

Technical Report on the Project

eAgriculture Research Network: Effectiveness of ICT-Based Interventions in Linking African Farmers to Markets (Grant No. 104482 -001)

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Project countries (in form of background studies): Kenya, Uganda, Benin, Madagascar, Malawi and Ghana

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Synthesis

Poor access to market information is an important impediment to the commercialization of smallholder agriculture in Africa. Yet, progress in agriculture is content upon farmer access to efficient input and output markets. Attempts to improve smallholder farmer access to efficient markets have recently shifted to the use of ICT-based interventions. A scoping study commissioned by IDRC found widespread use of ICT-based applications in agriculture. As a follow-up of IDRC study, the proposed study aimed at developing a research proposal that would systematically analyze the existing ICT-based interventions to determine what works and what does not in the context of smallholder agriculture.

The requested funding of Can \$ 98, 630 was to be used to facilitate background studies in six collaborating countries namely Kenya, Uganda, Ghana, Benin, Madagascar, and Malawi and formed an input into the proposal development workshop held in Antananarivo – Madagascar in June 2008. The workshop specifically refined the objectives of propose study; developed consensus on research methods; discussed the research and dissemination strategies; and prepared a work-plan for completing the proposal.

The outcomes of workshop were: a summary report/workshop proceedings; refined study objectives; consensus on research methods; draft research methods; research and dissemination strategies; and revised work-plan for the remaining activities leading finalization of a full project proposal

Research problem

Smallholder subsistence producers form the majority of both the total and rural poor in Africa. Enhancing returns from agricultural production through improved access to markets is therefore vital for the realization of poverty reduction goals of African countries. Improved market access can result in production of marketable surplus, facilitate access to income, spur commercialization of agriculture and hence directly impact on farmers' livelihoods.

Access to agricultural information by the poor subsistence or semi-subsistence smallholder farmers has the advantage that it can enhance productivity However, market access continues to be constrained by poor access to agricultural information, especially by smallholder farmers, in many African countries. Consequently, there have been efforts to use ICT-based interventions to reach farmers with timely information in Africa. Despite these efforts and application of ICTs in African agriculture, only a few studies have attempted to investigate the effects of such interventions. At the same time, none of the past studies systematically examines the effect that ICT-based market information systems have had on smallholder agriculture and their successes and/or failures in a broader context that encompasses, among others, the different cultures, commodities, and farmer types This proposed study aimed at filling these gaps in the literature.

The specific objectives of the proposed the project were:

- i) Assess smallholder farmers' awareness of the existing ICT-based applications and their perception of the relevance of these projects to their needs.

- ii) Examine the factors affecting the participation of smallholder farmers in the ICT-based information system projects.
- iii) Evaluate the nature of constraints to the participation of smallholder farmers in ICT-based market information services.
- iv) Identify and critically assess the problems that ICT-based projects for linking farmers to markets have encountered and success of strategies designed to overcome such problems.
- v) Examine the actual benefits to smallholders of participating ICT-based market information projects.
- vi) Assess the extent and ways by which the constraints to and benefits of participation in ICT-based market information projects differ by gender.
- vii) Formulate guiding principles and policy recommendations for mechanisms and strategies aimed at facilitating the participation of smallholder farmers in ICT-based projects and up- and out-scaling of such projects.
- viii) Enhance collaboration among African scientists and build capacity of project partners to assess and critically evaluate projects aimed at linking smallholder farmers to markets.

Pre-project activities

The pre-project activities included:

- ✓ **drafting the project concept note,**
- ✓ **selection of research partners/collaborator in each participating country through competitive vetting process,**
- ✓ **country scoping studies in each participating country,**
- ✓ **convention of a proposal development/methodology workshop,**
- ✓ **preparation of workshop report/proceedings,**
- ✓ **preparation of final project proposal with close participation of project partners, and follow up on funding of the project proposal.**

The proposal development workshop

In order to develop the draft concept note into a full proposal and as a culmination of proposal development process, a workshop was held in June 2008 in Antananarivo, Madagascar. The primary goal of the workshop was to bring together project partners from the participating countries, ICT practitioners and scientists to:

- ✓ Discuss the findings of country position papers ,
- ✓ Identify the gaps in the literature and constraints to adoption of best practice ICT interventions,
- ✓ Refine the objectives of the proposed study, and
- ✓ Develop a consensus on the research methods to be used in implementing the proposed study.

Each participating country representative/project team carried out a country background studies that built on earlier scoping study commissioned by IDRC to highlight the country-specific ICT and agricultural policy environments and cast the ICT-interventions in the context of smallholder

agriculture and market linkages. The country background studies were titled: “Position paper on ICT policy environment and the use of ICT-based interventions in agriculture: the case of _____”. These background studies:

- ✓ Compiled an inventory of all existing ICT-based innovations,
- ✓ Identified, if any, the best practice ICT interventions,
- ✓ Identified the relevant “boundary partners” and market linkages in the existing ICT interventions,
- ✓ Carried out preliminary investigation into constraints, opportunities and impact of existing ICT interventions,
- ✓ Conducted exploratory interviews with relevant stakeholders to identify the national agricultural and ICT policy environments in the participating countries, and
- ✓ Summarized findings of previous studies in the area of ICT and agriculture.

Workshop and project outputs

The outputs of the workshop and project were:

- ✓ Workshop proceedings that synthesized of the country position papers and highlighted (See Annex 1):
 - Past and existing ICT projects,
 - Donors and boundary partners of the existing ICT interventions
 - Stakeholder perceptions on constraints, opportunities and impact of existing ICT interventions
 - Agricultural policy environment,
 - ICT policy environment
- ✓ Refined objectives of the proposed study
- ✓ Consensus on the theoretical and empirical methodologies to be used
- ✓ Draft outline of theoretical and empirical research methodology section
- ✓ Revised outline of workplan for undertaking the remaining activities leading to development of final full project proposal
- ✓ Strengthened and cohesive network of researchers
- ✓ Revised proposal for submission to IDRC (see Annex 2)

Impact

The workshop and the rigorous process and proposal development enabled the e-ARN research team to reach a common intellectual understanding and appreciation of project design and analysis. The diverse backgrounds of the team members (market economists, policy analysts, and ICT-experts) were also useful in providing the synergy in developing project objectives, research questions and study design. In addition the interactive proposal development process has enhanced bonding among eARN team members and resulted in a strong cohesive team.

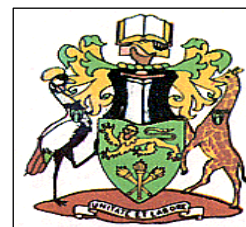
Annex 1: Workshop proceedings



Université d'Antananarivo
Ecole Supérieure des Sciences
Agronomiques



International Development Research Centre



University of Nairobi
College of Agriculture & Veterinary Sciences

ICT for Linking Farmers to Markets

Proceedings of the Pre-Proposal Development Workshop held in Antananarivo, Madagascar, June 12 – 13, 2008



Revised Version, September 8, 2008

Julius J. Okello and David O. Jakinda
University of Nairobi

Executive Summary

The Madagascar e-ARN proposal workshop was as a culmination of a process that began at the African Association of Agricultural Economists meeting in Accra – Ghana in 2007. It was motivated by the realization that smallholder farmers continue to face special challenges in accessing factor and commodity markets in Africa. The poor market linkage by smallholder farmers is driven, by among other factors, lack of access to market information. Lack of market information reduces access to improved agricultural technology and hence retards productivity growth. Recent attempts to overcome the problem of poor access to markets have spurred a number of ICT-based interventions for providing agricultural information to smallholders farmers. A scoping study by Hilda Munyua commissioned by IDRC found widespread ICT-based interventions in agriculture.

A team of economists from across Africa thus met in Accra to brainstorm the possibility of conducting an Africa-wide study of the effectiveness of ICT in linking smallholder farmers to markets. The meeting concluded that a network of researchers be formed to prepare a project proposal. A network of researchers drawn from six proposed participating countries (Ghana, Benin, Kenya, Uganda, Malawi and Madagascar) was subsequently formed. The countries were selected to capture regional diversity, ensure regional balance with regard to major language groups (e.g. French and English), target cases where there are/have been ICT-based interventions for linking farmers to markets, and also build on the findings of Munyua's scoping study. In addition to Ghana, Kenya, Malawi and Uganda which were highlighted by Munyua, the meeting suggested that Madagascar be included because it has innovative ICT-based interventions in agriculture hence would enrich the lessons of experiences arising from the project and provide a regional balance. The team proceeded to prepare a concept note which after further refinement by comments from IDRC Program Officer formed the basis of workshop.

