.

### Possible Partners

The selected African universities should have similar agricultural and climate conditions (as well as a common language). If the institutions are part of an existing educational consortium, it is appropriate to do the project within the context of that structure. The model could be used in South Asia as well. Likely U.S. project partners will be leading Land Grant Universities with a strong interest in international agriculture. Other U.S. universities with strengths in video-based instructional technology could be additional partners. The project will draw on U.S. and/or European faculty members with interests in the "New Agriculture" and ideally, with South Asian- or African-specific interests. While students in courses will be able to do some of the work to develop local video content with smallholders, additional partners who could specialize in this area may be needed to build an extensive collection of video modules focused directly on smallholder training. The projects would then need to be linked to maintain coherence.

### Literature Review

It is widely recognized that the key to technology-supported education is to have a mechanism that engages students in learning. Constructivist learning supports this by arguing that knowledge is constructed when it is placed in context. Facilitated video instruction (also tutored video instruction, TVI) does this by combining video based instruction with interaction with a facilitator and peers. Jim Gibbons of Stanford University described the results in a well-known article in Science, which included evidence that the TVI students out performed Stanford students who attend the live lectures. Additional studies have confirmed the results in other settings. This proposal has been informed by other work on TVI , which includes multiple deployments of TVI in higher education settings. Another related project is Digital StudyHall, which uses facilitated video for primary education in rural India. Although the African context is different, many of the central features from Digital StudyHall can be applied to this project including a hub and spoke model, building a publicly accessible course archive with an emphasis on facilitator training. One of the components of this project will be the use of participatory video for agriculture education, building on the work of Digital Green.

Anderson, R., Chen, J., Jie, L., et al. (2007). Supporting an interactive classroom environment in a cross-cultural course. Paper presented at the *IEEE Frontiers in Education Conference*, from http://classroompresenter.cs.washington.edu/papers/2007/BEIHANG_TVI_2007.pdf.

Bransford, J., Brown, A. & Cocking, R. (2000). *How people learn: Brain, mind, experience, and school*. Washington, DC: National Academy Press.

Duffy, T. M., & Cunningham, D. J. (1996). Constructivism: Implications for the design and delivery of instruction. *Handbook of research for educational communications and technology*,170-198.

Gandhi, R. et al. (2007). Digital green: Participatory video for agricultural extension. Paper presented at the *Information and Communication Technologies and Development Conference (ICTD); IEEE/ACM*, Bangalore, India.

Gandhi, R. et al. (2007). Digital green: Participatory video for agricultural extension. Paper presented at the *IEEE/ACM Information and Communication Technologies and Development Conference (ICTD)*, Bangalore, India.

Veeraraghavan, R., Yasodhar, N. & Toyama, K. (2007). Warana unwired: Mobile phones replacing PCs in a rural sugarcane cooperative. Paper presented at the *IEEE/ACM Information and Communication Technologies and Development Conference (ICTD),* Bangalore, India.

Sipusic, M. J. (1999). *Virtual collaborative learning: A comparison between face-to-face tutored video instruction (TVI) and distributed tutored video instruction (DTVI )*. Sun Microsystems.

Wang, R., Sahni, U., Sobti, S., et al. (2005). *The Digital Study Hall* No. TR-723-05. Princeton University.

# 6. Collaborative Content Generation: Building Digital Agricultural Content Modules

## Executive Summary

Agricultural students, faculty, extension staff, community knowledge workers and farmers in South Asia and Africa often do not have access to high quality, relevant educational content, including handbooks, textbooks and training materials. Information resources are often missing, out of date, too expensive, targeted to a research-level audience, not relevant to local conditions, or not available in local languages. This is particularly true for information related to agricultural practices relevant to community knowledge workers and women smallholder farmers. Conversely, their valuable knowledge is often not fed back into the educational system.

This project envisions an online digital library system that can address these shortcomings by facilitating the collaborative production of freely licensed agricultural content. Content will be user-generated, involving participants from all segments of the information ecology, from global to local levels. Content creation will occur on a wiki-type platform to allow information to be easily developed, modified, and updated. This process itself will be open, transparent, flexible, and will include support by content creation facilitators in the early stages, as well as in validation and editing stages. This on-line tool will provide the ability to produce output in a variety of media, including: PDFs, print, CDs, and cell phone texts. [Note: multimedia formats are discussed in detail in a separate proposal.] Content will be modular, and this tool will allow users to aggregate modules, mixing content to meet specific user demands to produce handbooks, textbooks, and other agricultural educational materials.

This project has two basic components: 1) the development of a platform for creating, managing, rating, updating and delivering content, and 2) developing agricultural content. Panels of agricultural subject specialists would likely oversee the production of content modules in major areas related to agriculture. Proposed subject groupings include:

- crop science and agronomic practices – special modules on women's crops;
- agroecology, integrated pest management, soil health, water resources, natural resource management and sustainable agriculture;
- food safety/food laws, food processing and value additions;
- applied biotechnology and tropical plant breeding;
- agribusiness;
- livestock and dairy.

It will be important to develop this program so that African participants can benefit from South Asian knowledge and vice versa. Subject panels should include specialists from multiple geographic regions. Gender issues must be considered also, with particular emphasis on participation of women in developing content specifically of value to women in agriculture at all levels.

## Project Description

This project envisions the creation of an online collaborative content tool for producing relevant and up-to-date educational materials that will support instruction for the New Agriculture in Africa and South Asia. The project requires a lead organization to establish a technical base for the project, supervise the adaption of an existing wiki-platform, and coordinate the effort of agricultural specialists from many institutions in Africa, South Asia and the developed world to build the content.

### *The Tool*

This project will involve both development of the wiki-platform itself, and development of agricultural educational content. The platform should be able to facilitate wiki-style content creation through open collaboration, allow content to be easily searched, provide users with the ability to select modules for aggregation, and enable output in multiple types of media. Several existing platforms offer options for rapid development of a digital content collection for the New Agriculture. The Wikibooks platform http://www.wikibooks.org/ supported by the Wikimedia Foundation is one option. Other programs such as the Global Text Project http://www.globaltext.org/ and Rice University's Connexions http://cnx.rice.edu/ illustrate alternatives. Designing the platform from scratch should not be necessary. Applicants for funding would need to specify the platform they intend to adapt and justify their choice.

Platform development efforts could focus on enhancements to the chosen system that would improve functionality in different ways. For example, developing efficient keyword tagging strategies, using one or more controlled vocabularies, would enable more consistent searching and allow navigating to broader or narrower content, as well as helping with the multilingual aspects of communication. Additional system enhancements could focus on structural metadata for digital collections, e.g., enhancing incremental versioning systems to be more sophisticated, using annotations on who-did-what-when at a level that would allow users to do more than compare the entire version "x" to version "x." Future proposals should be evaluated for their creativity in enhancing the functionality of the digital collection search and delivery mechanisms.

The system must also support offline delivery of content via multiple formats including, for example: print, CD, cell phone texts, and potentially experimentation with e-book readers.

### *The Content*

Panels of agricultural subject specialists would likely oversee the production of content modules in major areas related to agriculture. Proposed subject groupings include

- crop science and agronomic practices – special modules on women's crops;
- agroecology, integrated pest management, soil health, water resources, natural resource management and sustainable agriculture;
- food safety/food laws, food processing and value additions;
- applied biotechnology and tropical plant breeding;
- agribusiness;
- livestock and dairy.

Expert panels could be established for each subject grouping. For each sub-topic, a paid facilitator would be identified by the expert panel to supervise detailed content creation, identifying potential participants, including authors, peer validators, and editors. For example, the facilitator could be a university faculty member who would involve students and/or extension staff in the production. The facilitator, along with participants, would outline the module's content. Content, in turn, would be developed by participants along with others interested in the topic. After completion of a draft module, the facilitator would initiate validation and editing processes. A validated version would be available via the digital collection online, as well as through offline media, such as CD-ROM.

Consideration should be given to whether there is a need for different levels of content development. For example, content appropriate for a university level course may differ substantially from content useful to an extension worker. The submitted proposal should indicate in detail how both the platform and the broader content generation system will engage women and serve their needs. Project design should moreover integrate gender considerations in usability, language, and content issues. Finally, plans for ensuring the participation of women at all levels of the project – as designers, facilitators, contributors, validators, editors, and users should be described.

A submitted description of the proposed platform design process should include an understanding of women users and their needs. Likewise, the submitted description of a content production system design should include an assessment of how women's content needs differ in all segments of the information ecology, and how those needs will be met. Also, there should be consideration of whether different incentives are needed to engage women in the production of content. An assessment should be made as to the potential need for incorporating a gender review of all content, in short, a validation system which includes review of content by women.

### *Organizational Strategy*

At least two leads would likely need to be identified for this initiative: a technical lead, and a content lead or leads, depending on which options for content creation are pursued (see below). It is possible that these could be based in the same institution, but this is not required for a successful organizational strategy. As suggested above, the content lead would coordinate a group of sub topic facilitators who, in turn, would recruit partners to develop content in the subject areas. Subjects for the initial phase could be selected based on other funded projects, such as working with multi-institutional degree programs in Africa or Asia or working in the same area, if funded, as the Facilitated Video Instruction initiative.

One potential and promising model for overall organization of the program is the approach taken by the Encyclopedia of Life http://www.eol.org/home.html. Their approach to coordination of their project, to developing content, and to delivering information offer a concrete example of a similar undertaking led by experts in another field. This approach has the advantages of utilizing existing and new content to be further developed and enhanced by collaborators worldwide.

### *Key Synergies*

It will be important to develop this program so that African participants can benefit from South Asian knowledge and vice versa. Subject panels should include specialists from multiple geographic regions. It may be beneficial to use subject-based society meetings as a point of contact for subject panels to engage in face-to-face planning meetings and discussions. Subject-based societies could potentially also play key roles in overseeing content generation in topic areas.

Incorporating local knowledge is also a key component. Such incorporation requires that content developers in Africa and South Asia find ways to build local content and explore local language translation options in order to ensure value beyond just the university level. Major languages of Africa should all be considered for content development.

### *Options for Content Creation*

There are several options for creating and building the content base for this collection. Ideas for creating a specific module on a particular topic may come from an individual, a group of interested individuals, a professional organization, or be suggested by one of the panels. For example, if a topic is suggested by one of the panels, it could identify a facilitator to spearhead the development of this module. A paid facilitator would help identify and involve potential participants, including authors, peer validators, and community members.

Faculty and/or researchers in agriculture research organizations, universities or consortia programs would be invited to build the content development process into their courses. Students could then be asked to write chapters or modules on a particular topic, with a faculty member taking the lead in organizing the overall framework for content on a particular topic related to a course. For example, all Ph.D. plant breeding students in the

ACCI (African Centre for Crop Improvement) program could be asked to contribute a chapter on plant breeding for the main crop they are studying. A faculty member in the ACCI program could take the lead in vetting and compiling these chapters. After a topic has been sufficiently developed, the faculty member or facilitator will initiate a validation process. The validated version would be made available for dissemination by means other than the internet. A next logical step would be to have content translated into target languages. A live version of the module would also continue to be improved upon, and a validated version could be subsequently produced.

In a second, alternative scenario, textbook publishers, scholarly societies and organizations like the World Bank and FAO are likely candidate institutions to donate content for future updating via the project's facilitation/validation process. For example, the World Bank's Agriculture Investment Sourcebook http://www.worldbank.org/agsourcebook could be updated as needed via this model.

A third option would be to piggy-back on existing, relevant initiatives. For example, Wageningen University implements several projects that could be reorganized to fit within this collection-building model. Moreover, The Prota Database http://www.prota.org/uk/about+prota/ provides excellent crop content for Africa, but is unfortunately, in its present form, not very easy to use. In addition to Wageningen University's projects mentioned above, the same University also offers their TropCrop computer-based learning and reference database http://www.dpw.wau.nl/tropcrop/ on CD-ROM.

Intrinsic to this entire proposal is the idea that where existing content is adopted, consideration should be given as to whether it sufficiently represents women's demand for relevant content.

## Primary Customers and How They Will Benefit from the Project

Agricultural students, extension workers, community knowledge workers, and smallholder farmers, particularly women farmers, are the primary customers and beneficiaries of this project. Currently, students in agricultural universities in Sub-Saharan Africa and South Asia lack affordable, up-to-date textbooks, and often do not have access to a well-stocked agricultural library. These students will benefit significantly by gaining access to a free, relevant and accurate textbook or handbook, which also includes feedback mechanisms. Students will also benefit if they are brought into the process of generating some content for the digital library. Community knowledge workers will benefit from the same resources, equipping them with additional knowledge to advise farmers and, in turn, provide local knowledge back to the educational community. Women farmers will particularly benefit because some of the handbooks will focus on topics of specific interest to them, including subject matter such as dairying, raising poultry or goats, nutrition, vegetable gardening and other "women's crops." .Literacy programs, which use this new agricultural reading material, could also benefit from relevant and accurate information in these handbooks.

Material created for South Asian agriculture may also be relevant to Africa and vice versa, since many aspects of agriculture cut across geographical boundaries. However, since many agricultural projects also require local context, this model has the advantage of allowing for local customization and translation. In India alone, there are forty one State Agricultural Universities which could benefit from the availability of this content. In Africa, this project could be tied in with other curriculum enhancement efforts, such as regional post-graduate programs like the collaborative MSc program in Agricultural Economics in Eastern Africa.

All participants in the production process will gain collaboration, negotiation, and ICT skills. Networking will also be increased within the agricultural community, including universities, research centers, extension systems, and village information centers.

## Day in the Life

### *Agriculture Student*

Pre-Project: A student of plant genetics at an agricultural university runs to the library between classes, only to stand in line at the Reserve Desk in order to get access to one of very few copies of the basic plant genetics textbook for his/her class. Unfortunately, this book has already been checked out that day by a faculty member preparing for the next lecture. The next day he/she tries again and is successful, but the textbook copy available is approximately 10 years old. The student photocopies many pages from the book during the 2-hours that he/she has the book charged out, so that he/she will continue to have access to the material after returning the textbook.

Post-Project: A student of plant genetics at an agricultural university is issued a copy of the digital textbook for his/her class at the beginning of the semester. The textbook is downloaded from the digital library and copies are made for each student in the class on introductory plant breeding. The student can use computers at library or campus computing centers to read the text. What is also very exciting is the buzz that One Laptop per Child computers will soon be part of upcoming degree programs, with texts available for all courses within various programs.

### *Smallholder Farmer*

Pre-Project: A smallholder farmer needs information on whether to plant Bt Cotton and, if planted, how the management practices differ from growing traditional cotton. Unfortunately, the local extension worker has limited current information on Bt cotton. While a local input dealer was able to provide some basic information, this smallholder farmer would like to verify the accuracy of the information.

Post-Project: A smallholder farmer contacts the extension worker and/or input dealer, both of whom have access to a crops handbook on CD-ROM. An up-to-date chapter on Bt cotton is included. Luckily, an excerpt from the chapter was translated into several local languages by students at the nearby university. This translation was part of their crop science class, and made it easy for smallholder farmers to read and understand Bt cotton information. Moreover, included on the CD-ROM was information specific for crops grown by women, information that traveled fast to women in nearby villages.

### Evidence of Success

Open production of freely licensed material on a wiki has been successfully developed and implemented on Wikipedia since 2001. Over 8 million articles have been produced through this voluntary content creation process. Amazon.com also offers a successful example of reviewed/ranked content, while eBay offers a successful example of building online trust. Building a ranking/rating system into a Wikipedia-type system brings together the best of all of these models, creating a trusted agricultural education resource base.

Edited works with multiple authors can be incredibly challenging to complete, and many editors and compilers have faltered in the process. Harnessing the output of millions of students worldwide, facilitating their ability to create modules or chapters as part of coursework, will increase the likelihood of success in this endeavor.

From a sustainability perspective, Wikipedia again sets the standard. Millions of volunteers worldwide update Wikipedia articles on a regular basis. Many contributors on a common platform distribute the work out across the globe. This, however, leads to one of the major points of criticism of Wikipedia – is it reliable? Many people use Wikipedia, but often will not cite it. This project will need to overcome this problem.

In practical terms, this project should start with one or two major subject areas within the field of agriculture. Once material is available in these content areas, it will be fairly straightforward to replicate the system for other subject areas. The system could also be replicated for other subject areas once a solid foundation has been established.

### Force Field Analysis

Perhaps the major obstacle to be overcome, at least initially, is to create enough content to build a critical mass of material necessary to generate high use of this digital library. With use comes additional awareness, which then leads to additional volunteer participation.

A second challenge is that content developers may demand financial compensation. If this demand is answered at the beginning of the project, volunteer content developers may be more difficult to recruit or never emerge at all. One possible solution to this issue is to engage faculty members who are willing to invest the time to create content via student projects for their courses. Such a solution holds promise and offers a highly sustainable model for content creation.

The interface designed for this system must be user friendly from both the content user and content creator ends of the system. Studying successful systems like Wikipedia and others will be essential.

### Expected Cost Categories

Project Management

Project coordinator

Administrative support

Travel

Publicity and outreach

Assessment and Evaluation

Platform Development

Hardware

Software development

System Monitoring and Maintenance

Experimentation with Reader devices

Offline products

Content Development

Content Development Coordinator

Subject Specialist Panels

Facilitator Stipends

***Timeline***

5-year timeline. Details still to be determined.

### Duration of Project

TBD

### Project Assessment

Multiple measures such as the ones below can be used to calculate success. Building a well-functioning content development mechanism that is sustainable, and produces content that is widely used by numerous universities to teach their classes, will be the true success story. For example, Nyle Brady's Nature and Properties of Soils has been a widely used textbook, for basic soil science classes, for the last 30 years. This project will be extremely successful if it is able to create texts like Brady's, ones that are constantly updated for future generations of students, faculty and extension workers, and of benefit ultimately to smallholder farmers.

### Multiple Measures of Success

- number of books produced;
- number of books embedded in the curriculum;
- number of universities using content;
- number of books regularly updated;
- translations – number of translations, number of languages;
- growth of collection over time;
- number of PDF downloads;
- wiki rating (writing, importance, credibility, interest).

### Potential Project Partners

- Wikimedia Foundation;
- agricultural universities/consortia in the developing and developed world;
- Africa – African Center for Crop Improvement, Collaborative MSc Agricultural Economics Program, RUFORUM, Faculty partners at individual agriculture universities in Eastern, Southern and West Africa;
- South Asia – State Agriculture Universities in India, Sri Lanka, Pakistan, Bangladesh, etc;
- Europe/UK – Faculty partners at Wageningen University, University of Reading, French Ag University, Imperial College London;
- U.S. – Faculty/library partners at land grant universities (University of Arizona, University of Hawaii, Cornell, Michigan State, University of Florida, etc.);
- CGIAR Centers (GO-FAU);
- FAO;
- Scholarly societies;
- Textbook publishers, e.g. John Wiley and Sons, Prentice Hall, McGraw-Hill;
- WOCAN, International Taskforce on Women and ICTs, or other groups supporting gender equity;
- Amazon – Kindle reading device;
- SONY – E-Book Reader

## Literature Review

Aguolu, I. E. (1997). Accessibility of information: A myth for developing countries? *New Library World*, 98 (1132), 25.

Bruns, A. (2007). Produsage: Towards a broader framework for user-led content creation. In *Proceedings creativity and cognition* 6. Proceedings of the 6th Creativity and Cognition Conference New York: Association for Computing Machinery (ACM).

Bruns, A. & Humphreys, S. (2005). Wikis in teaching and assessment: The M/Cyclopedia project. *Proceedings of the 2005 interntaional wiki symposium,* 25-32. New York: ACM http://www.wikisym.org/ws2005/proceedings/

Fischer, G., & Sugimoto, M. (2006). Supporting self-directed learners and learning communities with sociotechnical environments. *International Journal Research and Practice in Technology Enhanced Learning*, 1(1), 31–64.

Foster, A. L. (2007). Software group gets online textbooks to the developing world. *Chronicle of Higher Education*, 54(12), A28(2).

Jones, M. C., Rathi, D., & Twidale, M. B. (2006). Wikifying your interface: Facilitating community-based interface translation. *Proceedings of the 6th conference on design and interactivity,* 321-330.

Mukiibi, J., & Youdeowei, A. (2006). *Agricultural research delivery in Africa: An assessment of the requirements for efficient, effective and productive National Agricultural Research Systems in Africa (Executive Summary and Strategic Recommendations Forum for Agricultural Research in Africa* (FARA). from http://www.fara-africa.org/library/browse/fara_publications/NARS_Assessment_exec_sum.pdf.pdf

Reinhold, S. (2006). WikiTrails: Augmenting wiki structure for collaborative, interdisciplinary learning. *Proceedings of the 2005 interntaional wiki symposium, 47-58.* New York: ACM

### *Additional Resource:*

OpenCourseWare (Consortium of more than 100 higher education institutions and associated organizations around the world creating a broad and deep body of open educational content using a shared model. http://www.ocwconsortium.org/index.php?option=com_content&task=view&id=16&Itemid=31.

# 7. Improving Agriculture Literature Systems in South Asia and Africa

## Executive Summary

Information is one of the most critical needs for countries in order to achieve the Millennium Development Goals. Access to information is essential for strengthening teaching and research, improving medical and agricultural practices, empowering experts to find locally relevant solutions, and enabling government officials to formulate sound policies (Aguolu 1997; WHO 2006). Recent revolutions in information and communication technology (ICT) have opened up an opportunity for addressing information poverty. AGORA, HINARI and OARE are highly successful online journal delivery programs, developed since 2002, that link researchers and students at eligible academic, research, clinical and government institutions in 107 countries to free full-text articles in over 4,000 peer-reviewed journals and databases covering all fields of agriculture, health, medicine, and the environment. There are more than 1200 institutions registered for AGORA and HINARI in sub-Saharan Africa, downloading tens of thousands of PDF full-text articles per month. These programs are complemented by a low-cost off-line agricultural journals database called TEEAL, which helps institutions bridge their information needs while becoming Internet ready. According to external evaluations of TEEAL, AGORA and HINARI (TEEAL User Study 2004; Scott Report 2006), these programs are:

- Strengthening the intellectual foundation of universities, enabling faculty to perform research on a par with peers in industrialized countries, develop their own publishing record, and enabling students to conduct research and seek education in new and emerging scientific fields;
- Leading to more science-driven public policies and regulatory frameworks;
- Building the capacity of organizations to gather and disseminate to the public new scientific knowledge in the medical, agricultural and environmental sciences and deliver improved services;
- Increasing the participation of developing-country experts in international debates;
- Increasing patronage of libraries at universities and enhancing the status of libraries.

Major challenges now are to ensure that the programs and content are used to their fullest extent. This involves not only an adequate ICT infrastructure with computers, Internet connectivity and good bandwidth, but also training of librarians, users, and integration of the content into research networks and university curricula. Another challenge is the complaint by users of these programs that there are not enough articles about research specific to their environments, countries, and regions. In addition, India is not eligible for these electronic journal delivery programs, but has a wealth of research material that is not yet in electronic format.

This proposal envisions addressing these challenges by scaling up activities that already have a track record of success, and introducing some new strategies. We recommend an initiative that can have immediate and long-term impact by focusing on 1) Journal delivery enhancements; and 2) Information fluency training. Journal delivery enhancements would include: a) increased distribution of TEEAL sets in Africa and South Asia; b) development of a cluster of interactive African-centric online journals to promote development and exchange of local content; c) digitization of important contributions from Indian agricultural science publications; and d) a current alerts pilot project in Africa that would deliver to information gatekeepers, such as network managers and librarians, regular updates about the latest articles available in AGORA and OARE for specific priority fields. Information fluency training would involve a) developing a post-graduate program in Agricultural Information and Communication Management and

an Agricultural Information and Communication module to be incorporated into agriculture Master's and Ph.D. programs; b) scaling up train-the-trainer workshops for TEEAL, AGORA, HINARI and OARE; and c) a Library Strengthening component with north-south and south-south library fellowships and exchanges.

## Project Description

### Part 1: Journal Delivery System Enhancement

*1.1 International Journals*

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 to a research library with the highest quality international 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). However, in most African countries, lack of Internet connectivity, inadequate bandwidth, no or reduced library budgets, and low information fluency skills among librarians, faculty and students limit full use. 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. This proposal outlines a plan for improving the effectiveness of these programs.

TEEAL: The TEEAL program is currently redesigning the interface for the TEEAL database. Because Internet access has not progressed as rapidly as hoped, TEEAL is still needed for many institutions in Africa and elsewhere that have limited bandwidth. This initiative proposes to set up a competitive application process for obtaining a TEEAL set with updates for eligible institutions and consortia. Many donors have resisted funding TEEAL sets for individual institutions because they do not want to handle small ($5000) grants. A large fund that can be devoted to increasing the distribution of TEEAL should be created, with criteria for selection of institutions set by a screening or advisory committee. TEEAL could also work collaboratively with online content development projects to help facilitate offline delivery options.

AGORA: System enhancement for AGORA has been funded by supporting institutions, such as FAO and other donors, such as DFID. This proposal will focus more on training for AGORA. Enhancing and expanding AGORA training programs can lead to greater uptake of the program and improved skills among the user base.

*1.2 African Agricultural Innovations - a New Journal Model for African Agriculture*

The tradition of publishing in African-based scholarly journals is not strong and journals have struggled to survive. A new electronic delivery model for regional journal content in specific subject areas is needed. Journals covering the needs of the researchers in the region ensure that local content is available to African researchers. One of the most successful journals currently is African Journal of Crop Science. This journal should be approached to consider participating in this project, which proposes the development of a new approach to online journal publishing. A new journal, potentially to be titled, African Agricultural

Innovations would be similar to the Nature Journals or American Journal of Physiology, which are both published in multiple subject components. Some of the following features could be considered for incorporation into the journal:

- Topical clusters —dairy, fisheries, food science, biotech, crop science, plant breeding (could be linked to AGRA initiative/ACCI), etc.
- Awards —article of the week or month, most highly cited
- Publish articles pre-peer review and facilitate online review of articles
- Allow for multiple layers of review and reader commentary, with provision for article rating by all readers
- Ability to create article ratings and measure number of hits, downloads, time on site
- Solicit articles covering different levels of research —action research, user research
- Links to research data files related to articles
- Research voices from the "field" —farmers share results of field trials, etc.
- Research wanted —questions farmers or other readers would like a researcher to answer — "Ask the Scientist" monthly column
- "Research templates" – 2 or 3 types of methodology that can be plugged in for a research project
- Research from our neighbors —Africa-South Asia sharing
- Student publishing —use contact information for all students who made dean's list, invite them to publish paper in the journal —give award for best article of the year, "junior agricultural scientists"
- Reader community à la Facebook (targeted readers —faculty, students, researcher, secondary readers extension, input dealers; special targeted audience for mobile edition – farmers and extension workers)
- Students/Extension agents do article extracts for mobile phone delivery
- Ag puzzle of the month —a grower's problem is solved —who can come up with most innovative solution —give prize or certificate to winner
- "Little known facts" in agriculture regular feature

French- and Portuguese-language journal equivalents should be considered for Francophone and Lusophone African countries, respectively. System architecture could be shared by the journals. Journal editorial boards would be comprised mainly of subject experts from Africa.

The likely business model for this journal content is open access. Revenue for sustainability could be generated using a variety of techniques including ads, sustaining memberships, job postings, etc. The African Journals Online (AJOL) http://www.ajol.info/ experience and business model exemplifies both the successes and challenges of online journals in Africa.

### *1.3 South Asian Scientific Literature*

The State Agricultural Universities (SAUs) of India have a long tradition of journal publishing. Currently these universities publish many journals to disseminate their research, but these journals are currently only available in paper and vary in quality. A program to move these journals into the online environment is needed, including a program to digitize back content. This would allow researchers across the 41-university system to access the content. While developing an online delivery system for sharing all of the current Indian agricultural journals would significantly enhance the availability of this research information, developing a more interactive system based on the proposed African model above would transform the Indian agricultural publishing system. It may however be more difficult to move into this new model because the standard publishing model is already in place.

### *1.4 Current Alerts*

Keeping up-to-date in one's research field is a key part of any researcher's, professor's or extension worker's job. Graduate students also need to access key new research literature. Actively seeking the newest and best literature can be challenging and time consuming, particularly when Internet connectivity is limited as it is in many African and South Asian countries. Traditionally services such as Current Contents and database alerts offered information about new articles, but said little about the quality of importance of any one article. Collaborative technologies now offer new ways of finding, recommending and rating the latest published research articles. For example, time invested by one soil scientist can be shared across the soil health community if the right technical infrastructure is put in place. In biology and medicine, a tool called Faculty of 1000 http://www.f1000biology.com/ offers an example of this type of service. This proposal envisions establishing a collaborative and evaluative alerting service for researchers in key areas of agricultural research in the developing world. One or two key subject sub-categories could be chosen for a pilot.

## Part 2: Agricultural Information Fluency Program Development and Implementation

### *2.1 Short-term Training: Resource-based training on AGORA-TEEAL-HINARI-OARE and other information resources—Train-the-Trainers workshops*

AGORA and TEEAL currently offer national-level workshops throughout Africa. Demand for these workshops always exceeds capacity, so this program should be expanded. Workshops in English, French and Portuguese should be offered across a diverse geographic range in Africa. Workshops could also be offered in eligible countries in South Asia. The number of workshops may depend on the country and the number of agricultural research and teaching institutions in that country. In addition to AGORA-TEEAL-HINARI-OARE, short-term training is appropriate for other information resources and systems, such as developing skills with Web 2.0 technologies, developing wiki content, management of information databases and repositories, digitization and digital preservation, among other topics. AGORA and TEEAL have partnered in the past with a number of organizations offering training in similar areas, including FAO which offers its IMARK program as well as AGORA. The Information Management Resource Kit (IMARK) is a partnership-based e-learning initiative to train individuals and support institutions and networks world-wide in the effective management of agricultural information. IMARK consists of a suite of distance learning resources, tools and communities on information management.

### *2.2 Library Strengthening*

In order to expand the core group of African library professionals who are able to teach higher level information literacy skills in agricultural sciences and to become advocates for integrating information literacy into the curricula of their universities' and institutions' educational programs, short-term fellowships and exchanges will be established. These will enable librarians from Africa and India to spend time at advanced libraries in their own countries or in the US or Europe to improve their skills in such areas as digitization, instruction, IT support, outreach, etc.

### *2.3 Long-term Training for Agricultural Information and Communication Management*

The AICM (Agricultural Information and Communication Management) program would endeavor to fill a gap in most agricultural training programs in African universities, whose graduates lack adequate capacity to integrate ICT in communicating agricultural knowledge, while ICT/M graduates lack specific knowledge to effectively package and communicate new developments in science. Intervention at the postgraduate level is intended to produce AICM experts with competence to develop and operate agricultural information systems, carry out research on issues relating to the use of agricultural information and provide professional AICM support. The goals of the proposed program are to enhance the competency of professionals in the agricultural field and other development workers in managing and communicating agricultural information for accelerated development and poverty reduction, and to strengthen the capacity of universities to provide high-level education and research services in AICM. The program is expected to produce consistently competent graduates with adequate AICM skills to take on development challenges that impact positively on agricultural productivity in Africa. Target beneficiaries include graduates of various fields of agricultural and social sciences; and all cadres of development professionals working in the areas of agricultural research, education, information and communication who need retooling to professional levels in AICM. In this manner, the program endeavours to promote career development in a way comparable to the MBA programs. The program will also seek to enhance the capacities of universities to train in AICM and to develop centres of excellence in this field.

The AICM program comprises 1) an MSc program and/or post graduate diploma (PGD), both of which target graduates and professionals from a variety of backgrounds, and 2) a course module that will be incorporated into on-going MSc programs in agriculture and related fields to enhance their ICT/ICM content. The MSc and PGD offer core course work focusing on information science and technology, agricultural sciences and agricultural information and communication. Specialization areas include agricultural knowledge management, agricultural communication management, records and archives management, scholarly publishing and Web resources management and others to be developed over time. In addition to the academic components, the program will run an institutional strengthening program with collaborative and interactive schemes aimed at enabling universities to effectively deliver the proposed curricula and to facilitate the development of AICM as a profession and discipline.

The program will operate through a network of participating universities supported by a regional secretariat. The universities and the regional secretariat will establish and maintain a close link with strategic partners including donor organizations, non-university organizations, civil society organization and relevant government departments, who will also contribute to the management and sustainability of the program. Quality assurance will entail an accreditation program as well as monitoring of program implementation and quality of graduates at both the university and regional levels.

It is envisaged that the regional secretariat of the AICM program should be hosted by a reputable organization involved in the coordination of research and training at the tertiary level.

### Primary Customers and How They Will Benefit from the Project

The primary customers for journal systems and information fluency training are faculty, researchers and students in the agricultural sector. Access to the scientific literature is essential for these stakeholders to perform in their roles. Extension staff can also benefit from these resources. The farmer benefits indirectly through the enhanced effectiveness of the other groups and conversion of these research level materials into information for the practitioner. Extension has historically been linked to the research community, and this link is essential for progress at the farm level. Targeting NARS and agricultural schools/faculty in Africa to create awareness and increase use of online resources will be a key component. An ongoing assessment of tertiary education in Africa could also help target training efforts.

Beneficiaries of long-term training include graduates in various fields in agricultural and social sciences, development professionals working in the areas of agricultural research, education, and information/communication who need retooling to professional levels in AICM.

Short-term training program beneficiaries include information professionals and faculty/researchers who are upgrading their skills to use innovative new information technologies to deliver state-of-the-art services.

The geographic target is sub-Saharan Africa and South Asia; the TEEAL and AGORA programs have been active in this region since 1999 and 2003, respectively. This new program proposal would have wide impact. Implementation should be at the regional level in Africa, and start with India in South Asia. Sub-Saharan Africa has over 1500 agricultural universities and research stations. India has 41 state agricultural universities and multiple research centers.

### Day in the Life

**Pre:** Programs such as TEEAL and AGORA have been successful in addressing some of the information needs of researchers, faculty and students. These programs, however, are underutilized because of less than optimal distribution of the TEEAL database system and inadequate access to the Internet to take full advantage of AGORA. Outreach and support for these programs needs to be increased to allow more institutions to take advantage of them. The model works; it just needs a boost.

Availability of literature from the developing world lags behind. According to FARA's report, Agricultural Research Delivery in Africa: An Assessment of the Requirements for Efficient, Effective and Productive National Agricultural Research Systems in Africa, the publication performance of the NARS is poor. There is a need for agricultural scientists in the developing world to make their research available to the wider global scientific community and among themselves.

**Post:** Access to research affects smallholders (including women) at multiple levels. Examples abound where literature reviews on TEEAL, AGORA and HINARI 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. In summary, the journal delivery programs enhance the output of the researchers and faculty, and the training programs build the skill-base for developing and delivering agricultural content, targeting it for the appropriate audience.

## Evidence of Success

TEEAL was first released in 1999 and is currently undergoing a retooling of its interface. It has operated in a self-sustaining mode for approximately 5 years. This proposal focuses on enhancing this currently successful program. AGORA has been in place since 2003 and has a commitment from the participating publishers through 2015 in synch with the Millennium Development Goals. 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.

FAO, ITOCA, CTA, INASP and others have done a significant amount of short-term training. The HINARI-AGORA review found that uptake of these programs was significantly increased where training workshops had been offered.

The African Crop Science Journal was established with the primary objective of providing a forum for presentation and review of research results on tropical crop science that can be readily accessed by researchers and development leaders in Africa and other developing countries, as well as all those concerned with agricultural development issues in the region. This journal, which has been published since 1996, has demonstrated quality and sustainability. This was in response to an identified need.

## Project Assessment

### *Journal Systems*

Measures of success: Regularity of journals, subject coverage, citations to journal, PDF downloads, use outside of region of origin

### *Short-term training*

Measures of success: Increased use of resources covered in training, e.g., AGORA PDF downloads, more efficient use of web resources, implementation of training topics, e.g., use of Web 2.0 technologies in home institutions.

