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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

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

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

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

WorldAgInfo

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 formative 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.

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

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.

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

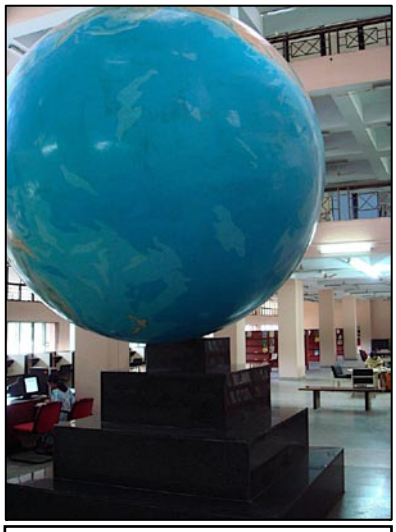
The three general categories of deliverables are as follows.

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.

A conceptualization of a possible portal design

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

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.

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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.

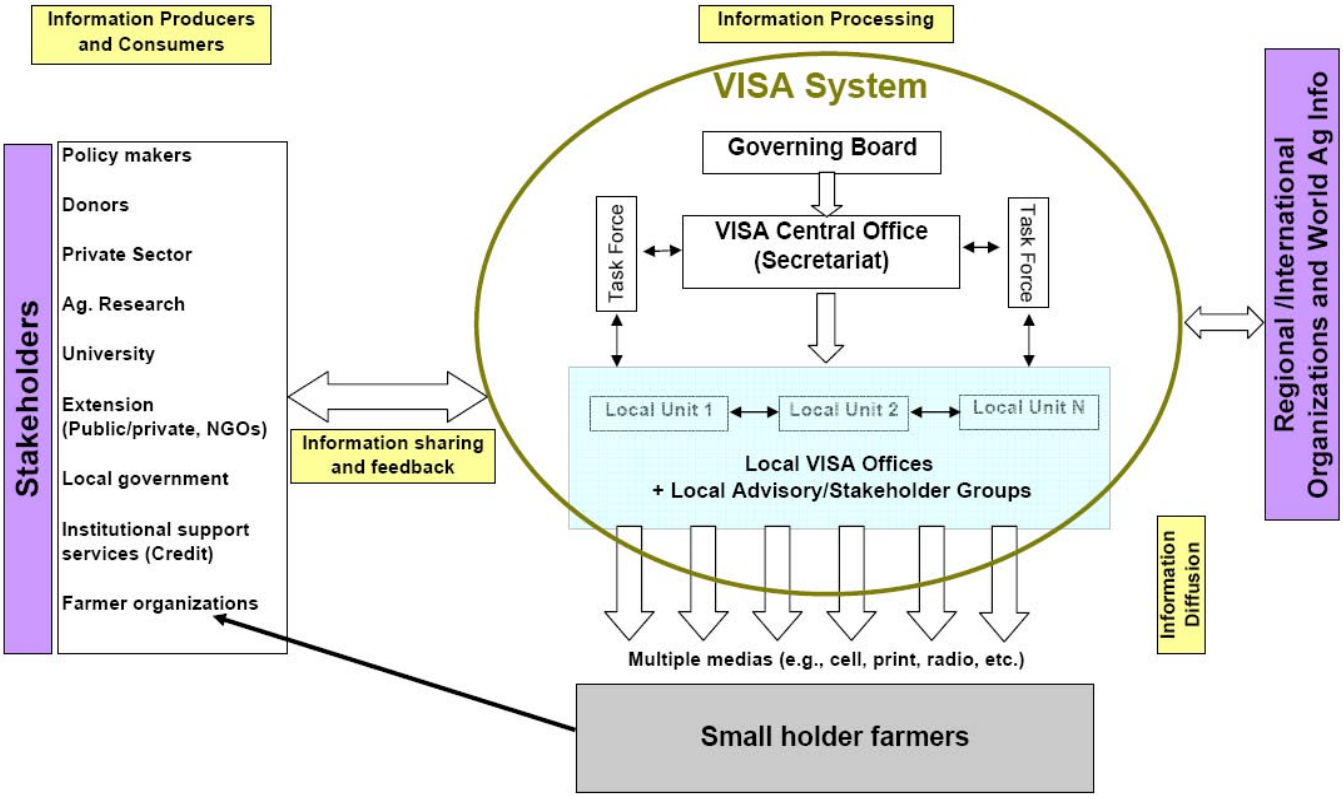
Information Producers and Consumers
Information Processing
VISA System
Governing Board
Task Force
VISA Central Office (Secretariat)
Task Force
Stakeholders
Policy makers
Donors
Private Sector
Ag. Research
University
Extension (Public/private, NGOs)
Local government
Institutional support services (Credit)
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.