The team secured funding from IDRC for background studies in proposed project countries to better understand the use of ICT-based interventions in smallholder agriculture, the policy environment within which the interventions operate, and the locus of intervention. These background studies acted as inputs into the workshop. The specific objectives of the workshop were: i) discuss the findings of country position papers, ii) identify the gaps in the literature and constraints to adoption of best practice ICT interventions, iii) refine the objectives of the proposed study, iv) develop a consensus on the conceptual framework, research design and research methods to be used in conducting the proposed study.

This workshop proceedings thus presents the activities undertaken at the workshop and the workshop outputs. The workshop brought together a team comprising market economists, ICT scientists, sociologists, ICT practitioners, donors and the media. It was hosted by University of Antananarivo – Madagascar and opened by Deputy Chief of staff of the Ministry of Agriculture.

Presentations of the background studies on each proposed participating countries' ICT policy environment and the use of ICT-based interventions in agriculture highlighted i) past and existing ICT initiatives in agriculture, ii) agencies that finance ICT initiatives in agriculture, iii) boundary partners and market linkages in the existing ICT projects, iv) the ICT policy environment, v) the general agricultural policy environment as relates to ICT. The invited practitioners of ICT-based project in different countries of Africa also made presentations on

their projects highlighting i) history of the project, ii) project goals and locus of intervention, iii) funding, iv) challenges, and vi) opportunities. The workshop also discussed a) project design, b) the expected outputs of the proposed project and dissemination strategies, c) the organization and governance of the proposed project, and d) the timeline for project proposal development.

The workshop reached consensus on the objectives and the design of the study. The workshop felt that general objective of the project should be to study the effectiveness of ICT-based interventions in linking African farmers to markets. The specific objectives suggested by the workshop were:

1. To analyze existing initiatives and the environments within which they are applied and select some for in-depth analysis.
2. To examine the effects on key stakeholders
3. To better understand which factors influence adoption
4. To assess the challenges facing MIS providers
5. To identify roles and partnership models for the public and private sectors (including NGOs)
6. To enhance collaboration among African researchers and to build research capacity of project partners and young researchers.
7. To formulate guiding principles and recommendations to inform policy and practice

The workshop also reached a consensus on the methods to be used for the study. It suggested that the study should use a theoretical framework that focuses on market efficiency both at micro and meso levels. At micro-level, the theoretical foundation is to be the transaction cost economics. The overall hypothesis to be tested is whether ICT-based interventions through providing access to market information lower the transaction costs and hence enhance smallholder farmers' market access. At the meso-level, theories of spatial and temporal market integration is to be used to test whether ICT-based intervention spur efficient operation of village, and regional markets hence promote access by smallholder farmers to better paying markets. For each objective, the empirical methods including data need, data sources, and method of data collection were discussed and agreed upon as well as the expected outputs/outcomes of the study and users of study results. Each country team developed a matrix of data needs, sources, method of collection, outputs/outcomes, and users of research result for each research objective.

The workshop further reached a consensus on the ways to use research outputs to influence policy and inform scientific dialogue. Among the strategies proposed include use of project launches, country discussion for a, policy briefs, posters, conference and journal papers.

DAY ONE, JUNE 12TH 2008

SESSION I: INTRODUCTION AND SETTING THE PACE

Chair: Abel Ratovo, University of Antananarivo

Introductory Remarks by Prof. Jean Rasoarahona, University of Antananarivo

“Mr. Director of Cabinet, representing His Excellency the Minister of Agriculture, Livestock and Fisheries,

Dear Colleagues,

Ladies and Gentlemen,

On behalf of the school of Agriculture of the University of Antananarivo, and of all the Malagasy team, I am very glad to welcome you in Antananarivo. I am particularly happy to welcome all those who came from very far, for instance from the other side of Africa. I wish you a nice stay here, and hope that all arrangements we did to make your stay comfortable and pleasant will satisfy you.

Many thanks to the Minister of Agriculture, Livestock and Fisheries, for the interest he gives to our workshop; please Mr. Director of Cabinet, tell him how happy and honored we are for that. We are beginning today reflections about a topic which is not very current: although market-driven approach of agriculture is a great subject nowadays, although NTIs are a very fashionable subject, in developing countries linking them is a new angle of view. Our colleague Julius Okello will develop later the context and objectives of our workshop, but let me share with you some reflections from common people I met recently. Someone said: ‘If farmers could be accurately informed of market prices or demand about commodities, and all these market-related things, maybe it would incite them to increase production, thus improve productivity’; I do personally think that it could be a major lever for poverty alleviation.

So, linking the small farmer to the markets, using NTIs is benefit for the major challenge in developing countries, which is fighting poverty especially in rural areas.

Ladies and gentlemen, let me wish to all of us a very fruitful workshop, and I renew the hope that your stay in Antananarivo will be pleasant.

Thank you”.

Opening Remarks by Edith Adera, IDRC

“Chief of staff representing the Minister for Agriculture,

Colleagues, Ladies and Gentlemen,

I have great pleasure to address this proposal development workshop. Allow me to extend my appreciation to the Madagascar team for their hospitality.

May I take this opportunity to say a little bit about IDRC. This is a Canadian government agency that supports research to address challenges faced by developing countries.

Today marks a milestone for the project at which we will design the research study aimed at enhancing the livelihoods of farmers in six African countries.

I wish to encourage you to have open and honest discussions on the design of the research study, to take ownership of the process and the resultant design so as to ensure we develop and deliver a project that will transform the knowledge base in this area so as to inform policy-making and influence practices in this area for Africa. IDRC is just a facilitator in this process; I would like to encourage you to take ownership of the project. With this I wish you fruitful deliberations.

Thank you for your attention”.

Opening Remarks by Rose Nyikal, University of Nairobi

“Our chief guest, our host, ladies and gentlemen:

I take this opportunity to welcome all of you to the Proposal Development Workshop. We recognize and are grateful for the Malagasy hospitality. We acknowledge the significance of access to markets in all strategies against poverty and hunger. All over Africa, specifically the Sub-Saharan Africa, there have been several breakthroughs in production. The equation, however, would be incomplete without markets and marketing issues.

We acknowledge the diversity of the membership of the team here, i.e. practitioners, academicians, policy analysts, policy developers. Together we should come up with a tool or tools to use for the improvement of small-scale farmers, who form the bulk of farmers in our populations.

I wish the team a fruitful time over the next two days.

Thank you.
Rose Nyikal”.

Introduction of the objectives of the workshop by Julius Okello, University of Nairobi

“The Honorable Minister,

Director, School of Agriculture

All protocol observed

Ladies and Gentlemen, I am excited to see all of you and join our colleagues & partners here in Madagascar in also welcoming you to this workshop

As you know, agriculture remains the primary sector of African economy.
Agriculture is the engine of growth

More than half of the farmers in Africa are small-scale

Majority are trapped in “low equilibrium trap” with low input use, low productivity, & low surplus for sale

Many are not linked to markets. In fact for many, the input markets fail and the output markets are thin & fragmented.

A major problem for these farmers is the lack of market information.

The state has been responsible for providing agricultural market information in most African countries. However, budget constraint has undermined these efforts.

More recently, we have seen a surge in private sector and donor-supported NGO led efforts to provide market information. New innovative means of providing agricultural market information have emerged. These innovations use ICT applications. Most of us come from or live in countries with projects based on ICT applications.

Last August (i.e., 2007) a number of us here met in Accra Ghana at the African AAE with the aim of conducting an Africa-wide study to understand the role these ICT-based innovations are playing in linking small farmers to markets. We challenged ourselves develop a research proposal on this subject.

This workshop is intended to be a culmination of the process of proposal development. It is intended to help us (the project team members comprising 6 African Universities) to develop a proposal that seeks to understand:

- ✓ The impact of these new ICT-based applications of providing market information to farmers
- ✓ The constraints/opportunities they have faced
- ✓ What works and what does not under what circumstances

And finally,

- ✓ Based on lessons learned: To draw policy recommendations for scaling up and out current projects and designing future projects with greater odds of success

We thought to specifically design an Africa-wide project and our partnership including Universities of Antananarivo, Malawi, Uganda, Kenya, Ghana & Benin reflects this idea.

The goal is capture diverse projects (young, growing, mature) under diverse culture. However, we are academics and are often very theoretical and abstract. That is why we invited among us here practitioners and policy markers (ultimate consumers of research output) to help us see the

issues we plan to investigate with different sets of lenses. We also invited FAO and IDRC, for who such issues matter a lot in their quest for finding solutions to smallholder farmer problems.

I am indeed excited that the ministry of Agriculture & also ministry of Information, in addition to the practitioners, are being represented here today. I pray that the minister will stay throughout the workshop and look forward to a very fruitful meeting

Thank you”.