*Long-term training*

Placement of graduates, more information literacy courses in university curricula

### Force Field Analysis

The post-graduate training and new online journal development will be the more complicated initiatives to develop and sustain. However, their likelihood of success will be enhanced by the rapid implementation of the shorter term components of the proposal such as wider distribution of TEEAL and T/A/H/O workshops, which are largely a matter of scaling up existing activities.

### Expected Cost Categories

- TEEAL competitive awards program
- Staff for training (ITOCA)
- Content and IT personnel for Current Alerts program linked to AGORA
- African Agricultural Innovations - journal development
- South Asian Agricultural journal development
- Training materials
- Short courses and workshop expenses
- Library strengthening fellowship and exchange expenses
- Post Graduate AICM Program
- Coordination (Secretariat with Coordinator and operations budget)
- Universities (training courses; staff development; publications; infrastructure)
- Monitoring and Evaluation
- Communication and overall project administration

### Timeline

TEEAL sets and T/A/H/O training workshops could be implemented within the first year, with up to 6-8 national workshops organized, depending on funding, and 50 to 100 LanTEEAL sets distributed with appropriate backstopping and follow-up. Workshops would continue throughout the 5-year period with the program being refined as trainees became more advanced. The first phases of the current alerts, post-graduate training and online journals components could be operational by years 2 or 3, with further development proceeding in successive years.

## Duration of Project

- 5-year initial funding with review

- 5-year second phase for continued refinement enhancement of short- and long-term training programs and continued development of journal publication programs

## Potential Project Partners

*Journal systems*

- Makerere University (African Crop Science Journal)
- Other African agricultural universities
- ACCI/WACCI – plant breeding specialty journal in African Agricultural Innovations
- Haryana University and Tamil Nadu universities
- Cornell University
- FAO
- INASP/AJOL
- Forum on Agricultural Research (FARA) and subregional organizations (SROs)
- Publishers, such as AAAS, Faculty of 1000
- NARS

*Training*

- RUForum
- "Model" University for South Asia
- Cornell University
- Other agricultural universities in U.S. and Europe (Wageningen, University of Reading, University of Ireland, etc.)
- Information Training and Outreach Centre for Africa (ITOCA)
- FAO
- CTA
- NARS
- IARCs – International Agricultural Research Centers
- FARA/SROs

## Literature Review

Aguolu, I. E. (1997). Accessibility of information: A myth for developing countries? *New Library World*, 98(1132), 25.

Aronson, B. (2005). Journal access programs For developing countries: Who has access to what, and does it work. Paper presented at the *UK Serials Group (UKSG) 28th Annual Conference and Exhibition,* Heriot-Watt University, Edinburgh. from http://www.uksg.org.uk/presentations5/aronson.ppt.

Aronson, B. (2004). Improving online access to medical information for low-income countries. *The New England Journal of Medicine*, 350(10), 966-968.

Arunachalam, S. (2003). Information for Research in Developing Countries—Information Technology, a Friend or Foe? *International Information and Library Review*, 35(2-4), 133-147.

Bergman, S. S. (2006). The scholarly communication movement: Highlights and recent developments. *Collection Building*, 25(4), 108-128.

Busagala, L. S. P. & Msuya, J. M. (2007). Awareness and skills of the Tanzanian researchers about scientific literature searching on the internet. *The South African Journal of Clinical Nutrition*, 15(2), 18.

Dulle, F. W. & Lwehabura, M. J. F. (2004). User information literacy: Challenges facing university libraries towards effective implementation. *African National and University Libraries (Standing Conference)*, Kampala, Uganda.

Hesse, E. (2003). Assessment of the readiness of libraries in Uganda, Kenya, and Ethiopia to access online scientific information resources (particularly AGORA). Consultancy report to the Agricultural and Rural Development Department of the World Bank. from http://www.ciat.cgiar.org/biblioteca/Documentos/Africa28aug03.pdf.

Katikireddi, S. V. (2004). HINARI: Bridging the global information divide. *BMJ (Clinical research ed.),* 328(7449), 1190-1193.

Long, M. (2008). Bridging the knowledge gap: The HINARI programme. *The Biochemist*, 25(6), 17 March 2007.

Lundy, M., Carlos, F. O. & Rubert, B. (2002). Value adding, agroenterprise and poverty reduction: A territorial approach for rural business development. Paper presented at the *First Henry A. Wallace Inter-American Scientific Conference, "Globalization of Agricultural Research.*" Turrialba, Costa Rica.

Lwoga, E. T. & Sife, A. S. (2007). African web-based animal health information: Analysis of online databases. *University of Dar es Salaam Library Journal*, 9(1)

Makings, S. (1967). *Agricultural problems of developing countries in Africa*. London: Oxford University Press.

Mukiibi, J. & Youdeowei, A. (2006). Executive summary and strategic recommendations. *Agricultural research delivery in Africa: An assessment of the requirements for efficient, effective and productive National Agricultural Research Systems in Africa*. Accra, Ghana: Forum for Agricultural Research in Africa (FARA).

Nyika, E. (2006). Development of an African marine science repository for electronic publication Odinpubafrica: Experience of the Institute of Marine Sciences, University of Dar Es Salaam, Tanzania. Paper presented at the *Open Repositories 2006 Conference*, Sydney, Australia. from http://www.apsr.edu.au/Open_Repositories_2006/edna_nyika.ppt.

Ochs, M., Aronson, B. & Wu, J. (2004). HINARI and AGORA: Revolutionizing access to scientific information in the developing world. *Serials: The Journal for the Serials Community*, 17(2), 175-182.

Rosenberg, D. (2006). Towards the digital library in africa. *The Electronic Library*, 24(3), 289-293.

Scott, J. C. (2006). *HINARI/AGORA usage review*. Unpublished manuscript.

World Health Organization (WHO). (2006). *Access to the world's leading journals*. Information brochure on HINARI and AGORA. Geneva: WHO

Wu, J. (2003). The FAO David Lubin Memorial Library, AGORA and information for developing countries. Paper presented at the *The Abdus Salam ICTP Round Table on Developing Countries Access to Scientific Knowledge*, Trieste, Italy. from http://www.ejds.org/meeting2003/ictp/papers/Wu.pdf.

Wu, J. & Ochs, M. A. (2007). AGLINET, AGORA, et al.: Enhancing access to information in support of research and extension in the developing world. *Information Development*, 23(1), 55.

# 8. Multimedia Knowledge Exchange Systems for Smallholder Farmers

## Executive Summary

Small and marginal farmers often lack knowledge that could immediately improve their livelihoods. But, to educate such a vast, scattered population, two key areas need to be developed: content production and distribution. Classical extension programs have typically 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, often 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).

This proposal seeks to use locally recorded video and audio, dispersed through "mediated instruction", integrated with existing extension systems. Because audio-visual formats are likely preferred by mostly illiterate, visually oriented groups, the idea is to encourage the use of audio (radio) and video (using a 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 or village knowledge worker, who is not necessarily a subject matter expert, is present to pause or playback the material, ask questions, encourage discussion, and otherwise stimulate participation. It is known to be a very effective use of recorded media for education. Information and instructional solutions cannot be solely technical. Social integration must be part of the solution. Building on extension systems takes 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 become a mechanism to capitalize on natural social dynamics to amplify a single extension worker's ability to communicate agricultural practices. The relationship that is developed between the content and the people involved in this approach will serve as a natural feedback mechanism. Devices, such as mobile phones and custom communication devices such as the Advancement through Interactive Radio (AIR) device, that are suited to local conditions and appropriate content being exchanged will be used to capture this feedback.

The initial phase of the project will involve about ten organizations that are either involved in agricultural extension or research. Agricultural research partners will be drawn from existing institutions, such as CGIAR, ICAR, and government-university departments of extension. And, partnerships with local community-level groups, such as non-governmental organizations like GREEN Foundation or Myrada, will be developed to establish rapport with farming communities. These partnerships will be coordinated by an international group of agricultural research and extension experts. This group will be responsible for motivating and training agricultural researchers to produce locally relevant and scientifically correct content. For content distribution, the consortium will have a significant role in improving the pedagogy and training of Village Knowledge Workers and extension staff. The consortium would establish regional hubs through local partners to initially bolster the content production and distribution activities. These hubs would serve as central sites for managing digitization and administrative processes.

To support the effective exchange of content amongst all stakeholders, an information system that supports user-generated media types and organizational features, including tagging and search, will be created. Though this repository will have a web-based interface, we also envision supporting

asynchronous access capabilities using robust networks such as shipping DVDs across the postal system to ensure the exchanges with the first-kilometer content consumers and producers. Traditional broadcast programs allow only a small number of one-way streams that are consumed by a vast number of content consumers. But broadcast models are poor ways of delivering customized content and allowing two-way exchanges. A main objective of this system is to provide high-bandwidth, any-to-any, point-to-point communications, which in turn enables a high degree of content customization and rich two-way exchanges, without waiting for the fat network pipes of the internet to reach these rural areas. For example, a New Agricultural University, particularly one that follows the paradigm of using facilitated video instruction to support curriculum development, might consume content that was produced in the field to improve the practical applicability of their courses as well as generate relevant content that could be distributed in the field. Our vision is to build a web-like network, targeting the vast segment of the society in developing countries, like India, that is beyond the conventional web today. Instead of relying on the costly infrastructures of traditional broadband, satellite, or even computers, this system uses inexpensive devices like mobile phones, radio, DVDs, TVs, DVD players, and camcorders.

### Project Description

The overall goal of the project is to disseminate targeted agricultural information to small and marginal farmers using a cost-realistic media exchange that is supported by existing, people-based extension systems and local facilitators, and rests on a number of key principles:

- Digital audio and video: This project is enabled by recent advances in digital audio and video technology, including low cost camcorders and PC solutions for editing digital audio and video. These advances greatly lower the cost of the project, and also allow local development of audio and video content. For example, the Advancement through Interactive Radio (AIR) project has developed a device that addresses the unidirectional limitations of community radio by providing a mechanism to communicate with the station from their work and home locations, and influence programming to make it more relevant to their livelihoods.
- Mediation: Audio lessons or videotaped demonstrations are not a complete extension solution because they lack the interactivity that is the hallmark of good extension. Our model relies on a local facilitator or Village Knowledge Worker, whose role is to occasionally pause the audio or video in order to engage the audience with discussion and in-class exercises.
- Target multiple levels of content production and consumption: The project includes instruction between institutional researchers and community-level organizations, community-level organizations and farmers, farmers and other farmers. There will be considerable synergies between the levels, and also opportunities for sharing content and infrastructure. One strength of the multi-level approach is that it will help link smallholder issues into broader agricultural education, research, and policy.
- Training: It is not sufficient to simply produce materials. It is also necessary to help researchers, extension staff, and Village Knowledge Workers to develop the skills to deliver the materials.
- Content localization: It is important that educational materials are relevant to local conditions (crops, climates, soils, farming practices). The use of audio and video provides opportunities for customization of materials.
- Partnerships: The emphasis of the project is on the development and delivery of digital content that can be used by organizations involved in agricultural research and extension. These are to

be used by partners who have existing research and extension programs, and who have considerable autonomy on how materials are consumed and produced. The goal is to strengthen existing institutions and groups – not to create new ones.

- Community based content: The project has will have an open model for dissemination of content so that they are freely available, by everyone, for use.
- Cost realism: To be successful and sustainable, this program must operate in environments with limited infrastructure and financial resources. This means paying attention to costs at all levels, and limiting the investment in expensive equipment. High bandwidth internet connections will not be necessary for participation in the project, since one option for receiving the audio content is by radio and video content is by DVD.
- Feedback: Enabling anyone to be a content producer and consumer can empower first-kilometer communities to have a voice. This is an advantage of the approach, but it will be difficult to manage accountability and feedback for such a diverse and geographically dispersed audience. Consequently, we propose to use audio and video media to capture new types of content (e.g., audience requests and responses) and textual media to collect general statistics on the time, location, attendance, etc., of showings. The latter task might be facilitated by using a SMS server to aggregate and publish data that was collected from SMS messages sent by Village Knowledge Workers after each showing to provide near-real-time reporting of field-level activities.

***Structure***

The project will have an oversight body, made of agricultural, education and informational specialists which will guide the development of establishing partnerships with agricultural research and community-level groups; bootstrap the initial phase of content production and distribution to generate a critical-mass of contributors; develop and support an information system for exchanging content and feedback; evaluate progress and iteratively evolve the approach; and provide some administration for the project. This group will be an international group of experts, drawn from the fields of Agriculture Research and Extension. The group will be formed at the start of the project, with some rotation of members through the duration of the project. Regional consortia of research institutions and community-level organizations will be put together for the development and deployment of the courses. Each consortium will consist of roughly ten groups from the same region. To the extent possible, the consortia will be built from existing groupings of institutions, such as CGIAR, ICAR, and government-university departments of extension. And, partnerships with local community-level groups, such as non-governmental organizations like GREEN Foundation or Myrada, will be developed to establish rapport with farming communities. These partnerships will be coordinated by an international group of agricultural research and extension experts. One of the organizations in each consortium will be a hub, which is a central site which manages the digital archive and performs some administrative functions. Ideally, the hub will have both a strong agriculture research as well as an extension department. Involving a research department will allow the content produced by the community-level groups to undergo scientific review. Organizations in the consortium will both produce new content and distribute content created by the other partners. Organizations will determine the combination of media that is both cost-realistic and locally appropriate for the conditions of their region. For example, radio might be used to broadcast awareness messages while facilitated video showings might offer specific instructions on a particular practice. Organizations would be given independence to produce and distribute the content that is appropriate to them. The goal is to give individual organizations maximum flexibility in how they use the materials. Still, the oversight body would use investments in shared infrastructure, such as radio and Village Knowledge Workers, to establish accessible resources for agricultural information at the community level. Moreover, the oversight body would also be available to consult on matters of content, technology, and mediation.

One of the most important aspects of the media exchange system is the inclusion of local farmers in the content production process. This is a subtle but critical feature. The placement of the farmer in a video is based on the fact that other farmers in the area are more likely to adopt a practice that is already being implemented by their neighbors. As an added benefit, the potential to be featured in media that is distributed to others can be used as an incentive in and of itself for the farmer to adopt a practice. Farmers themselves may also contribute insight or techniques during content production. It is important that this possibility is not over-romanticized – in the vast majority of cases, the expertise does lie, in fact, with the extension officer, and the primary value of the farmer's participation is to demonstrate willingness to learn.

As to the content, community-level extension staff and Village Knowledge Workers would be best attuned to the needs and local variations in what information should be provided to the farmer, and so by hitching the recording process to an existing extension system, appropriate content can be naturally generated.

*Activities*

There are several possible ways to make progress on this proposal:

Working with community-level organizations: An agricultural expert at a community-level organization can record the best agricultural practices that are applicable in a local region in audio or video form. This organization could hire a local facilitator or Village Knowledge Worker in a village to facilitate audio and TV showings. The Village Knowledge Worker would facilitate meetings, record questions and hand out materials that are discussed in shows. The facilitator then communicates with the organization's expert to better inform him or her of the needs of the local village. The expert can then use this village visit to target feedback. It is important to realize that we see it as an exchange rather than dissemination in a two-way dialog that can produce new knowledge.

Working with the government: Government extension systems have widespread coverage, and can be revamped by training them on audio- and video-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 government 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.

Working with existing development communication efforts: There are existing channels like India radio and public announcement systems that can be encouraged to use an interactive component, such as the eTuktuk (which just won the Stockholm challenge award) of narrowcasting by rickshaw. This is useful in places where there are local newspapers or "citizen journalist," like Zambian villages. In order to leverage the skills and interests of such groups, aptly placed billboards can disseminate urgent messages like "how to tuck in a malaria mosquito net."

Encouraging content from the farmer: While there are farmers who are real experts in their profession, they are often dispersed geographically and reliable traditions are often lost. Training the local farmers in the use of audio and video equipment, entrusting the equipment to local farmer-based organizations as a public good, and creating a way for them to post the recorded cassettes to a regional hub for processing would help collect and maintain local knowledge. Increasingly, social science research suggests that local knowledge is important, and participatory activities can alleviate biases within a community so that women, for example, could achieve merit-based equality that stymies the emphasis on caste and historical gender roles.

Having agricultural universities produce content: The real experts are often at universities. The idea is to stimulate audio and video content creation by simply encouraging extension workers and smallholder farmers to record their innovations. Their documentation offers a tangible product to encourage collaboration with university faculty, NGOs, and government extension staff through audio and video.

## Primary Customers and How They Will Benefit from the Project

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

### *Days in the Lives of Participants*

The multimedia exchange system should consist of (1) a participatory process for content production, (2) a locally generated digital media database, (3) human-mediated instruction for dissemination and training, and (4) regimented sequencing to initiate a new community.

### *Participatory Content Production*

The cycle begins with producing content. The videos could be captured using inexpensive camcorders, and audio could be captured with simple microphones. The majority of the media that will be produced should be instructional in nature. Instructional media are recordings of demonstrations that are made when an extension officer demonstrates new techniques to a farmer.The content producer should enforce a format in instructional content. For example, the production may include (a) a brief verbal overview of the process, (b) an itemization of the required resources and associated costs, (c) step-by-step instructions in the field (d) a showcasing of the uses and benefits, and (e) interactions with farmers to address common questions and concerns. Some advance "lesson planning" in the form of informal storyboarding could be used.

Content producers could be university scientists, NGO experts, field staff, progressive farmers, and other volunteers from the local community, with the most common producers of content being community-level extension staff. Extension officers could perform their regular extension duties, which mostly take the form of field assessments or demonstrations, and capture their interactions with farmers on a camcorder. In this way, an extension officer could produce one or two clippings per field visit.

### *Locally Generated Media Exchange*

Content recorded in the field, like all raw footage, would presumably be unusable as is. A video editor who has basic computer literacy, some bare understanding of the nature of the content, and who can be trained in the basics of media post-production would be required at each hub location. Media editors are the second and final point where the aforementioned recommended format of instruction video is ensured. Editors can check for the accuracy, clarity, and completeness of the content. Where content is missing, they can send content producers back into the field to gather missing footage. A minimum amount of titling and metadata could also be added for indexing in the information system, including tags for geographic location, language and thematic category.

Media could be digitized on a PC and edited using simple non-linear editing software. The media could then be either mailed via CD, DVD, or directly uploaded (if adequate bandwidth is available) to a hub site where this content could be made available for public use on a website under a Creative Commons license.

*Mediated Instruction for Dissemination and Training*

The principal means of distributing media from the media database to a village would be by physically mailing or couriering DVDs, with villages provided a minimum of either a radio or TV. In each farming community, Village Knowledge Workers would be hired on a part-time basis. These facilitators would be members and residents of the same communities with which they share content, to reduce the logistical challenges of regularly visiting a village and to provide local access to agricultural knowledge from a familiar source. Each week, the mediators could conduct a minimum of three showings per week during suitable evening hours. They would transport the media equipment (e.g., radio or TV) to different segments of their communities, maintain attendance records, and track the interest and adoption of promoted techniques. These mediators would be additionally supported by a full-time extension staff (e.g., belonging to a government or community-level organization), which provides mechanisms for feedback and audit for a cluster of villages.

Villages usually do not have a public forum in which farmers regularly gather, so location and timing of the screenings is a major concern. Because of the extensive time demands of farming, farmers might be able to take only a short diversion from their daily routine in the evening. In addition, political and socioeconomic differences within village communities rarely permit all the farmers to gather in one place at one time. Several small groups could be formed within a single village to show content on a regular basis, based on the availability and interests of the group. Since the screening locations preferred by each small group may differ, multiple screenings could be scheduled each week on a rotational basis. Actual locations would be left to the extension staff and the Village Knowledge Worker, who might choose from among bus stands, schoolhouses, storefronts, individual homes, and streets.

Extension staff would use this system as a tool to support their regular duties, and might require some training for its optimal use. Since extension workers often come from various backgrounds, the content could be used to train and standardize their interactions with farmers. In addition, the staff could be shown how to integrate the content into its existing extension activities through "teacher training" sessions run by a senior extension officer or a non-governmental organization. Training would introduce staff to the system, available content, and proper screenings techniques. Mediation itself and training in mediation is a critical element, so it is important that they follow the guidelines of established pedagogy for mediated instruction.

*Regimented Sequencing for Initiation*

Introducing a village to new agricultural practices cannot occur with a single showing. Communities should be approached in a particular manner and order: First, a village gathering can be organized in a central location to showcase highlights of the services that will be provided; interested farmers could be identified; new content would be recorded, with extension staff introducing a particular practice to the identified farmers in the field; informal screenings of content of peer farmers would be held; then, small groups of interested farmers would be formed with a regular schedule of content screenings (as described in the previous subsection); finally, community participation would be encouraged through peer pressure to learn, adopt, and innovate better agricultural processes.

Small groups that will regularly participate in the recording and screening content may be founded within formal structures of local farmer cooperatives and self-help groups (SHGs) or can be initiated by the system itself.

The ordering of content itself is important, and it will be crucial to first present practices which are known to have immediate results for the farmer. Local extension staff will be able to assist in determining the sequence of the content to be shown. Recently recorded videos which feature local farmers would be especially interesting for those interested in seeing themselves "on TV". As recordings would happen in season, they would be aligned with what other farmers are interested in seeing.

## Literature Review

The use of media in agriculture extension is by no means new, and this proposal was inspired by a number of different projects. These can be broadly categorized as IT for agriculture, video in agriculture extension, and mediated instruction for effective training with video. Ultimately, the hope is that this proposal is able to weave together the best of these three strands of work into a single system that maximizes the impact of agriculture extension workers.

### *IT in Indian Agricultural Development*

Several groups have sought to provide information to Indian farmers using technology. ITC's widely acclaimed e-Choupal initiative and Hindustan Lever's iShakti program were designed as kiosk-based web portals that would provide real-time weather forecasts and customized information to help farmers better manage their crops. e-Choupal has demonstrated success in streamlining the supply-chain for grain production; however, both e-Choupal and iShakti have faced difficulties in enabling farmers to recognize value from information that cannot directly be incorporated into their existing operations. IIT Bombay's aAqua is one service that has been deployed in kiosks to allow farmers to ask questions to agri-professionals over the Internet. Farmers typically receive answers after 24 to 48 hours, and there are indications that farmers trust the information that they receive. The e-Sagu system was established on the alternative assumption that farmers are unable to ask the right questions. In the e-Sagu system, local coordinators obtain the weekly crop status of a farmer's field by taking digital photographs. These photographs are compiled on a CD that is mailed to agricultural scientists at the university, who prepare personalized advice for each farmer. The system has shown that farmers can realize significant economic benefits with targeted expert support.

Whereas the e-Sagu system follows a push-based model that details how individual farmers should proceed on a weekly basis, aAqua captures farmer requests for information on a needs basis. Both systems have shown success in field trials, and both also require available experts to provide advice on an individual basis. In addition, aAqua depends on a farmer's ability to compose an appropriate query that can be sent via a SMS-enabled phone or a PC kiosk with Internet access. e-Sagu assumes these incapacities of farmers, but does not attempt to improve farmers' decision-making abilities in its push-based model. Recent efforts to provide agricultural information relevant to a farmer in a sugarcane cooperative was undertaken by creating a local SMS server and using SMS enabled mobile phones (Warana Unwired) to access the information. It was demonstrated that the phone-based system was better than the existing PC-based system.

### *Media in Agricultural Extension*

Many organizations involved in agricultural development tend to use a variety of media to reach the masses. For example, the Developing Countries Farm Radio Network (DCFRM) built repositories of scripts that organizations can use for community radio programs. There are 800 community radio stations in Sub-Saharan Africa alone, up from 10 stations 2 decades ago. Radio also covers over 80% of the sub-Saharan African area, where cell phone coverage is at 50%. Many farmers are not going to enjoy cell phone coverage for years to come. Others, such as the Government of Karnataka, sponsor daily agricultural programs on public television broadcasters, like Doordarshan on Krishi (farm) radio; and supplements in newspapers, like Prajavani. Some farmers may have access to these media sources, but the programs are typically produced by experts of a different socioeconomic status in model conditions. Consequently, only the most progressive farmers tend to connect the programs with improving their personal farming operations. Broadcast television programs and mobile cinemas have been used in agricultural extension system throughout the world, including the United States, Kenya, Nigeria, Uganda, and Fiji. The videos may complement T&V-based approaches to generate mass awareness. In the late 1970s, the World Bank supported the deployment of the PRODERITH system, which incorporated aspects of participatory video production and distribution in Mexico's tropical wetlands. Over 700 videos were produced, and PRODERITH successfully increased the incomes of 3,500 by 50-percent between 1977 and 1984. The Food and Agriculture Organization (FAO) of the United Nations also 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. These projects and others, such as Deccan Development Society in Hyderabad, India, have successfully demonstrated the potential of using participatory video. Earlier, however, audio-visual technologies were cost-prohibitive but these costs have fallen dramatically in the last decade. A 1996 FAO study suggested that audio-visual training activities would cost one-third to one-fifth of classical extension training. On the other hand, kiosk-based interventions to connect farmers with expert information using PCs continue to be impractical for the rural conditions of the developing world, which include illiteracy and undeveloped infrastructure. Furthermore, farmers prefer interpersonal methods of receiving information on new or innovative farming practices over mass media methods.

### *Tutored Media Instruction*

In the 1970s, Jim Gibbons pioneered the use of Tutored Video Instruction (TVI) at Stanford University. Under the TVI approach, minimally edited videos of unrehearsed lectures were viewed by groups of students assisted by a "para-professional" mediator. The mediator engages students by interrupting the video lecture and asking questions and replaying segments as necessary. Gibbons showed that students in TVI sections of an engineering course performed better than those that watched the videotapes alone, even out-performing the students who attended live lectures. The University of Washington's Department of Computer Science and Engineering similarly attempted to use TVI as a method to offer courses to local community colleges. The experiment showed that integration of video production and distribution into existing social and organizational structures is critical to their acceptance and relevance. The Interactive Radio Instruction project that was run by EDC has been a major project supported by various development agencies for decades. The project works by taping a radio show, playing it in a classroom with pauses for instruction coming via the satellite. The Digital StudyHall (DSH) project has extended the TVI paradigm by digitally recording the lessons of good teachers in urban centers, collecting the videos in a database, and distributing them on DVDs via the postal network to poor rural schools. DSH resolves the "impedance mismatches" that exist due to the socioeconomic differences of an urban school and a rural school by localizing content in slum schools.

*Infovation Flow*

This proposal differs from previous work by using cost-realistic technologies, like TV and radio, to build the capacities of farmers to be able to better manage their agricultural operations. The audio and video-based content improves the diffusion of better farming practices and reduces the expert support required for each farmer. The videos are localized to a region and feature the participation of familiar farmers, as opposed to experts in idealized conditions. In addition, Village Knowledge Workers facilitate the showing of these videos to ensure that farmers personally connect with the content on a regular, accessible basis.

Two case studies are discussed below as examples of projects that would fit into facilitated video. One is the Digital Green project (http:/www.digitalgreen.org) and the other is AIR (Advancement through Interactive Radio).

*Case Study 1: Digital Green*

One example of this approach is the Digital Green system. Digital Green is a research project that has sought to disseminate targeted agricultural information to small and marginal farmers in India using digital video. The unique components of Digital Green are (1) a participatory process for content production, (2) a locally generated digital video database, (3) human-mediated instruction for dissemination and training, and (4) regimented sequencing to initiate a new community.

Unlike some systems that expect information or communication technology alone to deliver useful knowledge to marginal farmers, Digital Green works with existing, people-based extension systems and aims to amplify their effectiveness. While video provides a point of focus, it is people and social dynamics that ultimately make Digital Green work. Local social networks are tapped to connect farmers with experts; the thrill of appearing "on TV" motivates farmers; and homophily is exploited to minimize the distance between teacher and learner. In a four-month trial involving 16 villages (1070 households), Digital Green was seen to increase adoption of certain agriculture practices by a factor of six to seven times over classical person-only agriculture extension. The hardware investment was a TV and a DVD-player per village, and one digital camera and PC shared among all 16 villages. These results are very preliminary, but promising. Figure 1 illustrates how information flows among components of the Digital Green project within the conceptual framework of a world agricultural information service.

*Gender*

This project will emphasize the role of women in agriculture, and will take concrete steps to ensure participation of women at all levels. Many agencies and researchers are coming to the consensus that sustainable community development can only happen when women are viewed, and included, as first class citizens (even if the community does not see this). Women are responsible for the health, education and often livelihood of the family, and yet are not able to access many ICTD interventions due to illiteracy or culture. UN, World Bank and other AID agencies have made proclamations that, if you want development to work, you focus on women, which currently bear the brunt of poverty more than men. Participants in the project include members of the oversight body, extension staff, Village Knowledge Workers, trainers, video and computing technicians, and support staff. Targets for female participation in each of these will be determined and tracked. Particular attention will be paid to the gender balance of

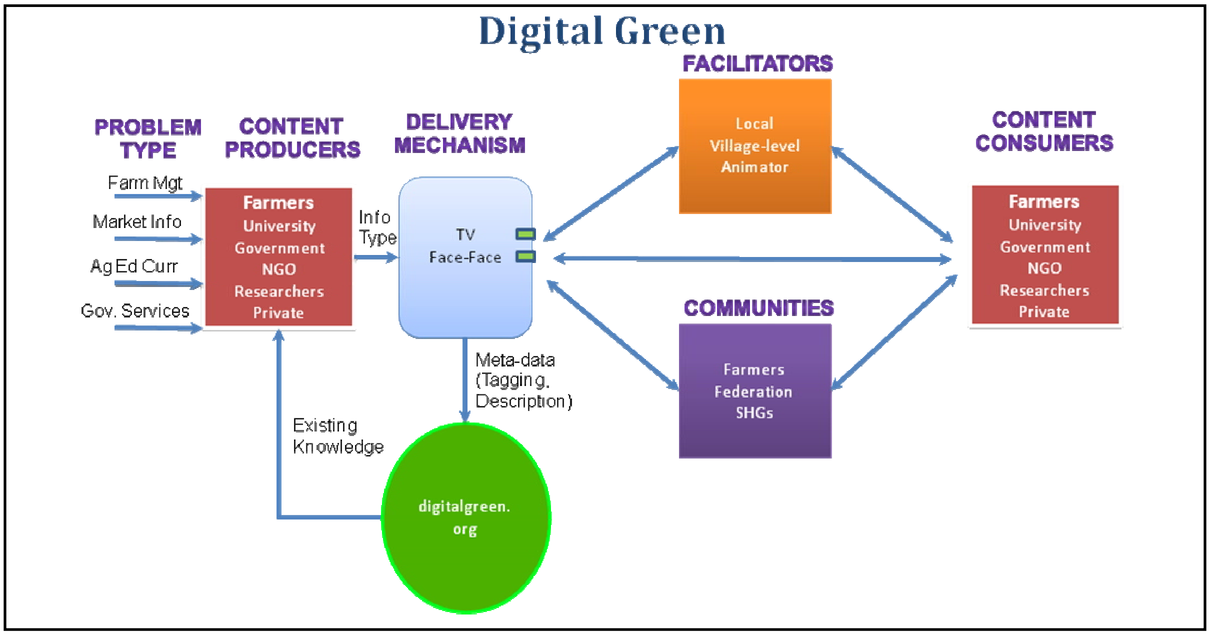



**Figure 1: The flow of information between components in the Digital Green approach**

the oversight body and in recruiting women for the video-recorded classes. As mentioned above, facilitators often advance their own teaching skills, so recruiting and training women facilitators could lead to additional women lecturers. Topics of relevance to women will be included in the content, especially topics related to crops that are grown by women.

One aspect of the content is its emphasis on real world problems. Radio and TV are very accessible media that allow equitable participation by men and women. However, in places where TVs and radios are not widespread, a shared TV or radio would be used. Village Knowledge Workers 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 considered and alternatives determined. Existing social group structures, such as Self Help Groups (SHGs), can also be used to involve women. There is a rich body of literature to support that existing women's SHG, all over the world, have contributed hugely to poverty alleviation through microcredit schemes. These groups have a long history of sharing technical equipment and tools, and engaging in radio listener groups, such as the "Development through Radio" program sponsored by Panis, where there are over 56 women's radio listening clubs in 14 African countries.

*Case Study 2: Advancement through Interactive Radio (AIR)*

Advancement through Interactive Radio (AIR) is an alternative, as well as compliment, to the audiovisual design of Digital Green. Originally designed for use in conjunction with local community radio stations, AIR facilitates direct community participation in a variety of development initiatives. AIR is a custom communications device that records voice content and forwards it to the terminus location – community radio station, NGO, or local extension office -- through the use of a wifi-based delay-tolerant network. AIR is specifically designed to address common barriers to ICT for development such as literacy, cost, and gender-specific barriers including mobility, time and cultural constraints. AIR is intended for communities that remain off the cellular and electrical grid, which includes large portions of the developing world, especially sub-Saharan Africa, where cell coverage is approaching 50%, but where huge areas are not likely to benefit from coverage for economic reasons.

Currently, AIR is being tested in Southeast Kenya, where forty women's agricultural collectives from 50-200 members are using the devices to "talk back" to their regional community radio station, demanding more relevant programming and sharing local knowledge. The push-to-talk interface of the AIR device makes for ease of use and is capable of recording thirty minutes of voice content (can be easily increased). The voice content is then sorted, compressed, and forwarded to the next AIR device that is both in range and closer to the radio station. This store-and-forward mechanism ultimately ends at the radio station, where staff can perform post-production editing as necessary, and patch the voices into radio programming. In addition to creating a cycle of feedback leading to more relevant radio programming, the act of hearing women's voices (most often sidelined in rural developing communities) is proving to elevate the status of both the speaker and the women's agricultural collective in the eyes of the larger community, thus addressing some of the issues of uneven development that can leave women marginalized and unable to benefit from the development intervention.

The AIR device is a natural technology extension for the World AgInfo's Community Radio scenarios, especially the Community Radio in a Box initiative. However, AIR can be retargeted to not only support two-way information exchange in a Community Radio context, but in any program where it is critical to support bi-directional information exchange. Thus, AIR may serve multiple contexts in different environments. AIR is a framework that can just as easily fit an agricultural extension model, where an NGO or local agricultural extension officers receives the incoming voice messages. In areas served by community radio, agricultural experts can solicit community information and feedback over the air, while collecting the requested information as a central facility or computer. Community farmers can ask questions based on A/V (Digital Green) or agricultural radio programs that have aired, and can report successes and problems relating to new practices. In addition, the AIR device is mobile, solar-rechargeable, and does not incur any user costs (no airtime or plans) – thus farmers do not have to disrupt their daily routine to use AIR, an advantage over other participatory development programs that mandate group meetings or focus groups. This is especially relevant in the case of women farmers, who may not access the mobility that men in certain cultures do.

While AIR can compliment Digital Green by providing participatory feedback and reporting capabilities, AIR can operate in lieu of Digital Green in communities that do not have the necessary infrastructure to support Digital Green, such as electricity. In sub-Saharan Africa, only 3% of homes have a television and 80% of the subcontinent enjoys radio coverage. While radio is the most popular mass medium in developing communities, the rise of Community Radio (especially in Africa and some parts of SE Asia) as an alternative to commercial and government programming is impressive. There are an estimated 800 community radio stations in sub-Saharan Africa, up from 10 stations twenty years ago – making it what many development experts deem "Africa's Internet." India has recently relaxed its broadcasting policy to allow limited community radio efforts; pilots in agricultural programming in India have already been initiated by organizations such as UNESCO. Just as Digital Green encourages community participation on the screen, AIR can provide farmers an avenue to be broadcast to the same positive effects that Digital Green farmer "actors" benefit from.