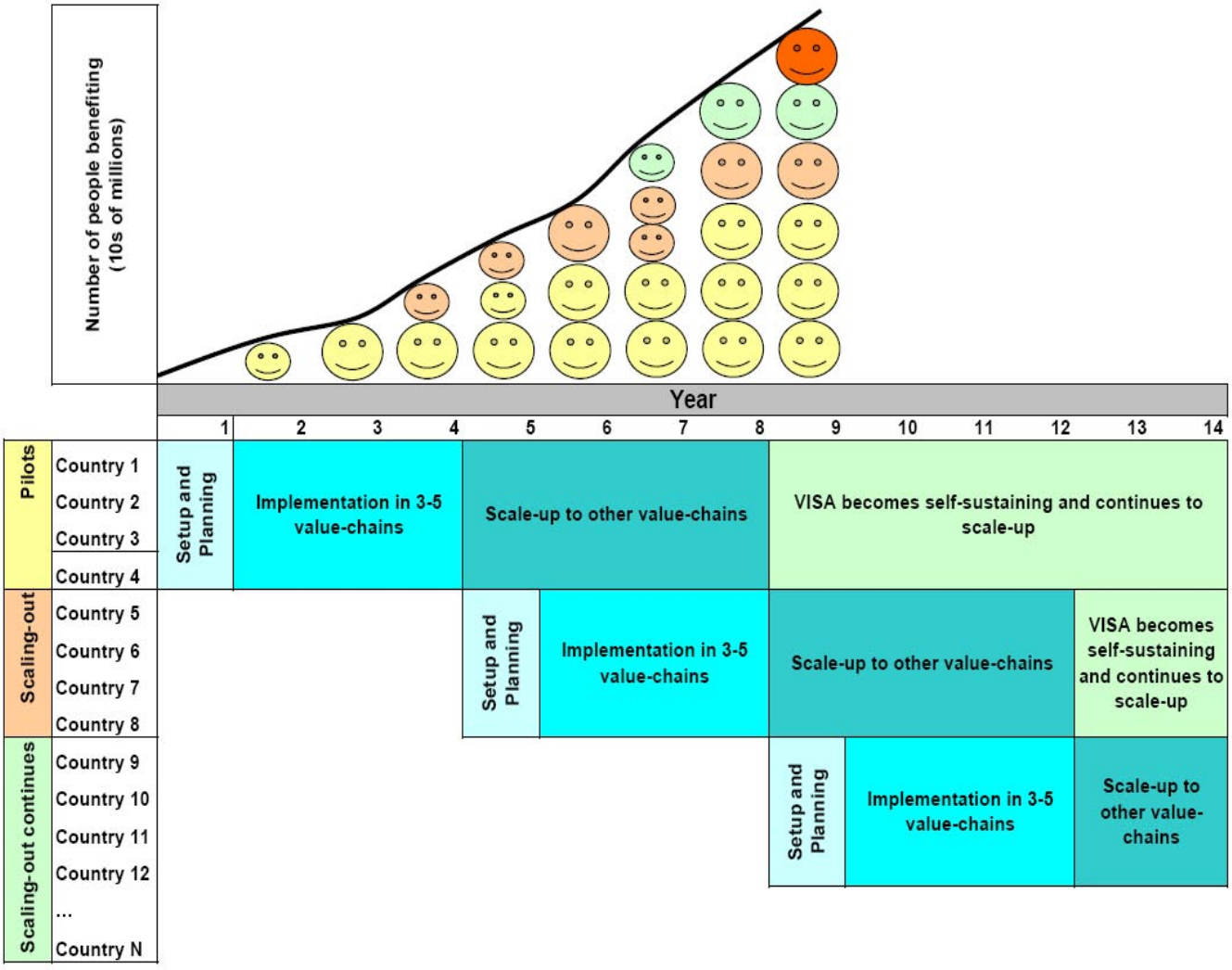

Figure 2. VISA Timeline

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	Consultancy	Overheads
			Equip.	Travel	Communication	Supplies			
Board	Governance Technical Direction			x	x	x			
Exec. Secretariat (Central office)	Day-to-day operation Content development Networking	x	x	x	x	x	x		
Local units	Outreach Information collection	x	x	x	x	x	x		
Ad hoc Task Force	Conduct assessment studies External evaluation							x	
Management Entity	Project setup and management M&E	x	x	x	x	x	x	x	x

Literature Review

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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.

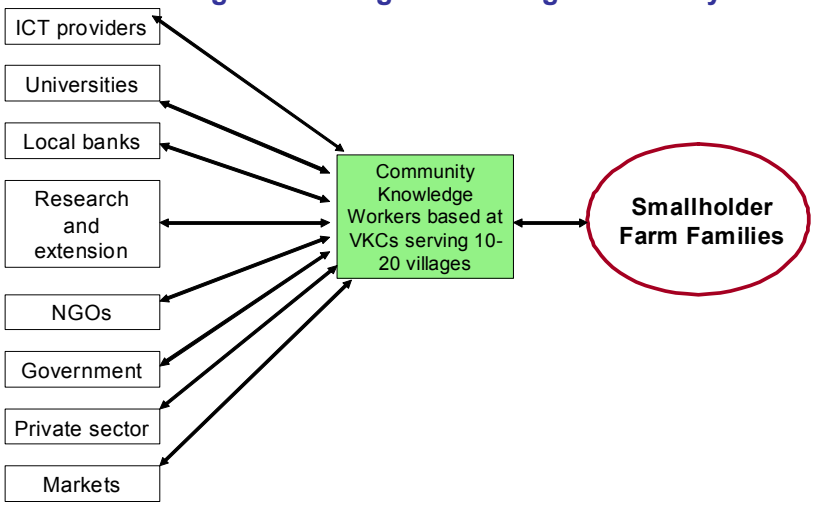
Box 2. Skill Set Requirement of Community Knowledge Workers

In recruiting CKWs, the following qualifications will be considered:

- Education – Primary school education (at least 6th 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:

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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.

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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.

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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

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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

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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