**Official opening address by Hon. Minister of Agriculture, Livestock and Fisheries,
Republic of Madagascar (*Read on his behalf by the Director of Cabinet in the Ministry*)**

“Ladies and Gentlemen:

Welcome to Madagascar.

Let me first, excuse his Excellency the Minister of Agriculture, Livestock and Fisheries, who really intended to come and see you face to face but his obligations did not allow that. So he asked me, and sent me to be with you here today.

We are glad to have you all here, sharing and exchanging with us your knowledge about new technologies of Information and Communication (ICT).

We all know that new technologies evolve rapidly and those who do not master these will be left behind, especially smallholder farmers.

So, at this time of food crisis around the world, the corresponding high prices among other problems, actions towards improving agriculture are needed.

Madagascar has begun to work on a Green Revolution within its Madagascar Action Plan (MAP) over 5 years period and this workshop is needed at the right time to help attain the objectives of the Green Revolution.

In deed, most Malagasy farmers are smallholders, and they need support and advice to improve their conditions.

So you will play an honorable role in this endeavor. Please enjoy your stay among us and I wish you a fruitful workshop.

Now, I declare the workshop open.

Thank you”.

SESSION II: OVERVIEW OF ICT IN AGRICULTURE – APPLICATION AND RESEARCH ISSUES

Chair: Noro Rahelizatoro, University of Antananarivo

Discussant: Edith Adera, IDRC

This session began with a formal introduction of all participants, followed with presentations on the current use of ICTs in linking farmers to markets.

Presentation: Keynote on the application of ICT in agriculture and emerging research issues by Mike Jensen, IDRC

a) Issues in African agriculture

- Weak linkages between agriculture and other sectors e.g. natural resources
- Limited access to animal power and mechanization
- Declining labor due to rural-urban migration
- Weak information systems
- Poor regulatory frameworks
- Inadequate market information
- Unfair trade barriers

b) Possible solutions

- Concentration on high value agriculture
- Large scale commercial agriculture
- Reduce transaction overheads on input purchases and output sales

c) Potential ICT solutions

- Mobile phones
- Access to internet
- GIS-based decision support systems
- Mobile mapping and hand held personal computers for data gathering
- Radio frequency identification tags

d) Examples of current use of ICT in Africa

- The International Livestock Research Institute (ILRI) uses GIS to map fences in livestock-wildlife ecosystems
- *M-Pesa* money transfer services in Kenya
- *Soko hewani* initiative by the Kenya Agricultural Commodity Exchange (KACE)

e) Research questions posed in the presentation

- Which ICTs have the most potential to improve farmers' lives and increase yields?
- What are the global and local factors that limit the uptake of these ICTs?
- What are the key entry/starting points?
- What types of agricultural enterprises (crops and livestock) are most in need of ICT support?
- How can the subsistence farmers be engaged in the application of ICTs?

Discussant's comments: Edith Adera

- The scope and depth of the ICT project should be clarified, i.e. whether a more holistic view of the value chain is desired or just a focus on market access
- A decision also needs to be made on the range of ICT tools to be studied, i.e. some or all of the ICTs used in agriculture
- The project should clearly highlight the outcomes of ICT use in terms of productivity and livelihood changes among farmers

Questions from Plenary Discussions

- How does the *M-Pesa* service work?
- Have you worked out the unit cost for each ICT tool/mode of communication?
- Your presentation is on demand-driven evolution of ICT use. Will supply-driven approaches succeed?
- Which delivery strategy is appropriate for ICTs; public, private or public-private partnership?
- How will we incorporate lessons learnt from sites outside Africa?

Answers to Plenary questions

- M-Pesa service: involves trading in airtime and real money across space. The concept is being currently used in Nigeria, Kenya and the Philippines
- No study has been done on unit costs of various ICTs
- A combined public-private approaches to ICT provision are better

Plenary Comments:

i. *Comments by Adrian Mukhebi, KACE*

Participants need to be clear on the research approach and its design. On the research approach, the problem at hand must be clarified; is it smallholder access to markets or what? The relevant economic theory and concepts should then be applied to guide methodological framework and interpretation of results. If market deficiency (markets do not work well for smallholders) is the problem of concern in the project, then the right concepts should include bargaining power, market integration, market transparency and market competitiveness.

The research design adopted should clearly delineate what is working where and why in terms of different ICT types, commodity types/value chains and market types. The design must also recognize that market information is one of the gaps that ICTs seek to address. Modern ICTs enable more timely and cost effective communication flow.

ii. *Comments by Narathius Asingwire, Makerere University*

There is need to involve policy makers and practitioners in understanding what made past initiatives work/fail and what can be done now.

Clarifications by Edith Adera, IDRC

This is not an intervention stage, but just an applied research on what exists on the ground. Theoretical discussions and contributions are quite relevant and will indeed be considered in subsequent sessions.

SESSION III: COUNTRY BACKGROUND STUDIES ON THE APPLICATION OF ICTs IN AGRICULTURE

Chair: Julius Mangisoni, Bunda College, University of Malawi

This section comprised of country background paper presentations. The presentations focused on:

- Current status of ICTs in agriculture
- ICT policy
- Existing project (s)
- Research design/methodology issues

Below are summaries of the presentations.

i) Ghana Background Paper

Presenter: Luke Abatania

Government policy on ICT

- Modernization of agriculture and development of an agro-based industry is one of the pillars of the ICT policy in Ghana
- Policy aims to use ICT to support production, processing, marketing and distribution in agriculture
- A telecommunication policy that encourages competition in service provision

Inventory of ICT interventions

A number of ICT initiatives are being implemented in Ghana. These include:

- MOFA agricultural extension information centers that provide information on production, processing, storage and marketing
- MOFA e-commerce project that provides a website of agricultural information
- GAPTO-MISTOWA project that combines mobile telephony with internet access to provide market information
- Eastern Corridor Agro-market information center
- Ghana Information Network Systems
- Ghana Information Network for Knowledge Sharing (GINKS)
- Market Access Promotion Network (MAPRONET)
- The Essential Electronic Agricultural Library (TEEAL)
- Farm Forums
- Commonwealth of Learning Media Empowerment (COLME)

Challenges

The presentation highlighted a number of challenges to the usage of ICT in agriculture. These include

- Unreliable electricity supply
- Low literacy on internet use
- Funding constraints
- Low cooperation among producers in accessing technology and bulk pricing
- Inappropriate content of ICT interventions for wide range of users
- High initial set up costs
- Lack of demand-driven ICT interventions

ii) Benin Background Paper

Presenter: Anselme Adegbedi

Government Policy

- Since 1990 reforms have been implemented in order to make the market more transparent and strengthen competition:
- The reforms included the liberalization of marketing activities
- Reorganization of cereal marketing board (ONASA)
- Establishment of market information system

Market characteristics

- Small, scattered and highly variable marketable surpluses
- Many intermediaries
- Few traders
- Multitude of units and techniques of measure
- Large product quality differences

Different ICT projects

- Projects which are conducted by ONASA
- Projects conducted by NGOs
- Projects conducted by “Chambre Nationale d’Agriculture”
- Finally, the MISTOWA project which aims to increase regional agricultural trade and food security by improving and linking the existing regional efforts to generate, disseminate and make commercial use of market information.

Main ICT technologies used

- Radio
- Billboard, bulletins
- Telephone
- Internet (web sites, e-mail)
- Mobile phone (SMS, phone call)
- Radio

Constraints

- Out of date price information
- High illiteracy rate among producers
- Limited territory coverage
- Limited product coverage
- Lack of electricity power and connection capacity (Internet)
- Mobile phone call costs hardly affordable

Lessons Learnt

- The need to address smallholder farmers is still of concern
- ICT technologies are known and used by traders
- There is an ECOWAS regional strategy of enlarging web power by sub-marine cable
- There is diversification of electricity power sources and providers
- The emphasis put on the promotion of local languages
- Finally, the government vision of the national policy on ICT

iii) Uganda Background Paper

Presenter: Narathius Asingwire

Overview

- The Ugandan economy is dominated by the agricultural sector.
- For the past two decades, agriculture has been the largest contributor to the country's Gross Domestic Product (GDP)
- However, its contribution has been declining over time due to faster growth in other sectors especially the service sector.
- The contribution of agriculture to GDP has declined from 51.2 percent in 1990/91 to 31.9 percent in 2006/07 representing a 19.3 percent decline.
- Although its contribution to GDP is declining, agriculture still remains a key sector in the economy.
- Agriculture accounts for 85 percent of the country's export earnings, 80 percent of employment
- It provides most of the raw materials to the mainly agro-industrial sector
- There are a number of government policies in place aimed at developing the agricultural sector in order to transform the mainly subsistence agricultural farmers to market-oriented farm producing units.