While the AIR program is currently in pilot phase, with only 100 devices in use, the AIR hardware and software was designed for easy modification and replication. AIR devices use all off-the-shelf commodity hardware, with an adaptable algorithm for routing messages most effectively considering distance, power consumption, and device status. The AIR handset is comprised of an ARM microprocessor, an A/D speech converter with a low-frequency bandpass filter, and USB fobs for storage and connectivity which can be swapped out to take into account advances in technology. Externally visible input and output devices include a microphone, a "push-to-talk" button, and three status LEDs (green, yellow, and red). These LEDs provide a variety of feedback regarding device status, including low charge or successful transmission. The AIR device is enclosed in a rugged plastic housing measuring approximately 7.5x15x2.5 cm. Fully configured, the device weighs less than 100 grams. Devices are charged by a stand-alone solar recharging station, consisting of a solar panel and 12-volt automobile battery. The automobile battery power source also offers users the opportunity for extra income generation, as they can change other devices for a fee.

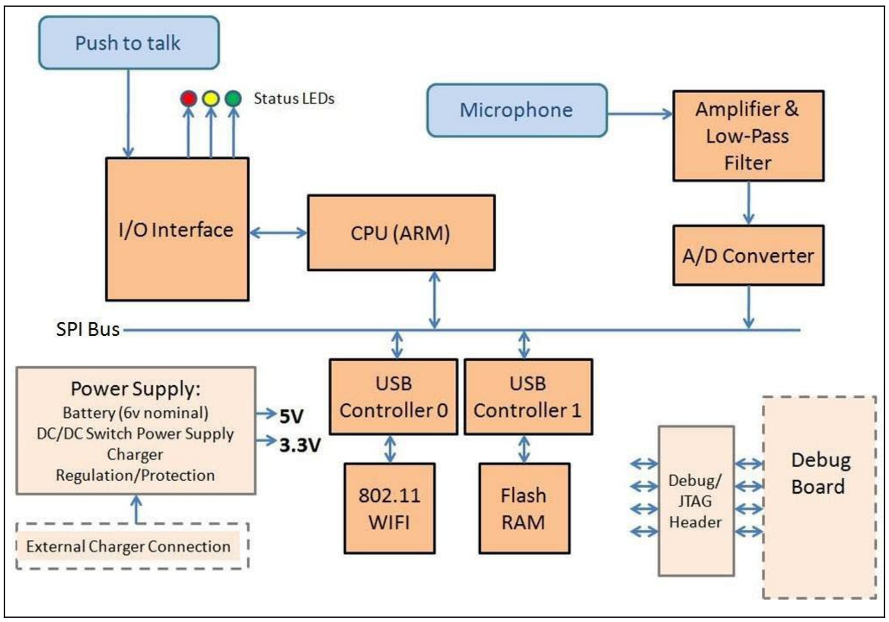



**Figure 2. AIR Block Diagram**

AIR devices are currently hand-built, costing approximately $100 USD to construct each of the 100 devices in use. With a larger demand, the board construction could be outsourced to commercial manufacturers, dropping the price of a large order (5000-10000) to under $5 USD. We recommend an initial run of 10,000 devices to support both the Community Radio and Multimedia exchange scenarios per above, which will be fleshed out depending on the technical/communications infrastructure and policy environments of the areas involved. The AIR team is evaluating options for its second version of the system, including an embedded radio to integrate listening and responding (both "normal" radio, as well as wifi-based transmissions); as well as a hardware device that can upgrade AIR capabilities to a full-fledged cell phone as conditions warrant. These scenarios could be helped along with additional support.

## Evidence of Success

The project will actively involve sites for three years. After three years, there should be a significant collection of courses to continue using, as well as the available expertise to continue making additional content and distribute courses through village-level facilitators. The equipment required for replay and lecture capture is not too expensive – radios and TVs so continued maintenance (and replacement) should be within the financial resources of most sites (providing that the program is providing value). At the end of three years, the project will continue for another three years, helping to support offering of courses, to provide continuity as the institutions support the courses on their own. Replication of the project to other regions should be straightforward. New content will be developed for different regions, although access to content recorded in different regions will also be available. Site selection will take into account factors such as agroecology, demographics, and culture.

- 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.

### Force Field Analysis

There are a number of risks to consider. Some of these risks can be evaluated during the startup/planning phase of the project, with appropriate adjustments made. Many of the targets are easy to quantify – such as creation and offering of courses – so it is possible to build metrics into the project from the beginning.

- 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.

## Timeline and Duration

The entire project will involve a start up phase followed by the launch of the regional consortia. Funding for each consortium will last for six years. The first three years of funding will support developing the capacity for the production and distribution of content through agricultural researchers, extension staff, Village Knowledge Workers, and local communities. The second three years will be at a lower level of funding to support sustaining new content production and distribution processes.

The first year of the project could be done as a planning grant, with the scale, duration and funding levels of the full project influenced by the outcome of the planning phase. The total number of consortia, and the duration and level of funding at each site is variable, and would be dependent on meeting various milestones.

The first step for the project would be to form the oversight body. A series of workshops will be held on the media exchange system to help identify the agricultural expertise that could formulate locally relevant content for transforming farmers' "conventional" operations. These workshops will be used to determine the types of the content to be exchanged as well as identify the group partners and members of the oversight body. The next step will be to build the initial partnerships of agricultural research and extension organizations by developing pilots processes of content production and distribution. Prior to the launch of the consortium a pilot extension system, pilot content should be recorded by one agricultural research organization and distributed by a different community-level organization via Village Knowledge Workers.

The table gives a roll out plan for five consortia over a 10-year project. The launch speed is accelerated for the latter sites, since there will be materials from other sites available and a body of experience to accelerate adoption. When a site is active, there will be support for developing new course materials, and when a site is supported the funding will be at a lower level to allow for further adoption of the course materials.

| | | Active sites | Supported sites |
|---|---|---|---|
| **Year 1** | Establish Consortia | | |
| **Year 2** | Launch Site | 1 | 1 |
| **Year 3** | | 1 | |
| **Year 4** | Launch Site 2 | 1, 2 | |
| **Year 5** | Launch Site 3 | 2, 3 | 1 |
| **Year 6** | Launch Site 4 | 2, 3, 4 | 1 |
| **Year 7** | Launch Site 5 | 3, 4, 5 | 1, 2 |
| **Year 8** | | 5 | 2, 3, 4 |
| **Year 9** | | | 2, 3, 4, 5 |
| **Year 10** | | | 4, 5 |

### Project Assessment

The project will have a set of benchmarks for content creation, media distribution, and farmer feedback. Enabling anyone to be a content producer and consumer can empower first-kilometer communities to have a voice. This is an advantage of the approach, but it will be a difficult to manage accountability and feedback for such a diverse and geographically dispersed audience. Consequently, we propose to use audio and video media to capture new types of content (e.g., audience requests and responses) and textual media to collect general statistics on the time, location, attendance, etc. of showings. The latter task might be facilitated by using a SMS server to aggregate and publish data that was collected from SMS messages sent by Village Knowledge Workers after each showing to provide near-real-time reporting of field-level activities.

Evaluating the knowledge that is transferred to farmers, whether the interests of farmers can be sustained, and whether there is a significant increase in the number of practices that farmers adopt on their individual fields, would occur through this media exchange. The deeper question is about the long-term adoption of the practices, the quality of these adoptions, and ultimately the improvement in agronomic productivities provided to farmers. Assessment will be done using standard techniques for agricultural extension evaluation. Independent evaluation is necessary to determine whether the content covers smallholder needs.

### Possible Partners

This proposal is partially based on the Digital Green project at Microsoft Research India in which a few organizations, including community-level NGO GREEN Foundation and the Government of Karnataka's Joint-Director of Veterinary Sciences and Animal Husbandry are already involved in a pilot project. Several other groups in Karnataka, India, including Myrada and the University of Agricultural Sciences, have expressed an interest in joining the consortium. Others, as far away as the Africa Rice Center (WARDA) in Benin, have produced content that has been shared amongst partners on the system but lack the resources to distribute content to farmers in their own vicinity. This proposal is also partially based on the Advancement through Interactive Radio (AIR) project which is being piloted with Radio Mang'elete in southeastern Kenya in order to bring community voices onto the airwaves and highlight community knowledge and needs. Farmers, women's SHGs and other community participants can use a communications device such as AIR to record questions and feedback, as well as suggest programming ideas based on a local practice or interesting community story/event. AIR devices collect voice feedback (eliminating literacy as a barrier to use), and use a delay-tolerant network to forward these voicemails back to a central organization such as an extension office or NGO or community radio station. AIR is an interim solution until cell phone coverage is made broadly available, although there are many rural communities where cell coverage may exist but cost prohibits the use of cell phones, and where women are not allowed to use them. Given that AIR devices use 802.11 wifi as well as solar recharging systems, they do not incur any user cost, which may encourage people to use them, especially if the result is being "heard" – either literally on community radio, or figuratively in the form of communication directly with an NGO or extension agent. The AIR team is investigating ways to create a seamless upgrade scenario to cell phones as communities come "online."

On the agriculture side, it will be very important to draw in researchers with interests in the New Agriculture, and ideally with an interest in the developing world.

## Projected Costs of the Project

In each village, the system has two primary types of expenditures: fixed equipment costs for TV and radio players and recurring honoraria of the facilitators. TV equipment costs about US$250 and the Village Knowledge Workers might be paid maximum performance-based honoraria 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 radios, TVs, and/or DVD players, but an individual's willingness to share her private commodities with her community would diminish over time. Local village radio and/or cable stations 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 Village Knowledge Worker to instill a sense of ownership.

## Literature Review

AMARC. (2006). "Voices for a Better World: Community Media and Social Justice." Conference proceedings of the World Association of Communtiy Radio Broadcasters held in Kathmandu, 21-27 February, 2003. Web site: http://www.isiswomen.org/index.php?option=com_content&task=blogcategory&id=64&Itemid=124

Amt, W. (1986). "DCFRN: a radio network for farmers," *Development Communications Report*, 52: 11-10.

Anderson, R.J., Dickey, M., Perkins, H. (2001). "Experiences with tutored video instruction for introductory programming courses," *SIGCSE*: 347-351.

Coldevin, G. (2003). *Participatory communication: a key to rural learning systems*, The Food and Agriculture Organization of the United Nations, Rome.

Engelhard, R. (2003). "ICTs - transforming agricultural extension?" *Proceedings of CTA's Observatory on ICTs*, Leiden.

Fraser, C. & Restrepo-Estrada. (1997). "Communication for Rural Development in Mexico," The Food and Agriculture Organization of the United Nations, Rome.

Fraser, C. (1987). "Pioneering a New Approach to Communication in Rural Areas: The Peruvian Experience with Video for Training at Grassroots Level," The Food and Agriculture Organization of the United Nations, Rome.

Gandhi, R., Veeraraghavan, R., Toyama, K. et. al. (2007, December). "Digital Green: Participatory Video for Agricultural Extension," to appear, IEEE/ACM ICTD.

Gibbons, J. F., Kincheloe, W. R., Down, K. S. (1977). "Tutored videotape instruction: A new use of electronics media in education," *Science*, 195(3):1139-1146.

Jato, M. (2004). *Gender-Responsive Programming for Poverty Reduction*, UNFPA, Addis Ababa.

Karnani, A. (2007, February). "Fortune at the Bottom of the Pyramid: A Mirage," November 2006, *Ross School of Business - Working Papers Series*. Web site: http://ssrn.com/abstract=914518

Kumar, R. (2004, September). "eChoupals: A Study on the Financial Sustainability of Village Internet Centers in Rural Madhya Pradesh", *Information Technologies and International Development*, 2(1):45-74.

Kuriyan, R. & Toyama, K. (eds.). (2007). "Review of Research on Rural PC Kiosks."

Ramamritham K., Bahuman, A., Duttagupta, S. (2006, June). "aAQUA: A Database-backended Multilingual, Multimedia Community Forum (A Demonstration)," *SIGMOD*, Chicago.

Ratnam, B. V., Reddy, P. K., Reddy, G. S. (2006). "eSagu: An IT based personalized agricultural extension system prototype--analysis of 51 Farmers' case studies," *International Journal of Education and Development using ICT* (IJEDICT), 2(1).

Riesenberg, L. E. & Gor, C. O. (1989). "Farmers' Preferences for Methods of Receiving Information on New or Innovative Farming Practices," *Journal of Agricultural Education*.

Veeraraghavan, R., Yasodhar, N., Toyama, K. (2007, December). "Warana Unwired: Mobile Phones replacing PCs in a rural sugarcane cooperative. Video for," to appear, IEEE/ACM ICTD.

Wang, R., Sahni, U., Garg, N. et. al. (2005, January). "Digital Networking Going Postal and Tale of Three Schools," *Small Change Magazine*, India.

# 9. Mobile Phones with Bundled Agriculture Information Systems

## Executive Summary

Smallholder farmers have difficulty accessing timely and relevant information about inputs for crop and livestock farming and with finding timely information about the markets for their outputs. This proposal's goal is to assist smallholder farmers with the timely access to these forms of information. The primary method for communicating this information is by creative use of mobile phones. The use of mobile phones by smallholder farmers has increased dramatically over the last five years with continued growth for the foreseeable future. The proposal describes methods by which the growth of mobile phone ownership can be increased and how this new communication medium may be used for the access to the critical information they require.

The initial pilot project would potentially include:

- A structured financial deal for 1,500,000 mobile phones to be sold at discount to participating farm organizations in two selected countries in Africa and one state in India.
- A discount scheme on talk-time purchase would be negotiated between the projects and the mobile phone companies so that the service is affordable, attractive and most importantly generates income for the farmer organizations as they can in turn sell the airtime to the villagers.

The anticipated stakeholders of this system would be smallholder farmers, farmer organizations, agricultural universities/technical colleges, extension agents, commercial mobile phone operators and other non-government organizations (NGO), traders associations, producers associations and other private sector organizations.

## Project Description

This project intends to improve the farmers' knowledge base and enhance communication amongst farmers through a mobile phone system, whereby local knowledge will be collected, organized, and then disseminated back to the wider farming communities for the benefit of the farmers. This approach is aimed at motivating farmers to participate as individuals and farmer organizations to build a knowledge bank of best farming practices and agricultural input and output information. The plan is that the proposed systems will ensure that agricultural information relevant to the smallholder farmer is harvested, organized and then made accessible via the mobile phone network. Currently, mobile phones are not being widely used by smallholder farmers for agricultural information. Farmers are accustomed to sharing their knowledge with other farmers but they are limited to the farmers they physically come into contact with. The WorldAgInfo design team found during its visits to South Asian and African villages that peer-to-peer sharing amongst farmers was commonly the most trusted form of information in the eyes of the farmers. This project intends to build on this successful communication strategy by maintaining the peer-based communication metaphor but at a larger scale. This project will also disseminate knowledge that integrates local indigenous knowledge and conventional scientific knowledge.

The successful uses of SMS messaging and agricultural support via mobile phone are easy to find. Mobile phones are such a powerful communication tool that many forms of information that were not possible in the past are now well within reach. While access to mobile phones is improving rapidly, there are certain populations, such as women, who do not have enough access. Other systems are well received but sponsoring institutions either could not afford to operate at the scale required to fulfill the farmers' needs, or do not have the technical skills to effectively take advantage of the mobile phone system's capabilities. In some cases, the provider of information might be using an older form of technology simply because they had not considered mobile phones. These success stories, currently nascent and fragmented, can become an important vehicle for agricultural information. The support systems described in this proposal look to maximize this potential.

*Farmers Association Support Model*

The project will partner with interested commercial mobile phone network providers to sell modern low-cost mobile phones capable of delivering high-quality multimedia (images, audio and text) services and airtime as a bundle for participating farmer organizations. The bundle will basically be financed through a structured finance scheme that allows benefiting farmers to pay for the phones over a period of three years.

The initial pilot project would potentially include:

- A structured financial deal for 1,500,000 mobile phones to be sold at discount to participating farm organizations in two selected countries in Africa and one state in India.
- A discount scheme on talk-time purchase would be negotiated between the projects and the mobile phone companies so that the service is affordable, attractive and most importantly generates income for the farmer organizations as they can in turn sell the airtime to the villagers. The generated income can then be used to sustain the work of the farmer organizations' activities. Several special services offering discounted call and SMS rates would be negotiated under the bundle scheme with the mobile phone company such as:
- Free talk-time: Free calls for registered members would be offered. The members would be offered 5 minutes free talk-time each week for personal use with the purchase of every 30-minute talk-time coupon to encourage use of the mobile phones.
- Free SMS: Messages sent or received directly related to agricultural information services would not be charged.
- Group Free calls: Several mobile phone networks in Africa now offer group-calls deals such as 'friends & relatives network' schemes where one registers frequently called friends and can call and SMS them for free, as long as they are within the same network
- Toll-free numbers: Special toll-free numbers will be set up for farmers to call in to the Information Bank and the Call Centers.
- Farmer organizations initially selected to participate in the project will be selected on the basis of their interest and prior relevant group activities like radio listening clubs, women's associations, farmer groups, trader associations and other village agricultural collectives. As the system develops, all farmer organizations will be welcome to participate. This first round of participation will help to refine the services the project will offer once in full operation.
- Involving farmers at village level is critical to ensure project ownership from the onset; therefore, it is envisaged that the farmer organizations platform would be the entry point for the project.
- Individual farmers who would like to join the mobile phone information scheme and already have

mobile phones would be welcome. At some point, the selling of discounted phones will be unnecessary and the project will focus entirely on promoting the flow of agricultural information.

- Other partners working at village level as information brokers such as Knowledge Community Centres and front line agents (extension agents and knowledge workers) will be also given the opportunity to join the mobile phone information scheme.

## Primary Customers and How They Will Benefit From The Project

*Farmer-created Information*

The creation of these agriculture-oriented mobile phone systems creates an almost endless number of possible services. The design team found that smallholder farmers were using the communication systems available to them with an impressive degree of creativity. This project will look for ways to offer services that will enable the farmers to obtain, produce, and share information. The exact nature of these services will naturally depend on what the mobile phone companies are able and willing to provide, the capabilities of the phones, and the interest of the farmers. Below are just a few services that could be offered. While these systems would be free or low-cost for the phones owned by the farmers' organizations, there is no reason that farmers could not use their own mobile phones.

*Sharing general information*

- SMS alerts from the farmer organizations to its members regarding meetings, weather alerts, and announcements of births and deaths. While some of these services are not agricultural in nature, they have the effect of promoting the use of this system as their primary information channel.
- Government agencies and NGOs are starting to collect real-time market information. This information could be sent to farmers via SMS.
- SMS messages with broadcast times for agricultural shows on community radio stations could be sent out. Missed shows could be listened to by calling an audio agricultural database. Both of these ideas are provided for in the community radio proposal.
- Low-cost call-in numbers for asking general agricultural questions. These answers may be from the farmers' association, a local university or a government agency.

*Sharing of technical information*

- Farmer-to-farmers
- Farmers will be able to share their local knowledge on best practices with other farmers through services such as message broadcast
- Farmer-to-agricultural research/education
- Agricultural research and education will be able to access the farmers' knowledge based on best practices through the information bank
- Farmers will be able access information on the new agricultural technologies via SMS and multimedia services (MM).

- Farmer-to-frontline service providers
- Farmers will be able to access information on agricultural inputs and outputs
- Frontline service providers will be able to access information on demand for their services
- Farmer-to-policy makers linkages
- Farmers will be able to access and share information on government agricultural programs and plans
- Policy makers will be able to get information on farmers' needs and market conditions
- Policy makers-to-frontline service providers/education/research linkages
- Policy makers will be able access information on the types, quality and coverage of the services provided to farmers
- Frontline service providers will be able to access information on the rules, regulations and priorities of the government with regard to the agriculture sector

*Solution*

Farmers already have experience and knowledge that can be collected (through several strategies) and harnessed and shared with other farmers. This information will be collected and sifted and stored in an information bank with an automated question-and-answer system (Q&A) that may be accessed via mobile phones. Mobile phones can be used to collect this knowledge via SMS, audio (voice) or image. To encourage the building of a critical mass at the launch of the project, an innovative promotion of the services available for farmers will be run targeting the farmers' organizations and mobile phone companies. The mobile phone bundle financing scheme would involve mobile phone companies in providing a mobile phone, line and talk time to farmer organizations and recovering the cost over a period of 36 months. A percentage of the call cost will be used to repay the mobile phone company for the phone and line.

Profiles for each of the farmers in the scheme (name, district, type of farming, interests, number, level of education, etc.) will be collected making it possible to customize message broadcasts to districts and regions. It would then make it possible for the project to raise funds thorough selling advertising SMS mail-shots to interested traders who want to deliver advertisements via SMS to selected segments of the farming community.

*Information Bank*

The information collected from farmers, farmers' organizations; NGOs and government offices will be stored in a national agricultural information bank of each country. This information bank ownership will be led by the national farmer's organization network like the MVIWATA (Tanzania's Network of Farmers Organizations) to ensure community participation and accountability. Further, each national information bank would be mirrored to the WorldAginfo system so as to ensure redundancy and to allow for the identification of common themes.

Profiles of farmers and farmer organizations participating would be registered to the national information bank. A user once registered with the national information bank, gets a user ID and is prompted for his/her profile information, including demographic and geographic data (district and village), the national information bank system would send an automatic welcome message explaining different services that are available and instructions on how to use the system. The user can then select the required service.

### *Call-in Center*

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 that 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.

### *Soil-Testing Network*

Another service could be the creation of a soil-testing network comprised of local women. Like the Garmeen Telcom's pay-mobile-phone system, local women could charge for soil testing. This model has worked well for mobile 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. This project is described more fully in the soil testing proposal.

### *Banking Services*

A second stage of the proposed project could be added that enables commercial transactions via the mobile phones. This could begin as an internal record keeping system for farmers organizations, but it could later include the mobile phone based banking that have already begun to appear in several of the SSA countries.

## Timeline

### *Pilot Project*

The First Phase of the project would involve two countries in Africa (Mali, Tanzania) and one state in India. For Tanzania and Mali the selection criteria would be to identify districts that are outside the major cities with mobile phone coverage; districts with reasonable infrastructure such as electricity and telecommunication; and practicing mixed farming systems (i.e. cropping and livestock farming). For instance, in Tanzania districts could be picked out of the Tanga and Mbeya regions that include diverse farming systems. In India, a state would be selected using the same criteria.

In each targeted area, 500,000 phones would be sold through the scheme which would include airtime recharging to farmer organizations. Priority would be given to women smallholders. There is no reason this program could not be extended well beyond the initial 500,000 phones. The number of 500,000 is simply to assure the mobile phone companies that the project is worth their attention. Farmers already with mobile phones would be welcome to join the scheme.

### *Up Scaling*

Two years after the launch of the initial project a Second Phase would be launched within the selected countries (Mali and Tanzania) that will see the expansion of the project into 5-6 more districts across different provinces/regions in each of the countries within a year. The goal would be to sell 500,000 mobile phones per phase per country bringing the total to 3m mobile phones in the participating three countries by year 5. Lessons would be documented and the model viability assessed based on experiences of the two phases.A Third Phase to take the models to more districts and also different countries in Africa and South Asia can then be considered based on the success and lessons from Mali and Tanzania.

*Project Management*

NGOs or CBOs (preferably local not-for-profit organizations) would be invited through a competitive grant to design and implement the projects in the three countries. One of the criteria could be that the selected NGO collaborates with the national farmer organizations for the implementation of the project in order to facilitate local skills building for farmers.

*Linkages with existing initiatives and traditional socio economic systems*

The project will collaborate with the existing initiatives which deal with information and knowledge dissemination in the rural areas in order to strengthen their structures. Village Knowledge Centers (VKC) and Community Knowledge Workers (CKW) will be instrumental in publicizing and promoting the use of mobile phones and teaching farmers how to use them. This would be some of the services provided by CKWs as described in the VKC proposal.

Traditional leadership and social networks such as village heads and chiefs play a major role in the lives of the small holder farmer and the projects will leverage on these traditional networks to ensure buy-in from the community.

## Day in life: Pre/Post

*Local knowledge*

Without: Local knowledge, while valuable, has been limited to the small number of people the farmer has the opportunity to meet.

With: It is thus imperative to collect, process and disseminate local knowledge for wider application in the area with similar agro-ecological domains. This project will ensure the broader utilization of knowledge by collecting, adding value and sharing it through mobile phones.

*Lack of access to timeliness, reliable content*

Without: Farmers frequently make decisions that either result in lower than optimal output or loss of income at the marketplace simply because they lacked a critical piece of information.

With: The project will add value in terms of improving timeliness, reliability and relevance of their information sources. The system will also allow farmers to provide their feedback through SMS. Thus, the project will provide the feedback mechanisms so important to maintaining the relevance of the service. The mobile phone is the most pervasive form of bi-directional communications in the hands of the smallholder farmer. The recent explosion of mobile phone access has left agricultural information systems behind. The move to mobile phone-based systems is natural and potentially very beneficial. The early evidence from the mobile phone based projects the design team visited in South Asia and Africa strongly indicates the success of future projects.

Mobile phone technology is not standing still as agricultural information systems attempt to catch up. Mobile phones are currently able to transmit data, even video files, to mobile phones with sufficient memory capacity via the mobile phone's data service. Soon, it will be possible to project these videos onto a nearby wall or connect to a common TV set. As popular as mobile phones are now, the potential for mobile phones to become part of a television broadcast system could revolutionize many parts of the world.

The mobile phone network could also work along the lines of a podcasting system or on-demand system for audio content. Audio content is extremely important for a population where the majority cannot read. A user of such a system would request information that would be delivered at night when the mobile phone company is not otherwise using their infrastructure. If the mobile 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 for Success

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 National Farmers' Union (ZNFU) uses SMS message to distribute market prices.

- In Uganda, FoodNet, a non-governmental organization working to get better prices for farmers, collects wholesale and retail price information for some 25 agricultural products that are updated daily into a database. Farmers can send an SMS to obtain prices. Users of the service generate several thousand SMS per month (ITU 2004:10).
- Similarly, the Kenya Agricultural Commodity Exchange (KACE) uses mobile phone short Messaging Service (SMS) to disseminate low-cost market information to the farmers in order to improve their bargaining power for a better price to the market place, and to link the farmer to market more efficiently (KACE 2007).

### Expected Benefits of the Project

This project has the potential to dramatically increase access to agricultural information. The mobile 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. Furthermore, it allows the farmer to become a source of information.

Through access to timely and relevant information, farmers will help with the adoption of farming technologies; improve livestock management; increase crop yields and output per person day; increase their production surplus; and also increase competition among various front lines which will reduce cost of production and marketing. There is generally a high adoption rate of homegrown and relevant farming technological solutions, and this project will leverage on that.

Women and women's groups will benefit from the dissemination of relevant content such as information on nutrition and gardening, which is a passion for rural women. This will in turn impact on health and general well being of the farmers and their families. Mobile phone service providers involved will be able to access real-time agricultural information that shows various levels of demand for their services. This information will enable them to increase their client base; to reduce cost of marketing; to increase their profit margins; and to increase economies of scale that will reduce the cost of their services .Civil societies, NGOs and government will also be able to access up to date information that may improve the way they plan and implement their intervention programs in a region or district. This information may also provide feedback on the impact of government policy decisions. Research and academic institutes will also be able to access timely feedback information on the impact of the technologies that they are developing and publicizing to farmers for adoption. They will also be able to access local knowledge which they can integrate with the conventional technologies.

***Sustainability and Scale***

This project benefits from the fact that the use of mobile phones is projected to grow rapidly in Africa and South Asia, and the 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 scaling 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 mobile phone company. If a normal SMS message cost ten cents, one cent could be allocated to the project by the mobile phone provider.

The dissemination of information via mobile phone will also ensure community participation which has been a fundamental characteristic in sustaining various ICT projects in the rural areas.

Farmers' organizations will be involved from the beginning of the project to ensure ownership of the project. Farmers will participate in the governance of the project and through other services such as question and answer services, broadcasting services, market information services and feedback through SMS.

One possible use of this system is to use a SMS based system to transfer information from automated soil testers. Local soil testers 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 mobile phone. The mobile 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 (More fully described in the Africa Site Visit Report). 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 became more widely used and included 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 mobile phone could allow for the insertion of advertising. This could be a significant revenue source for the project. There would be strict standards for advertisers so that the project's content does not appear biased.

### Expected Costs

The initial project would involve two African countries (Mali and Tanzania) and one state in India. The main costs will be content creation in local languages and into multiple formats (text, audio, video, image); and system development (database design, hardware, software). We would anticipate that WorldAgInfo Systems would undertake the development of these services.

It is estimated that three million dollars would be required for the development of each national center (personnel, information bank development and systems setup). In some countries, such as Tanzania 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.

### Project Assessment

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, percentage of usage, user experience and the likelihood of using the same system again are useful. Mobile phone providers may not be interested in providing these services or may want to price these services beyond the budget of the smallholder farmer. Lack of enabling policy environment in some targeted countries may slow the growth of mobile phones in rural areas.

### Force Field Analysis

Farmers are constrained from using the mobile phone to share their knowledge due to the lack of supportive national ICT policies and regulatory framework necessary to create an enabling environment and to assist developing countries to deploy, harness and exploit ICTs for socio-economic development. Other barriers that hinder farmers from using mobile phones include high level of illiteracy, lack of electricity, limited opportunities for women to access ICTs, inadequate financial resources and lack of infrastructure in terms of telecommunication, water, roads, and electricity.

Major factors that may contribute to the success of the project may include the provision of the gender-related contents in order to motivate women to use the service. This information will be provided through a question and answer service as well as broadcasting. Further, the project will disseminate multimedia content in terms of video and audio (such as voice mails) to facilitate the non-literate users. The project will also collaborate with all stakeholders to conduct training to the farmers on how to use mobile phones to access information. The project will also collaborate with the government officers in terms of information generation and dissemination in order to influence and improve the weak policy frameworks that exist in most of the countries in Africa and South Asia.

The NGO implementing the project would extensively collaborate and involve farmer organizations as information generators and disseminators so that critical masses can rapidly be achieved in order to increase viability of the project.

## Literature Review

Bayes, A., von Braun, J. & Akhter, R. (1999). Village pay phones and poverty reduction: Insights from a Grameen Bank initiative in Bangladesh. *ZEF Discussion Papers on Development Policy* No. 8, Center for Development Research, Bonn, June 1999. from http://www.telecommons.com/villagephone/Bayes99.pdf.

Eggleston, K., Jensen, R. and Zeckhauser, R. (2002) Information and communication technologies, markets and economic development. In G. Kirkman et al. *The Global information technology report: Readiness for the networked world,* pp. 62-63. New York: Oxford University Press.

International Telecommunication Union (ITU). (2004). *African telecommunication indicators 2004.* Geneva: ITU. http://www.itu.int/ITUD/ict/publications/africa/2004/material/AFTI04.pdf.

Mukhebi, A. (2007). Linking farmers to markets through modern information and communication technologies in Kenya. The Kenya Agricultural Commodity Exchange Limited (KACE). from http://www.kacekenya.com/home/index.asp

Song, G. S. (2003). The impact of information and communication technologies on rural households: A holistic approach applied to the case of Lao People's Democratic Republic. http://www.koreagsis.ac.kr/research/journal/vol5/5-06-Gi-Soon%20Song.pdf.

# 10. Community Radio Support Systems

## Executive Summary

Community Radio is one of the most accessible, viable, and commonly used ICTs in Africa and South Asia. For many smallholder farmers it is the only means for obtaining agricultural information, other than face-to-face interactions. The use of interactive radio for educational purposes is well known and has demonstrated its effectiveness. Also, the concept of community radio stations for delivering agricultural content has shown itself to be effective (for example, the Observatoire du Marché Agricole in Mali, which uses community radio to deliver market news to rural farmers). Making community radio listening an interactive experience has the potential to improve the information that the radio provides by making certain it is meaningful for listeners, but it also has the potential to provide smallholder farmers, and women smallholder farmers in particular, a voice in the content. This project will provide a suite of materials and services. Among the possible elements to be provided would be:

- A Community Radio Starter Kit that includes multimedia directions on how to create and/or maintain a community radio station
- An Agricultural Radio Program Starter Kit with pre-packaged generalized agricultural materials such as one-minute "public service announcements"
- A Community Radio Development Newsletter for current community radio stations on ideas for agricultural programming and how to provide avenues for communication
- A group of Community Radio Support Specialists to support to community radio stations as they incorporate these services
- A Community of Users to which any station using these services could sign up in order to provide community radio stations the opportunity to feedback their experience in using the materials to the larger body of users
- A service called AgRadioCall, which would assist community radio stations in their efforts to incorporate cell phone technologies into their programming
- A service called AgRadioBank, which would act as a clearinghouse to collect, digitize, host, and distribute relevant agricultural programming through a system accessible via cell phone
- A service called AgRadioSMS, which would establish an SMS service that will allow community radio stations to share their programming schedules with their listeners

Once the community of users reaches a critical mass of participants it is assumed that several of these services will becomes self-sustaining and self-expanding. For example, the need for a large staff of community radio support specialists would be unnecessary as this role would be taken over by the community of users. The sustainability of the services that do not become self-sustaining can be assured with effective incorporation of advertising. The success of this project would be determined through a series of measures, including surveys of usage and effectiveness and through the development and sustainability of the community of users. In addition, many formative evaluation strategies would be used within these services. The greatest challenge will be the need for these services to be offered in a number of local languages. The automated translation systems, SMS and online audio databases proposed by WorldAgInfo would be very useful for the expansion of this project.

## Project Description

Radio as a communications mechanism has a reputation for being staid and inflexible. If that were ever true, it will not be true over the coming years. Already, there are tremendous opportunities for digital radio, radio-based education, satellite radio, and the simultaneous broadcasting of high-speed digital information. We also see devices, such as cell phones, as gaining radio receiver capabilities. The recent advances in creating ultra-small and inexpensive carbon nanotube radios and the possibility that radio service will become more common in electronic devices will make the creation of a community radio system more a question of content than of purchasing equipment. While we cannot know which technologies will be turned into products and which of those will reach the service areas, we see the potential for a flourishing of community radio not seen since the 1920s and '30s.

Community radio is far from ubiquitous in many regions. During the site visits, the design team found that interactivity, which is very popular with smallholder farmers, was not being provided. This is due to the fact that community radio has long been a one-way information delivery methodology simply because there was no effective method by which listeners could contact the radio station. The rapid (and accelerating) adoption of cell phones changes this equation. Furthermore, visits with local farmers and with the staff of community radio stations indicate that interaction is desired. This mutual desire for interaction is rarely made manifest. There are two main reasons for this: radio stations don't have experience with providing interaction and both the listeners and the stations have problems affording the cost of the calls. This project aims to develop a set of products and support services that will allow any existing or newly created community radio service to become a two-way, participatory forum. The product that would be developed would take the form of materials (such as pre-packaged agricultural materials) and directions on how to create and/or maintain a Community Radio service that is participatory and interactive – particularly focused on making certain that smallholder farmers are involved with the radio programming in an interactive and meaningful way. The focus of these materials will be on developing feedback protocols using a diverse array of technologies that allow the end user to have a voice in the content that is delivered. The services that would be developed would take several forms, such as support in the community ratio stations' efforts to incorporate interactive technologies such as cell phones and SMS, and community radio specialists who will initially assist community radio stations in their efforts to incorporate the materials. An association of participating community radio stations will be developed and maintained in order to provide a forum for users of the services to share their experiences and modify the materials to meet their needs.

### *Materials*

The materials will be designed to provide interested parties with the training and information needed to establish or maintain a community radio station with a focus on creating an interactive dialogue with the smallholder farmers. Taking the form of materials (e.g., pre-packaged agricultural content), training (e.g., tutorials on how to set up call-in shows featuring agricultural content), and information (e.g., descriptions of participatory technologies and how to incorporate them into radio content delivery), these materials will provide a roadmap for how to involve the listening audience in the community radio experience. A few examples of the type of elements that would be included in these materials are:

- Information and examples for assisting the creation of agricultural programming – especially programming oriented towards the inclusion of user participation. It will demonstrate strategies for the development of call-in radio programming that would answer the questions that farmers have about their practice. Such programming would leverage local experts (extension officers, community knowledge workers, local agricultural university faculty) to answer the questions, but could also include a more community approach where farmers not only call-in with questions, but also with answers to other farmers' questions.