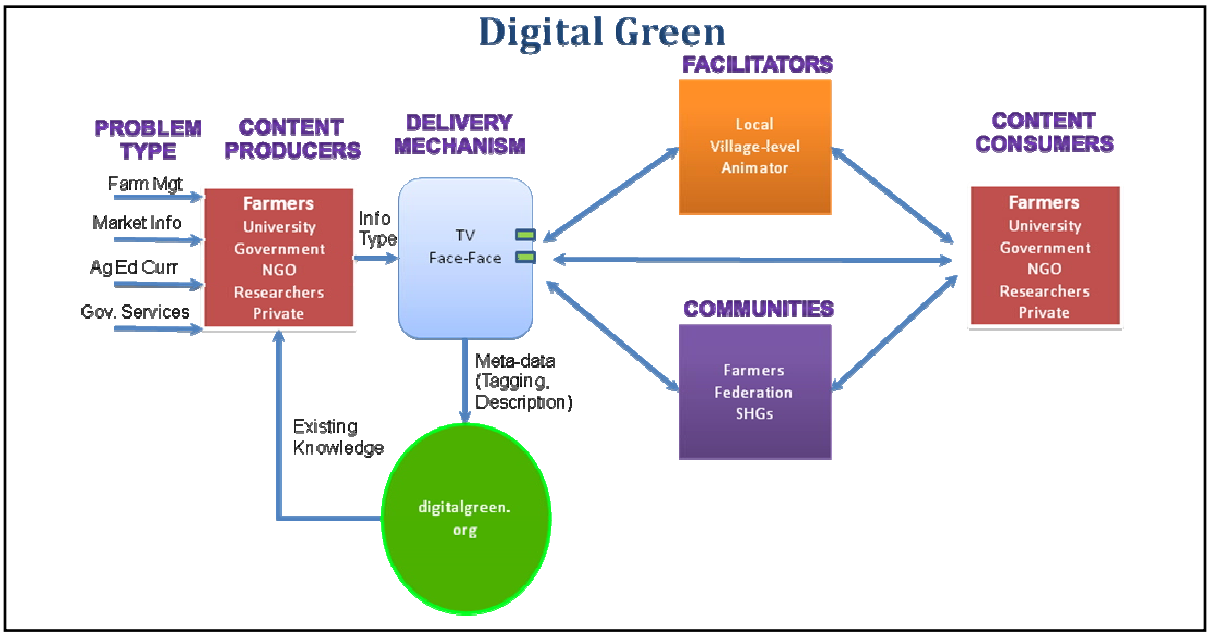

Figure 1: The flow of information between components in the Digital Green approach

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.

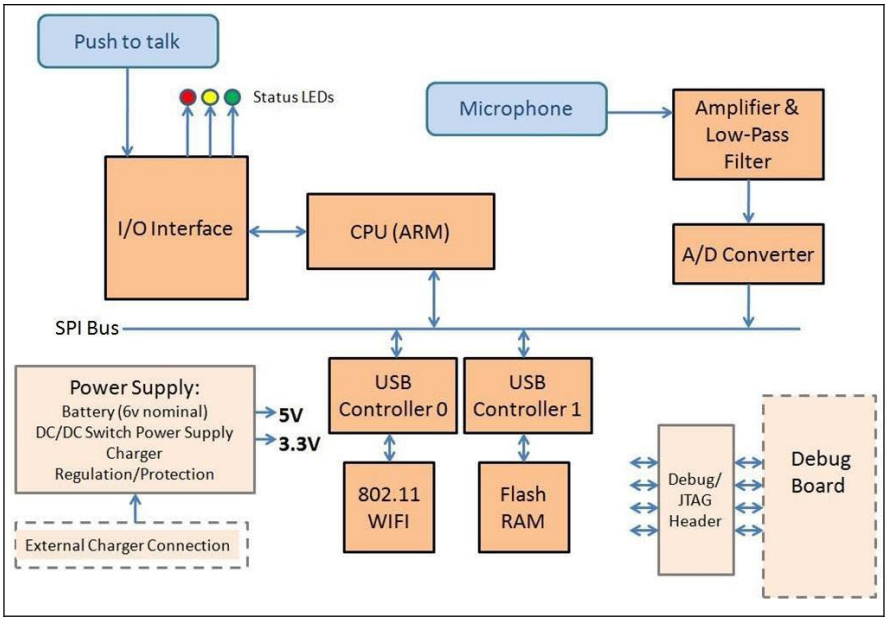

Figure 2. AIR Block Diagram

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.

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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.

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- 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

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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 Material development Material piloting and evaluation
Year 2	Partnerships developed with appropriate external agencies Publicly available Community Radio Starter Kit Begin building community radio station associations Develop communication media for community of users Formative project evaluation at six- month intervals
Year 3	Partnerships developed with appropriate external agencies Community building activities continue Formative project evaluation at six- month intervals
Year 4	Partnerships developed with appropriate external agencies Community building activities continue Formative project evaluation at six- month intervals
Year 5	Partnerships developed with appropriate external agencies Community building activities continue Formative project evaluation at six- month intervals Sunset of project staff (dependent on reaching self-sustaining tipping point for community of users) 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

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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

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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.

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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

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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 ▪ Breakout groups report back to plenary
16:00	Adjourn
19:00	Dinner at the Chrismar Hotel
	Dinner Remarks "ICTs for the New Agriculture" *Gracian Chimwaza, Project Director, ITOCA, Johannesburg, South Africa*

FRIDAY, NOVEMBER 16, 2007

7:30 – 8:30	Breakfast
8:30 – 8:40	Administrative Announcements *Mary Ochs, Design Team*
8:40 – 9:00	"A Zambian Perspective on the New Agriculture" *Mike Weber and Jones Govereh, Michigan State University*
9:00 – 9:30	Discussion
10:30 – 11:30	Writing Session ▪ 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 ▪ Evaluation ▪ 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

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