Government Policy on Agricultural Development

- The Plan for Modernization of Agriculture (PMA) is the Uganda government's economic development policy for the operationalization of the Poverty Eradication Action Plan (PEAP) framework in as far as modernizing agriculture is concerned.
- Within the PMA framework, the major focus is to transform subsistence agriculture to commercial agriculture
- To achieve the above, government established the National Agricultural Advisory Services (NAADS) in 2001 to empower farmers with information critical to modernizing the sector.
- NAADS overall supervision is vested in the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF).
- NAADS aims to increase farmers' access to information, knowledge and technology through a decentralized, farmer owned and private sector service extension delivery system.
- NAADS empowers farmers to access fee-based agricultural advisory services and market information.

ICTs in Agriculture in Uganda: A Historical Context

- There are various initiatives by government, NGOs, and donors to disseminate agricultural information to smallholder farmers in rural Uganda.
- In the 1990s, the government undertook a unified extension approach to train and support extension workers (EWs) in order to transfer knowledge and technologies in all fields to groups of farmers
- Because the EWs were not adequately facilitated their impact on smallholder farmers was so minimal.

- In addition to the work done by extension workers, government-owned radio and television broadcasted programs that were meant to provide agricultural information to the farmers.
- Because there was only one Radio station and one Television station (Radio Uganda and Uganda Television) owned by the government, the multiplicity of programs to be aired meant that there was little time allocated to agricultural programs.
- Many farmers could also not afford Television sets and radios, and this meant that information largely was confined to urban centers at the expense of rural areas that needed it most.
- It is perhaps this dilemma that has spurred the use of ICT-based technologies to disseminate relevant and timely agricultural information to the producers, and thus necessitating the need of an ICT policy.

Current Status of ICTs in Agriculture in Uganda: Policy and Practice

- Uganda has established a framework in terms of legislation and an institutional arrangement by establishing the Ministry of ICT and other institutions such as the Uganda Communications Commission (UCC).
- There is a National ICT policy draft document which considers information a resource for development
- The National ICT policy identified fourteen key objectives, which include, among others, improving connectivity and human capacity, sensitizing society about the role of ICT in development and promoting local and foreign direct investment in ICT.
- The policy provides for a number of laws, statutes, and acts that are pertinent to the agricultural sector. Prominent among them is the Communications Act, 1997 and the Rural Communications Development Policy (RCDP).
- Following the privatization and liberalization of the telecommunications sector, there has been rapid development of the telecommunications market in Uganda.
- Mobile phone subscribers have since then increased from 3,500 in 1996 to 3,015,493 in 2007 representing about 86,000 percent growth. Fixed phone subscribers increased from 46,000 in 1996 to 137,916 in 2007 representing about 199 percent growth.
- Private FM radio stations have increased from 14 in 1996 to 158 in 2007 representing about 1028 percent growth.
- Private televisions have also increased from 4 in 1996 to 32 in 2007.
- Despite all this development in the telecommunication sector, rural areas where majority of the population lives have benefited less.
- In an effort to improve the access and utilization of ICTs among the rural communities, the government formulated the Rural Communication Development Policy in 2001 and created Rural Communications Development Fund (RCDF) to provide subsidies to facilitate access to basic communication services such as telephone, computer and internet.

Existing ICT Initiatives and Projects in Agriculture

- A number of NGOs such as Women of Uganda Network (WOUGNET), Busoga Rural Open Source Development Initiative (BROSDI), and government agencies such as Uganda Commodity Exchange (UCE) have been involved in providing agric. information using ICTs.

- The information is published on their websites, and made accessible to local farmers through various information centers that are usually equipped with computer and internet facilities. For a much wider audience the information is usually broadcast on radios in various local languages.
- Using email and internet, UCE operates a Rural Information System project that provides market information and services to buyers and sellers of agricultural commodities. Beneficiaries targeted are mainly organized rural farmer organizations, and information provided to them includes commodity profile, current prices and trends, accepted quality standards of commodities, best practices among others.
- The UCE project is an online resource for commodity traders; facilitating trade of graded produce such as maize, beans, rice, soybean, sesame, coffee, among others. The project has a warehouse facility with an ICT-crop marketing bureau that focuses on improving access to available commodities for buyers. It also provides technical information to farmers to assist them in meeting quality standards.
- In Uganda, the Agricultural Research Extension Network (ARENET), under the joint effort of National Agricultural Research Organization (NARO) and NAADS aims at improving sharing of information between research and extension.
- ARENET uses web technology (internet) to create space for interaction between extension agents in the villages, researchers, and apex centers of NARO and NAADS.
- Like ARENET, Busoga Rural Open Source and Development Initiative (BROSDI) reach a large share of its rural clientele through SMS on mobile phones.
- Organizations such as Women of Uganda Network (WOUGNET), Food-Net, and Council for Economic Empowerment for Women of Africa (CEEWA) are using mobile phone to disseminate market information to farmers.
- Callers can receive market information regarding who is selling, what price, who is buying, place of advertisement to buy or sell agricultural commodities.

Research Issues

- A few questions come to mind that provide the basis of research focusing on three vital variables and concepts; (i) Smallholder Farmer, (ii) Usage of ICT, and (iii) Market.
- In the Concept Note by Okello (2007) a detailed justification of the proposed study is made, but suffices to note is the gap between the impressive reported strides in the ICT sector, and the minimal effects on the smallholder and rural African farmer.
- To me this represents the knowledge or research gap, which is based on the constraints and challenges faced as we try to reach our smallholder farmers with knowledge and information
- Could it be that we have focused very much on the hardware aspect more than the software?
- Modern ICTs straight away imply change of ways of how business is transacted. Did we or have we prepare our conservative rural communities to embrace the technology?
- Did we or have we tried to adequately unravel smallholder farmer's attitude and perception regarding the change we are trying to usher in?
- It is natural that mankind tries to resist change, and this could be partly due to lack of trust that this will be a vehicle to propel his/her progress.

- I want here to provoke everyone gathered here on how we can generate knowledge on building trust among the African farmer that ICTs can be trusted when it comes to transacting business.
- This based on the belief that “seeing is believing”. We are talking of the situation where the African farmer could be dealing with a potential buyer of his produce that he has never physically seen! How can we help this woman, this man that this is worthwhile venture.
- On the other hand, how can this woman and man be protected from unscrupulous players masquerading as market representatives?

Methodological Issues

- The current concept note (see Okello, 2008) provides useful guidelines on the methods to be used.
- A study of this nature requires a research design that will bring on-board key constituents—the African farmer, the practitioners and policy makers both in government and CSOs
- I concur with Okello that we need a combination of qualitative and quantitative methodologies to implement this proposed study
- Different techniques of data collection will need to be employed so that triangulation can be made where each of the methods complements or verifies the other.
- We however need to be cautious on how we sample study areas/communities/households. The concept note alludes to the important study aspects such as “lessons, challenges and impact”. Of all these three, I find “impact” more intriguing. It begs a carefully thought, especially in sampling of study areas—possibly having “experimental” and “control” study areas.
- In the presumed absence of “baseline or benchmark” data, control areas could provide data upon which impacts and effects can be assessed.

iv) Malawi Background Paper

Presenter: Noel Jambo

Overview

- The Malawian ICT policy was formulated in 2003 and revised in 2006
- It aims at addressing Malawi’s development challenges and accelerating the nation’s socio-economic development process
- Promote utilization of ICT in agro-business industry
- Support and promote research in agricultural production and processing using ICT
- Strengthen agricultural extension using ICT

Progress in ICT

- Cheap mobile phones introduced by Celtel and Telecom Malawi for use by farmers
- Initiative for Development and Equity in African Agriculture (IDEAA) disseminates information on commodity prices to buyers and sellers in market centers

- Malawi Agriculture Commodity Exchange (MACE) provides timely market information to smallholder farmers
- Radio programmes, websites and SMS services sponsored by MACE and IDEAA

Challenges to ICT in Malawi

- High transportation costs
- Poor access to electricity in rural areas
- Lack of websites and e-mail facilities
- Lack of awareness of the value of ICT, i.e. most people regard mobile phones as a luxury and not a tool for farm business
- Inadequate financial, human and technical resources and capacity
- Taxation on computers and other ICT products and services
- Brain drain in ICT sector due to low remuneration
- Sub standard ICT schools and training

Opportunities for use of ICT in agriculture

- Production and processing of non-traditional export commodities
- Information on access to foreign markets
- Liberalization of telecommunication sector in Malawi
- Government policy on provision of computer training in secondary schools
- Supportive financial sector encouraging farmers to borrow funds for ICT development

Research issues

- This study should also focus on the impact of ICT on efficiency of marketing smallholder farmers' produce

v) Kenya Background Paper

Presenter: Lydia Ndirangu

The ICT Policy in Kenya

- ICT policy in Kenya focuses on simultaneously targeting the development of the ICT sector and its use as a broad-based enabler of national development. It is based on 4 guiding principles:
 - ✓ Infrastructure development
 - ✓ Human resource development
 - ✓ Stakeholder participation
 - ✓ Appropriate policy and regulatory framework

Various ICT-interventions operational in rural areas were considered in the study because:

- Any intervention that improves the livelihoods of rural households impacts agricultural production and marketing
- Access to payphone will for instance increase access to information
- Information access in turn frees up time for agricultural production thus raising production and hence incomes.