- Provide directions on how to allow farmers to rate content that has been broadcast (through, for example, SMS technologies, which may require the project to make an arrangement with a local SMS services provider).
- An agricultural content "starter kit" made of generalized agricultural content (e.g., scripts, major language recordings, and one-to-two minute "community service announcements"), and the strategies used in their production. This would be enough programming to "seed" a radio station and would cover the programming requirements for approximately six- weeks.
- Provide information and guidance on how to identify technologies, such as the AIR unit, cell phones, call-in shows, field visits, etc. for participatory programming opportunities. For example, the project could include the provision of cell phones to participating community radio stations for the purposes of facilitating call-in programming, to have a mechanism where the audience could submit questions/feedback and program ideas for future shows, or be used to take informal surveys. The station would be able to use the cell phones for these purposes on any of their programming, but calls made during agricultural programming could be free through an arrangement with cell phone companies.
- A Community Radio Development Newsletter could act as a related service to the starter kit. It would serve to help currently existing community radio stations and would provide a form of in-service training for community radio stations that have recently started.

*Services*

Community Radio Specialists, acting as community support agents, will advocate for the adoption of the materials, support community radio stations that adopt it to maximize its use, and will provide support for communities wishing to begin new agricultural community radio stations using the materials and services. In order to reach a critical mass of users, it will be imperative to have enough highly trained community radio specialists to interact with community radio stations effectively. These individuals would be highly trained, well paid, and required to travel for extended amounts of time. During initial interactions with the radio stations, these individuals would temporarily live and work locally and would perform tasks such as:

- Work with the radio stations and community radio associations to incorporate agricultural programming (initially from the Agricultural Radio Program Starter Kit if necessary).
- Incorporate interactive programming elements such as cell phone call-in shows or SMS-based content rating systems. This would include assisting the station in determining the appropriate technologies for these interactions.
- Work with radio stations on advertising strategies - including methodologies for offering advertising on their stations and methodologies for advertising the new interactivity.

Assuming that the appropriate interaction between a community radio specialist and a community radio station is between 2 and 4 weeks (which would give substantial support to the community radio station's efforts to incorporate the materials and services), any one community radio specialist would be able to work with between 12 and 25 radio stations per year. AMARC (2005) stated that Sub-Saharan

Africa had a total of 800 community radio stations servicing approximately 80 percent of the population. Similar numbers for Asia are not known; however, it is assumed that approximately 400 community radio stations in each of Sub-Saharan Africa and Asia would be necessary to fully reach a critical mass of users and create a viable and self-sustaining community of users of the materials and services. Based on these numbers, a cohort of 10 community radio specialists in each geographic area, if fully effective, would be able to facilitate this number of users in between 2 and 4 years, with a more conservative estimate being between 5 and 10 years. This is substantial support for each of the radio stations, but would be necessary to provide the initial support for the users that would allow them to successfully support their own community of users in the future.

***Community of Users of the Materials***

A variety of technological solutions (for example, Internet-, cell phone-, and paper-based), will be developed that will facilitate communication within and across the members of this community of users of the materials. This communication will allow the users of the materials to modify their content and tailor them to changing local conditions. The purpose of this community of users would be to:

- Provide community radio stations the opportunity to feed back their experience in using the materials to the larger body of users.
- Open the materials up to modifications by the users, who will hopefully take ownership of them and tailor them to their own purposes.
- Provide community radio stations (whether already using the materials or new to them) support in using them.

By allowing this type of interaction, and the subsequent social network that it would create, the materials can become self-sustaining. The users will, hopefully, take ownership of the materials in such a way that they can improve upon the materials and services themselves (in conjunction with their agricultural audience participating). If such ownership comes to pass, and the community of users becomes self-sustaining and self-expanding, then it would be unnecessary to continue to maintain as large a managerial footprint. In essence, the community of users would replace the community radio specialists, and would perform the type of support for their membership that these individuals offered initially. Wikipedia has demonstrated that a community of users is capable of providing content and policing itself if there are enough individuals involved and they are sufficiently invested in the process. In addition, effective advertising strategies could be used to support those elements of the project that do not become self-sustaining. While the agricultural populations being served are poor, they are familiar with concepts of advertising. And, as businesses, they will have purchases of various types. A creative use of advertising, especially when profit-sharing with the stations is involved, should be successful in creating a sustainable model. Other methodologies that could be incorporated to assure sustainability are:

- The requirement of a fee for use of the materials - the cost of this fee could be offset by negotiated discounts with radio equipment vendors with a total value far higher than the price of the materials themselves.
- The materials could include advertising. The materials could also come with a monthly newsletter that would also have opportunities for advertising.
- The toll-free call-in line could include agricultural advertisements. The profit from the ads could off-set the calling cost and perhaps be split with the radio stations.

- People listening to the digitized recordings of previous broadcasts would still hear the advertisements from the original broadcast. It's possible that stations might be able to sell the advertiser on the idea of paying a fee for each listener. An alternative is to insert advertising in the middle of the broadcasts and share that profit with the responsible community radio station.
- The SMS messaging could cost the same to the user but part of the cell phone company's profit could be shared between the project and the radio station.
- Once the community of users becomes self-sustaining and self-expanding, the use of participatory elements in radio could become commonplace.

*AgRadioCall*

Directions will be provided that will teach community radio owners/administrators how to leverage the power of cell phones to allow smallholder farmers to select which programming will occur. For example, this project could help local stations by negotiating a special call-in rate for user call-in lines. These call-in lines would be the same price for the person calling in but the profit of the call would be shared with the radio station. This provides long-term viability and encourages the production of engaging shows. Another example would be assistance and direction in setting up partnerships with cell phone companies to provide interactivity between the farmers and the stations and profitability to both the station and the cell phone company. Examples of the type of assistance would be to initially offer toll-free numbers for radio stations offering agricultural content or to work with national cell phone companies to create partnerships to which community radio stations could sign up. In order to assure sustainability, this would act as a starting point and as a model for future similar community-led initiatives.

*AgRadioSMS*

An SMS service called AgRadioSMS designed to distribute messages with either the community radio station's full programming listing for the day or in the form of an alert when an agricultural show is to be broadcast (based upon the interests of the smallholder farmers). The radio station has a natural interest in letting its audience know of its programming through a mechanism other than its own radio broadcasts, as this methodology would reach the audience in a more interactive way. One mechanism for gathering this data would be for radio stations to submit their programming information through SMS, which could then be re-broadcast to users. When on the site visits, the design team was surprised by how often farmers with low levels of literacy were using SMS. But, when in examining the actual messages, we found that the number of words required to understand the messages were fairly small. We believe that using SMS to deliver agricultural community radio content to, and receive feedback from, the farmers could be very effective.

*AgRadioBank*

An online community radio programming database called AgRadioBank will be created to collect the audio recordings of community radio shows involving agricultural issues and make them available in an online database. While this database could be accessible via the web, the most common means to access it could be through cell phones. The community radio station would submit its programming to this central repository along with indexing information such as original broadcast date of the show, show title, host, topic, language, and length, which would be the means by which the caller or web site user could find the show of interest. The users would have the ability to listen to shows they missed and could leave feedback on the recordings. This service could be made sustainable by offering advertising. If a percentage of the advertising revenue was returned to the radio stations based on number of times the material was listened to and how highly it was ranked, then they would have an additional incentive to produce and record high quality shows and to describe them in a way that makes the shows easy to discover.

### Primary Customers and How They Will Benefit from the Project

As mentioned earlier, AMARC stated that as of 2005, about 80 percent of people living in rural areas and in the vicinity of towns had access to community radio stations. This project targets these 80 percent of people living in rural areas which have access to community radio, by making them more participatory, thus improving the quality and relevance of the content they hear. Of particular importance is the benefit that this methodology holds for female community members. Radio programs aimed at females, focused on crops and agricultural practices pertinent to females, broadcast at times when females are most likely to benefit from the information, and utilizing feedback mechanisms to which females have access, have the potential to greatly benefit this segment of the population.

Additionally a reliable collection of best practices for sustaining existing stations will help keep them on the air, thus ensuring continued access to agricultural information. It also targets the remaining 20 percent as it provides materials and services which facilitate setting up new sustainable, participatory stations using a model which is continuously evolving based on successful sustainability practices learned from the combined experience of the network of community radio stations.

Also, the development of a self-sustaining network of community radio stations provides a method of formative evaluation where the stations can measure their own success based on feedback from their listeners and through interaction with other community radio stations in the CRS social network. The services and materials will provide some simple matrices for assessing the success of a new technique.

Indirectly, private sector advertisers that may wish to use community radio for advertising would have a medium with feedback from listeners, thus giving the advertisers a more accurate description of their potential target demographic. That, in turn, would benefit the CRS because an advertiser may be more likely to use it as a medium because the station can more easily provide measurable impact.

### Day in the Life: Pre/Post

**Pre:** Currently, smallholders in Asia and Sub-Saharan Africa are in desperate need of information, but are similarly in need of a voice. Communities in remote areas of these regions are deprived of vital information pertaining to their livelihoods, often resulting in living conditions bereft of human dignity. The smallholder often struggles to make ends meet. The fact that they depend to a large extent on their farm produce for sustenance, combined with relatively high levels of illiteracy, make their lives substantially uncertain. The galloping pace of advancement in many parts of the world has only ended up widening the gap.

**Post:** Effectively involving the smallholder with the agricultural information they receive may lead him or her to a higher quality of life. Area specific information is the basic requirement along with the linking of market information. The community radio station will be an effective agency to provide this link. The community-based and community-supported venture will bridge this gap in the lives of the smallholder. The local radio stations will act as a facilitator to develop effective farming practices, provide a voice to the smallholder farmer, facilitate economic development for smallholder farms and provide the lifeline of agricultural information needed to pave a way to prosperity for the smallholder.

### Evidence of Success

Narrowcasting, a process where audiocassettes are played to community groups at the village level has been demonstrated to be successful in the absence of rural community radio stations. The agricultural information narrowcasts of All India Radio have been effective in disseminating information, and have been an acknowledged component of prosperity for smallholders and women's self-help groups. The direct participation of these groups forms the core content of this program.

The broadcast concept was not effective as it failed to address the area specific needs. If the community radio is developed on the lines of "build, operate, and own" with a facilitator, it has a greater chance of survival and success. Sustainability is assured with community ownership, wherein resources will flow from the community itself – possible forms for this would be a small fee for the service and the content input, advertising revenues and/or a portion of cell phone charges returned to the radio as part of partnerships with cellular telephone services.

### Force Field Analysis

Major barriers or obstacles that could impede the success of the project:

- Accessibility to the local radio stations owing to the conveyance and communication problems
- Revenue generation for sustainability during the formative years.
- Conveying practical mechanisms for engaging women in interactive radio.

Among the many ways in which ICTs are being implemented to address issues of poverty, radio is perhaps the most promising for reaching women. However, there are still important gender considerations that will need to be addressed. Materials will need to integrate general knowledge already gained from experience serving women with rural radio (for instance, running certain shows at times of the day when women are most likely to have radio access). Additionally, the new element of interactivity in radio may bring in new issues for ensuring women's access. The use of cell phones, for example, may be controlled by men or there may be cultural or other barriers which create different levels of participation between women and men in "call-in" shows. This project would attempt to ensure women's access to interactive elements. Also, in the area of content generation this project would build on existing experience of these issues in rural radio. As an example, programs focusing on farming practices for particular crops will need to ensure that women's crops are included regularly.

Major factors which may contribute to the success of the project:

- Involve the local agricultural program service infrastructure and agricultural science students in field experience internships
- Local knowledge workers and information centers could be a strong link of inputs and management of community radio stations.
- Design features in the project that reflects this analysis and increase the likelihood of success:
- For the viability of the project, the initial start-up costs of the project will be shared with the community radio stations in order to assure accountability.

- The mechanism of dissemination, utility of information, and the progress in the status of the project in the community.

## Expected Costs

- Start up costs, including Materials, Development, Translation (per language) and Community of Users Communication Media
- Recurring costs categories, including Materials, Translations (per language), Production (per unit); Community Building, Community Building Specialist
- Salary, Travel Expenses, Training of Local Personnel, Project Management, including Project Director Salary and Travel Allowance.

## Timeline

### *Phase One*

The services will be developed and field-tested over the course of 1-2 years. During this time, the materials will be translated into several targeted languages. This will include translation of the printed and audio materials into major Sub-Saharan African languages as well as major Asian languages. Once the services have been field-tested and have demonstrated their effectiveness, they will be offered free of charge through multiple channels (e.g.,, wikis, CD-ROM, paper). Future versions of the Community Radio Starter Kit and the Agricultural Radio Programming Start Kits will reflect the suggestions and examples offered by the community radio participants.

### *Phase Two*

During phase two project personnel will work with radio stations to implement participatory elements into current agricultural programming and to help in the development of new content. Each participating radio station would be asked to join an association so that experiences may be shared. If the country has a viable radio association, partnership with that association will be explored. Each member of the association would have access to add to, update or modify the materials to meet his/her own specific needs. For example, users could help with translation into local languages, list local resources, and add new content. The project will attempt to create the same level of participation in each station's listening community. Much the same way as listeners are able to rate the content that is broadcast, built into the materials will be interactive tools that will allow its users to rate its content.

### *Phase Three*

Phase three will entail the transition to community control of the materials, and the final move of the project to sustainability. The goal is to have an association of community radio stations that will create a sustaining development process – one requiring little outside supervision. When such a "tipping point" is reached, the managerial aspects of this project could sunset. At that point, a partnership will have been created with a pre-existing community radio organization (e.g.,, the World Association of Community Radio Broadcasters, aka, AMARC), which will entail maintaining the tools that the community of users controls.

As the emphasis is on developing a self-sustaining and self-expanding community of users, it is best to think of this in terms of the time necessary to reach the tipping point. Assuming that this tipping point can be reached when half of the existing community radio stations adopt the participatory materials and become participants in the community of users of these materials, it is estimated that this can be done in as little as five years.

Iterative formative assessments will be conducted at six-month intervals in order to determine progress that is being made on the development of the community of users. These assessments will be done in order to assure that progress is being made in a timely manner and in such a way as to assure the ability to sunset the direct management of the project.

The following table demonstrates how each of these phases would overlap and work over a ten-year time frame.

| **Year** | **Project Activities** |
|---|---|
| Year 1 | Partnerships developed with appropriate external agencies<br><br>Material development<br><br>Material piloting and evaluation |
| Year 2 | Partnerships developed with appropriate external agencies<br><br>Publicly available Community Radio Starter Kit<br><br>Begin building community radio station associations<br><br>Develop communication media for community of users<br><br>Formative project evaluation at six- month intervals |
| Year 3 | Partnerships developed with appropriate external agencies<br><br>Community building activities continue<br><br>Formative project evaluation at six- month intervals |
| Year 4 | Partnerships developed with appropriate external agencies<br><br>Community building activities continue<br><br>Formative project evaluation at six- month intervals |
| Year 5 | Partnerships developed with appropriate external agencies<br><br>Community building activities continue<br><br>Formative project evaluation at six- month intervals<br><br>Sunset of project staff (dependent on reaching self-sustaining tipping point for community of users)<br><br>Summative evaluation of project success |
| Years 6-10 | Necessary if community of users has not reached a tipping point (community building activities to be reviewed in depth from years 2-5 to determine areas of weakness in community building…primary focus moving forward would be to continue community building based on best practice). |

## Project Assessment

There will be different measures of success depending on the phase of the project. In the first phase, which will see the development and testing of the materials and services, the success measures will be:

- Agricultural content production
- Non-agricultural specific content production
- Pilot implementation and formative evaluation
- Farmer participation in content development/provision
- Based on evidence collected through the pilot evaluations, the second phase will be triggered. During the community development phase, the measures of success will be:
- Farmer participation in content development/provision
- Program uptake with existing community radio stations
- Program uptake with new community radio stations
- Community participation (as measured by modifications to the materials)
- The growth and sustainability of the community (that is, the association of users) as measured by non-directed participation.

Throughout the entire project, a formative evaluation strategy will be in place that will foster group participation, farmer communication and data collection. Analysis of these data will be done in real-time in order to inform mid-flight course corrections.

## Potential Project Partners

- AMARC (World Association of Community Radio Broadcasters)
- AMARC-WIN: The Women's International Network is a large assembly of women's communicators working to ensure women's right to communicate through and within the community radio movement.
- Advancement through Interactive Radio (A.I.R)
- Developing Countries Farm Radio Network http://www.farmradio.org/english/
- Linking Agricultural Research for Rural Radio in Africa (LARRA) http://www.uoguelph.ca/~hhambly/

### Literature Review

AMARC (World Association of Community Radio Broadcasters). (2001). T*he African community radio manager's handbook: A guide to sustainable radio.* Lusaka, Zambia: AMARC Africa. from http://www.amarc.org/documents/manuals/The_African_CR_Manager.pdf

UNESCO. *How to do community radio*. from http://portal.unesco.org/ci/en/files/17593/11014593six-81Com_radio.pdf/Com_radio.pdf

Sterling, R., O'Brien, J., Bennett, J. (2007). Advancement through interactive radio (A.I.R) University of Colorado at Boulder Computer Science Department Technical Report. http://www.cs.colorado.edu/department/publications/reports/docs/CU-CS-100six--0six-.pdf

# 11. New Agriculture Skills by Radio for Smallholder Farmers

## Executive Summary

This project offers smallholder farmers basic education in agriculture, micro-entrepreneurship, literacy, numeracy, and life skills through participative radio and/or other mediated formats, so that they can use and act upon new and existing sources of information. This capacity to understand and utilize information will empower smallholders to increase their productive capacity for on-farm and off-farm activity and improve the quality of life for themselves and their families. This project will be delivered in three yearly stages: stage one, basic agricultural skills with literacy and numeracy training; stage two, agriculture and other skills; and stage three, advanced agriculture and other skills. For the "New Agriculture," access to price and other sorts of information is necessary, but not sufficient. Studies have shown that the majority of smallholder farmers, especially women, have not completed their primary education and have limited or no literacy skills. Their limited literacy skills make it difficult for them to access up-to-date information, which is or will become available from many different sources. Smallholders also have limited knowledge of basic science, problem solving and life-skills, such as money management, deficits that also inhibit them from using such information. The proposed project will develop and deliver a radio and other multimedia instructional system covering core agricultural knowledge, life skills, entrepreneurial skills, interpersonal skills, critical thinking, decision making, and health education, including HIV/AIDS education. The program design involves thirty-minute programs, broadcast four days a week, covering these topical areas using a new model of radio-based instruction for rural adults developed by the project. A fifth broadcast each week will utilize a call-in facility to allow listeners to submit questions either directly or through a village facilitator to the community radio station. Based on tested principles of interactive radio instruction, programming will utilize simplicity, repetition, participation and activity, and will include a radio drama each day, plus songs and games included in some broadcasts. Programs will be mediated by a community volunteer who will receive training as a facilitator. Each community volunteer will be provided with support resources including a wind-up radio, MP3 or other delivery device and a facilitator's guide, giving the details of each lesson. The community volunteer will be sponsored and accountable to a local village organization.

Literacy and numeracy training, facilitated by the community volunteer will be tied to the content of the radio programming, and will address day-to-day reading needs of the farmers, such as the need to read fertilizer bags, pesticide instructions, and basic farming-oriented brochures, magazines and literature. The literacy level achieved is intended to be such that farmers will be able to access basic real-time information via SMS technologies. Near real-time revision of lessons will allow multiple iterations of the lessons each year. This iterative model anticipates that timing, duration and even content of programming may have to be adjusted based on early experience. This program offers the promise of high impact for small farmers in general and disadvantaged groups such as women in particular. Using this method, for example, women could study together in single-gender groups or even, if necessary, at home. As part of the radio education program, special modules will be developed for women that address gender-specific agricultural issues, and added training in related areas such as health and life skills. Training through the radio will provide easier access for women, whose commitments and cultural constraints often prevent them from participating in other kinds of educational activities. The radio education proposal offers several compelling innovations that offer significant benefit to smallholders including:

- Content informed by gender-specific smallholder job descriptions
- Two-way feedback loops added to a highly participatory interactive-radio-instruction-type radio methodology

- Agricultural skills training combined with literacy or basic education
- Scaling the success of radio
- A new radio-based methodology for teaching adults based on the proven design principles of IRI education
- Current and future farmers reached (i.e., both adults and out-of-school youth)
- Near real-time monitoring, evaluation and revision of program materials and delivery protocols

## Project Description

Today, agriculture and food consumption systems are undergoing rapid and revolutionary change. The increasing interdependence of global markets, availability of new inputs and technologies and availability of a number of new distribution channels, to name but a few changes, has changed the competitive landscape for the smallholder farmer. Danger exists that underdeveloped countries will be increasingly marginalized if they do not increase the knowledge content of their economies, and diversify them through learning, innovation, and two-way information flow. As a result of these rapidly unfolding changes, the prescription for smallholders' success is literally changing before our eyes. Subsistence agriculture is giving way to an emphasis on commercial farming, and the historical focus on production is shifting toward a demand, market-driven orientation. Local consumption, while still important, is being augmented by new opportunities to sell to regional, national and even global markets. Smallholder success, amidst these changes, requires a two-way flow of information, whereby farmers have voice in creating practical policy solutions to problems they face day to day, and also receive various sorts of information necessary to be aware of and able to meet the demands of the market. Even while new technologies emerge, participative radio nonetheless stands out as a successful media for providing accurate and timely agricultural information to smallholders, as well as how to use this information in the process of making daily on-and-off farm decisions. Meanwhile, additional sources of information are becoming accessible to the smallholder as new technologies such as cell phones, community radio and video extend their reach.

In short, information is becoming more important and available to the smallholder farmer, but many farmers lack the basic skills required to access, utilize, respond to and act upon the information they need. At the same time, basic agricultural and micro-entrepreneurship skills will be required to take full advantage of the opportunities presented by the New Agriculture.

In this environment, smallholders' pathway out of poverty involves at least four basic strategies: a) improve productivity; b) offer value-added labor and services to other, more successful farmers; c) involve themselves in rural non-agricultural employment that arises from non-farm activity like trading, agro-processing or providing goods or services for the local, rural economy; d) or migrate out of the village in pursuit of new, urban economic opportunity. The proposed radio education program is designed to facilitate success in any of these pathways. Studies have shown that the majority of smallholder farmers, especially women, have not completed primary education, and has limited or no literacy or numerical skills. In addition, they lack basic agricultural training, entrepreneurial and critical thinking skills, indeed ones which would enable them to manage their small holdings more effectively, moving them from subsistence farmers to small-scale commercial farmers, thereby increasing the potential for lifting themselves out of poverty. Their limited literacy/numeracy skills make it difficult for them to access up-to-date information that is or will become available from many different sources. Moreover, limited knowledge of basic science, business problem-solving and life-skills inhibit them from using such information to full benefit. A recent study by Tutwiler and Straub (2005) offers compelling evidence that smallholders need improved knowledge and understanding of how market chains operate on their behalf. It follows that education is closely correlated with improved productivity of smallholders, even while factoring in the size of holding.

*The 21st Century Smallholder Skillset and Job Description*

To support the design of this project's curriculum, smallholder job descriptions for both men and women will be developed. This will be achieved through two separate but related processes. First, a search of the literature on smallholder task requirements will be conducted to develop first cut job descriptions. Then, field research will be conducted to study smallholders' day-to-day activities in order to further refine job descriptions. Field research will target a sample of "typical" as well as "ideal" smallholders, in order to conduct a gap analysis. Successful male and female smallholders will be studied to determine what skills are required for success. Typical male and female smallholders will be studied to identify what skills are likely to be missing and in need of further development. The job description's focus will extend beyond farming requirements, and address market literacy in general, and other aspects of smallholder livelihood and the skills required for success. Identifying unique job responsibilities for both men and women will inform curriculum design in important ways. The identified overlap between the male and female job demands will allow curriculum modules to be developed that simultaneously meet the skill requirements of both men and women. This is expected to be perhaps 50-75% of the total curriculum. The remaining modules will be tailored to the special needs of both men and women, as well as for other marginalized groups in rural society. Pilot tests of the programs will be designed to determine whether a gender-specific curriculum is attractive only to the target group, or whether all members of a study group will participate in all modules. Based on the results of the Smallholder Job Analysis and resulting Smallholder Job Description, a 21st Century Smallholder Skillset will be identified and articulated. While a detailed listing and taxonomy of these skills is yet to be developed, we know from our review of existing literature, and our initial site visits, that the following general categories will emerge:

**Agricultural Skills:** While debate continues about the future of smallholders, and even the viability of the smallholder economic model (Dorwar et al., 2004), fundamental demographic forecasts suggest that large numbers of smallholders will exist in the global agricultural space for the foreseeable future. These individuals will be sharing a finite amount of agricultural land, making it imperative that they develop the skills to optimize their output and use of the land. A prioritized set of modules will be developed to address the most important areas for improvement of agricultural performance. These will focus on simple, but powerful interventions, to enhance agricultural skills. Examples of the type of skills anticipated in these modules include: basic literacy and knowledge to use material inputs, like seeds, fertilizers, and pesticides successfully and efficiently; "how to" skills to access new, affordable technology, through value-chain entry via media coverage; similar "how to" access to output markets; and skills to involve smallholders in processing and marketing. Some skill modules will emphasize initiatives that can be taken with little or no extra cost. Other skill modules will highlight accessible technology, inputs or approaches that will cost small amounts, but should be within the reach of roughly 80% of the smallholder population. Modules will also discuss costs, as well as further sources of information and suggested ways and means for obtaining new inputs or appropriate technology. Effective use of inputs, utilization of accessible technology, and innovative techniques will be emphasized.

**Micro-Entrepreneurship Skills:** The historical focus on helping smallholders increase production has been shown to be useful, but insufficient. New demand driven models for smallholder success are being developed which empower the smallholder to move beyond subsistence producer to market-oriented seller. This change in the overall agricultural landscape, driven by consumer demand in an overall process of urbanization and globalization, suggests fundamental changes in the required skill set of smallholders. While agricultural skills remain important, a new set of business skills emerge as co-equal in their criticality. The farmer will have to expand his/her focus beyond production, to considerations involving the entire value chain information system for agriculture of which they are a part. Such expansion would include taking into account that as poverty reduction takes place, multiplier effects occur on local markets for other goods and services provided by non-farm rural poor, including construction, agro-processing, supplying inputs and repairs. All of these opportunities require new skill sets that could be provided in the context of entrepreneurship training via radio. Radio programming would be timed according to smallholders' required and anticipated skills, including knowledge acquisition and feedback considerations. For instance, in pre-production planning, farmers need market information to be able to evaluate production options, including crop choice, input choice, the relative economic value of increasing yield, emerging opportunities, and so on. In the course of production, information needs also evolve, and farmers may need to manage employees (whether part of the family or not), continue to monitor and make agriculture and business decisions regarding the optimization of their crop's yield in terms of market expectations, and review established or new trading partnerships. In post production activity, farmers will require market information and skills in order to determine when and where to sell their surplus production, whether to sell their surplus production as is, or engage in some level of processing activity. Moreover, since many smallholders are net consumers, they also need information about where to purchase goods at the most affordable prices. And finally, it is imperative for smallholders to prepare for future cycles of agricultural activity, given that margins for error are narrow and chances for further impoverishment loom large. To address these specific needs of smallholders, basic finance, marketing, production management and human resource management modules will be developed and delivered.

**Life Skills:** Productivity of smallholders is not an end in and of itself. Improving health and family circumstances can at once contribute directly to the livelihood and well-being of smallholders, as well as productivity of smallholders' farming efforts, with the added benefit of increased human happiness. Therefore, this project intends to develop and integrate into radio programming basic life-skill modules that will offer both health and social value. Gender-unique smallholder job descriptions created during the development phase of this project will identify special life-skills for both women and men that can be addressed through these modules.

**Numeracy, Literacy and Critical Thinking Skills:** Through new and traditional means, the 21st century smallholder will increasingly be able to access a variety of information sources, some traditional and some unprecedented. In both cases, smallholders' ability to understand, analyze and ultimately act upon that information will determine its ultimate value. Basic literacy, numeracy, and critical thinking skills will provide a powerful foundation for processing wide varieties of information bombarding the smallholder from multiple sources. While the primary objective is to build these skills as a support for smallholder success, a spin-off benefit will be that smallholders will gain a new set of "portable skills," ones that can serve them well in a variety of circumstances. The results of training, then, will be: 1) more productive farmers; 2) marketable skills which could lead to other non-farm rural employment chances; 3) and information about new opportunities, and skills to take advantage of them, to migrate out of smallholder agriculture. Both (2) and (3) are extremely important, because Davis (2004) found that in more than 55 studies of rural economies, in almost every case, rural non-agricultural employment provided between 40% and 60% of incomes and jobs.

*Program Delivery*

As a basic practice, four days a week, a half hour radio broadcast will be followed with a half hour to one hour activity, conducted by a village facilitator. The radio broadcast will be content focused, while the facilitated activity will reinforce content of the day's broadcast while systematically developing literacy and numeracy skills based on vocabulary and concepts presented in the broadcast. Activities will be designed to utilize local materials, such as the packaging used to distribute pesticides and fertilizer, as well as other items readily at hand in the village scene. Emphasis on currently available items in the village is one strategy for allowing self-updating of the program. The fifth program each week will be interactively designed, with cell phone call-in capability to experts who will be available to answer questions and offer further explanation on the programming delivered earlier in the week. AIRS technology may also be incorporated into the interactive feedback strategy. Village facilitators will be identified and trained during year one. Based on the successful model of the IRI, contact is made with an existing village entity such as women's group, village council, or farmer's cooperative. It is actually this group that takes responsibility for selecting, supporting and holding accountable the facilitator. After the facilitator is selected, he or she will undergo facilitator training to prepare him or her for her role. Ideally, the facilitator will have a standardized, yet to-be-determined, level of education. Supplemental materials such as posters with facilitators' scripts on the back could be developed as support for facilitator work. Based upon programming research, and field study analysis, radio program content will be developed and delivered in a manner that is appealing to local cultures and preferences. Programs will include stories, skits, and "soap operas" designed to be educational and entertaining. IRI pedagogical principles will be utilized, including: mediation/ facilitation, repetition, redundancy, simplicity and participation.

*Sustainability Beyond Proposed Funding Period*

Beyond the proposed funding period, this radio project's approach to sustainability involves integration into a market based value chain to improve the lives of smallholder farmers. Building on existing community organizations, including local and district farmers' associations, womens' clubs, public and private NGOs, local agro-processors and distributors, private trade associations, financial institutions, extension services, and universities and technical training institutes, this agricultural information radio will be sustained by stakeholder underwriters, advertising and other sources of public and private support. Such integration will create private incentives that will be sustainable in ten years time. Expectations are that previous, successful radio ventures will serve as catalysts for new and emerging radio ventures involved in improving lives of smallholder agriculture as they more fully integrate into an evolving market information system.

## Primary Customers and How they will Benefit from the Project

Smallholder farmers and their families are the primary and intended beneficiaries of this project. Two to three countries in Sub Saharan Africa and two to three countries in South Asia will be included in the project's Phase I, lasting five years. Specific geographical locations within these countries will be based upon where community radio currently exists. As both producers and consumers, smallholder farmers need information via radio on more than just market/pricing information, including interactive programming on how to obtain support services (credit, management training); location and focus of nearby NGOs; information on commercial contacts and communicative interactions with them; quality and delivery expectations, and establishing reliable trading relationships. All of these factors will benefit smallholder farmers in the form of higher profits, lower and more assured prices for supplies, and improved educational and training opportunities through interactive radio programming. Smallholders would also benefit from thematic programming, with topics selected according to seasonal needs and farmers' challenges, including information related to accessing inputs (fertilizers, pesticides, seed); emerging markets, product quality specifications, cooperative formation opportunities and on-going educational and entrepreneurship programs.

Secondary beneficiaries would include those involved in rural, non-farm employment, or work generated by increased farm productivity. These opportunities could reside in manufacturing, agro-processing, transportation and other non-production areas. As Dorward et al. (2004) has suggested, as the capacity for smallholders diminishes to provide the sole means for significant poverty reduction, secondary non-farm beneficiaries play an increasingly important part in overall poverty reduction, and information that both primary and secondary beneficiaries can receive and use is critical to this overall development process.

### Day in the Life

While visiting the busy market town of Choma, 188km northeast of Livingstone, the capital of the Southern Province of Zambia, a smallholder farmer was preparing to walk back home to her village, after selling retail grass for house roofs, and small quantities of passion fruit. She loved going to market, especially because she had made many friends there, and learned about new opportunities for selling. Declining prices for grass and fruits, however, was becoming very discouraging. Selling maize to make nshima wasn't a money-maker either. But her friend told her about a new opportunity, heard about on the radio, to grow various new spices that were in demand at restaurants in Choma and nearby towns and cities. She decided to spend the evening in her friend's village and listen to the radio program. That night, she was surprised that the program was broadcast in her local dialect of Tonga, as well as in English, the lingua franca of the country. Though this was primarily an educational and agricultural radio broadcast, the evening's broadcast touched briefly on HIV as well, with special information by and for women regarding how to protect themselves and where to get tested. It was also fun to listen to this program because of the local discussion that took place afterwards, facilitated by a village volunteer. Local musical traditions were integrated with agricultural information. She liked getting the "message in the music," and the evening's broadcast on specialty spices and foods in demand at nearby hotels and restaurants was especially helpful. She and her friend were able to interact with the program's host via her friend's cell phone, and she was able to find out where to receive more information about where to find seeds for growing the spices, and which seeds were appropriate for local agricultural conditions. On the way home the following day, she stopped at a hotel restaurant, and asked the kitchen chef about where he procured his cooking staples. He also was a regular listener to the agricultural radio program, and promised he would call in the following evening with information about emerging demand in specialty spices, and some fruits and vegetables. Tuning in to the program the following evening with a friend's radio, lo and behold, the chef called in with the information he promised, and also noted how tourists liked local wood and copper crafts, ones that would fetch top kwachas in the hotel's gift shop. Based upon the information that she received, the smallholder farmer decided to let her friends know about these opportunities, because together, they would have the money to buy seeds and raw materials for small crafts for the hotel's gift shop. They also responded to the chef's information, and promised to stop by the hotel the next time they went to market to find out more details about this emerging opportunity they found out about through interactive radio.

### Evidence of Success

This program builds upon proven principles of radio education, and is thus less risky than a proposal to introduce unprecedented technologies or approaches. Early indications suggest a strong likelihood of success. Adult literacy programs appear to be gaining momentum in many communities where they are available. Some of these have been targeted specifically toward women, others more general in their appeal. Over 100,000 children in Zambia have participated in the IRI radio education program with success rates rivaling the formal education system. These children were located in many of the same geographic and socio-economic areas targeted by this program. Some adults have participated in this primary radio education as well. In one noteworthy situation, prisoners followed the basic education curriculum in a program facilitated by a convicted murderer. We expect that the opportunity to gain basic literacy and information skills, while gaining agricultural and basic business skills, offers a compelling value proposition to smallholders hoping to take advantage of the New Agriculture. A study by Rees et al., (2003) demonstrated that current and future media preferences expressed by farmer groups differed for different types of agricultural information awareness, technical and marketing. The principal current media for awareness information were radio, extension workers, and local leaders. Men gave higher weight to radio and extension than women did, suggesting unequal access to these media between men and women. Men also mentioned newspapers as quite important. Both men and women farmers' recommendations for improved communications of awareness information emphasized radio and extension workers, and also mentioned greater use of print materials and newspapers, study tours, workshops and the use of emerging mobile phone networks. Only men mentioned study tours as a useful media for communicating awareness information, whereas only women mentioned workshops.

In the same study, the main media by which men and women farmers received technical information were extension, demonstrations, followed substantially behind by radio (136). Farmer recommendations for improved communication of technical information emphasized the use of several types of media: print media (especially recommended by women), extension workers, demonstrations as well as workshops and study tours. Rees et al., (2003) also found that little marketing information was available to farmers, and a considerable demand for this was expressed. Important for the potential of radio in this area, the main media by which men and women receive marketing information was radio, followed by extension workers and newspapers (all of these were rated more highly by men than by women), as well as local leaders, and neighbors. Importantly, farmer recommendations for improved communication of marketing information emphasized radio and extension (equally highest) as well as local leaders and family. Newspapers, and other print media, markets and emerging mobile phone networks were also suggested. According to Rees et al., (2003), the most frequent source of agricultural information for farmers was based around their social networks—easily accessible family, neighbors and friends. Outside of this network, local extension workers were cited as the most common source of information, with non-government intermediary organizations cited as locally important in some areas. In remote areas (more than 30 km from a main district town or 5km to the nearest trading center) contact with government or NGO sources of information could be as infrequent as once a year. With respect to radio-broadcast information, access was similar across similar farmer wealth categories, but key weaknesses centered on: uncertain reliability; difficulties in knowing when broadcasts would occur; and choices of topics and enterprises to be discussed were made according to sponsors' interests rather than users' needs of this particular media.

### Force Field Analysis

Major barriers or obstacles that could impede the success of the project:

- Smallholder reluctance to take time to listen, interact and use information provided by interactive radio programming
- Failure to effectively translate information from one level of understanding to one of practical use for smallholders

- Insufficient feedback loops to make on-going corrections in radio programming that does not effectively and efficiently meet smallholders' current and emerging needs
- Smallholders and non-farm poor may be highly averse to taking market risks, owing to food security issues and cultural constraints
- Not effectively reaching women and other marginalized social groups through programming bias and smallholder face-saving

Major factors which may contribute to the success of the project:

- Further research of evidence demonstrating that southern Africans rate radio as their most important source for news, and the medium is highly regarded for accuracy and fairness
- Willingness by facilitators and listeners to enter into a dialogue, generating new ideas and innovative solutions to complex smallholder issues
- Providing programming that is receptive to local and regional tastes and preferences, and enjoyable to listen to and interact with

Design Features of this Project that Increase Likelihood of Success

- Interactive radio programming includes in its broadcast design, feedback loops involving the smallholders themselves
- Such feedback can be acted upon quickly and at low cost
- As smallholder developments continue apace, multiplier effects, i.e., impacts on rural non-farm rural actors, are built into the design of this project, and programming
- prepares smallholders for new possible roles in the rural economy

Two risks stand out as particularly important: 1) Uncertain response of smallholder farmers: Will sufficient numbers of farmers be willing and able to devote one-to-two hours per day to this program? 2) Sustainability: Will communities be willing and able to take on the responsibility to maintain and support village-level facilitators over time?

### Expected Cost /Major Cost Categories

| Structure | Function | Staff Salary | Equipment/ Supplies/Travel | Airtime Costs |
|---|---|---|---|---|
| Board | Governance | No | | |
| Local Hosts | Day-to-day operation | Yes | Yes | Yes |
| Information Stringers | Market information; arbitrage opportunities | Yes | Yes | |

| Structure | Function | Staff Salary | Equipment/ Supplies/Travel | Airtime Costs |
|---|---|---|---|---|
| Village Facilitators/ Local Knowledge Workers | Training of new hosts | Yes | Yes (cell phones, radios, other technology) | |
| Management, Train the Trainer Entity | Oversee phase/ yearly goal monitoring | Yes | Yes | |

## Timeline

It is anticipated that the highest level of investment will be required in the first two years, conducting needs analysis, developing programs and training facilitators. Once the five-year cycle is completed, a tried and tested set of radio programs will have been created which can be used in other community radio stations and national radio stations with very little change. The project entails a time line of ten years, with sustainability achieved by this point, providing a platform for scaling out to other regions, and up to other countries, until fully integrated into the WorldAgInfo system. Three training levels or stages will be offered, each one lasting one year:

**Stage 1:** Agriculture with basic literacy and numeracy (possibly two years in length).

**Stage 2:** Basic Agriculture and other skills.

**Stage 3:** More advanced skills such as contained in agricultural certificate courses (possible certificate to be issued upon completion).

***Proposed Five-Year Development/Delivery Cycle***

**Year 1:** This time will be devoted to curriculum development and pilot testing. Specifically, smallholder job analysis and descriptions will be finalized during this year, and first year curriculum will be developed and piloted. Relationships will be established with village-level organizations, and facilitators will be identified and trained.

**Year 2:** Full implementation of Stage 1 curriculum (basic agriculture, literacy and numeracy) in target communities will take place. Real time feedback will also be collected, which will inform further refinement of the curriculum still under development and revision. Stage 2 and Stage 3 curriculum will be developed at this time as well.

**Year 3:** Full implementation of Stage 2 curriculum (basic agriculture and other skills). Stage 1 is repeated.

**Year 4:** Full implementation of Stage 3 curriculum (more advanced agricultural and other skills). Stage 1 and 2 are repeated.

**Year 5:** Revision of Stage 1, 2 and 3 curriculum is made using feedback (IRI "feed forward" curriculum revision) from the first three years of implementation. At the end of year 5, a field-tested and fully revised curriculum will be available for scaling out to other communities and scaling up to other countries.

*Scalability of Program*

**Phase 1:** Covering years 1-5.

During this phase, similar projects would be duplicated in 2-3 countries in southern Africa and 2-3 countries in southern Asia. Regional learning communities would emerge in this process, covering approximately 300 villages, in 2-3 districts, using existing community radio infrastructure. Three community radio stations would serve this process, and village facilitators would be actively trained and recruited on an on-going basis. According to our best estimates, with an average of 20 smallholders per listening group, such Phase I programming could reach a total of 6,000 listeners. In the meantime, facilitators could be continually selected and trained as potential national manager talent would be identified and trained for Phase 2.

**Phase 2:** Covering years 6-10.

During this phase, interactive radio projects would continue in the same countries. Based upon lessons learned in Phase I, district level expansion would take place, to full national coverage, with careful attention paid to local and regional variation of needs and interests. It is projected that an additional 20 countries would be included in interactive radio programming in this phase, based on funding availability, human resources, and host country interest and support.

**Phase 3:** Covering years 11-20.

In the third and final phase of this project, interactive radio would become available on a global basis, and would be fully integrated into the WorldAgInfo technology and information system. Interaction on this global level will generate new innovations in information diffusion and feedback loops that will make possible customer-based input into the continuous improvement and sustainability of the system.

The total duration of this entire project would be 20 years, with donor funding covering only the initial ten years, consisting of Phases I and II, each lasting for five years.

### Project Assessment

This program is designed to improve the capacity of smallholder farmers to utilize a variety of information sources that are available to assist them in improving their productivity and livelihood. At the most basic level, farmers will be able to read instructions and make basic calculations relevant to their day-to-day farming activity. Capacity for critical thinking will also increase, allowing farmers to do basic cost-benefit calculations as they choose whether or not to adopt new inputs, technologies, techniques, and crops as they move forward. Through micro-entrepreneurship training, they will be better prepared to operate their holding as a commercial concern, responding more effectively to market forces as well as family needs. Some specific indicators of success are listed below.

- Women more fully involved in decision-making and income generating activity
- Literacy levels increase
- Numeracy skills increase
- Farmers use information to support decision-making
- Farmers know where to obtain information

- Farmers actively seeking new sources of information
- Basic agricultural skills are strengthened
- Improved productivity
- Increased number of smallholders participating in interactive radio
- New job creation, both on and off farm
- Smallholders begin to think of their activity in business terms
- Consider high value crops
- Processing options
- Diversification
- Focus on income in addition to production

With respect to formative and summative evaluation strategies, several practices should be put into place to insure reliable evaluations. These would include:

- Ongoing interaction and feedback with farmers, facilitators, and other system actors, including listener surveys and other communications that will generate a record of deliberations for assessment of project success
- Task force feedback surveys will be administered to measure smallholder willingness to participate in interactive radio initiatives, as well as the perceived benefit of such participation and interaction by smallholders
- Production and marketing data will help in the measurement of production changes
- Smallholder income changes will also be assessed, as well as indicators of wealth accumulation
- At least three iterations of program revision each year
- Comparative data gathered on radio, mixed media, and exclusively asynchronous (MP3) program

In the Agricultural Radio Education project, assessment is viewed as a key component of a larger, on-going, continual improvement mechanism. Such a mechanism is intended to ensure that management, trainers, facilitators and smallholders' successes and failures are subject to review, fostering accountability and quality improvements in programming and processes. Periodic assessment meetings will be scheduled, where challenges, gaps and opportunities can be articulated and acted upon.

### Potential Project Partners

- Education Development Center (currently using IRI in schools and communities in Africa)
- American Institutes of Research (staff member who developed IRI in Africa).
- Community radio partners in Africa/Asia; smallholder organizations in Africa/Asia; womens' organizations in Africa/Asia.
- Value Chain Information System for Agriculture, VISA. (Proposal in process)

### Literature Review

Bagnall-Oakley H, Ocilage M, Imairkorit-Oumo, Nangoti, N. (2003). Development of procedures for the assessment and management by farmers of their agricultural information networks and needs at the sub-country level in Uganda. Entebbe, Uganda: National Agricultural Research Organization (NARO).

Davis, J. R. (2004). *The rural non-farm economy, livelihoods and their diversification: issues and opinions.* University of Greenwich. UK: Natural Resources Institute.

Dorward, A. Fan, S., Kydd, J. et al. (2004). Re-thinking agricultural policies for pro-poor growth. *Natural Resource Perspectives*, Number 94. London: Overseas Development Institute.

Fardon, R. & Furniss, G. (Eds.) (2000). *African broadcast cultures: Radio in transition*. Oxford, UK: James Curry Ltd.

Martins, A. A. (2003). Radio drama for development: ARDA and the Rainbow City experience. *Journal of African Cultural Studies*, 16 (1), pp. 95-105.

Nixon, R. (2007, July 22). Africa, offline: Waiting for the web. *The New York Times*. Business, 22.

Pitts, G. (2002). Radio listening and news prominence in Zambia. *Journal of Radio Studies*. 9(1), pp. 146-160.

*Pitts notes that Zambia has experienced growth of private radio, citing that private radio stations in Lusaka have attracted nearly half of the listening audience away from government radio. Importantly, listeners rate radio as their most important source for news, and the medium is highly regarded for accuracy and fairness. Challenges exist, however, since private radio stations lack national coverage and political and economic clout to challenge government broadcasting.

Rees, D. J., Imairit-Oumo, F, Nangoti N. et al. (2003). Design and implementation of a communication strategy for agricultural research in Uganda-experiences and lessons learned. *Uganda Journal of Agricultural Sciences* 9(1), pp.132-136.

Tutwiler, A. & Straub, M. (2005). Making agricultural trade reform work for the poor. *International Food and Agricultural Trade Policy Council*: An IPC position paper. Washington, D.C.: IPC.

# 12. Soil Testing Probes for Smallholder Farmers

*Introductory Note:* This proposal has not been reviewed by soils experts. The concept being forwarded is primarily the business model, which could conceivably be coupled with other kinds of agricultural advice or services.

## Executive Summary

This project creates a network of independently functioning soil testers who will provide low-cost soil-testing services to smallholder farmers. The testers will be given rudimentary training on how to perform a few simple chemical soil tests using a basic kit of a soil probe and other required devices and a simple visual guide on how to analyze the principle soil characteristics based on the results of the physical tests and from observation. The tester will send the results in real-time via mobile phone SMS messages to the project's central WorldAgInfo soil/crop database. The central database will send the soil tester a set of recommendations for the optimal combination of soil preparation (e.g., fertilizer, seed variety, tilling method, etc.). The goal is for the smallholder farmer to achieve the optimal soil conditions for their upcoming crops.

Soil health is a major factor in crop productivity. Smallholder farmers rarely perform soil analysis and thus have a lack of information necessary for making decisions about the care of their land. In India, a common concern is that they are using too much fertilizer whereas, in many parts of Africa, the principle concern is about having too little fertilizer. In both cases, knowing what level of soil inputs would result in a given crop output has the potential to transform the farmer's decision-making process. The farmer who invests too much into output or other crops will be disadvantaged compared to the African farmer, who has the confidence to purchase more fertilizer because the expected return is far more predictable than it would have been otherwise.

This projects works well at a small scale and even better at a larger scale. Ideally, every farmer in a region or nation would use this system. As the database accumulates more information, the statistical inferences that can be made will become more meaningful. The use of currently existing mobile phone networks for the carrying of SMS messages makes this system capable of scaling quickly and inexpensively. The data processing required is fairly simple, and even a low-end PC server should be able to handle tens of thousands of soil test reports a day. Creating the required soil database and training soil testers will require approximately six months. The training will require a week's time for each group of testers. The soil database will require approximately four months to develop and two months to tests and improve. Success can be measured on two levels: the individual farmer and at the regional level. The farmer immediately benefits from the results of making better-informed decisions. The nation gains as trends and patterns are identified. The benefit of the farmer is paramount because without the farmer, the test results cease. If the policy makers and researchers/educators are using the statistical results to adjust their activities, the smallholder farmer may benefit from more applicable policies and from more relevant research. There are many ways to measure the impact of this project. The number of tests is perhaps the most direct measurement. The crop improvement of participating farms is less direct but perhaps potentially more meaningful. The impact on policy and research will be more difficult to measure statistically. The number of times database statistics are used by policy makers and within publications will be the best evidence of impact here.

### Project Description

Soil testing is an important aid to improving soil health and to increasing crop productivity. Very few smallholder farmers currently have access to soil testing services. With the availability of commercial fertilizers, new seed varieties, new irrigation and tilling techniques, the farmer cannot safely rely solely on traditional knowledge. This project would combine the benefits of soil testing with a knowledge base of best practices. Soil testing today is usually performed by placing a soil sample in a plastic bag and then sending it to a distant agricultural lab. The results come back weeks or months later. But research of soil testing literature clearly indicates most of the important factors are the result of in-person observation, such as soil drainage, root depth, and worm population densities. The chemical tests, such as the ones for PH and nitrogen levels, are important but by no means the only important measurements of soil health. While a complete soil test produces dozens of measurements, the majority of the important conclusions come from a few simple measurements. We have been in contact with a number of firms involved with soil testing equipment, and it appears that a low-cost and simple to use soil testing device/kit could be feasible for this project. Clearly, one of the first tasks of this project would be to test and modify any equipment and training materials to make sure they work as intended.

The mobile phone allows for a low-trained individual to perform the relevant tests and ask appropriate questions to guide the smallholder farmer to the optimal combination of soil preparation and crop choice. The tests would be conducted by first running the chemical tests, assessing the soil environment and crop history, and by asking the farmer questions about local pests and anticipated crop selections for the coming session. These results would be correlated on an identification classification chart to a category code. Each category code would represent a meaningful profile, such as: low-medium soil moisture and rain feed. That particular combination may result in a code of "W13." This code and all the other similar codes could then be sent via SMS to the project's central database. The database may send back further questions or provide recommendations.

The individuals working as local soil testers would operate as small-scale entrepreneurs. They would pay the project a fee for each test they performed and would collect a fee from the farmers. The farmers would be willing to pay this fee because the knowledge the tests would provide would be likely to greatly increase their crop yields. Participating farmers could also sign up for free additional services. These services could include weather alerts, pest warnings, optimal planting times, and a report of their land's soil health over time. These additional services would help to reinforce the relationship between the farmer and the local soil tester. As the system becomes more widely used, the database begins to develop a meaningful regional/national soil map. Over time, patterns, cycles, and trends will be discernable as data are collected. In the short term, droughts and infestations can be identified; in the long term, basic soil health, acceptance of new seed varieties and farming techniques can be spotted. At a larger scale, the information may start to become useful for market predictions. Gluts and shortages of certain crops might potentially be identified even before the upcoming crop cycle has started. While the project can operate at a small scale, it clearly works best at a larger scale. Because the system is based on currently existing mobile phone networks, the ability to scale is uncomplicated. The infrastructure is already in place. The centralized server, once programmed to the relevant knowledge bases would work as well for millions as for thousands. In fact, the system should learn from historical results to become even more accurate.

The main costs will be that of communications. The number of SMS messages going back and forth could become a significant cost factor. If the fee system for testing is used, the project should have the potential to become profitable. The initial programming of the database and the training of the first group of soil testers will be a significant up-front cost. The cost recovery time will depend on the scale of operation. In this case, the more usage, the faster the project will recover the initial outlay.

Developing the interactive database will be the largest initial effort. The database would share some of the features found in other WorldAgInfo services and thus the cost may be distributed somewhat, but the training of what questions to ask in response to the test results supplied will require a fair amount of collaborative work with a team of programmers, statisticians and agricultural soil experts with knowledge of local conditions. One of the key objectives will be to identify test results that are inconsistent enough to indicate some sort of testing error or the start of some sort of new trend. For example, withered leaves moist soil might indicate some sort of plant disease or a recent irrigation to otherwise drought-stricken soil. For this system to be truly effective, it must have features that look for new patterns – much in the way credit card companies use data mining to discover fraud or merchants use purchasing patterns to optimize floor displays.

The soil tester is a vital element of the system. The soil testers need to be trained consistently so that farmers will have confidence that the fee they pay will produce a consistent result. The testers will quickly identify the strengths and weaknesses of the system and thus should be provided means by which they can provide feedback. After each test, the tester should receive an SMS message asking a few simple rating questions. The tester gets a credit for each SMS message they return. The system should thus be able to identify testers, regions, and soil/crop types that receive particularly good or bad ratings. This evaluation system would allow the system to rapidly improve. The soil tester will also be able to call for technical help from the project, at no cost. Every call to the project office is an opportunity to further optimize the database.

There are many possible tie-ins with other WorldAgInfo projects. The community radio project could link to this project by having a daily ten-minute show featuring the most common questions of that week along with a discussion of what the answers might be. The education radio project could use the results of database to determine what types of knowledge are most in need. This would also be true for the databases serving the agricultural libraries. This project is essentially creating a gauge of what local farmers need to know at that time. The facilitated video project would obviously look for trends and skills most commonly reported by the database when deciding which new videos need to be produced. Not only would they know which videos should be produced, but also they would know when and where each video is most needed.

### Primary Customers and How They Will Benefit from the Project

There are three primary customers with this project. The most important customer is the smallholder farmer. They will benefit by having more productive crops due to accurate knowledge of soil health factors and the required inputs for the optimal outputs. The soil testers benefit by having a source of extra revenue and by having knowledge of soil health. Soil health is a major factor in many places in Africa and South Asia. Having local people with knowledge of soil health and its importance is a strong social good. The third set of customers is the researchers/educators and policy makers. The project helps them by providing useful and real-time information about the local agricultural conditions.

### Day in the Life: Pre/Post

Pre: The smallholder farmer has poor harvests due to not knowing what the right mix of soil inputs are best suited for the crop being grown. The low income resulting from this inefficient use of land results in the farmer being unable to purchase animal traction and other factors that would allow the farmer to escape the harsh constraints of hand-hoe farming.

Post: The farmer greatly increases the harvest and makes enough profit to afford the labor saving devices that are required to become commercially viable. Knowledge of the right inputs gives the farmer enough confidence in the future in order to make informed decisions about leasing additional farmland. As farmers better understand the importance of soil health and the control they have over the factors leading to better soil health, farmers will expect prospective landlords to furnish proof that the soil is healthy.

### Evidence of Success

The literature leaves no doubt that soil health is a major factor in agricultural productivity. This fact is all the more important in South Asia and Africa because soil health is generally very poor and because farmers are highly susceptible to the negative impacts of a poor harvest. Inexpensive soil testing has been performed over a number of years in East Africa. The system of using a database of recommendations has been done with FAO's soil salinity. The use of SMS messages has become commonplace with the farming populations of South Asia and Africa.

Soil testing has it failures. The routine of sending soil in a plastic bag and receiving chemical breakdowns is inefficient, slow, and lacking in context. This project will be immediate, targeted, responsive, and contextualized. The use of independent soil testers is based on the Grameen Mobile Phone model of having local women selling time to those without their own mobile phones. While the women in the Grameen model now face the problem of operating in an environment where most people have their own mobile phones, soil testing is unlikely to become commonplace. Because the project is using pre-existing infrastructure, the cost of operation is fairly low. Regular mobile phones using existing mobile phone towers supply the main ingredients. Scaling is relatively simple because the mobile phone companies have a vested interest in expanding infrastructure to meet any unmet need.

The project should be easy to replicate to other countries. The content may need to be translated and adjusted for local crops and conditions, but the principles would be the same. Because the project would have a fee structure and provide value that can be seen in monetary terms, it should have the potential to become sustainable in a short amount of time.

### Project Assessment

Measuring the success of this project can be assessed in a number of ways. The number of soil tests is the easiest measurement. Over time, the growth in soil tests provides strong evidence that smallholder farmers are receiving value. The fact that both farmers and soil testers pay a small fee means that farmers are not likely to have their soil tested without them believing it has value, and soil testers will not inflate the number of tests because they pay for each test. If anything, the system may slightly under report its true usage. The value to researchers can be ascertained by the number of times data from the system is referenced in their research papers. Because the system has at its core a system for collecting rankings and discovering new patterns, it should be to measure what aspects of the system are working better than others. For example, even when total numbers are increasing, some regions may have a reduction in numbers because the system does not have accurate information on the crops used in those areas. Being able to find these subtle patterns is an important feature this system has for the person using formative evaluation techniques. We believe the proper evaluation of the system is one of its most important features.

## Force Field Analysis

The feasibility of the project depends on the accessibility and costs of mobile phone ownership in the project country. If government or corporate policy were to make the ownership of mobile phones difficult to support, that could make the project too expensive for the audience of smallholder farmers. Even if the smallholder farmer believes that the results will help obtain a much larger profit, the amount of money that farmer as at the start of the crop cycle is still small. In other words, a benefit of $500 dollars is not worth a $10 dollar fee if one has only $2 dollars.

We see no indication that mobile phones will reverse in terms of distribution or coverage. In fact, as new services are added, the project may be able to offer entirely new services and further reduce costs. For example, the mobile phone companies may start to allow their mobile phone towers to be used to triangulate a willing customer. A soil tester would thus be able to precisely identify the tested soil's location without access to GPS equipment. Of course, as GPS equipment becomes more common in mobile phones, this too will allow for geo-coding soil samples. The key element for the success of this project will be the use of formative evaluation. The constant monitoring of soil test results, the number and location of tests, and the feedback of the soil testers in the field will provide a wealth of information. If this information is properly analyzed and acted upon, there should a strong chance that any significant flaws in the system will be fixed.

## Expected Cost Categories

The following are the expected cost categories for this project. The majority of the cost will be in the startup of the project. After it is running, we expect the costs to drop significantly and remain at that lower level for a number of years.

- Staff (e.g., project administrator, trainers, agricultural expert in local soil conditions, software programmer and system administrator, statistician/evaluation specialist, accountant)
- Developing and purchasing soil device/kit with production of associated materials
- Computer hardware and interface to SMS network
- Supplies and distribution of those supplies to network of soil testers.

## Timeline

The project will require approximately six to nine months to hire staff, create a soil testing device/kit, produce training materials and to train the first soil testers. It will probably take at least a few crop cycles for the system's effectiveness to be recognized. After that point, there should be a high level of growth in the use of the system.

## Duration of Project

This project becomes more valuable as time goes by because the historical data on a farm's soil health is both relevant and unattainable now through any other mechanism. The goal of the project is for it to generate enough income in user fees that the project can be sustained and developed.

### Potential Project Partners

Partners would be the FAO's current soil health efforts, local agricultural research institutes, local agricultural universities, and NGOs currently advising farmers on best practices. In India, the network of agricultural call-in centers would be a potential connection.

# Cornell International Workshops on Agricultural Education and Information Systems
# Workshop II: Pathways Out of Poverty

## Livingstone, Zambia
## 11 November – 16 November 2007

A team of agricultural, educational, ICT, development, and evaluation experts is considering 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. This workshop is the capstone on a series of activities – including field trips, literature reviews, surveys, and a workshop at Cornell University – to identify the critical challenges and potential solutions to improve the exchange of agricultural information with smallholder farmers in South Asia and sub-Saharan Africa. The ultimate objective of the project is to create and improve agricultural information and knowledge systems that support smallholder farmers in improving their livelihoods. The Bill and Melinda Gates Foundation funds the project.

**Workshop Objectives**

- Create a vision of Solution Scenarios to improve agricultural education and information systems to benefit smallholder farmers.
    - Review, critique, improve, and consolidate a set of Solution Scenarios to improve agricultural information systems to benefit smallholder farmers.
    - Identify additional solutions to improve agricultural information systems to benefit smallholder farmers.
- Develop detailed descriptions of specific Solution Scenarios.

---

**SUNDAY, NOVEMBER 11, 2007**

16:00 – 19:30 Registration

18:30 Reception

19:00 Dinner
- Welcome
- Introductions
- Agenda Review

---

**MONDAY, NOVEMBER 12, 2007**

6:30 – 8:30 Breakfast

8:30 – 8:40 Opening Comments
*Dwight Allen and Mary Ochs, Co-Chairs of the Design Team*

**Pathways out of poverty: the role of agricultural education and information**

8:40 – 9:00 Pathways out of poverty in the new agriculture
*John M. Staatz, Michigan State University*

9:00 – 9:20 Pathways out of poverty: the role of education and information
*Doug Allen and Thane Terrill, Design Team*

9:20 – 10:20 Discussion

10:20 – 10:40 Introduction of Breakout Groups
*Dwight Allen and Rex Raimond, Design Team*

10:40 – 11:00 Break

11:00 – 13:00 Breakout Group Discussions

- 9 groups of 5 participants each discuss a cluster of solution proposals
- The group should identify one or two potential proposals per cluster to develop in more detail for the assigned topical area. The groups should draw from the solution scenarios they think are most likely to offer pathways out of poverty.
- Participants develop the proposal scenarios in more detail using the proposal template and the following questions.
  - What can be done to ensure sustainability and scalability/replicability of the proposal?
  - How would you address women's issues in the proposal?
  - What feedback mechanisms and formative evaluation methodology should be included in the proposal?
  - How would you ensure reciprocal input by users and providers of agricultural information in the proposal?
  - What research inputs (regarding technology, institutions, gender issues) are needed to ensure the long-term success of the solution?

13:00 – 14:00 Lunch

14:00 – 15:30 Breakout Group Discussions - Continued

15:30 – 16:00 Break

16:00 – 17:00 Breakout Groups Discussions - Continued

17:00 Adjourn

19:00 Dinner at the Chrismar Hotel

Dinner Remarks "The new agriculture in South Asia"
*Jagdish C. Katyal, Vice Chancellor, Haryana Agricultural University, Haryana, India*

---

**TUESDAY, NOVEMBER 13, 2007**

7:30 – 8:30 Breakfast

8:30 – 8:40 Administrative Announcements
*Mary Ochs, Design Team*

8:40 – 9:00 "The Role of the Private Sector in Improving Information for Smallholders"
*Janaki Kuruppu, Director, Strategic Planning, Cargills (Ceylon) Limited, Sri Lanka*

9:00 – 9:30 Discussion

9:30 – 10:30 Breakout Groups Report to Plenary (5-minute reports followed by 15-minute discussion. Groups may prepare material to be printed and PowerPoints (if used) should be loaded by 10 pm Monday night)

10:30 – 11:00 Break

11:00 – 13:00 Breakout Groups Report to Plenary - Continued

13:00 – 14:00 Lunch

***Parallel Activities***

14:00 – 17:30 Village Visits

19:00 Dinner at the Chrismar Hotel

Dinner Remarks "IT for Enhancing Rural Livelihoods: Rhetoric or Reality?"
*Kenneth Keniston, Massachusetts Institute of Technology, USA*

**WEDNESDAY, NOVEMBER 14, 2007**

7:30 – 8:30 Breakfast

8:30 – 9:00 Opening Remarks
*Roy Steiner, Bill and Melinda Gates Foundation*

9:00 – 9:30 Panel: Reflections on Village Visits: Information and Technology Perspectives.
- A panel, followed by discussion, of insights or ideas, either regarding possible solution scenarios or regarding challenges.

9:30 – 10:00 Discussion

10:00 – 10:30 Break

10:30 – 13:00 Breakout Group Discussions

13:00 – 14:00 Lunch

Afternoon and Evening Free

**THURSDAY, NOVEMBER 15, 2007**

7:30 – 8:30 Breakfast

8:30 – 8:40 Administrative Announcements
*Mary Ochs, Design Team*

8:40 – 9:00 "New Approaches to Developing Online Content"
*Florence Devouard, Wikipedia Foundation, France*

9:00 – 9:30 Discussion

9:30 – 10:30 Breakout Groups

10:30 – 11:00 Break

11:00 – 13:00 Breakout Groups

| | |
|---|---|
| 13:00 – 14:00 | Lunch |
| 14:00 – 16:00 | Plenary Discussion<br>▪ Breakout groups report back to plenary |
| 16:00 | Adjourn |
| 19:00 | Dinner at the Chrismar Hotel |
| | Dinner Remarks “ICTs for the New Agriculture”<br>*Gracian Chimwaza, Project Director, ITOCA, Johannesburg, South Africa* |

**FRIDAY, NOVEMBER 16, 2007**

| | |
|---|---|
| 7:30 – 8:30 | Breakfast |
| 8:30 – 8:40 | Administrative Announcements<br>*Mary Ochs, Design Team* |
| 8:40 – 9:00 | “A Zambian Perspective on the New Agriculture”<br>*Mike Weber and Jones Govereh, Michigan State University* |
| 9:00 – 9:30 | Discussion |
| 10:30 – 11:30 | Writing Session<br>▪ Participants work on detailed descriptions of solution scenarios/RFPs |
| 10:30 – 11:00 | Break |
| 11:00 – 13:00 | Writing Session |
| 13:00 – 14:00 | Lunch |
| 14:00 – 15:30 | Closing Plenary and Wrap Up<br>▪ Evaluation<br>▪ Closing Comments |
| 15:30 | Adjourn |
| 16:00 | Sundowner Cruise |
| 19:00 | Dinner at the Chrismar Hotel |

**SATURDAY, NOVEMBER 17, 2007**

Participants depart on Saturday, November 17.

## Cornell International Workshop on Agricultural Education and Information Systems
## Part II: Delivery Systems
## Livingstone, Zambia, 11-16 November, 2007

Carole J. Allen
Anthropologist
USA

Douglas B. Allen[1]
Associate Professor
Department of Management
University of Denver

Dwight W. Allen[1]
Educational Reform Specialist, Eminent Scholar of Educational Reform
Old Dominion University
Norfolk, VA USA

Richard Anderson
Professor
Department of Computer Science and Engineering
University of Washington
USA

Peter Ballantyne
President
International Association of Agriculture Information Specialists (IAALD)
USA

Blessing Chataira
Conference Assistant
Information Training and Outreach Centre for Africa (ITOCA)
South Africa

Gracian Chimwaza[1]
Executive Director
Information Training and Outreach Centre for Africa (ITOCA)
South Africa

Benson Chishala
Senior Lecturer
School of Agricultural Sciences
Department of Soil Sciences
University of Zambia

Philip Christensen
Project Director, RECLISA
American Institutes for Research
South Africa

U.V. Deepa
Technical Associate
Kerala Agricultural University, IPR
India

Dady Demby
Forum for Agricultural Research in Africa
Ghana

Philip DesAutels
Academic Developer Evangelist
Microsoft
USA

Carl K. Eicher[1]
University Distinguished Professor Emeritus
Michigan State University
East Lansing, MI USA

Shirley Eicher
Independent Consultant
USA

Stefan Einarson
Director, Information Technology - IP/PLBR
Cornell University
USA

Florence Devouard
Chair
Wikimedia Foundation
France

John Fereira
Programmer
Cornell University
USA

Rikin Gandhi
Graduate Student
Columbia University
USA

1. Member of the Design Team

Jones Govereh
Research Fellow
Food Security Project
Zambia

Sheebah Hamusimbi
Graduate Student
University of Zambia
Zambia

Prasanna Hettiarachchi
General Manager
MAS Holdings
Sri Lanka

Melissa Ho
Program Officer
Agricultural Development
Global Development Program
Bill & Melinda Gates Foundation
Seattle, WA, USA

Sophia Huyer
Executive Director
Women and Global Science and Technology (WIGSAT)
Canada

Christine Kanyengo
Conference Assistant
Information Training and Outreach Centre for Africa (ITOCA)
Zambia

Kelvin Kasuba
Graduate Student
University of Zambia
Zambia

Jagdish C. Katyal
Vice-Chancellor
Haryana Agricultural University
India

Kenneth Keniston
Director
MIT India Program
Massachusetts Institute of Technology (MIT)
USA

Janaki Kuruppu
Head of Strategic Planning
Cargills (Ceylon) Limited
Sri Lanka

Kelvin Laputo
Faciliations Team Leader
Agricultural Support Programme
Ministry of Agriculture
Zambia

Edda Tandi Lwoga
Sokoine National Agricultural Library
University of Agriculture
South Africa

Karim M. Maredia[1]
Professor and Program Director
World Technology Access Program (WorldTAP)
Institute of International Agriculture
Michigan State University
USA

Mywish Maredia
Deputy Director
Bean/Cowpea CRSP
and Adjunct Assoc.
Michigan State University
USA

Sebastian Mazuba
Agribusiness Manager
Zambia National Farmers Union

Janet McCue
Director
A.R. Mann Library
Cornell University
Ithaca, NY, USA

Dorothy Mukhebi
Coordinator
Regional Agricultural Information Network
Uganda

Dr. Shamsun Noor
Principal Scientific Officer
Bangladesh Agricultural Research Institute
Bangladesh

Mary Anderson Ochs[1]
Head of Information Services and Collections
Albert R. Mann Library
Cornell University
Ithaca, NY USA

Patrick M. O'Shea[1]
Director
HARP (Handheld Augmented Reality Project)
School of Education
Harvard University
USA

Ravi Palepu
Field Architect
Rogue Wave Software (formerly of Cyberplex Africa)
Africa

Rex Raimond[1]
Facilitator
Meridian Institute
USA

Raghavan Nagamangalam
Director
Broadcasting Corp. of India
India

Steven Reiquam
Professor
Applied Communications
University of Denver
USA

Stephen Rudgard
Chief of Outreach Programs
WAICENT, FAO
Rome, Italy

John Staatz
Professor
Dept. of Agricultural Economics
Michigan State University
USA

Roy Steiner
Senior Program Officer
Agricultural Development
Global Development Program
Bill & Melinda Gates Foundation
Seattle, WA, USA

Revi Sterling
PhD. Student
Computer Science
University of Colorado at Boulder
USA

Thane Terrill[1]
Adjunct Associate Professor of Computing and Education
Teachers College, Columbia University
New York, New York USA

Richard Trewby
Education Development Center
Zambia

Jaron Turner
Conference Assistant
Cornell University
USA

Rajesh Veeraraghavan[1]
PhD Student
Information Science
University of California, Berkeley
USA

Mike Weber
Professor and Co-Director
Food Security III Cooperative Agreement
Michigan State University (base)
Zambia

# 3

# 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

1. Eicher, Carl K., Karim Maredia and Idah Sithole-Niang. 2006. Crop Biotechnology and the African Farmer. *Food Policy*. 31(6): 504-527.

2. KATYAL, J. C. 2006. State of Agricultural Education vis-à-vis Emerging Concerns and Challenges. Draft Report of the Committee headed by Dr. J.C. Katyal.

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.

## References

1. Anderson, Jock. 2007. Agricultural Advisory Services. A background paper for WDR 2008. Washington, D.C.: World Bank. http://www.worldbank.org/wdr2008

2. Eicher, Carl K. 2007. Agricultural Extension in Africa and Asia. Staff Paper 2007-05. East Lansing, Mi: Department of Agricultural Economics, Michigan State University.