Key constraint

Assessment of ICT usage in Kenya reveals that:

- Lower use of telecommunication services in agriculture than for social purposes
- Majority of the people have access to the radio (research results suggest that about 80% of the population have access to radios)
- More than 50% have access to mobile phones
- Reading rate is relatively low, thus limiting the use complex ICT applications such text messaging
- Quick impacts likely to happen through interventions that use the radio and mobile phones due to widespread ownership even in rural areas
- There is very limited access to and use of internet

Table 1: Access to various ICT media in Kenya

Media	Estimated Number	Estimated proportion (%)
Radio**	-	89 own a radio
Mobile phone*	11,440,077	51 access
Fixed lines*	264,882	1 (4 in urban areas)
Fixed wireless*	193,064	-
Local Loop*	10,493	-
Internet*	1, 700,000	1 of urban dwellers have internet at home
Television**	1,386,000	42
Pay television**		1 of urban dwellers own pay TV
Newspaper		

Source: Steadman Research Services International, 2007

Table 2: Usage of various media in Kenya

	Yesterday	Past 7 days	Past 4 weeks	Long ago
Listened to radio	79	12	3	6
Sent an SMS using a mobile phone	26	16	8	50
Made a call using a mobile phone	42	15	9	34
Watched TV	39	17	12	32
Read or paged through a newspaper	23	21	12	45
Used the internet	2	3	4	91
Used mail	2	3	3	92
Went to the mobile cinema (open air projected	1	2	5	93

on a screen)				
Made a call from a fixed line	2	4	7	87
Read or paged through a newspaper online (using the internet)	1	1	1	97
Listened to radio through a mobile phone	4	4	3	89
Read or paged through a book	27	17	11	45

Source: Steadman Research Services International, 2007

Case studies considered in the background study

- There are 30 cases of ICT-based initiatives in Kenya
- About 50% of the initiatives are on extension and market access
- The cross-cutting issues include: gender equality, community development, education and training, health and HIV/AIDS
- Most interventions focus on crops, with only a few targeting livestock

Figure 1: Thematic areas covered by existing ICT interventions in Kenya

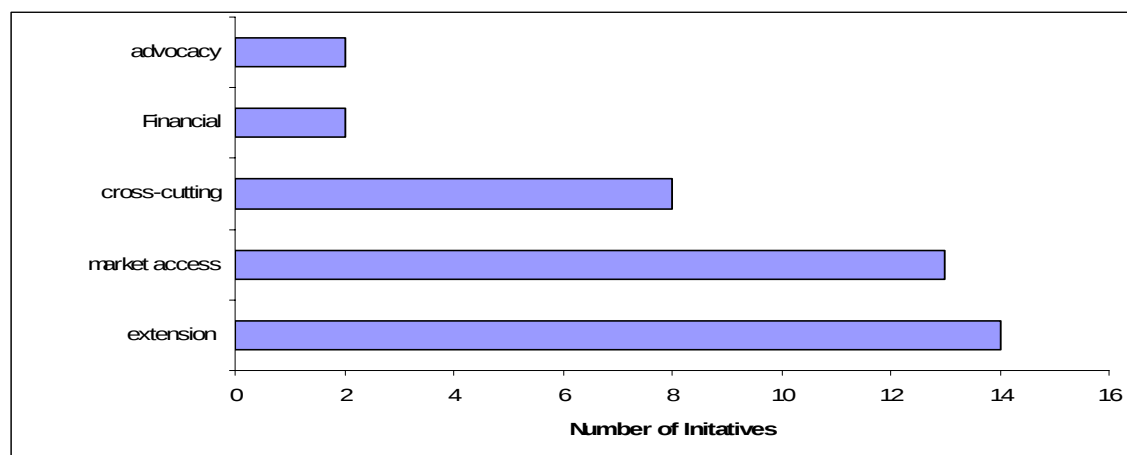
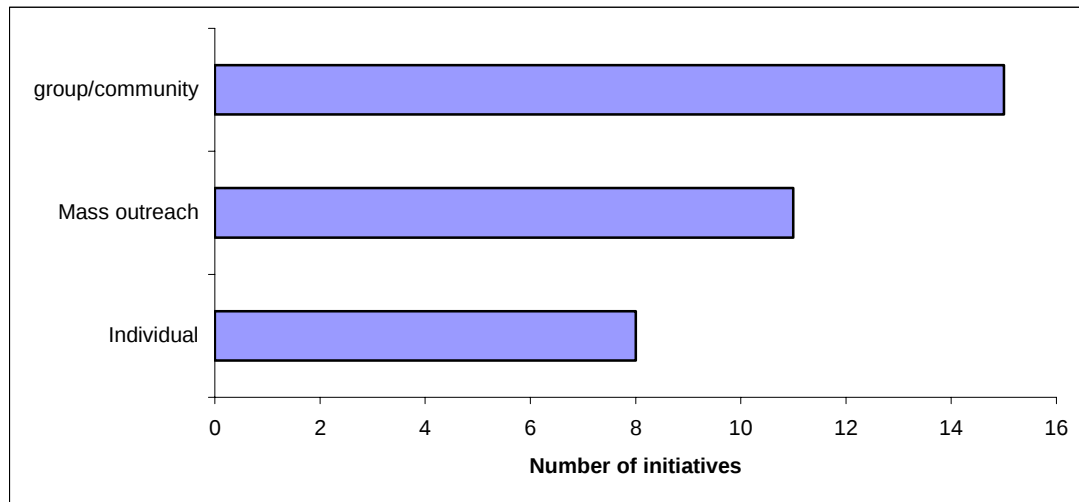


Figure 2: Mode of intervention used by ICT implementers in Kenya



Loci of interventions

- Interventions that focus on provision of extension services target crop and livestock production/farming activities
- Market access interventions target markets, value addition and entrepreneurs
- ICT intervention that target provision of financial services tend to also promote access to input/output markets

Research areas

- There are no systematic studies that examine the impact of existing ICT interventions on agriculture and hence market performance.

vi) Madagascar Background Paper

Presenter: Noro Rahelizato

Agricultural Policy in Madagascar

- Approximately 75% of the 19 million Malagasy population live in rural areas
- Thus, agriculture holds a prominent role in the economy of Madagascar.
- Of the 75% of Malagasy population who live in rural areas, about 80% are considered “poor” subsistence or semi-subsistence smallholder farmers
- However, the GDP has remained almost unchanged over several years. Agriculture, the primary, sector contributes to about 35 % of GDP, the secondary sector to 14%, and the tertiary sector to 51%.
- Further, Agricultural Production has tended to lag behind population growth
- Madagascar therefore has to import some of its food needs, including rice. These imports require foreign currencies, sometimes impacting negatively on the domestic capacities to invest.

- Hence Madagascar relies on foreign aids and financial support from donors (World Bank, IFAD, EU, FAO, etc.) for its agricultural development.
- Madagascar aims at becoming a regional granary by transitioning from a subsistence-based to a modern and market-based agriculture.
- The Madagascar Action Plan (MAP), a five-year program covering the period 2007-2012 and is intended to help the Island attain rapid development, considers rural development as the fourth goal among eight existing ones.
- The Ministry of Agriculture, Livestock & Fisheries (MALF) policy concentrates around six main challenges namely;
 - ✓ Assuring land security,
 - ✓ Improving access to rural financing,
 - ✓ Achieving the African green revolution,
 - ✓ Promoting market oriented activities,
 - ✓ Diversifying agricultural activities, and
 - ✓ Promoting agribusiness
- Clearly ICT can play a significant role in resolving the above challenges through provision of agricultural information.
- According to the Ministry of Telecommunication, Post and Communication (MTPC), agricultural information is necessary for:
 - ✓ Achieving and sustaining rapid economic development,
 - ✓ Facilitating businesses and,
 - ✓ Improving communication between Malagasy citizens and foreigners.
- Over the period 2007-2012, the MTPC aims at achieving four main goals namely;
 - ✓ Increasing its coverage to all areas so as to increase the use of ICT services;
 - ✓ Improving the broadcasting of information to the regions via the radio and television;
 - ✓ Fostering networking and communication among economic agents throughout the country; and
 - ✓ Promoting partnership with the private sector while reinforcing and setting up new structures at the national and international levels.
- Four strategies have been developed to facilitate achievement of these objectives namely;
 - ✓ The development of the telecommunication infrastructures (setting up of the backbone, international connection using underwater optical fiber). This strategy is being pursued through two regional projects:
 - The project of the Ocean Indian islands network. This project was set up early 2008 and supervised by the Indian Ocean Commission (COI) and the Common Market for the Eastern and Southern Africa (COMESA). It will let Madagascar connect to the underwater cable network SAFE via the Reunion island,
 - The East African Sub-System (EASSy) project that will start at the end of 2008, and is intended to connect the southern and eastern African countries to high rate of flow networks in the world.
 - ✓ The enhancement of the public access to ICT services (including fixed and mobile phone, internet, radio, and TV among others) and modern postal services;
 - ✓ The review of the regulations to facilitate sector liberalization;
 - ✓ The development of ICT technological poles for a dynamic private sector.