3. Gallagher, Kevin, Arnoud R. Braun and Deborah Duveskog. 2006. Demystifying Farmer Field School Concepts. *Journal of International Agricultural and Extension Education.*

4. Sulaiman, Rasheed V. and Andy J. Hall. 2006. Extension Policy Analysis in Asian Nations. In *Changing Roles of Agricultural Extension in Asian Nations*. Editors A.W. van den Ban and R.K. Samanta. Delhi: B.R. Publishing Corporation. pp. 23-54.

5. Van de Fliert, E. 1993. Integrated Pest Management: Farmer Field Schools Generate Sustainable Practices. A Case Study In Central Java Evaluating IPM Training, Paper No. 93-3, Wageningen Agricultural University, Netherlands.

## 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.

## References

Brown, O. (2005). Super Market Buying Power, Global Commodity Chains and Smallholder Farmers in the Developing World, UNDP Human Development Report.

Reardon T., Timmer, C.P., and Berdegué, J. (2004). "The Rapid Rise of Supermarkets in Developing Countries: Induced Organizational, Institutional, and Technological Change in Agrifood Systems". Website: eJADE: electronic Journal of Agricultural and Development Economics (www.fao.org/es/esa/eJADE). Vol. 1, No. 2, 2004, pp. 168-183.

Tschirley, D. (2007). "Supermarkets and Beyond: Literature Review on Farmer to Market Linkages in Sub-Saharan Africa and Asia" (internal literature review).

## 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

Kruger, A., Lemke, S., Phometsi, M., van't Riet, H., Pienaar, A.E., and Kotze, G. (2006). Poverty and household food security of black South African farm workers: the legacy of social inequalities. Public Health Nutrition, 9, p. 830-836.

## 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.

### References


1. R. Kuriyan and K. Toyama (eds.), "Review of Research on Rural PC Kiosks," 2007. http://research.microsoft.com/research/tem/kiosks/Kiosks%20Research.doc

2. G. Coldevin, *Participatory communication: a key to rural learning systems*, The Food and Agriculture Organization of the United Nations, Rome, 2003.

3. The Digital Green System: http://www.digitalgreen.org.

4. The Farm Radio Initative: http://www.farmradio.org.

## 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.

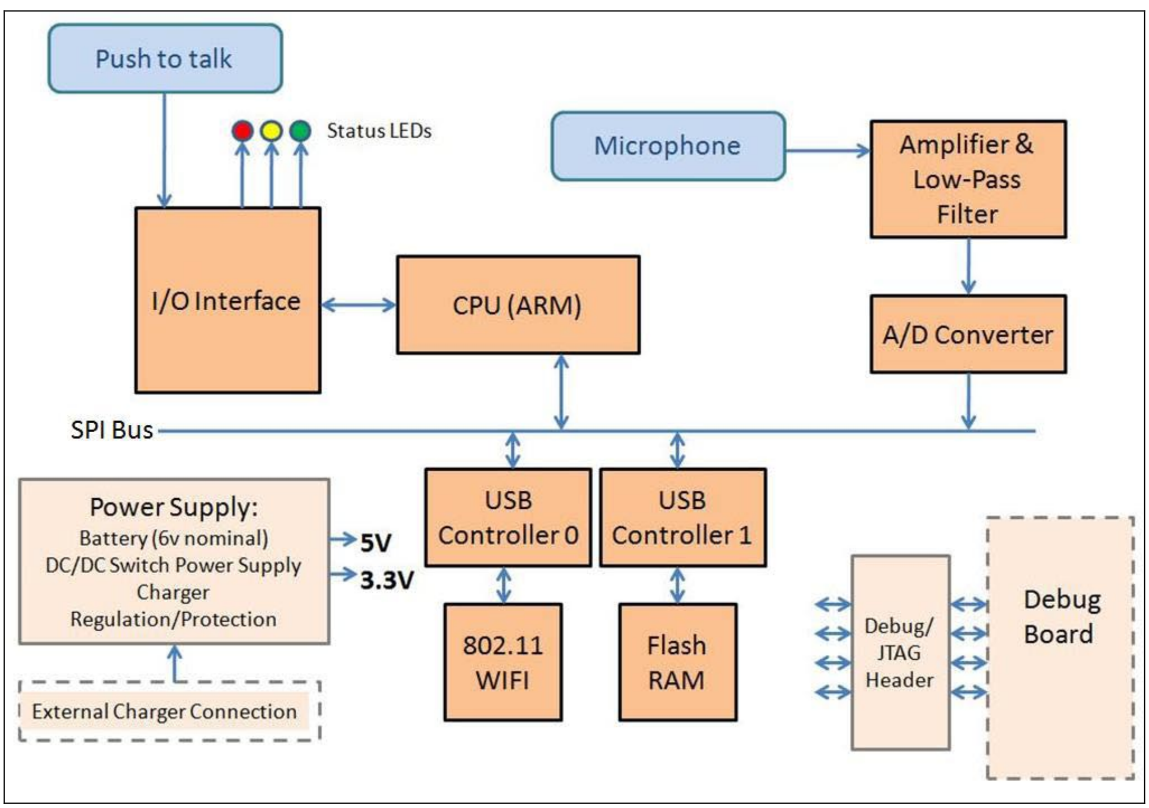
## 5. Measures of success

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

## References

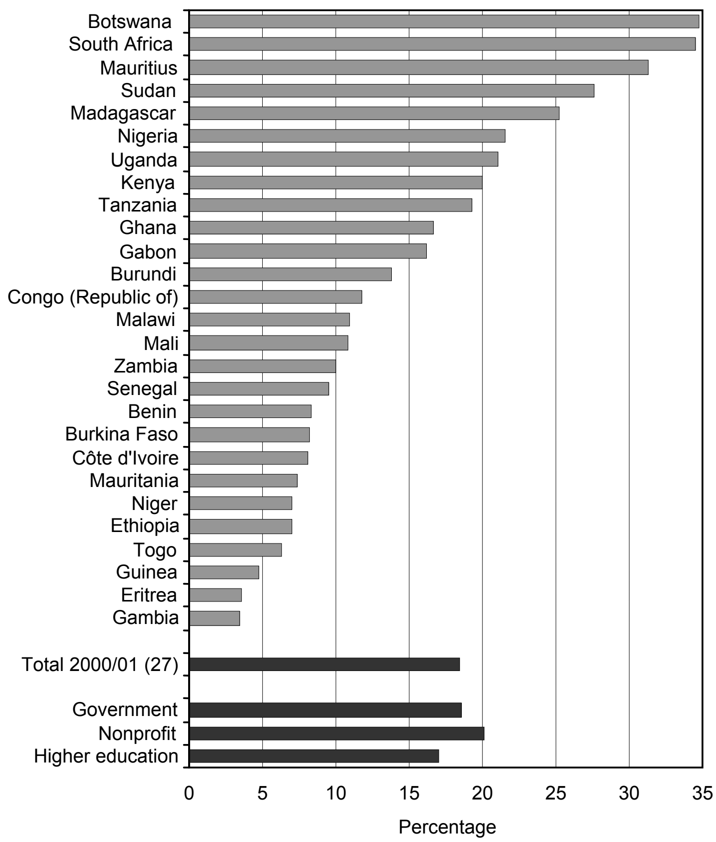

1. Boserup, Ester. 1972. Women's Role in Economic Development. Chicago: University of Chicago Press.

2. Spencer, D. 1976. *African Women In Agricultural Development: A Case Study In Sierra Leone.* Washington DC: Overseas Liaison Committee, American Council on Education.

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

4. Sara Boettiger. 2008.


**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.

### References

1. Eicher, Carl K. 2006.The Evolution of Agricultural Education and Training: Global Insights of Relevance for Africa. Staff Paper 2006-26.East Lansing, MI.:Department of Agricultural Economics, Michigan State University.
2. World Bank. 2008. World Development Report 2008: Agriculture for Development. Washington, D.C.: World Bank.

3. Johanson, Richard and William Saint. Forthcoming. Cultivating Knowledge and Skills to Grow African Agriculture: A Synthesis of Research Commissioned by the World Bank. Washington, D.C.: World Bank.

4 . International Assessment of Agricultural Science and Technology(IIASTD)2007.Global Report. Washington D.C.: IAASTD.

**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.

### References

Rosegrant, M., X. Cai, and S.A. Cline. 2002. Global water outlook to 2025. Washington, D.C. and Colombo, Sri Lanka: IFPRI and IWMI.

# 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*

<u>**Session 6: The Future of Information**</u> **(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–2nd FLOOR)**
*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

Ramziath Adajo
Graduate Student
Department of Agricultural Economics
Michigan State University
East Lansing, MI USA

Douglas B. Allen[1]
Associate Professor
Department of Management
University of Denver

Dwight W. Allen[1]
Educational Reform Specialist, Eminent Scholar of Educational Reform
Old Dominion University
Norfolk, VA USA

Jacqeline Ashby
Allianza Cambio Andino
International Potato Research Center (CIP)
Cali, Colombia

Cephas Ametefe
Farmer
Ghana

Suresh Chandra Babu
Senior Research Fellow
International Service for National Agricultural Research (ISNAR)
Washington, DC, USA

Ousmane Badiane
Senior Research Fellow / Senior Research Advisor
Africa Coordinator, International Food Policy Research Institute (IFPRI)
Pretoria, South Africa

Peter Baker
Graduate Student
Educational Curriculum and Instruction
Old Dominion University, VA, USA

Venkataraman Balaji
Head, Knowledge Management and Sharing
International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)
Patancheru, India

Marianne Banziger
Director
Global Maize Program
International Maize and Wheat Improvement Center (CIMMYT)
Nairobi, Kenya

Sara Boettiger[1]
Strategic Planning and Development
Public Intellectual Property Resource for Agriculture (PIPRA)
University of California Davis
Davis, CA USA

Gracian Chimwaza[1]
Executive Director
Information Training and Outreach Centre for Africa (ITOCA)
South Africa

Gopal Chowhan
Executive Director
Sustainable Agriculture and Farming Enterprise (SAFE) Development Group
Dhaka, Bangladesh

Loy Van Crowder
Senior Officer
Extension Systems
Research and Extension Division
Natural Resources Management and Environment Department
Food and Agriculture Organization (FAO)
Rome, Italy

Nango Dembele
Assistant Professor
International Development
Michigan State University
and Coordinator, PROMISAM (Projét de Mobilisation d'Initiatives en Matière de Sécurite Alimentaire)
Bamako, Mali

Vibha Dhawan
Vice Chancellor
TERI University
New Delhi, India

1. Member of the Design Team

Carl K. Eicher[1]
University Distinguished Professor Emeritus
Michigan State University
East Lansing, MI USA

Mushtaq Gill
Director General
On-Farm Water Management
Punjab Provincial Department of Agriculture
Lahore, Pakistan

Ken Giller
Professor
Plant Production Systems
Department of Plant Sciences
Wageningen University
Wageningen, The Netherlands

Lutz Goedde
Senior Program Officer
Agricultural Development
Global Development Program
Bill & Melinda Gates Foundation
Seattle, WA USA

Diana Grusczynski
Associate Program Officer
Agricultural Development
Global Development Program
Bill & Melinda Gates Foundation
Seattle, WA, USA

Jeanette Gurung
Director
Women Organizing for Change in Agricultural and NRM (WOCAN)
Ithaca, NY, USA

E.A. "Short" Heinrichs
Research Professor
Department of Entomology
Consultant to INSORMIL and IPM CRSP
and
Secretary General
International Association for the Plant Protection Sciences (IAPPS)
University of Nebraska
Lincoln, NE, USA

Robert Herdt
International Professor
Applied Economics and Management (Adjunct)
Cornell University
Ithaca, NY, USA

Melissa Ho
Program Officer
Agricultural Development
Global Development Program
Bill & Melinda Gates Foundation
Seattle, WA, USA

Barbara Hutchinson
College of Agriculture and Life Sciences
University of Arizona
Tucson, AZ USA

Henry Kalomba
Regional Manager - North
National Smallholder Farmers' Association of Malawi (NASFAM)
Lilongwe, Malawi

Nidal Mahah Karim
Graduate Student
Ecological/Community Psychology
Michigan State University
East Lansing, MI, USA

Margaret Kroma
Assistant Professor
Education
International Extension
Cornell University
Ithaca, NY, USA

Edward Mabaya
Research Associate
Emerging Markets Program
Department of Applied Economics and Management (AEM)
Cornell University
Ithaca, NY, USA

Vongai Kandiwa Majaha
Graduate Student
Department of Development Sociology
Cornell University
Ithaca, NY, USA

Karim M. Maredia[1]
Professor and Program Director
World Technology Access Program (WorldTAP)
Institute of International Agriculture
Michigan State University

Pamela Marinda
Sustainable Agriculture Centre for Research, Extension and Development in Africa
Bungoma, Kenya

Janet McCue
Director
A.R. Mann Library
Cornell University
Ithaca, NY, USA

Lakshmi Murthy
Assistant Director, Documentation
National Institute of Agricultural Extension Management
Hyderabad, India

Gorettie Nabanoga
Senior Lecturer
Community Forestry Extension
Faculty of Forestry and Nature Conservation
Makerere University
Kampala, Uganda

Sameena Nazir
Graduate Student
International Agriculture and Rural Development
Cornell University
Ithaca, NY USA

Margaret Ngwira
College Librarian and Secretary
UbuntuNet Alliance for Research and Education Networking
Kamuzu College of Nursing
University of Malawi
Lilongwe, Malawi

Jean Njiru
Graduate Student
International Programs
Cornell University
Ithaca, NY, USA

Mary Anderson Ochs[1]
Head of Information Services and Collections
Albert R. Mann Library
Cornell University
Ithaca, NY USA

Willis Oluoch-Kosura
Program Director
Collaborative Msc in Agricultural and Applied Economics
African Economic Research Consortium (AERC)
Nairobi, Kenya

*Patrick M. O'Shea
Post-Doctoral Fellow
Harvard University
Cambridge, MA USA

Chris Pal
Computer Science Department
University of Rochester
Rochester, NY  USA

Ranjit Page
Chief Executive Officer
Cargills (Ceylon) Limited
Colombo, Sri Lanka

Alice Pell
Director
Cornell International Institute for Food, Agriculture, and Development (CIIFAD)
Cornell University
Ithaca, NY, USA

Athula Perera
Director
Postgraduate Institute of Agriculture
University of Peradeniya
Peradeniya, Sri Lanka

Rex Raimond
Facilitator
Meridian Institute
Dillon, CO, USA

Vanaja Ramprasad
Director
Green Foundation
Bangalore, India

Sieglinde Snapp
Soils and Cropping System Ecologist
Department of Crop and Soil Science and W.K. Kellogg Biological Station
Michigan State University
East Lansing, MI, USA

Roy Steiner
Senior Program Officer
Agricultural Development
Global Development Program
Bill & Melinda Gates Foundation
Seattle, WA, USA

Thane Terrill[1]
Adjunct Associate Professor of Computing and Education
Teachers College, Columbia University
New York, New York USA

Eugene Terry
Independent Consultant
Formerly, Director of the West Africa Rice Development Association (WARDA) and Implementing Director of the African Agricultural Technology Foundation (AATF)
Washington, DC, USA

Robert Tripp
Research Associate
Protected Livelihoods and Agricultural Growth Programme
Overseas Development Institute
London, UK

Terry Tucker
Associate Director
CALS International Programs and CIIFAD
Cornell University
Ithaca, NY, USA

Srikant Vasan
Senior Program Officer
Global Libraries
Global Development Program
Bill & Melinda Gates Foundation
Seattle, WA, USA

Rajesh Veeraraghavan[1]
PhD Student
Information Science
University of California, Berkeley
USA

Cholani Weebadde
Assistant Professor and Associate Director
World Technology Access Program (WorldTAP)
Institute of International Agriculture
Michigan State University
East Lansing, USA

# 4

# Ideas for Other Potential Support Initiatives

As the Design Team gathered information which led to the selection of the final twelve initiatives to develop into tentative planning proposals, many other ideas which are worthy of further consideration were generated. Below is a partial list of more than 50 such ideas.

**Women**

1. Explore opportunities to encourage and support women to undertake independent smallholder production in farm and non-farm areas.
2. Explore emerging market opportunities for women, for instance small-scale dairy operations, processing, and marketing.
3. Increase the number (as a percentage of total) of women extension workers, and set them up for success at the community level.
4. Assess information and education implications for developing local processing options, especially for women.

**Enhancing Access to, Sharing, and Use of Information**

5. Raise smallholder awareness of the power of information.
6. Help smallholder farmers make more informed decisions by enhancing problem solving skills (e.g., simple cause-effect analysis).
7. Conduct a global best-practice scan for information access, evaluation and use at the village level.

8. Introduce principles of the learning organization (i.e., build systems for information and knowledge sharing at village, organizational (NGOs, extension agencies, etc.), and other levels.
9. Integrate indigenous knowledge systems as a part of the new knowledge system (storytelling traditions, consultative processes, elders, etc.).
10. Explore the elements of a critical mass for village level information systems.
11. Build and facilitate natural knowledge communities to enhance the potential of information sharing by proximate stakeholders.

### Credibility

12. Build and integrate strategies to validate the credibility of information (e.g., by ensuring farmer input and feedback).
13. Assess risks of the spread of misinformation and develop strategies to guard against it or counter it.
14. Build capacity for public, private partnerships to enhance credibility of their information provision.
15. Build reliable channels for up-to-date information about cheaper inputs, new varieties of seeds, processing and marketing opportunities.
16. Share "proof of success" through witnesses and testimonials disseminated through a variety of media.
17. Develop a user report and rating system for suppliers, traders, extension officers and others via cell phone.

### Types of Information

18. Develop a list of information needs at macro and micro levels, e.g. staging the growing and processing of crops, and diversifying crops to eliminate peaks and valleys in the market (e.g., avoid everybody growing tomatoes at the same time).
19. Develop alternative models for environmental education for smallholders.
20. Develop a radio delivered primary school alternative curriculum based on agricultural skill training in the context of basic education.
21. Encourage market and technology driven curriculum enhancement at all levels of education, formal and informal.
22. Investigate opportunities for using e-government services to improve access and efficient use of time for smallholders.

### Contextual Factors Affecting Information Access and Use

23. Assess who may be threatened by improved information access (e.g., traders, government agencies).
24. Identify points of leverage and their potential deployment and use (e.g., timing for infrastructure coming "on line," coordination of existing resources, promoting new technologies, social interventions, or combo-plays involving several of the above simultaneously).

25. Create choice and help farmers understand their choices. The market can't be relied on when smallholders do not have adequate choice.

## Information Systems

26. Explore options for automated translation to "localize" information materials in local languages.
27. Digitize relevant historical agricultural texts and grey literature (e.g. French records from the 1920's are still valuable). A scan mobile with trained staff may be an option.
28. Use data extraction technology to reduce complexity of scientific knowledge and concepts to the smallholder level of complexity.
29. Develop group SMS and/or voice mail dissemination for real time information.
30. Develop action alert systems via voice mail, SMS and radio for various categories of information (including person-to-person communication tree).
31. Develop potential for cell phone connection to speaker systems to broadcast voice mail information to village audiences.
32. Develop IT "in a box" kits for village distribution, telecenter development, and other standardized IT applications.
33. Create a domestic Internet policy for connecting ISP and cell phone providers to a local data repository that doesn't require access to the international Internet (i.e., local country LAN).
34. Develop a project to explore GIS applications and uses by smallholders.
35. The Mali experience with remote weather information collection may have parallels with remote soil testing and the resultant radio information bulletins.
36. Develop alternatives for remote data collection by relatively untrained, even illiterate data collectors for a variety of uses, using devices such as digital pens, GPS pads, PDA with software and cell phones. This involves technology and training with an end goal of capacity building at the smallholder level.
37. Develop support systems to enhance agricultural listings in Wikipedia.

## ICT Infrastructure

38. Evaluate and promote opportunities for low cost Internet access at the village level.
39. Project 5-year accessibility of Internet services at the village level and its impact on the construction of village knowledge ecosystems.
40. Improve ICT infrastructure development and bandwidth.
41. Develop an ICT source map for South Asia and Africa by country, province and region that would help identify priority needs, underused current resources, and collaborative and cross-platform potential initiatives (e.g., collect data from existing data from cell phone companies). Possibly pilot in one country.

## Intellectual Property

42. Bring useful information out from behind information firewalls through linkages, partnerships and data extraction.

### Sustainable Business Models

43. Develop sustainable business models for village level information centers.
44. Conduct a world-scan analysis of successes and failures of village level telecenters.
45. Fund consulting teams to focus on a variety of specific business and other questions related to smallholders and the information ecosystem supporting them.
46. Deploy consulting teams to help women develop business models for their entrepreneurial efforts.
47. Deploy consulting teams to offices such as the Office du Niger to help develop credit plans.
48. Deploy consulting teams to help develop a business model for village level soil analysis.
49. Developing alternative small business training and development initiatives (refer to the 2 pager)

*An opportunity exists to access low-cost resources (e.g. MBA students) to assist local stakeholders in developing sustainable business models. Teams should include local people to ensure that the projects build and/or strengthen local capacity and to ensure continuity in service to smallholder farmers and other clients.*

### Best Practices and Project Synergies

50. Document spontaneous current cell phone uses that have not been anticipated or systematically supported (potentially a world survey) and propose strategies for expanding and encouraging their systematic use.
51. Identify under-adopted best practices and explore alternatives to encourage their wider adoption.
52. Appoint a taskforce to visit foundation-sponsored projects and explore possible synergistic cross-project efforts. The taskforce might have a pool of funds to allocate for synergistic ventures.

### Institutional Capacities

53. Build African institutional capacity to carry out local field studies by students.
54. Create the Baobab Institute (African equivalent of the Aspen institute), a think tank for high-level (political) leaders to exchange information and ideas.
55. Develop alternative models for the involvement of local journalists in serving as information channels for smallholders, the modern storytellers of inspiring anecdotes, promising practices, and unmet needs (journalists as "information mediators").

# 5

# Site Visit Reports

A key component of the Design Team's terms of reference was to consult, interact and seek input from smallholder farmers and public and private institutions supporting smallholders in South Asia and Africa. This consultation process included site visits to South Asia in June 2007 and Africa in August of 2007.

Our group started with the following three general assumptions.

1. Information is a critical component of agricultural success.
2. Feedback mechanisms are the key to creating a healthy agricultural information ecosystem.
3. Recent advances in the field of information technology make possible new models of information sharing.

The purpose of both site visits to South Asia and Africa was to investigate the validity of these assumptions and to get a feel for what was happening with agricultural information "on the ground." We wanted to determine what information people had, what they needed, and what people and institutions were doing to create, transmit, organize, and understand information. While the number of locations we could visit in South Asia and Africa was albeit limited, the diversity of the environments and the conditions of places we visited enabled us to come away with clear ideas of the central themes in the intellectual and technological landscape of agricultural information.

# Report on the WorldAgInfo Visit to South Asia (India and Sri Lanka)[1]
# June 2-16, 2007

## Introduction

Five members of the Design Team visited India and Sri Lanka from June 2-16, 2007. We visited with more than 500 farmers, local market workers, extension workers, bank officers, representatives of the private sector, researchers and with the staff of three universities and their associated libraries. This report provides a summary of the meetings and discussions in India and Sri Lanka with various stakeholders and institutions, key observations, and preliminary recommendations based on the interactions and input from the stakeholders.

India and Sri Lanka differ greatly in size and historical experiences; they provided our trip with a useful contrast in terms of institutional structure and educational systems that support smallholder farmers.

The main goal of the site visits was to gain first-hand experience about the problems and information needs of smallholder farmers and the role that institutional innovations and information and communication technology (ICT) can play in fulfilling the four objectives just listed.

One of many group meetings with farmers

## Site Visit to India

India is a vast country with more than 600,000 villages and home to one billion people and 100,000 extension workers. More than two thirds of the population depends on agriculture for their livelihood. More than 70% of the farmers in India are smallholders, defined as farmers with less than a hectare of land holdings. Farmers are the consumers of the majority of farm produce and the surplus is sold in local markets. The literacy rate in India is around 60%.

In India, agriculture is a state subject primarily supported by the state governments with additional funding coming from the central government and other sources. Each of the states in India has at least one State Agricultural University (SAU). These universities are similar to American agricultural universities that were created by the U.S. Land Grant System. The SAUs have a mandate for research, teaching and a shared mandate for extension with the State Department of Agriculture and the Central government. The front line extension workers are employed by the State Department of Agriculture while SAUs provide extension specialists and technical support to field programs.

The Indian Council of Agricultural Research (ICAR) operates and supports more than 80 agricultural research institutes across India that focus on specific crops and agricultural constraints. In addition, ICAR

1. This site visit summary report was prepared by Design Team members Karim Maredia and Carl Eicher in collaboration with Cholani Weebadde, our guide for the Sri Lanka portion of the trip, and with input from the other team members who participated, including Dwight Allen, Mary Ochs, and Thane Terrill. Melissa Ho of the Bill and Melinda Gates Foundation also joined the team on a portion of the trip.

provides financial support to more than 500 Krishi Vigyan Kendras (KVKs or Farm Science Centres) that are located in every district of India. The KVKs play a role in training, demonstration and outreach activities. Recognizing the need to foster interactions among various stakeholders, the Government of India has established a group of agencies called Agricultural Technology Management Agencies (ATMA).

Considering the diversity of agroecosystems and cultures, two states—Haryana in northern India and Kerala in southern India—were selected for site visits and interactions with the smallholders and institutions that support them. The neighboring states of Haryana and Punjab are considered to be the "bread basket of India," producing more than 40% of the national staple food grains (wheat and rice). The state of Kerala, on the other hand, is known for plantation crops (coconut, rubber, and spices), fruit crops and rice-based diverse cropping systems. The Design Team visits to Haryana and Kerala were organized by the CCS Haryana Agricultural University in Hisar and the Kerala Agricultural University in Trichur, respectively. The visits to these two states were complemented by consultation with various stakeholders through a roundtable forum organized by The Energy and Resources Institute (TERI) in New Delhi, visits to the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), National Institute of Agricultural Extension Management (MANAGE), and E-Sagu and Digital Green—a video-based agriculture training and information system.

### Site Visit to Sri Lanka

Compared to India, Sri Lanka is a small country with around 12,000 villages and a total population of about 20 million people. Sri Lanka is one of the top twenty-five richest countries in terms of biodiversity. The literacy rate in Sri Lanka is 93%, one of the highest in the developing world. The majority of the farmers in Sri Lanka are smallholder farmers with less than one hectare of land.

Sri Lanka's attainment of almost complete self-sufficiency in rice production has been a major achievement over the past 40 years. However, agricultural growth has fallen to 1.5% per annum. The government's priority is to enhance the rice production from around 3.5 to 5 tons per hectare. A 2007 World Bank Study[2], calls for a shift from being supply-driven (producer of rice) to producing more high-value crops, livestock and related products.

The Design Team visited smallholders in the Dambulla area in the North Central Province of the country. With the support of the Cargills (Ceylon) Ltd Company, the Design Team met with smallholders from 19 districts across the country and discussed their sources of information and future research and extension priorities. The interactions with the smallholders were complemented by a roundtable discussion with stakeholders in Colombo and visits to the Department of Agriculture, IWMI (International Water Management Institute), RRDI (the Rice Research and Development Institute, Department of Agriculture, Sri Lanka), and with the University of Peradeniya which has the only post graduate institute of agriculture in the country.

## Key Agricultural Observations from India and Sri Lanka

1. **Overview of Concerns and Opportunities with Agriculture in South Asia**

   **A. Concerns**

   a. Smallholder poverty

   b. Declining yields of food staples

2. "Reviving Sri Lanka's Agricultural Research and Extension System: Toward more innovation and market orientation"

c. Rising rural wages
d. Declining water tables
e. Negative impacts of farm subsidies.
f. Declining performance of key agricultural support services
g. Lack of smallholder access and information on credit and insurance
h. Prospects of negative impacts of climate change

**B. Opportunities**

a. Improving access to technology and technical training
b. Providing greater access to trusted, timely information
c. Expanding cell phone coverage by smallholders
d. Providing better access to market prices and the requirements of products destined for the international market
e. Expanding private sector participation in providing market information and infrastructure
f. Growth of community lending groups and farmer cooperatives
g. New government regulations that extend loans for agricultural purposes

**2. Smallholder Farmers' Objectives**

Based on discussions with smallholder farmers in India and Sri Lanka, the team observed that the smallholder farmers were eager to gain access to information related to new crops, updated farming practices, affordable credit, new technologies, market pricing and to the standards required for selling products on the international market. The central factor was accurate and timely information. Farmers might have the ability to purchase or lease additional land, but they cannot afford to make a commitment without having accurate information regarding market prices, cost of production and new rules that may assist or hurt the anticipated use of that new land. The farmers frequently asked for information on how to obtain the information that would allow them to make economic decisions.

One of the most exciting and promising findings is that the smallholder farmers, in at least the relatively remote areas we visited, are eager to access and use new communications technology, particularly where the younger generation has access to upper-secondary school education.

Haryana field with water conserving beans

**3. Decline in Agricultural Productivity**

The very success of the Green Revolution of the 1970s and 1980s has produced a period of complacency and policy indifference to agriculture over the past 15 years. This might be acceptable if the techniques and strategies of the Green Revolution continued to work successfully, but the reality is that agricultural productivity is declining in most regions of South Asia with further prospects of even greater loss of productivity due to a combination of water scarcity and deteriorating soil health. The people we met well understood these two major impacts and the disastrous consequences of the current trend in declining productivity.

Making the situation even more challenging is the unpredictable influence of global weather changes. It is one thing to respond to a challenging situation from a condition of health, and yet another thing to respond while ill. It is clear from our visit that timely and accurate information will be vital to responding to this rapidly evolving set of agricultural challenges.

**4. Agricultural Support Services: Education, Research and Extension**

**a. Agricultural Education**. The 41 State Agricultural Universities (SAUs) in India and the agricultural faculties in Sri Lanka are underfunded and understaffed. In 2005, about 30% of the academic positions in the SAU systems in India were vacant (Patil et al. 2006). This hiring restriction severely limits the ability of the SAU's to initiate badly needed new postgraduate programs in food science, biotechnology, food processing and agribusiness. Similar trends related to declining budgets and their impacts on the quality of higher education were observed in Sri Lanka.

At the undergraduate level, the disconnect between the current agricultural curriculum and the manpower needs of the society was underlined in conversations with students and faculty who agreed that a large majority of agriculture graduates don't pursue an agriculture related job. We were informed by agriculture students that agriculture universities are commonly viewed in India as "also ran" places for prospective students not admitted to "more desirable" schools. In one of our meetings with a group of 30 students, only a handful saw themselves working in agriculture after graduation.

At a time where flexibility and mobility are essential for responding to rapidly evolving agricultural challenges, agricultural institutions are hobbled.

**b. Agricultural Research**. Our group observed that in many cases, research findings are known at the university/research level but that this information is not effectively conveyed to the smallholder farmer. There is also a surprising lack of sharing of information among research entities in different Indian states. Clearly the means to communicate between institutions should be improved so that solutions to common problems may be shared.

**c. Agricultural Extension/Outreach.** Our group observed that the current extension systems in India and Sri Lanka are weak and not very effective in delivering real-time information to smallholder farmers. During our group meetings we asked farmers to identify their main sources of agricultural information. The answers we receive depended on the type of information being sought. Weather and general information was sought on television and radio. Newspapers carry general information and may also include a section covering the type of questions local farmers are having and the answers to those questions. Farmers expressed concern that the information sources often didn't agree and they lacked the ability to determine which source was timelier or more trustworthy.

HAU's agricultural call center

When it came to more specific information, the farmers had a much more difficult time finding the information they desired. At the Haryana Agriculture University (HAU) we visited one of the new Kissan Call Centers. These call centers have been established in each state in India to provide individualized answers. For example, how much fertilizer to apply or what to do when plants turn an unusual color. We initially assumed that the farmers we met did not know about this new service because they expressed frustrations at not having the type of information that we knew the call centers claimed to supplied. What we heard from the farmers was that they did know about the call centers and that they had the access to village pay phones and to cell phones. The problem was that they could not get through to the call centers.

During our visit to HAU's call center, we discovered the reason why farmers could not get through: the call center had one telephone. That single telephone was designated to support Haryana's 1.7 million farmers. HAU knew that this coverage was not adequate but did not have the financial resources required to operate more lines. Our meetings with farmers indicated that they would be willing to pay for the call if they could get the information they needed. On more than one occasion the farmers said they would be willing to buy a cell phone if it could be used to access important agricultural information.

Community radio is a promising concept, but in India there are regulatory issues blocking it. Our discussions indicated that India might be at a point of possible reconsideration of these restrictions. It is also possible that podcasting and other more directed forms of mass communications could be an alternative route to providing the benefits of community radio.

**5. Markets and Food Systems**

The roundtables on agriculture marketing systems noted the expansion of supermarkets and the benefits the private sector could bring to smallholder farmers. The team was impressed with the innovations of the Vegetable and Fruit Promotion Council in Kerala (VFPCK), a collaborative that has helped develop a network of smallholders in fruit and vegetables production, marketing and microfinance. These farmer innovations are helping to address the inequities of pricing by middlemen who have the best access to market information. In many cases, the farmers said they had no idea of the market prices in other towns or what middlemen received for their sales. The middleman was by far the most disliked and least trusted component of the supply chain.

Typical Kerala wholesale market

Cargills (Ceylon), a large supermarket chain of 117 stores throughout Sri Lanka, uses a combination of superior market information and direct purchasing from the farmer to provide a 20% premium on the sale price for farmers and assure the best value for its consumers. We were impressed with Cargills' agricultural extension program. The farmers we met were very pleased with the information Cargills' employees supplied them on agricultural practices. The only significant problem the farmers reported was their inability to sell their entire range of products to Cargills.

In both cases, the value of cooperatives and supermarket out-reach programs can extend beyond the community of participating farmers. Farmers are quite collaborative by nature. Many times our group found that farmers referred to other farmers as the main source of trusted information. When new information sources permeate the community as a whole, they put pressure on middlemen to offer fair prices.

**6. Post-harvest Losses of Fresh Produce**

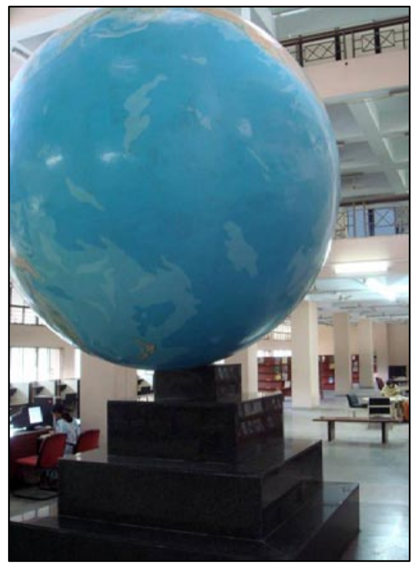
One third of the fruits and vegetables produced in India and Sri Lanka are lost to spoilage or the inability to sell them after harvesting. In Sri Lanka we met one man who purchased leftover produce for his pig farm. He paid virtually nothing for the day old produce simply because the farmers did not have access to a refrigerated facility. The lack of market information and inflexible transportation options means that farmers have no option other than to bring produce to the market with the hope that all will be sold that day. The Design Team was frequently asked about new international markets as an opportunity to absorb the local peaks in production that frequently now go to waste.

**7. Credit/Microfinance**

In the absence of effective microfinance organizations, the smallholder farmers are in the clutches of private money lenders who are charging interest rates ranging from 60 to 120% per year (as compared with 7-12% from local cooperative and commercial banks). Because rural wage rates are rising, farmers are keen on purchasing farm machinery to replace hired labor. While India law has created a number of loan programs for the benefit of the smallholder farmers, the Design Team found that farmers were either unable to qualify for these loans or were asked for collateral in situations where the law indicated that none should be required. We were left wondering if the bankers were unaware that farmers were not finding the loans to be as expected or whether the farmers we spoke to misunderstood the loan parameters and were thus disappointed. This situation seems to be one where even a little more information and feedback on the part of bankers and farmers might have a huge impact.