- Within the MALF, the Agricultural Sector Program aims to promote availability of targeted, reliable and timely information for decision-making for both the policymakers and producers and through all entities responsible at different levels (micro, meso, and macro). The Ministry intends to promote greater use of local media (e.g., radio) and newer ICT-based means.
- Two departments are concerned with the development and use of ICT-based technologies under the MALF namely;
 - ✓ The “*Direction des Systèmes d’Information (DSI)*” is in charge of the Ministry policy regarding information and monitoring as well as evaluation matters.
 - ✓ The “*Direction d’Appui à l’Organisation des Producteurs (DAOP)*”, is in charge of the support to the farmers’ associations and organizations, the rural world structure and the improvement of rural financing access.
- NGOs and the private sector also have on-going ICT-based projects. However, they are not well known.
- Three cell phone operators are currently present in Madagascar. However, the dominant cell phone company is CELTEL with network coverage of more than 250 towns. Figure 4 gives the areas covered by CELTEL
- Four Internet providers exist (Telma, DTS-Moov, Simicro, Blueline)
- At the same time, Madagascar is currently also building the Undersea Cable just as the rest of Africa. Figure 5 presents the Madagascar undersea cable.
- Despite all these developments, the ICT sectors in Madagascar continues to face a number of challenges. Table 3 below summarizes some of these challenges as well as the opportunities various forms of ICT face in Madagascar.

Research Questions

- In the case of ICT contribution to development, it is argued that the gap between those who have access to ICT and those who do not could further increase the gap between the poor and less poor.
- Thus the effect of information dissemination (coverage/penetration), and access (physical and socioeconomic) through ICT, and the general use of ICT channels needs to be investigated.

Figure 4 : CELTEL Network Coverage in Madagascar.

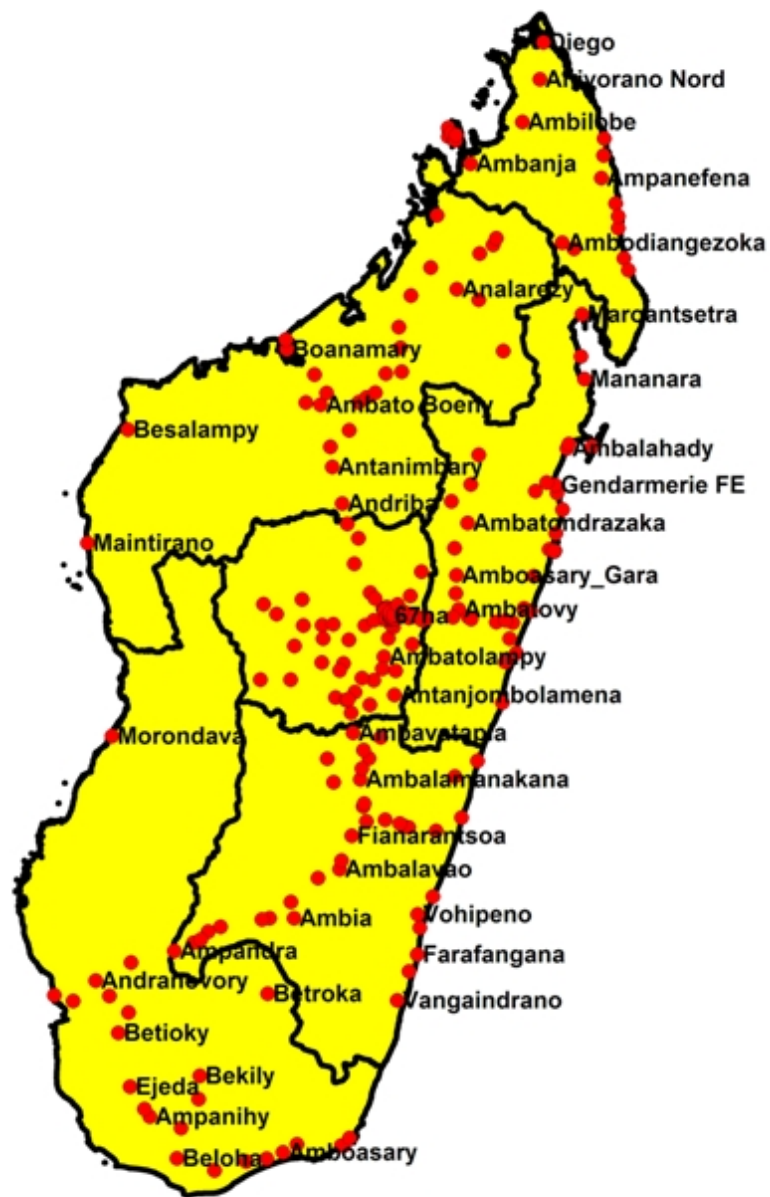


Figure 5 : The Malagassy Undersea Cable



Table 3: Constraints, Opportunities of some of the ICT interventions in Madagascar

ICT	Constraints	Opportunities	Impacts
Fixed and Cell phones	Lack of electricity in remote area ⇒ problem to recharge the batteries Economic and socio-cultural access by smallholder farmers need to be investigated	Used by some heads of farmers association or extension agents to communicate with agricultural projects and other stakeholders Used by economic operators to be aware of prices and quantities of products available Three cell phone operators present in Madagascar	
Documentary film of 10 to 15mn	Lack of electricity in remote area. Too expensive to use frequently	Show real life and situation at the level of understanding of the farmers	
Video projector and “diapositives”	Lack of electricity in remote area	Show real life and situation at the level of understanding of the farmers	
Radio	Punctual interventions on farmers’ needs	Use of the national network as well as local existing networks	Reaches many areas and targeted farmers
TV	Punctual interventions on farmers’ needs	Use of the national network as well as local existing networks	Reaches many areas and targeted farmers
Internet	Lack of electricity in remote area Connection availability	Used by local and export operators of Agricultural products	Awareness of the local or worldwide market prices

Plenary questions on country background studies

Ghana

- Is the GAPTO project the same as the Trade Net project?
- Were ICT projects in Ghana demand-driven or supply-driven?

Benin

- Is there an ICT policy in place? If yes, what does it say on Agriculture?
- Was Centre Sonai considered as an intervention?

Uganda

- Is the ICT policy still a draft?

Kenya

- What ICT interventions are there in Kenya and what impacts have they had?

Madagascar

- Are there existing ICT projects linking farmers to markets in Madagascar?