**8. Libraries**

The Design Team visited three university libraries: Haryana Agricultural University, Kerala Agricultural University and the University of Peradeniya (Sri Lanka). The team also met with librarians at MANAGE, ICRISAT in Hyderabad, and IWMI in Colombo, Sri Lanka.



Kerala Agriculture University library

The librarians at all three university libraries we visited were knowledgeable about new ICT technologies and their applications for libraries. However, to varying degrees, the librarians were frustrated by serious funding issues, which prevented them from effectively serving the university's students and staff. The key issues identified by the librarians included: staff shortages, poor Internet connectivity, old and/or inadequate numbers of computers, cuts in journal subscription budgets, and seriously outdated collections.

We found the librarians we met to be creative and energetic at providing the best service possible within the tight constraints they experienced. For example, their libraries participate in various networks for document delivery and have developed exchange agreements with other institutions to obtain publications. Several libraries have set up "book banks" for students to borrow textbooks, and they are launching projects to digitize theses and dissertations. Given the serious shortages of books and journals, the digitization of agricultural information and subsequent access to it via the Internet or DVD readers appears to be one of the most practical means by which these libraries can be brought up to international standards.

Libraries in national centers, such as MANAGE, and international centers, such as ICRISAT and IWMI, which are part of the Consultative Group on International Agricultural Research (CGIAR), are considerably better off in terms of funding, infrastructure and facilities. They offer tailored collections of books, journals and online resources for staff members of their organizations, and they participate in outreach activities, such as training and digitizing projects. The staff at these libraries may well be ideally suited to assist with the needed modernization projects we found to be required at the university libraries.

### 9. Collaboration with CGIAR Centers

Our group visited ICRISAT and IWMI and noted the pressures from donors to work on development projects rather than on their core research agenda. While ICRISAT and IWMI appeared to have improved funding, the reality is that an increasing share is earmarked for specific projects. The result is that the individual projects are well funded but core institutional services constantly have to adjust to limited financial resources. These are distractions that cannot continue if the CGIAR centers are to play an active role in assisting the universities.

### 10. Partnerships, Linkages, and Scientific Collaboration among Various Institutions in South Asia

Our group found that the linkages among various public research and academic institutions are weak in the South Asia region. These institutional linkages need to be enhanced and nurtured through a combination of technology projects and the sponsoring of regional conferences of topics of common interest.

Farmers showing their cell phones

### 11. Cell Phone and PC Access

While a large effort is being made to install PC-based kiosks, the potential near-term ICT success story in India and Sri Lanka is the use of cell phones by smallholder farmers. From our conversations with farmers, we estimated that 20% of farmers in Haryana and 60% of farmers in Kerala have access to cell phones. Approximately 40% of farmers in Sri Lanka have cell phones. That number is rising rapidly. However, the farmers reported that they rarely use their cell phones for accessing agricultural information.

Our group noted that the personal computers have an important role to play in terms of information access at the university and KVK levels. However, there are many barriers to the widespread use of computers by smallholder farmers, including the substantial costs, irregular supply of power, lack of technical support and infrastructure, and lack of supporting business models. Even if personal computers and Internet access were practical, most farmers lack computer and literacy skills to make effective use of them. The computer-based ICT information systems are currently being built on shaky foundations. This will, of course, change as the infrastructure and literacy rates improve. There is no doubt that the PC with a fast connection to the Internet is the optimal platform for access to agricultural information.

## Key Information Technology Related Observations

### 1. Establishing Trust

Getting information to farmers, or anyone else, is futile if that information source is not trusted. Any system that is to serve the smallholder farmer must both function in their technical environments and instill the sense of trust. The technical issues, as difficult as they are, are trivial compared to the trust issue.

Perhaps the most consistent truth we observed related to the information needs of the smallholder farmer was the constant refrain that farmers respect the opinions of other farmers. Lack of trust in most sources of information was a consistent theme on our trip. Farmers don't trust middlemen, bankers, agriculture extension workers, and vendors (specifically in the sale of such basics as fertilizers, pesticides, and seeds). Given that all these elements of the agricultural environment will continue, the real question is how to make the information they provide trustworthy. We believe that the fact that farmer-to-farmer communications are trusted could supply a needed foundation of trusted feedback and evaluation that would either force the other entities to become more worthy of trust or their information would be deemed trustworthy, when warranted.

A PC in the field in India

Feedback, especially that which comes from farmers, supplies the only mechanism we could identify for assaying the value of the many information sources we explored. We visited research institutes, NGOs, and universities with various collections of research papers, reports, journals, and dissertations. Valuable information is certainly locked in these documents repositories. But determining what is a vein of valuable information and what are the less valuable surrounding materials is not easy task. The only solution we could identify is to openly and genuinely welcome all sources of information and to provide the feedback mechanisms that would allow for the proper classification of worth. The "many eyeballs" phenomenon of multiple user validation of information is one of the prime initiatives to pursue.

**2. Breaking the Language Barrier**

India reinforced our belief that some form of computer-assisted translation is necessary for any large-scale agriculture information system. Our investigations indicated that perhaps five or six of India's twenty-three official languages might be required to achieve even near universal information access.

We saw demonstrated a program that placed an English document in two panes side-by-side. The right-hand pane then started to be translated into Hindi. Those words that the system could not translate were kept in the original English. The human translator could select each unknown word and then put in the Hindi word. As each word is added, all future translations will benefit accordingly.

The key to this system's effectiveness is the language structure rules and the completeness of the dictionary. We were told that having approximately five thousand known good translations between a second language and English would provide the structural information required. The facility to translate words is directly related to the completeness of the second language/English dictionary being used by the computer.

Fortunately, there are bodies of documents in India that are in parallel languages. For Hindi, the primary source would be the Indian government because of its legal requirement to have documents in both languages. Of course, if a body of agriculture documents could be found in target languages, it would be even better. As for the dictionary, we were told during our visit to the Indian Institute of Technology in Mumbai that they were well on their way to creating an open source Hindi/English agriculture dictionary. We believe that the systematic translation of English language agriculture information into Hindi is well within sight and should be given serious consideration. We should also mention that many of the sources of local information we observed in the various agricultural universities we visited were primarily in English. These sources of information are potential goldmines of relevant local agricultural knowledge and their translation to other languages could make them more available to even the local populations served by the universities.

### 3. Rebuilding Agricultural Libraries

The majority of libraries we visited were under-funded and in need of updated resources. Creative solutions are needed for increasing library budgets for journal subscriptions and books while building new systems for improving access to open access documents. The libraries we visited all identified the Internet as a primary information source for their students. This claim was all the more remarkable when one saw that the library only had half a dozen old computers sharing an anemic Internet connection. If there is going to be a satisfactory solution to the deficits of the current agriculture libraries, it will be through the Internet and other online sources similar to the transformation taking place in American university libraries.

Clearly, the more agricultural information available to an online representation, the more feasible and valuable an online system would be for agriculture university libraries and for other conduits for agricultural information. India is one of the principle centers for document and book scanning. Specifically, Carnegie Mellon University's Million Book Project has India as one of its main processing centers. Agriculture is one of the Million Book Project's core assets with partnerships with the UN's FAO, the United States National Agriculture Library, and U.S land grant libraries, including Mann Library at Cornell. This collection, which has yet to be released, should be further augmented by the holdings of the local agriculture universities in India. Potential supplemental projects could include an Indian online agricultural journals portal, repositories for providing access to extension documents (one already in pilot stage at MANAGE), and a thesis scanning project (in pilot stage at Haryana Agricultural University). Every indication we saw is that such a comprehensive online collection would be extremely important to the agriculture universities and could potentially be transformational in its effects.

### 4. GPS and Satellite Imagery

Agriculture is unlike most other disciplines in that it is highly geo-specific. This is a very important fact to keep in mind as information becomes accessible on a global basis. What may work well in one location could be disastrous in another location. At IWMI (International Water Management Institute), we were told of how their staff use of Google Earth's satellite images with local volunteers to take precise measurements of water use. The volunteers go out in the field to fixed GPS coordinates and report what they see. That information can then be used by the IWMI to calibrate its image processing system so that it makes accurate measurements from the images. IWMI is primarily interested in water management and they have already determined that reported water use is quite different from actual water use. These discrepancies are not surprising given that some forms of water use are fee based and thus under-reporting is in the farmer's interest. It would obviously be highly significant to know if the water table will be depleted in five years rather than in ten.

Farmers showing their national awards for rice growing

It would be very interesting to explore if this system now being used for water could be used for other agricultural measurements. The percentage of cultivated land should be reasonably easy. More difficult, but worth substantial effort, would be assessments of specific crop acreage. One of the problems we observed was that the farmers had no reliable information about what other farmers were growing. Thus, they were likely to plant the same crop that many other farmers were growing and therefore risked planting a crop that would eventually be sold in a saturated market place. Any tool that could give an approximate indication of future crop yields would be highly useful. One of the saddest moments of our visit was to a farm family's house in Kerala.

The farmers were award winners for their rice farming techniques. They were quite literally among the best farmers in India. Yet they were close to bankruptcy because they had leased land for the purpose of growing ginger. Unfortunately, many other farmers did the same and now the price is so low that any further efforts to cultivate ginger just increases their losses. It was hardly a surprise for us to learn that the farmer's son wants to become a civil servant.

### 5. Reaching the Illiterate

One of the primary obstacles to access to information is literacy. A substantial number of smallholder farmers are illiterate. The use of text-to-audio is clearly going to be a principle method for making information available, but developing the system to the point where that process can take place is still a barrier that requires a solution. Microsoft Research in India is currently developing interfaces that use cartoon figures and common symbols to replace written instructions. The system also provides a video on the first screen that demonstrates how the system works and how the data being accessed got there in the first place. This is a concept that frequent users of the Internet and online data might never question, but it is easy to understand that someone with no technological background might find the billions of documents available on the Internet to be unnerving because it could appear that local computer contains all that data. Computer literacy for people who have never been exposed to computer technology requires a deeper level of assistance than it would for a person familiar with computer technology and the many virtual worlds where interactions with other people are performed in a mediated fashion.

This research starts to answer what the important issues are in reaching illiterate and first-time users of technology. We believe that the current work could become the starting point for designing a system for agricultural information for use by the smallholder farmer.

### 6. WorldAgInfo Online System

The site visits were quite encouraging in terms of our investigation into the viability of a WorldAgInfo system. The WorldAgInfo online system is a conceptual test-bed for the principles and mechanisms of most interest to this project. The visits to Microsoft Research in Bangalore, India and to IWMI in Sri Lanka indicated that some of the key technical challenges we identified for a successful WorldAgInfo system are more than solvable; they are in working form and in some cases performing the tasks we envision for WorldAgInfo. It was also encouraging to see a number of efforts aimed at collecting and distributing agriculture information. Many of the people with whom the team interacted were either interested in some sort of large-scale agricultural information repository or were working on components to achieve this goal. While some of these projects appeared promising, none of them incorporated the degree of feedback mechanisms essential to WorldAgInfo's operation, nor did any of them look beyond their geographic or content focus.

The main lesson learned from the site visits in terms of WorldAgInfo is that partnerships that allow for WorldAgInfo to aggregate and distribute the materials of other projects will be essential. The technology for accomplishing this is not difficult; rather, it will be the letters of understanding that create a mutually attractive partnership that will be challenging. One of the primary obstacles to access to information is literacy. The use of text-to-audio is clearly going to be a principal method for making information available, but getting into the system to the point where that process can take place in still a barrier that requires a solution. Microsoft Research in India is currently developing interfaces that use cartoon figures and common symbols to replace written instructions.


The screen on this page represents what an article on WorldAgInfo might look like.

## Conclusions

**1. Curriculum reform and enhancement at agricultural universities and other educational institutions in South Asia region** – With the changing structure of agricultural markets, and the emergence of supermarkets, there is a need for market-driven curriculum reform and enhancement, including agricultural marketing, food processing, food safety, food packaging, agribusiness, supply chain management, etc. In addition, the curriculum reform needs to encompass the new and emerging areas of science and technology including biotechnology, biosafety, intellectual property rights, geographic information systems, remote sensing, etc.

**2. Human Capital Improvement** – The human capital base in agriculture in South Asia is depleted. There is a serious need for continuing education and networking programs that link scientists and faculty members from South Asia with each other and with centers of excellence around the world through professional exchanges and sabbatical/study leaves. There is a need to improve incentives, and to recruit scientists and faculty members of international caliber.

**3. New Models of Extension** – Given that the current extension systems are not effective, there is a need for piloting new extension models such as the village level extension models and ATMA. Special attention should be given to the financial sustainability of public, NGO, and private extension models. The new pilot models should harness the modern ICT tools to help improve smallholder access to real-time information and new technologies.

**4. Need for WorldAgInfo – A Global Ag Information Resource** - With the new trends of globalization of the agricultural sector, there is a need for a global information resource encompassing diverse areas of agricultural research, education and extension. As a starting point, the WorldAgInfo resources should be piloted using the key priority areas identified by the Design Team prior to the South Asia site visit. The key challenge will be collaboration, partnerships, and intellectual property issues associated with information resources included in the WorldAgInfo. Our site visits confirmed our group's belief that a comprehensive information resource—based, as envisioned in our WorldAgInfo functional overview document—is both feasible and necessary. The visit to Microsoft Research offices in Bangalore provided compelling evidence that some of the most technically challenging aspects described in WorldAgInfo are indeed possible. Other visits, such as that to the Indian Institute of Technology in Mumbai, demonstrated a belief that aggregating and distributing agricultural information on a large scale was timely. WorldAgInfo has the potential to both extend the current agriculture information projects and to reinforce their impacts. However, it will be important to develop any system in consultation and collaboration with already existing large-scale agricultural information systems.

**5. Enhancing Agricultural Libraries** – Strengthening university libraries has the potential to significantly strengthen research, teaching and extension. The agriculture libraries need investments in the following areas:

- Development of institutional digital repositories for enhancing access to all types of publications, including multi-media.
- Collaborative E-Journals publishing for agricultural libraries throughout South Asia that would have access to journals from all of the universities. Libraries throughout the world would potentially subscribe to the collection as well.
- Digitization of graduate theses and dissertations for easy access and sharing of research findings from South Asia with the global community.
- Connectivity and equipment through high quality, high-speed reliable Internet access and adequate computers, including literacy classes to teach students how to use online resources.
- Consortia purchasing of international journals to reduce costs.
- Acquisition of books and journals in emerging fields of agricultural research and development covering areas such as climate change, biotechnology, food processing, supply chain management, agribusiness, etc.

**7. CGIAR Centers** – Based on our visits to ICRISAT, Hyderabad and IWMI in Sri Lanka, we observed the increased pressures from donors in pulling CGIAR researchers downstream to work on development problems. Also, a number of Indian researchers expressed their concern about the lack of CGIAR attention in building the scientific capacity of NARS. This is a common problem throughout the CGIAR system and the one that deserves a major study over the next three to five years. The CGIAR Centers have accumulated a wealth of knowledge and experience in specific areas and crops through global agricultural research network. Development of special modular learning materials (based on specific focus and strengths of CGIAR centers) in key areas by the CGIAR centers seems much more reasonable than undertaking any kind of degree offerings by the CGIAR. New forms of partnerships should be encouraged and supported such as the one created by IWMI with the Imperial College in London to create learning modules on Water Resources and Water Management for a master's degree program.

**8. Institutional Innovations in South Asia** – Considering the weak linkages among institutions and programs in South Asia region, a competitive grant program should be initiated for enhancing inter institutional collaboration, cooperation and partnerships. These linkage programs should foster and build cooperation and collaboration among institutions within India, within South Asia region, between South Asia and Africa, and enhance linkages with advanced research and educational institutions globally. In addition, in an emerging era of privatization, the competitive grants program should foster public-private sector partnerships. This program could also be designed to encourage the inclusion of women in the inter-institutional partnerships, since in many institutions they are at a significant disadvantage.

**9. Moving on Key Technical Hurdles** – Our visits with various organizations involved in the testing and implementation of new technologies indicate that it is not too soon to begin large scale evaluation of key technologies, such as automated language translation.

## References


Anderson, Jock R., Gershon Feder, Sushima Ganguly. (2006). The Rise and Fall of Training and Visit Extension: An Asian mini-drama with an African Epilogue? In A. W. Van den Ban and R.K. Samanta eds., Changing Roles of Agricultural Extension in Asian Nations, New Delhi: B.R. Publishing Company: 149-172.

Birner, Regina & Jock R., Anderson. (2007). How to make Agricultural Extension more Demand Driven? The Case of India's Extension Policy: Addis Ababa. ISNAR/IFPRI. Draft.

Federation of Indian Chambers of Commerce and Industry (FICCI). (2006). Indian Agriculture: The Winds of Change: FICCI-YES Bank Knowledge Institute. Delhi. FICCI.

Gopal, Gita. (2007). Evaluating a Decade of World Bank Gender Policy: 1990-1999. Washington D.C.: World Bank.

Johanson, Richard & William Saint. (2007). Cultivating Knowledge and Skills to Grow African Agriculture: A Synthesis of Research Commissioned by the World Bank. Washington D.C.: World Bank.

Katyal, J.C. (2007). State of Technology Transfer. Proposal for a New Extension Model. Harayana Agricultural University.

Kalkat, G.S. (2006). Keynote address: International conference on agriculture for food, nutritional security and rural growth. Summary and recommendations. New Delhi, 25-27, May 2006.

Swanson, B.E. (2006). The Changing Role of Agricultural Extension in a Global Economy, Journal of International Agricultural and Extension Education, 11(3):5-17.

Tripp, R., M. Wijeratne, V.H. Piyadasa. (2005). What Should We Expect from Farmer Field Schools? A Sri Lanka Case Study. World Development, 33(10): 1705-1720.

University Grants Commission (UGC), India. (2007). Exporting Indian Higher Education: Opportunity, Policy and Action Plan. New Delhi: UGC, Draft.

Van den Ban, A.W. & R.K. Samanta (eds). (2006). Changing Roles of Agricultural Extension in Asian Nations. New Delhi: B.R. Publishing House.

World Bank. (2006). National Agricultural Innovation Project. Project Appraisal Document. Report No. 34908IN, New Delhi: World Bank.

World Bank. (2007). Reviving Sri Lanka's Agricultural Research and Extension System: Towards more Innovation and Market Orientation. Colombo: World Bank.

## Schedule for Site Visits of WorldAgInfo Design Team in India and Sri Lanka

## June 1 - 16, 2007

Trip coordinated by Dr. Karim Maredia – Michigan State University
Dr. Cholani Weebadde – Michigan State University

**June 1: Departure from U.S.A.; Arrival in New Delhi, India June 2/June 3**

**June 3: Weekend**

**June 4: New Delhi**

**Host:** Dr. Vibha Dhawan, Vice Chancellor, TERI University,

Hosted by TERI, roundtable meeting and discussion with stakeholders involved in providing agricultural information (related to agricultural inputs, credit, production practices, and market information).

**Travel from New Delhi to Hisar, Haryana**

**June 5 – 6:** Hisar, Haryana (Dr. J. C. Katyal and Dr. Ram Srivastava)

**Host:** Dr. Ram Srivastava, Professor and Associate Director, IP/Technology Transfer Office, Haryana Agricultural University (HAU), Hisar

Hosted by Haryana Agricultural University (HAU). Overview of Agricultural Extension System in India and in the State of Haryana; visit to agricultural knowledge center (KVK), rural technology providers, interactions with farmers, visit to local market, etc.

**June 6: Travel from Hisar to Hyderabad**

**June 7 - 8**: **Hyderabad, Andhra Pradesh (Dr. Venkataraman Balaji and Dr. P. Krishna Reddy)**

**Host:** Dr. Venkataraman Balaji, Head, Knowledge Management and Sharing (KMS)
ICRISAT Campus, Patencheru, Hyderabad, Andra Pradesh

Visit to International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) Information Systems program, and e-Sagu project.

**June 8: Travel from Hyderabad to Kochin, Kerala**

**June 9 - 12: Kochin/Trichur, Kerala (Dr. David Alexander and Dr. C. R. Elsy)**

**Host:** Dr. C.R. Elsy, Assistant Professor
Kerala Agricultural University, Thrissur, Kerala

Hosted by Kerala Agricultural University, visits to Kerala Vegetables and Fruits Promotion Council (KVFPC), Extension service of KAU, rural technology providers, interactions with farmers and visit to a village, visit to a local market, etc.

**June 12: Travel from Kochin to Colombo, Sri Lanka**

**June 13 - 15: Colombo, Dambulla, and Kandy, Sri Lanka**

**Host:** Mr. Adrian Mendis, Commercial Specialist

**Host:** Dr. Cholani Weebadde, Michigan State University

Hosted by the U.S. Embassy/USDA, Colombo, roundtable meeting with stakeholders, visits to the Department of Agriculture, University of Peradenyia, and Cargill's Food Company (farmer-friendly marketing), interactions with extension personnel, rural technology providers, interactions with farmers, visit to a local village, visit to local market, etc.

**June 16: Travel from Colombo to U.S.A.**

# Report on the WorldAgInfo Visit to Africa (Mali and Zambia)[1]
# August 3-19, 2007

## Introduction

This report highlights some of the issues and opportunities we encountered during the Design Team's site visits to Mali and Zambia in August 2007. It is organized in three sections. The first two describe our observations in each country. The final section reflects on some major themes emerging from this trip and from the Design Team's trip to South Asia in June 2007.

We gratefully acknowledge the help of Professor John Staatz and Professor Michael Weber, both of Michigan State University (MSU), in facilitating our trip. With their capable staff and collaborators, they made sure that no valuable connection was left untapped and that we always had the context required to understand what we were experiencing. Their support was integral to the success of this trip.

## Site Visit to Mali

### Country Information


Mali, a landlocked country slightly less than twice the size of Texas, is located in a French-speaking section of Western Africa. It has been a functioning democracy for 15 years. According to the CIA World Factbook, nearly 12 million people live in Mali and 65% of its land area is classified as desert or semi-desert. Eighty percent of the population is involved in some form of farming or fishing, and industrial activity is focused on processing these farm products. According to 2008 International Monetary Fund (IMF) data, Mali's per capita purchasing power parity (PPP), which is used as a measure for standard of living, is about US$1,400 per year. This places Mali near the bottom decile of nations.

### Community Radio

Claims we heard that Mali is a leader on the African continent in the area of community radio seem to be well-founded based on our experiences on this visit. Mali has more than 200 active community radio stations and the use of these stations for the benefit of the smallholder is impressive. The large number of radio stations may sound excessive until one considers the fact that Mali has over 50 languages—15 of which are official languages. Supplying market information is one of the primary contributions of community radio to smallholders. This aspect will be covered in more detail elsewhere in the report, but it is important to note that community radio is thriving and already serving a substantial agricultural information role.

One example of how local radio can be leveraged was introduced during our discussions with IPR/IFRA, Mali's college of agriculture and natural resources in the town of Katibougou. During the discussion, a presentation was made on a call-in radio show hosted by a member of the agricultural university's

1. This site visit summary report was prepared by Design Team members Patrick O'Shea and Thane Terrill, with input from the others who participated including Dwight Allen, Doug Allen, Gracian Chimwaza, and Karim Maredia.

teaching staff. Each week a two-hour show is produced and broadcast with the assistance of other university personnel. During the show, listeners are able to call in with questions that are answered by the presenters. Reproducing this process at other radio stations, or even offering these programs for wider distribution, would be an effective way to partner agricultural institutions with communications media to provide interactive agricultural education.

The principal problem we observed with community radio is that stations charge for all the programming, even if the programming is a public service. There appears to be no concept of a public service announcement in Mali. None of the content providers had considered the option of 30- to 60-second radio spots. It is possible that radio stations might be willing to offer these short spots because they provide a community service without sacrificing too much revenue. Given the right incentives, students and faculty in the agricultural departments of universities, or staff at agricultural research institutes (among others) could be trained to produce such "spots." This could result in a mutually beneficial relationship between information providers and smallholder farmers. Farmers would have more information, and feedback elicited by the community radio stations would allow for meaningful information reaching the agriculture universities.

**Segregation of Women**

The concept that men and women undertake different roles in agriculture is not a new one. What did surprise us was Mali's segregation of women to entirely separate crops, such as Shea nut production, which is referred to in Mali as "women's gold." This has significant ramifications for agricultural information delivery because the normal channels of communication are focused on technologies and areas where women may not play a role. The result is that often even the most basic information does not reach them. In the case of Shea nuts, we were told that women farmers often lose a substantial portion of their crop's value simply because they are not aware of the elements required for achieving maximum quality from their product. How women process Shea nut is frequently related to how the village has done it previously rather than any calculation of effort in relation to possible product price. The women knew there was a wide price range for Shea nuts, but they were unaware that they had control over many of the factors that influence the final value of their product.

It was our observation that women in Mali are clear and outspoken about what they need. We had expected that the power dynamic of the village would not allow for the free flow of ideas and a free discussion of the needs of all participants, and that the only way to get any female perspectives would be to separate men from women, and even to separate young women from older women. We were pleasantly surprised to see several instances where women were open and honest with their opinions in the presence of men, including the village chief. When we arrived in the village of Manabougou, located approximately 40 kilometers north of Bamako, the men were already gathering. During the initial stages of preparation for the discussion, it was decided that women in the village should be invited to the discussion as well. During the discussion, the women expressed many important concerns, such as wanting information about entrepreneurial opportunities. They made clear—even with men present— that men could not be depended on to provide the information they wanted and needed. We asked one of our male translators why men would hold back information from their wives when such information could benefit the entire family. The answer we received was that Malian men would prefer to have power over their women even if it resulted in a worse economic future for the family.

Thus, informing the men cannot be assumed to be the same as informing the family. Information intended for women needs to bypass forms of communication that are controlled by men. It is probably not surprising that when we asked women how they obtained information, they most frequently mentioned radio. Radio is one of the few communication systems that bypass men because it is directly accessible in the home. It is thus very important to realize that women have different information needs from men and that information to meet these needs must be communicated in forms and at times of the day when women are available.

**Use of Cooperatives**

Cooperatives appear to be an effective starting point to leverage the power of the smallholder farmers. A visit with a women farmers'association involved in horticultural production and food processing in Niono revealed several issues of concern, chief among these was the fact that they were working very hard for marginal gains (each woman's share was about $40 after three months of work). However, the cooperative idea demonstrated that there is strength in numbers. Through the coop, the women have been able to raise some initial funding through grants and micro-loans. They have also been able to access certain types of seed more easily. In addition, the coop has given credibility to their work, which in turn has led to their husbands giving them permission to be involved with the coop work. The coop has also promoted literacy training. The women report that out of 100 women in the cooperative, 3 read and write French and about 30 can now read and write Bambara.

However, even with the new skills and some economies of scale, the women still report that very basic information they need is not available to them. This includes information on issues such as planting times, fertilizer, equipment and crop options as well as market prices. The opportunity to participate in value-added processing, such as onion drying, has great potential. However, for the coop to really pay off, the women require more information than they currently have.

**Rural Access to Agricultural Information**

Malian farmers generally lack access to relevant agricultural information that could improve their livelihoods. The farmers we met in the village of Manabougou reported that they were unaware of basic government and NGO services available in the nearby capital, Bamako. Several times, even during these interactions with us, the participants would voice a concern or indicate a need, only to have one of our accompanying Malian agricultural experts describe where the desired service could be obtained. It should be noted that this was in a village only 40 km down a well-paved road from Bamako and accessible to the cell phone network. The latter fact is particularly pertinent as we found that approximately 10% of the farmers, including a few women, had cell phones. This disconnect was also a problem going the other way, with people in Bamako unaware of the information gap with farmers.

**Marketing Information System**

One answer to the lack of agricultural information in rural areas is demonstrated by the Observatoire du Marché Agricole (OMA). This agricultural market information system utilizes personnel in the field (the man in the photo wearing the hat is one such person) to gather price data for a series of crops. This is done through observing individual sales in the marketplace to improve the accuracy of the information. This information is then transmitted to a central information clearinghouse in Bamako via a computer modem connected to a radio transmitter. The consolidated information is then shared with individual community radio stations and analyzed for an executive summary circulated to a number of Mali's top ministries.

We found widespread awareness of the radio broadcasts of market information. One interesting insight was that transferring written content into audio form is not enough for illiterate farmers. Farmers told us that while they appreciated and trusted the radio-based market information, the information was often read so quickly that they were not able to remember it. While our observations were quite informal, they do point to a need for information providers to assess the effectiveness of their information distribution systems. Literacy is just one issue. In Mali, there are many languages and not everyone who understands a language may do so as a first or even as a second language. For example, a listener might be capable of listening to a radio station broadcasting music and light news in French or Bambara (the most commonly spoken local language in Mali), but may still need agricultural information to be in his or her local language. Of course, this is in addition to the basic question of whether the information being provided is appropriate for the intended audience. Much of the information we saw was suitable for the agricultural researcher or for the agricultural extension officer, but not for the smallholder farmer. There is much work to be done to determine what information is relevant and how best to digest and present that information.

**Market Timing**

Market timing was frequently raised in our meetings as a structural problem by smallholders. Farmers indicated that they were forced to sell their crops immediately after harvest in order to be able to pay their water irrigation bills. This means that the farmers are forced to sell at the exact point when their goods are at their lowest sale point (due to everyone else having to sell at the same time). This results in a system where traders are able to purchase these goods using credit, store them, and then sell them for a higher price later in the year (often back to the smallholders themselves!). This is a very profitable venture for the traders at the expense of smallholder farmers.

In discussions with the Office du Niger, the organization that controls water management, the idea of allowing a delay in repayment of the water fee was raised. Another opportunity that came to light during our meeting was the fact that they were in the process of building a number of new canals. We pointed out that when building new canals they should consider including conduits in the canals' structure for electrical lines and fiber optic cables. Any project building canals, roads or railroads should consider what other infrastructural support it might provide. It is safe to assume that all three types of projects will result in high population densities surrounding them, and going back later to install infrastructure will be far more expensive.

**Internet Access Limitations**

There are two serious concerns with Internet access that affect the ability of the average Malian user to gain access: high operating costs and structural inefficiencies with Internet connectivity. Our visit to a Centre Local d'Information et de Communication (CLIC) located on the outskirts of Bamako illustrates the fundamental problem of Internet access (see photo next page). The center had subsidized Internet

access for its first year of operation with funding from a grant. Once the grant ran out, the center was forced to stop its Internet service because the service was no longer cost-effective. The small amount of money the center currently earns comes primarily from typing local students' term papers.

The problem experienced by this CLIC is widespread throughout the country. The cost of Internet bandwidth is so expensive that even a heavily used center—as this one was during the time it had Internet access—is often not financially viable. Bandwidth costs are far higher in Mali than in North America. Frequently, we found that sites offering Internet access had 128 to 256 Kb connections and paid between US$1,000 and US$2,000 per month. These same fees in North America would purchase at least ten times the bandwidth and would certainly not have the frequent interruptions we experienced.

Some of the government officials we met claimed that there was simply not enough bandwidth coming to West Africa, while other people claimed that it was the government of Mali's telecommunication regulations that make prices so high. Whatever the cause, the Internet is out of reach to the average Malian. While new sources of bandwidth will ultimately need to be found, there may be short-term solutions at the national and pan-African levels that could be identified by a technical assessment. Worth considering may be an initiative to differentiate between infrastructural problems that require technical solutions and policy and tariff issues that require changes in government policy and practice. There appears to be the possibility of improving pricing and access with relatively small changes in government policy. A comprehensive assessment of the short- and medium-term prospects for Internet access in Africa will be critical to identifying the opportunities for information dissemination over the next five years.

### Regional Common Concerns

An impressive level of cross-national cooperation is already taking place across much of the Francophone area of Africa. Besides use of a common currency (the CFA franc) in a dozen countries, the Institut du Sahel (INSAH) facilitates collaboration across nine member states (Cape Verde, Senegal, Gambia, Guinea Bissau, Mali, Burkina Faso, Niger, Chad and Mauritania) on a variety of agricultural issues. For instance, INSAH houses the SPC (Sahelian Pesticide Committee), which provides information on pesticides and grants licenses for those pesticides approved for use across the member states. INSAH also encourages information exchange to promote the sharing of resources among academics and researchers. INSAH lacks the resources required to extract information required for the smallholder farmer and translate it into local languages. INSAH is a good example of an organization that possesses a substantial collection of potentially useful information for the smallholder farmer if only that information could be presented in a suitable form and language.

### Inter-Agency Networking

One of the most immediate and apparent benefits of our visit, which we observed in Mali as well as in Zambia, was that the roundtable sessions in which we participated brought people together who normally do not interact on a regular basis. Our visit provided an opportunity for people from different agencies to network, discuss issues, share different perspectives and learn from each other. This was a benefit that the participants themselves noted. In many cases, various individuals and agencies were either unaware of, or not benefiting from, the knowledge resident in other like-minded agencies.

This being the case, it would appear that efforts should be made to fostering intra- and inter-institutional as well as intra- and inter-national communication. Using the model of social networking software packages such as Facebook and MySpace, forums for this type of communication can be created technologically. Technological solutions should be only one form through which these connections are made. Other non-technological solutions, such as conferences, workshops or guided discussions, would also be effective. The need is to develop a variety of mechanisms through which participants can share their experiences, discover overlaps between projects, explore means for creating efficiency and effectiveness, and develop appropriate solutions to shared problems.

### Policy Creation

It was our impression that currently important policy decisions are not being made in a fully informed environment. The debate over biotechnology and the potential for Genetically Modified Organisms (GMOs) is one example. During a meeting with a group of biotechnology experts, they claimed that much of the wary attitude towards biotechnology and GMO crops in Africa is because Africa's policymakers are not receiving all the facts. These experts disagreed with current restrictions on GMO crops. While proponents argue that GMO crops could revolutionize African agriculture so that fewer pesticides, less water, and less fertilizer are required to obtain higher outputs, opponents warn that GMO crops could significantly reduce biodiversity, harm local plants and animals, and make farmers dependent on foreign corporations. Regardless of the position one takes, it is critical that exchanges of perspectives take place with the benefit of the very latest research. Without a more informed environment, optimal choices are unlikely.

## Site Visit to Zambia, August 12-19


### Country Information

Zambia, which achieved independence in 1964, is a large and sparsely populated country with 78 languages, of which 7 are considered major. It is approximately the size of Texas, with a population of about 12 million. A significant portion of its arable land is contained within its many nature parks. Despite being one of the largest per capita recipients of international aid, the average annual purchasing power parity (PPP) per capita is about US$1,200. This places Zambia in the bottom decile of nations (IMF 2008 data). Agriculture constitutes a key livelihood source for over 75% of the rural households in Zambia. A total of more than 1.3 million households in the country are totally dependent on agriculture for their livelihood and are classified as agricultural households (Zambia Central Statistics Office 2000).

### Educational Radio

Quality Education Services Through Technology (QUESTT) is a project sponsored by Zambia's Ministry of Education through the Educational Development Center (EDC), and funded by the U.S. Agency for International Development (USAID). QUESTT uses community radio to educate approximately 80,000 Zambian children otherwise unable to attend school. The EDC broadcasts one 30-minute English-language radio presentation per day for each elementary education level. In addition to the broadcasts, the class monitor (a volunteer 9th-12th grade graduate) spends approximately one hour covering auxiliary materials and discussing the broadcast.

The program uses radios with both a solar panel and a hand-cranked generator because many classes take place in areas where dependable electricity is not available. According to EDC officials, these 90 minutes of instruction each day produce test scores approximating the scores of students attending traditional Zambian schools for four or five hours a day. If this is verified with further statistics, the results are truly remarkable. The idea that students do equally well outside of school with an untrained teacher and with less time indicates the EDC's model may hold the potential to reach vast numbers of rural households.


The fact that basic literacy is being taught with solar-powered radios (seen to the left) in places that do not have a school or electricity points to a need for technical literacy. In North America, users learned how to operate a cell phone after decades of using landline telephones, answering machines, email programs, and pagers. In India, Microsoft Research had a computer application designed for illiterate users. The first thing the application did was to show a video demonstrating how information got into the computer and what the user was supposed to do to make it work. As new systems are developed with ever greater technical complexity, it may be wise to consider what type of technical training might be required by the end user.

In our discussions with Zambia's mobile telephone company, Celtel, we found that they had a training system for teaching users how to use their cell phones. It could very well be that one of the reasons cell phones are popular is due to the fact that the distributor of the technology is providing training concurrently. The cell phone companies underplay this work because they do not want to embarrass their users by bringing attention to their inability to use the cell phone. In fact, their training system is designed as a form of entertainment. The participants believe the main focus is their entertainment rather than learning how to use a cell phone.

**MP3 Devices**

EDC is currently evaluating the use of video iPods as a potential replacement and/or augmentation for its radio programming. The potential benefits are significant. With radio broadcasts there is a set amount of time during the broadcast for class discussion, but that time is not necessarily the same for everyone. Using MP3 devices, such as an iPod, the instructor can control the amount of time used for discussion. Controlling the scheduling and pace of the class is an immediate benefit, but content providers can also now add supplemental content or include the same content in other languages. MP3 devices can also be used to record student and staff feedback. Students could ask a question and have it relayed to a central support center. The main barrier we see with the use of MP3 devices is the need to have a computer to transfer files back and forth.  Where there is limited access to computers in real time, alternatives can be explored to provide asynchronous access, giving students expanded information access.

One possible solution is to use cell phones as MP3 devices. A number of cell phones currently play MP3 files and a few can download MP3 files over the cellular network. In Zambia, we were told that the entire national network has data network service. At present, Celtel is moving from GPRS to EDGE data transmission standards. Fortunately, the speed of the connection is not critical in this scenario because MP3 files are not being played in real time. It does not matter if it takes an hour or 10 minutes to transmit a 30-minute class to the teacher. The quality of the file is exactly the same regardless of how long it takes to transfer. It should be equally feasible for students and teachers to provide feedback via uploading an MP3 file or by calling the main office.

Cell phones currently have the capability of transmitting information via SMS messages. SMS could be used for anything from asking questions, to requesting certain "broadcasts," to processing information about student attendance and grades. In the near future, it should be possible to transmit video and audio from a cell phone to a standard television. We saw examples of video-based presentations via MP3 player at EDC. These presentations were designed for the instructors because the videos were shown on the relatively small screen of an iPod, and thus were too small to be seen by a class full of students. Once a television can become the display device, the options are greatly increased.

**Radio Listening Groups**

In both Mali and Zambia we found that radio audiences, especially women, listen to broadcasts in groups. In some situations this may be due to a lack of enough radios, but mostly it seems that the women want to have a support network and because there is an expectation that these listening groups may lead to organized business ventures. The fact that the radio groups tend to be comprised of women demonstrates both the lack of information reaching women in Africa and the eagerness of women to have more information access. In both Mali and Zambia we heard that men were not inclined to share information with women – even with their wives. Radio technology is well-suited to address this challenge as it does not require a middleperson to reach women.

We visited a number of groups created around a radio broadcast and found a wide range in the groups' effectiveness. The Radio Women's Forum we visited outside of Kabwe clearly had the most positive attitude about agriculture as a way of life. One of the most inspirational points of our trip was hearing the women singing a song that spoke about their experience with learning via the radio. The song described their wish to become "commercial farmers" so that they could better educate and feed their children. When we asked if they wanted their children to become farmers, they were universally excited about the prospects. On further questioning, it was clear that they were talking about their children becoming successful, profitable commercial farmers as opposed to subsistence farmers, which they are now. In Zambia, most farmers do not sell their produce on the market. Most of what they grow is consumed by the family or traded with other farmers.

The women we met did not classify themselves as commercial farmers. Their optimism was nothing less than inspiring. In all other villages we visited in Africa and South Asia, parents overwhelmingly reported that they did not want their children to be farmers. The insight we gained from our visit to this group was that the question might not have been asked correctly in earlier settings. We did not think to specify that the children might become commercially successful farmers. We strongly suspect that the answers we were given might have changed if the parents thought farming could offer a good living for their children.

Not every radio-based listening group was as successful or the participants as optimistic. We met one women's group whose members were raising pigs without adequate training and financial resources. The agricultural experts we had with us were very concerned that these women would lose their pigs to disease and end up forfeiting their entire investment.

The lesson we learned was that radio education can get farmers started on new ventures, but the one-way nature of radio means that critical pieces of information may be left out. The women clearly understand this weakness of the broadcast model. When we asked if they would like to have the ability to use their cell phones to call into the radio station, they were universally enthusiastic. Alternatives to make radio-based agricultural education more interactive should be a development priority.

### Digital Resources

The Acting Director of the University of Zambia library informed us that the library's principle resource was an offline based resource called The Essential Electronic Agricultural Library (TEEAL). TEEAL is an impressive collection of agricultural scientific journals delivered on hard disk for installation on a LAN (Local Area Network) connected computer. The library also subscribes to the free online journal delivery resources, AGORA, HINARI and OARE, which are led by the FAO, WHO and UNEP, respectively. Unfortunately, the library does not have the ability serve its 10,000 students with these valuable resources because it has only 10 computers. We were told that every morning at 8:00 a.m. there is a rush of students to sign up for computer time on these 10 computers. As with the libraries in India, the University of Zambia is doing the best it can do with a virtually impossible situation. As bad as the computer situation is, it is clear that computer-based information systems are the only viable way to bring the University of Zambia's library up to international standards.

In our meeting with FAO, we learned that even when funding is available for technology, it does not always guarantee a successful outcome to a problem. There is also the issue that sometimes related information is housed in multiple databases, which makes it difficult for managers and users to see important patterns that might emerge if the information could be consolidated. This problem is then exacerbated when within countries there are misalignments between political and organizational districts. What we took away from our meetings at the University of Zambia library and the FAO is that digital resources and new equipment will only have a positive impact if the entire system is well thought out. In the case of FAO, they are losing some of the value of their data because related information systems within Zambia are not coordinated. In the case of the University of Zambia's library, adding new databases will have virtually no impact if the library only has 10 computers. Information interventions should be more comprehensive in scope and funding made available for networking opportunities to promote information sharing.

### Leveraging Private Cell Phone Networks

Cell phone technology has consistently been one of the most promising technologies our team observed. Zambia's experience with cell phones only confirmed our positive impressions.

We visited two organizations that use SMS messaging systems for agricultural purposes. Zambia National Farmer's Union (ZNFU) allows farmers and wholesalers to obtain weekly agricultural pricing information. ZNFU's system functions more like a commodity trading index because the system is based on bid and ask prices, not actual sales. Although this SMS system is definitely an improvement over not having any access to market information, it does not have the accuracy that we saw in Mali, where the price was determined by the market enumerator physically seeing a trade taking place.

The Zoona Project uses SMS messages to transfer funds. Most Zambians do not have bank accounts. Not only is interest on bank accounts very low but any movement of money comes with a large transaction fee. A high level of inflation also makes bank accounts unattractive. Zoona is not designed to provide banking services, however, its SMS messaging service to transfer money enables people avoid the expensive money transfer fees common in Zambia. While still new and not yet widely deployed, this service does allow for greater movement of money than previously.

Generally, farmers immediately spend their harvest earnings on livestock or other material purchases. The livestock is then sold to purchase seeds and fertilizer. In this economic model the farmer is constantly selling when the market is saturated and purchasing when many other farmers are also purchasing. Both in Mali and Zambia, farmers would benefit substantially if they were able to hold their harvested crops off the market for short periods of time or to buy when the prices were lower. Celtel recently spun off a business unit, Celpay, which will explore the potential for cell phone-based banking. However, this will be a challenge in Zambia due to the high rate of inflation.

Everywhere we traveled in Zambia we saw evidence of Celtel's signal and observed signs of its operations. Celtel currently accounts for 15% of the cell phone market in Zambia; market penetration is expected to increase to 40% within five years. Based on these figures, we can reasonably assume that most communities in Zambia will have substantial access to cell phones in the next five years. Celtel's creation of a nationwide bi-directional communication system is a truly remarkable accomplishment and we believe one that could only have been achieved by the private sector.

Celtel, however, has a strong interest in the poorest segments of Zambia's population, especially the inner-city areas of Lusaka called "compounds." These densely populated areas are Lusaka's poorest areas but Celtel's most profitable. The rural areas are not nearly as profitable, but Celtel needs to assure nationwide coverage as many of the residents of the urban townships have rural relatives with whom they wish to communicate.

Celtel has also devised, though inadvertently, a socially beneficial service called "Me to You," which involves the transfer of cell phone minutes. Any Celtel subscriber can transfer purchased talk-time minutes to other subscribers. The transfer of minutes is used by rural populations as a surrogate for money transfers, eliminating the expensive bank transaction fees. Celtel's motivation is to increase cell phone use and reduce the number of physical phone cards they must sell. If a smallholder farmer knows someone in a city who can purchase cell phone time and transfer it to him/her, s/he can then transfer time to neighbors for cash. When it takes hours and may cost a bus ticket to get to a cell phone refill center, this electronic transfer system is highly desirable. We were told that this system is actually being used as part of a barter system.

Over all, we observed that the private sector can play both constructive and destructive roles, and often even a combination of both. For smallholder farmers, the main problem in depending on the private sector is that they normally do not the economic clout for the private sector to cater to them profitably. This means that they tend to be ignored as a market segment. We believe that associations with the private sector can be beneficial to both the company and to the community as long as those asking for help are cognizant of the corporation's primary responsibilities to its shareholders.

**Some Final Observations from the Site Visits to Africa**

It is clear from our visits that improving access to information is critical for all levels of farmers. In fact, as the farm size gets smaller, access to accurate information becomes relatively more important, and, on occasion, can mean the difference between life and death. Until recently, farmers relied on others in their village and nearby villages with whom they traded for their "information system." Today, we refer to the world as the global village. In today's village the farmer does not have access to all the pertinent information necessary to survive and compete. The farmer of the past knew who was growing what, what seed varieties were available, and what the wholesale and market prices were. Technology of various types has created the global village. Now the task is to use technology to reintegrate the farmer into the information landscape of this new world.

There are many barriers between designing an information system and making it happen. There is also the temptation to believe that the answer to problems in these regions is to reproduce what we know already works in the West.

As attractive as it might seem to solve the problems of South Asia and Africa with massive influxes of computers and satellite dishes, the results would likely be mixed, at best.

**National Intranet**

In both Mali and Zambia we saw a strong need for improved Internet access. As previously mentioned, access is expensive and unreliable because of the dependency on satellite connections and weak connections to the global Internet network. In this context, it is relevant to think about what the Internet enables, namely the collection of content and ability to create content. This becomes meaningful in thinking about cell phone networks, which in fact have the data carrying capacity for Internet access. The only reason they are not used for such access, as far as we could determine, is because of the impracticality and expense of accessing the Internet outside of national and continental borders. This raises the question whether it might be possible to create a local call environment.

Most of the agricultural information farmers in Mali or Zambia need is probably available within their respective countries. This would be even more the case if content had been translated into a local language. We already know from examples of how TEEAL is used that valuable content can be pre-packaged for local delivery. The conclusion we came to was that Mali and Zambia could use cell phone data networks and use all the Internet standards and Internet tools, such as web browsers, to access web servers located physically within the country. Normally, the physical location of a server has little meaning on the Internet, but in Africa it makes all the difference. Moreover, the construction of a healthy local Internet system would greatly increase the likelihood that international Internet providers would want to connect with Africa. Until Africa demonstrates the same degree of penetration with the Internet as is now occurring with cell phone systems, there will be little incentive to install connections.

Technically, it should be quite feasible to create a national-level Internet. The beauty of the Internet is that it works on principles that scale to any size. Essentially two things need to happen. First, a local Internet exchange location must be established where all the national Internet providers can have high speed access. Secondly, the Internet providers need to structure a billing system so that customers are billed at a much lower rate for local information and are alerted when a link to information outside the national system is required.

Once a certain momentum is achieved, the system should become self-sustaining and profitable. It is also likely that efforts to produce content for the Internet locally would become much more attractive. The reference to the Internet as an information highway is not an empty metaphor. In Africa it is all too clear what happens when a good road does not exist. The same is true with information. Without a dramatic change in the current Internet connection rates for Africa, the only viable solution we could identify was the creation of a national-level Internet.

### Formative Evaluation

In the development of any future information system, feedback must be a key component. It is already the core element of virtually every successful information system we saw. Time and time again, we heard that farmers most respected the views of other farmers. The ability to interact with and understand the context of persons providing the information is essential to how credible farmers perceive information to be. Every successful project we saw had some sort of feedback mechanism and every system that was not working did not have such a mechanism and was out of touch. The need for feedback and community applies not only to farmers, but is key to all information solutions. However, focusing on developing new alternatives in the smallholder context may suggest new solutions for the developed world as well.

One of the most notable aspects of our trip was how often those responsible for projects did not really know the effectiveness of their projects. The general assumption was that a practice put in place at the beginning of a project would remain fixed until completion. We saw very few cases where near real-time information was being collected and even fewer situations where such information was being used to make programmatic changes. Partly this was due to a lack of resources and partly, we suspect, it was due to the terms of program funding. Grants tend to have specific language on how a project is to be carried out. Performing a mid-course evaluation might be a waste of time if the grant obliges the organization to only one course of action. Ironically, a grantee could get in trouble for making improvements if those improvements were outside the scope of the original grant proposal. For many projects, the only evaluation may be when they seek another grant. This process produces built-in biases. The grant seeker will usually want to demonstrate the correctness of the previous work rather than show that another direction might have been better. The visit to the village of Manabougou in Mali was illustrative of this problem. Service providers in the capital were feeling successful because they were creating materials and producing new seed varieties needed in the rural areas. The shortcoming was that no one was measuring the ultimate effectiveness of these inputs. In terms of the grant, they were successful; in terms of the benefits for the farmer, they were not successful. Until grants specify formative evaluation as an integral component of a project, we believe a substantial amount of valuable work will continue to be dissipated.

One particularly good example of formative evaluation, however, is the FAO's Disaster and Recovery Department's use of near real-time data collection in Zambia. The FAO is using a digital-paper system to collect information and cell phones to transmit the information via a series of SMS messages. Digital paper (seen to the left) is a special type of paper that uses a grid made of faint lines and dots running vertically and horizontally. This grid, barely visible to the eye, allows a special pen to record via a small built-in optical sensor the markings on the page. FAO uses this paper for their disease report forms. The FAO's person in the field fills out these digital paper forms in exactly the same way he or she would have done before, but now the information on the form has been digitized. At the next available connection, the cell phone then sends the information via SMS messages to FAO's data collection server.

We think this use of digital paper is an excellent example of a low-cost system for collecting near real-time information. While it would have cost about the same to have used a smart PDA to collect the information, digital paper has the advantages of being more durable in harsh environments. It creates a backup copy of the information on paper, and it requires very little training because the user's experience with the digital paper form is almost identical to using a regular piece of paper. The next step for the

FAO is to develop their database reporting tools further so that information coming into the system can be analyzed more effectively. Currently, information is often misinterpreted because Zambia's diverse administrative zones are not always clearly aligned. Thus patterns of disease that might be discovered are lost. We suggested that a GIS system for mapping the data might be a good solution.

The only place we saw true formative evaluation was at the major cell phone provider, Celtel. Celtel both measures results and make changes based on those results in near real-time. For example, they found that the poorer areas of Lusaka were in fact their most profitable areas. They used this information to improve infrastructure services to these areas. They also looked for towers that were under utilized in order to identify problems that required solutions. One lesson Celtel said they had learned was that illiterate people needed help with how to use a cell phone but were too proud to ask. So Celtel customized a truck to visit the rural areas with an entertainment system that also includes tutorials on how to use cell phones. People would be attracted to the music and would stay to see entertaining demonstrations on how to use the phone. No one needed to be embarrassed because the entertainment aspect was reason enough to be present. We were very impressed by the creativity of Celtel's approach. It should be noted that the best example of formative evaluation we saw is being undertaken by a commercial venture. As a profit-making endeavor, it has a vested interest in making sure that its practices are as effective as possible. There is a lesson to be learned there for non-commercial endeavors.

In every case where we discussed the advantages of formative evaluation, there was great interest. We believe that training in how to incorporate formative evaluation in a wide range of development efforts would be both welcomed and highly beneficial.

**Fertilizer, Seeds and Lime**

Based on our interactions on the sites visits to South Asia and Africa, it appears that farmers in South Asia frequently use too much fertilizer and farmers in Africa use too little. In Zambia we attended a number of presentations indicating that African farmers were using too little fertilizer and lime and that soil fertility is a major issue in Africa. Another important issue relates to government subsidies. Government subsidization of fertilizer often consumes the largest share of the agriculture budget. As oil prices, and hence fertilizer prices increase, the strain on the government increases and the likelihood that any other agricultural project will be funded decreases.

Unlike India, where the soil and water are being pushed to their limits, African soil productivity can be greatly improved. An obvious question is why farmers are not using more fertilizers. One reason seems to be that even with government subsidies, fertilizer in many African countries is still more expensive than in South Asia. Another reason is that farmers lack information about how much fertilizer needs to be applied.

Zambia has a nationwide standard of fertilizer use called "four by four." The argument for using this cookie-cutter model is that it is a baseline amount from which every Zambian farmer can benefit. We also heard that very few of the farmers were able to follow this recommendation. What is clear is that farmers currently do not know how much fertilizer and lime they should be using. The amounts that should be used vary greatly based on such factors such as soil type, crop being grown, soil pH, and the current conditions of the soil. Something as simple as having the wrong pH or not having water to activate the fertilizer can result in the fertilizer being wasted. While soil testing is available to farmers through various outlets, only a few thousand farmers, almost all of whom have larger land holdings, take advantage of these services. What is needed is some sort of soil testing device that provides information on the critical soil factors and recommendations based on farmer-controlled variables. Our meetings with farmers indicate that farmers do not always choose to achieve the maximum output due to reasons of food security, payment schedules, and various opportunity costs. The important thing is that farmers are fully informed as to their options. They will more likely make the best decision based on enhanced information.

One of the principle barriers to the greater use of fertilizer in Africa is its high cost. Fertilizer is not just expensive, it is two, three, or even four times more expensive in Africa than it is elsewhere in the world. Transportation is the primary reason for this surcharge. When we asked if the fertilizer could be mixed locally so that the heaviest inert elements did not have to be shipped, we were told that this could be done for some types of fertilizers with potentially large cost savings. The reason this is not being done is because African farmers are not likely to trust that the local mixing would result in the same quality of fertilizer. This is clearly an information problem. We heard many times that seeds and fertilizers were adulterated by vendors. A system that could effectively monitor or test the major inputs would be extremely valuable.

**Viability of Smallholder Farmers**

Finally, another issue we debated with officials in Mali and Zambia is the future viability of the smallholder farmer. Some people argued that the operations of subsistence, resource-limited farmers are simply not viable and thus less worthy of support than larger, more commercially successful farmers. Others claimed that the issue is not so much the size of a farmer's operation as it is access to information and education that may allow them to choose profitable crops and engage in additional value chain activity.

We offer this observation in the spirit of searching for sustainable solutions. We note that although there is a strong trend to urbanization in much of Africa, the absolute number of people living in rural areas is forecast to grow. This means less land to allocate among a growing rural population, in which case the question of viability becomes even more acute. Does the future of the smallholder farmer lie in improving their productivity? Or does a future acceptable level of prosperity require that a substantial number of smallholders take on new, more viable careers either to replace or supplement farm income and/or migrate to larger towns and cities?

Absent a clearer understanding of this fundamental question, it seems that hybrid interventions that can assist smallholders improve their productivity on the farm as well as provide choices about alternative livelihoods may be very powerful.

# Tentative Schedule of Activities for the WorldAgInfo Design Team
# Mali, August 8-11, 2007[1]

**Trip coordinated by MSU Mali (PROMISAM) Office**

**Dr. Nango Dembélé – Based in Bamako**

**John Staatz – Based in East Lansing**

**Saturday, August 4**

- Arrival in Bamako

**Sunday, August 5**

- MSU office for briefing by MSU team on: (a) brief history of food and agricultural development in Mali, (b) information issues in Malian agriculture, (c) role of MSU food security project in helping smallholders, policy makers, and consumers, and (d) discussion of the Mali trip agenda
- Visit with farmers in the village of Manabougou, about 35 km from Bamako (on the road to Koulikoro).

**Monday, August 6**

- Ministry of Communication and New Technologies (Minister: Gaoussou Drabo) [confirmed]
- Ministry of Agriculture (Minister: Seydou Traoré)
- Visit to Food Security Commission:
  a. Commissioner (Mme. Lansry Nana Haidara)
  b. Food Security Commission Information Center: www.csa.org (Coordinator: Ibrahima Djiré)
- Market agricultural information system (Observatoire du Marché Agricole – OMA) headquarters: www.oma.gov.ml (Coordinatior: Salif Diarra)
- Institut du Sahel – Discussion regarding online databases: www.insah.org (Director General: Moustapha Amadou; webmaster, Aguibou Coulibaly)

**Tuesday, August 7**

- Round table discussion in Bamako among agricultural researchers, extension workers, and the users of research (farmers). Meeting held at the National Agricultural Research Institute (IER) headquarters [www.ier.ml (Director General: Bino Temé], involving IER, National Council of Agricultural Research, NGOs, Farmers' groups (comités des utilisateurs de recherché, women's associations, AOPP (Association of farmer professional organizations), SYCOV (cotton farmers' union), IPR/IFRA (Ag. School, with staff member focusing on livestock issues).
- Discussion with those working on rural connectivity issues, including rural internet center networks (CLICs) and linked village kiosks (cybertigi). Meeting held at and co-organized with Commissariat à la Sécurité Alimentaire (CSA).
- Working dinner with Nango Dembélé and John Staatz to recap the day's discussion

**Wednesday August 8**

- Travel to Office du Niger (Niono) area (Mali's largest irrigated rice area)
- Visit decentralized market information offices and meet with staff of local rural radio stations to discuss how the two organizations work together
- Meet with women farmers' association involved in horticultural production to discuss their information needs and current sources of information.
- Visit local rural internet center (CLIC)

**Thursday, August 9**

- Roundtable discussion with farmer associations, local NGOs involved in extension, IER researchers (from Niono rice research station) and Office du Niger workers regarding agricultural information needs of smallholders and sources of information, training needs, etc. Hosted at IER regional research center
- Return to Bamako.

**Friday, August 10**

- Meeting with USAID in Bamako to discuss its work in agricultural information
- Travel from Bamako to IPR/IFRA in Katibougou
- Meet with IPR/IFRA staff and students to discuss their use of information technology and their role as a regional training center for agriculturalists in Francophone Africa.
- Return to Bamako.
- Reception (Key stakeholders and MSU alums)

**Saturday, August 11**

- Meet with IPR/IFRA students (in Bamako) about follow-up survey on farmers' information needs and sources
- Wrap-up team meetings in Bamako

## Schedule of Activities for the WorldAgInfo Design Team
## Zambia Site Visit, August 13-19, 2007[1]

**Trip coordinated by FSRP/MSU Cooperating with ACF Zambia**

**Dr. Jones Govereh – Based in Luska at FSRP**

**Dr. Michael Weber – Based in Lusaka FSRP**

**Dr. Klaus Droppelmann – Based in Lusaka at ACF**

### Sunday, August 12

- Overview briefing on Design Team visits. Review of Zambia briefing documents. (Jones Govereh and Michael Weber FSRP/MSU)

### Monday, August 13

**AM**

- Welcome and overview of ACF and key Zambia Agriculture policy documents and donor activities in Zambia in agriculture
- Overview of FSRP research/outreach, and smallholder farming situation. Also overview of the importance of private extension and outgrower models (Cotton outgrower story including conservation farming)
- Presentation/discussion by Dr. Thomas Jayne on Smallholder Farming Constraints and Opportunities in Southern Africa, including data on Zambia
- Open Discussion

**PM**

- Zambia eBrain Forum Offices. Sebastian Musonda, eBrain Forum Program and Information Officer. Introduction and overview of eBrain Forum, including discussion of Thematic Groups [http://www.ebrain.org.zm/thematics.php] and the *Zambia National Information and Communication Technology Policy* (Final Draft) including overview of Section 6.8 on ICT and Agriculture and Section 6.10 on ICT in Tourism, Environment and Natural Resource Management.
- Open discussion/questions from WorldAgInfo Design Team
- Ministry of Education Meeting - Zambia Quality Education Services Through Technology (QUESTT) Project [**http://ies.edc.org/ourwork/project.php?id=3602**] (Educational Development Center (EDC)) funded by USAID as part of their support efforts in education.
- Visit Lusaka food markets. *CSO/FSRP 2007/08Urban Food Consumption Study Overview* [**http://www.aec.msu.edu/fs2/zambia/CSO_FSRP_Urban_Food_Survey_Overview_July17_2007.pdf**]

1. August 10, 2007 working version of the schedule

**Tuesday, August 14**

**AM**

- PANOS Institute Southern Africa Offices. Round Table Presentations and Discussions on Radio Forum Experiences and innovations to strengthen agricultural and natural resource extension and farmer learning. Participating in Round Table: NAIS National Agricultural Information (Mr Mukelebai, Director); MACO Extension; PANOS Institute, Southern Africa (Parkie Mbozi, Director)
- Zambia National Farmers Union (ZNFU) Offices. Mr. Hamusimbi Coillard. Review and discuss ZNFU's program of market information access via SMS [**http://www.farmprices.co.zm/**]. See ZNFU website: Commodity Price Information
- Discussion and overview of field activities to be seen on Wednesday in Kabwe

**PM**

- Working Lunch at Show Grounds with Representatives of Agriculture Lead Donor Group (SIDA, USAID, World Bank Zambia) and Other Donor Programs
- Zambia Agricultural Research Institute (ZARI). Mr. Davy Simumba, Project to Develop an Effective Information Flow Network for ZARI.

**Wednesday, August 15**

**AM**

- Ministry of Community Development and Social Services. Mr. Henry Nkhoma, Director of Community Development
- Depart Lusaka to travel to Central Province Kabwe
- Golden Valley Agricultural Research Trust (GART) and Conservation Farming Unit

**PM**

- Kabwe Radio Marantha, 103.5FM Community radio station. Mr Hangala, Station Manager.

**Thursday, August 16**

**AM**

- Field visits in and around Kabwe, including Ministry of Agriculture and Cooperatives (Kabwe District Office); Kabwe Agriculture Market Information Service (KAMIS); Kasanda Market demonstration on price collection; ZNFU District Farmers Association telecenter and information centers; National Agricultural Information Service (NAIS) Rural Radio Forum and Natuseko Womens Groups.

**PM**

- Ministry of Community Development Adult Literacy Training and Kabwe Skills Training Center
- Return to Lusaka

**Friday, August 17**

**AM**

- University of Zambia (UNZA). Round Table Discussion with staff and others on Information Communication Technology Applications in Zambia: Mr. Sikaaba Mulavu, Project Manager, VLIR UNZA IUC Programme, and co-author of *Towards an African e-Index (SMS e-Access and Usage across 14 African Countries*. Also member of "Research ICT Africa." Dr. Akakandelwa Akakandelwa, Acting Head Librarian UNZA Library. E-resources and related development strategy of the UNZA Library. Include comments on ICT activities of the Library Association of Zambia. Collins C., Chinyama, Director Computer Center, UNZA. UNZA ICT Strategy

**PM**

- To be decided: COMESA ICT Program and/or Agricultural Support Programme Extension Efforts and Insights. Document about MOAAS
- Profit Project and Local Partners Quick Pay Zoona Project via cell phones.
- FAO Vet and Animal Information Transmission and Database?

**Saturday, August 18 (Wrap up)**

### Other Ongoing Activities and Resources Available Online for Potential Use by the Design Team

1. International Institute for Communication and Development (IICD) Portals for work and support in Mali and Zambia, among other African countries.
2. PANOS West Africa
3. PANOS Global Network - Aims to ensure that information is effectively used to foster public debate, pluralism and democracy. Works with the media and other communicators to help developing countries shape their own agendas. Particularly focuses on amplifying the voices of poor and marginalised people. Does a lot of innovative work with rural radio forums.
4. PANOS - Radio listening clubs in rural African communities (Including a Guide Book)
5. Radio Farm Forum and Afronet: Learning from Successful ICT Projects in Zambia By: Raja Bobbili and Marta Luczynska
6. Fair Access to Internet in Africa - Report by Link Center, Jensen, M, and RIA! network members, JHB, 12 February 2004
7. UN-ECA- African Network of the Global Alliance for ICT and Development
8. UN-ECA Overview: Regional ICT Best Practices Forums - West Africa
9. NEPAD e-Africa Commission - The purpose of the NEPAD ICT programme is to accelerate development of ICT infrastructure and ICT skills. It is also intended to bridge digital divide in Africa and between Africa and the rest of the world.
10. COMESA ICT and Information Technology. Also Food & Agricultural Marketing Information System (FAMIS)
11. e-Agriculture.org - A global initiative to enhance sustainable agricultural development and food security by improving the use of information, communication, and associated technologies in the sector. Multi Donor Support
12. Web2forDev - Participatory Web for Development (25-27 September 2007) Networking, collaborating and exchanging knowledge in agriculture, rural development and natural resources management. Web2ForDev 2007 is the first conference devoted to exploring the ways in which international development stakeholders can take advantage of the technical and

organizational opportunities provided by Web 2.0 methods, approaches and applications. Multi Donor Support.

13. infoDev - Information for Development - Focusing on information & Communication tools to combat poverty. infoDev works to promote better understanding and effective use of information and communication technologies (ICTs) as tools of poverty reduction and broad-based, sustainable development. Multi Donor Support.
14. Rural ICT Toolkit -infoDev Publication
15. IAALD Blogspot - Agricultural information news from IAALD (International Association of Agricultural Information Specialists)
16. CGIAR ICT-KM Program - Connecting People, Technology and Knowledge for Agricultural Innovation
17. OECD-DAC Network on Poverty Reduction: "Good Practice Paper on ICTs for Economic Growth and Poverty Reduction"
18. CTA Update - Issue 37: Podcasting A new way to reach rural communities - June 2007 (CTA is an ACP-EU institution working in the field of information for development.)
19. ICT DevLibrary - Commonwealth Telecommunications Organization's (CTO) ICT Development Digital Library thatrovides a unique collection of ICT-for-development reports and documents for policy-makers and practitioners in developing countries.
20. Building Digital Opportunities (BDO) Programme - Information and Communication Technologies (ICTs) and Poverty Reduction in Sub Saharan Africa A Learning Study (Synthesis) By Richard Gerster and Sonja Zimmermann, October 2003
21. The cost and benefits of ICT's for direct poverty alleviation by Kenny, C, World Bank, 2002
22. ICT4Africa/Country Report Zambia (From WikiEducator)
23. ICT4Africa/Country Report Mali (From WikiEducator)
24. Soul Beat Africa Search on articles for Mali
25. Soul Beat Africa Search on articles for Zambia
26. Zambia Page on Information Communication Technology (ICT) on the FSIP for Africa Portal http://www.aec.msu.edu/fs2/test/links.cfm?Country=53&Topic=22&Lang=en
27. Mali Page on the Information Communication Technology (ICT) on the FSIP for Africa Portal http://www.aec.msu.edu/fs2/test/links.cfm?Country=31&Topic=22&Lang=en

# 6

# Smallholder Survey

## Introduction

To supplement the lessons learned during the site visits to Africa and South Asia, additional data were gathered through focused interviews held with individual farmers within rural villages in India, Sri Lanka, Mali, and Zambia. Local agricultural university students, using an interview protocol designed by project members, conducted 530 interviews in approximately 80 different villages throughout these four countries. After a short introduction to the interview protocol, the students were provided with a digital recorder with which they were to record each of the interviews that were undertaken. These interviews were transcribed locally, and each university student compiled a report on his/her findings.

The interviews with farmers typically covered daily activities; number of household members; formal education; what type of inputs were used and where they were obtained; crops produced; where these were sold; land ownership status; cooperative membership status; where/how agricultural information was obtained; information sources; local NGO activity; electricity/water/other infrastructural problems; cell phone usage, if any; and radio usage. It is important to note that the sampling for these interviews was not done scientifically, and, as such, cannot be said to be representative even of the farmers in these villages.

Keeping with the philosophy of formative evaluation, the data from the interviews was analyzed quickly to attempt to triangulate findings from the site visits and to raise any obvious additional points that may have been missed during those visits.

## Results

During these interviews, the smallholder farmers discussed several concerns. In addition to those areas of need that would be expected from such a discussion (e.g. consistent and trustworthy extension support, transportation, water, and labor to name just a few), three main information delivery methods/needs were consistent throughout the interviews. Each of these areas of need would benefit from more widespread and rigorous data collection and analysis.

First, farmers, even those who own and regularly use cell phones, do not necessarily appreciate their agricultural applications. Access to cell phone network infrastructure is a major limiting factor that isolates many of the poorest farmers. However, even when good cell phone coverage is available, often there is a lack of meaningful agricultural information that could be delivered via the available cell phones.

Second, many farmers appear to get a good amount of their agricultural information from magazines and newspapers. These traditional media retain their dominant popularity; even in areas where more sophisticated radio, TV, and telephone systems exist. A good plan may be to frame these higher tech media within the constructs of more traditional media. For instance, find out what people like about magazines' information, format, etc., and tailor electronic systems to those preferences.

Third, there is a desire for information on new agricultural crops, particularly specialized export crops. Many farmers desire to diversify to flowers, organics, and other non-traditional agricultural products. They are a profitable source of additional income for both men and women. Likewise, women within these groups seem to have more equitable situations than in more traditional settings. It is unclear whether or not strategies like these are viable options in more isolated areas of India and Africa. Demand for this type of product may not exist in these rural, isolated areas, however, when looking for pathways out of poverty, this would be an area that would warrant further research.

## Conclusions

More cell phone use was found than expected. However, agricultural information was not often available or sought via cell phone. Though many areas are constrained by access, building data bases which make real time agricultural information available to farmers by cell phone is a promising area to pursue.

Traditional print media area still an important source of information for many (literate) smallholders. Perhaps technology-delivered alternatives can be developed to more closely parallel those traditional delivery systems

Smallholders seem open to new ideas – new crops and new sources of income, but in general they lack the infrastructure support that would give them confidence to try, since they lack good safety nets and have little margin for failure. Exploring alternatives would seem to be a good investment.

# 7

# Literature Reviews

The following literature reviews were commissioned by the Design Team to inform the project and to serve as future resources for staff at the Bill and Melinda Gates Foundation. Due to space limitations they are not reprinted here. Copies are available at the WorldAgInfo website (www.worldaginfo.org).

Also developed was a small database of additional relevant resource materials and references collected during the course of the project. This database is accessible at the WorldAgInfo website as well.

**Major Agricultural Information Initiatives: With Emphasis on Developing Country Services**
Barbara Hutchinson
University of Arizona

**Agricultural Extension in Africa and Asia**
Carl K. Eicher
Michigan State University

**Corruption and the Smallholder: A Review of Current Literature and Research**
Chris Webster

WorldAgInfo

**Curriculum Enhancement and Reform to Meet the Needs of Smallholder Farmers in Developing Countries: Survey of Literature**
Mywish Maredia
Michigan State University

**Supermarkets and Beyond: Literature Review on Farmer to Market Linkages in Sub-Saharan Africa and Asia**
D. Tschirley
Michigan State University

**First Kilometer Incentives: A Review of the Literature**
Patrick O'Shea
Harvard University

**The Private Sector and Smallholder Agriculture: Best Practices with Relevance to Mali, Zambia, India and Sri Lanka**
Steve Reiquam
University of Colorado

**Soil Health and Soil Quality: A Review**
James Kinyangi
Cornell University

**Integrated Pest Management Resources**
Karim Maredia and Dieudonne Baributsa
Michigan State University

**Radio Education: A Review of the Literature**
Patrick O'Shea and Simon Richmond
Harvard University