Answers to plenary questions

- GAPTO project is the same as Trade Net
- ICT interventions in Ghana were supply-driven
- Benin's national ICT policy is focused on governance, with aspects of improving economic activities
- Centre Sonai is an NGO project in Benin
- Since Uganda's ICT policy is still a draft, there is need for advisory committee and participatory approaches of data collection and sharing of results with rural communities to be incorporated in the draft
- There are about 30 ICT interventions in Kenya, for example DrumNet and *Soko Hewani*
- Madagascar has various NGO projects on different aspects, but there is none that specifically focuses on ICT use by farmers

Further comments on background studies and suggestions for research design

- Collaboration with all stakeholders in different parts of the world (including sharing recent experiences in ICTs from India) is very important when developing the research design. However, it is difficult to involve all actors, especially the private sector managers who are often busy and place a high premium on their consultation time. The way forward is for the research team to develop a thorough research design that yields better results, which could influence the policy cycle at an appropriate time. The research design sessions should therefore critically explore mechanisms of incorporating various actors.
- In using ICTs to link farmers to markets, it is essential to appreciate the role of "brokers" or middlemen. Further efforts should be made to enlighten farmers about the importance of middlemen in the value chains, and the need for their mutual co-existence.
- Particular attention also needs to be paid to sampling and site selection for the project
- Digital poverty needs to be pursued further in relation to agriculture in Madagascar
- Information on input market is as important as that on output market
- Communication tax in Ghana (on phones, internet use) will severely affect the use of ICTs
- Existing ICT use is mainly on pilot activities on small areas, and their impacts cannot be measured until after several years. Caution needs to be taken to avoid attributing all development impacts to ICTs. Instead, research should focus on improved access to information, lower costs of information, expanded markets due to ICTs, more sales, better prices and reduced price risks due to ICT use in marketing
- In order to attract private sector in applying research findings, simple writing and creative/innovative presentation styles need to be adopted
- Although both ICT and non-ICT components are important in agriculture, the project scope is specific on use of ICT in agricultural marketing

SESSION IV: PRACTICAL EXPERIENCES IN LINKING FARMERS TO MARKETS USING ICTs

Chair: Rose Nyikal, University of Nairobi

In this session practitioners presented some of the on-going ICT-based initiatives in the proposed study countries. Its aim was to inform the workshop of the opportunities and challenges of ICT use in agriculture as seen by ICT project implementers.

i) Kenya Agricultural Commodity Exchange (KACE) Project, Kenya

Presenter: Adrian Mukhebi

Origin and goals of KACE

- It is a private sector firm set up in 1997 in Kenya
- Links farmers to input and output markets through provision of timely data and information
- Set up to stem “exploitation” of farmers by middlemen when marketing boards collapsed
- KACE borrowed from experiences of commodity exchange initiatives in Zimbabwe, South Africa and the United States of America
- It was started through own-funds (hence supply-driven), with the expectation that service users would pay for services offered
- It collects, processes, and stores market information on commodity prices, transportation costs, etc.
- It links farmers through matching offers and bids
- It operates marketing information points (information kiosks) where farmers get market information on notice boards
- It also uses mobile phones, Internet and radio services to disseminate market information to farmers. One such initiative is the *Soko Hewani* programme where offers and bids are verified and radio programme staff link buyers with respective sellers of various commodities

Lessons learnt from the KACE experience

- Information alone is not enough. Other support services e.g. transportation are also critical in marketing
- Temporary storage services are important while searching for markets, to avoid spoilage
- Smallholder farmers can pay for convenient, affordable and value-based services

KACE Evaluation

- External evaluation and an M.Sc thesis study have found that KACE has improved farmers’ bargaining power and market integration, especially for maize farmers
- KACE provides consultancy services to other countries, such as Uganda, Malawi, Nigeria and Zambia to set up similar initiatives in these countries

ii) The TradeNet Project, Ghana

Presenter: Mark Davies



This presented highlighted the activities of TradeNet in West Africa. The presented indicated that demand for information by farmers is strong and ubiquitous. Farmers demand services rather than information. The services include

- Managing outgrowers
- Low cost communication
- Efficient transport coordination
- Supervising Farm Practice
- Tracing Product for export
- ePayments

It also highlighted the fact that mobile phones have the potential to revolutionize agriculture in Africa. Mobile phones facilitate coordination between the office and field and make it easy track

- field activities
- harvest
- inventory
- pest/disease outbreak
- transportation/logistics

However to achieve this the presentation suggest that focus be on farmer groups rather than individuals and that the project must endeavor to build trust with the farmers through use of language, reputation, and attending to farmers credit needs. The presentation pointed out the key opportunities for ICT in African agriculture and major questions that beg answers. These are:

i) Opportunities for ICTs include

- Rural communities are the last frontier for ICTs
- Mobile networks change everything (they are internet)
- Think of a distribution channel first, MIS second
- Private sector understands “saving money” not “sharing information”
- \$\$\$\$ needed to get to the ‘network effect’
- Public MIS emerges from a vibrant private system
- Success to be measured by paid renewals
- Private company is driver; public sector key partner

The questions to be answered are:

- How to prove a causal relationship between broad market improvements and smallholder incomes
- Linking information to increased incomes is hard to do
- Isolating gains from broader market changes (price increases)
- Does access for some lift all? (echoupals)
- How to link information flow to diminishing price variations
- What issues around literacy?
- Is this a social or technical challenge?
- How does shared ownership impact profiling?
- What role does trust play in expanding trade circles?
- Are phones required for impact?
- Does anyone use the web?
- Deals: problem of attribution

- What software skills required by projects?
- What role does culture (education) play in innovation?
- How can assessment be neutral and honest?

ii. The DrumNet Project, Kenya

Presenter: Robert Kinuthia

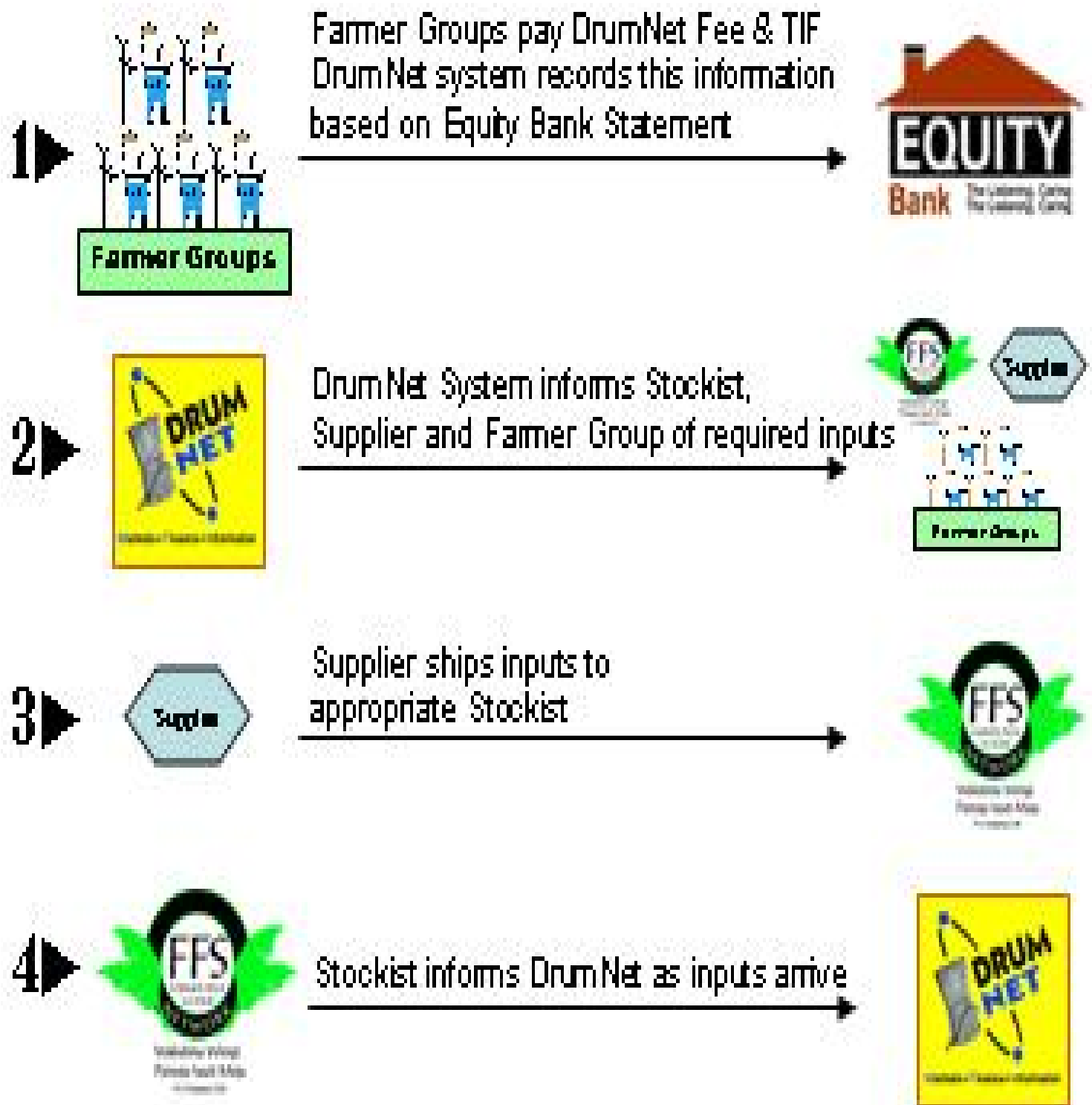
What DrumNet does:

- DrumNet launched in late 2002 by PRIDE AFRICA is designed to deliver support services directly to the African smallholder farmers.
- DrumNet links large-scale buyers, commercial banks, smallholder farmers. It also links retailers of farm inputs through a cashless micro-credit program
- We exist to bridge the gap of unmet demand for market linkages - using our unique platform that provides market information, financial services, through the DrumNet ICT system.

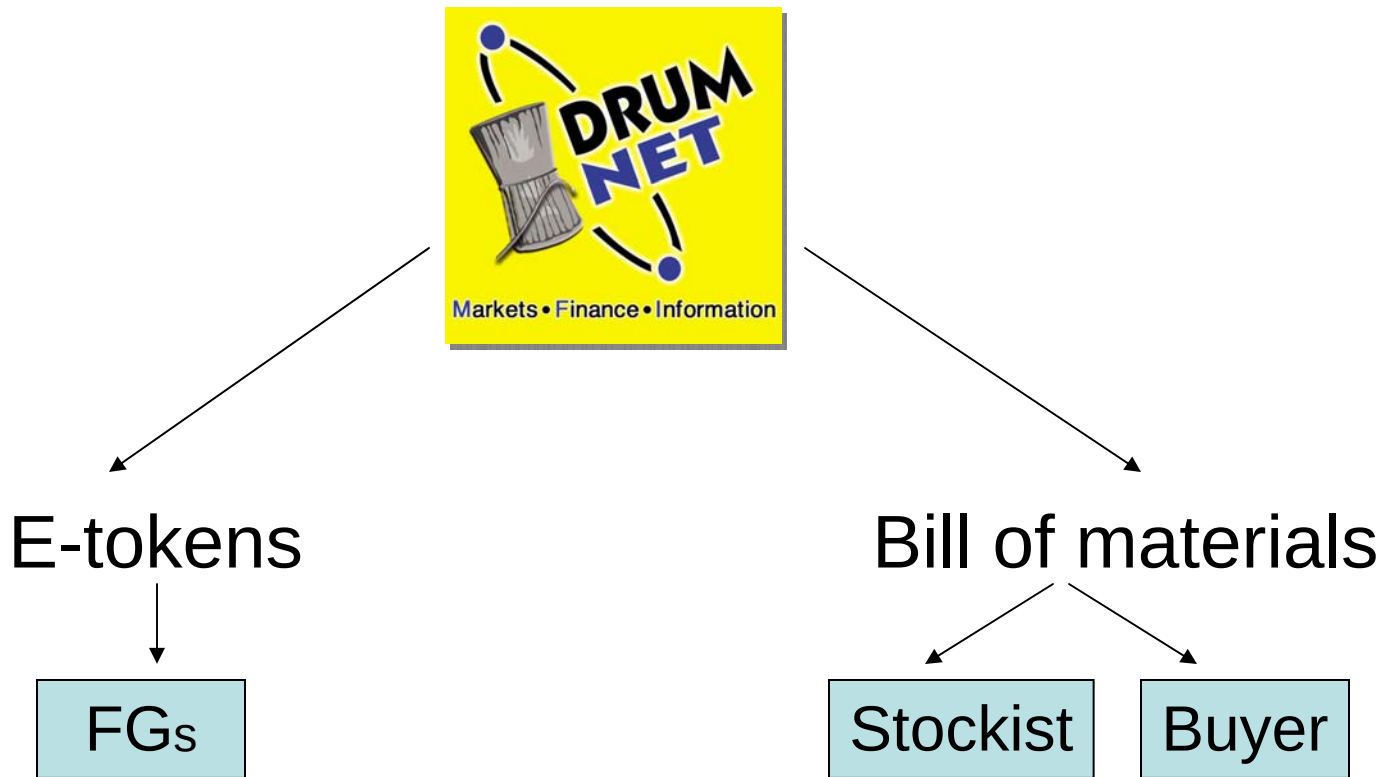
How DrumNet operates:

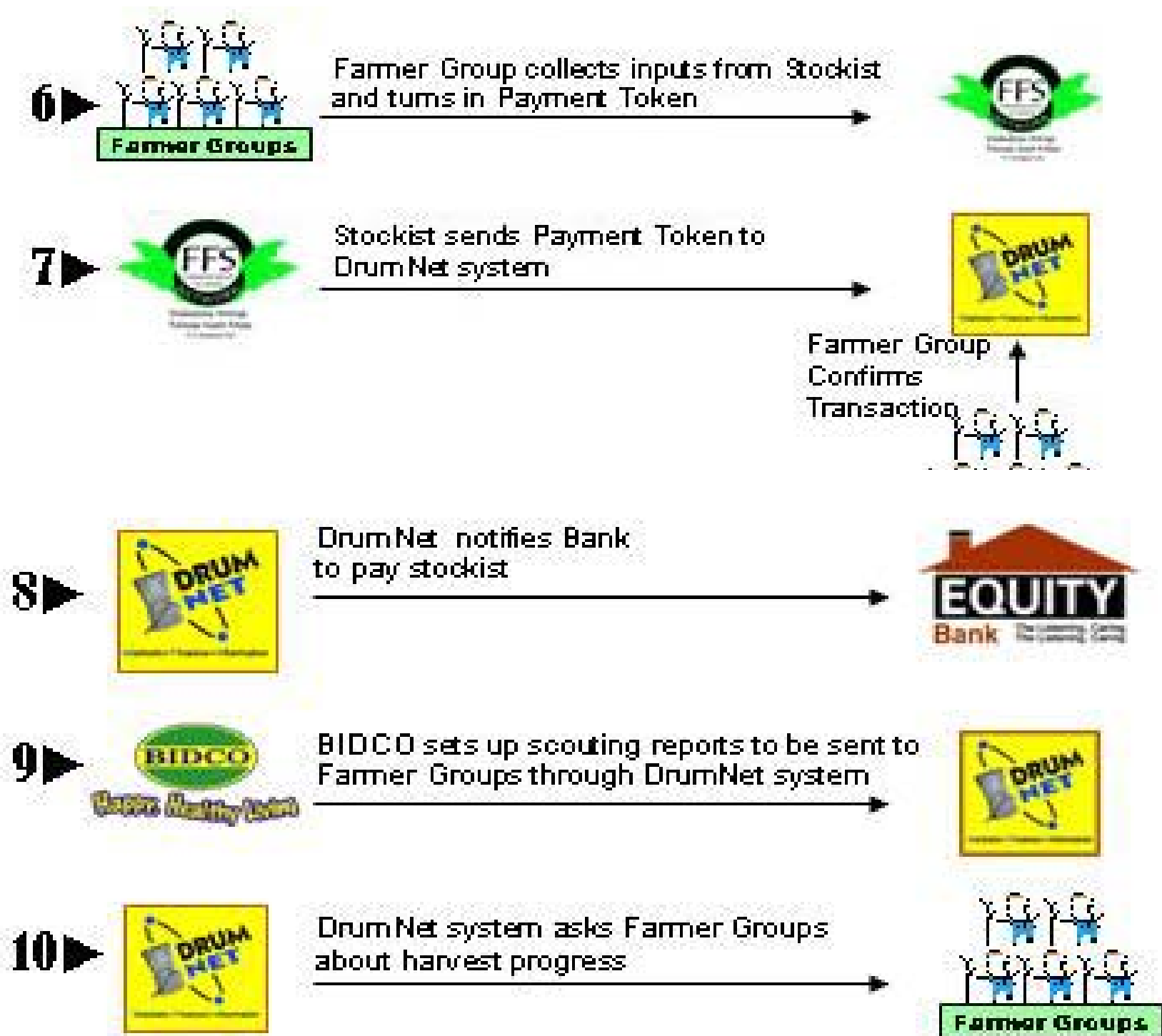
- Farmers, organized into co-guaranteed solidarity groups, are able to access required farm inputs at the local participating stockists through an established Line of Credit.
- After harvest, DrumNet deducts principal, interest payments and its management fees from farmer group's net returns. It also tracks credit history and, if required, enforces group guarantees.
- The participating bank is shielded from the complexity of the many small transactions as it simply opens a single line of credit – there after receiving regular principal and interest payments from DrumNet from this revolving account.
- In addition the DrumNet platform links large-scale buyers/transporters, through an integrated marketing and payment system. In the current scenario the buyer is BIDCO, the producers are Farmer Groups (FGs) aggregated by Farmer Field Schools (FFS), the Bank is Equity and last time we used only one AGMARK certified input supplier - Bungoma Chemists
- The Bank transfers the sales proceeds from BIDCO to a “lockbox” (controlled disbursement account) for payment execution according to standing orders and priority of claims.
- Lockbox standing orders automatically repays the Bank principal and interest and debits the FG credit account
- From the remaining balance the lockbox pays the DrumNetN commission and fees into its DDA.
- After satisfying all claims, lockbox transfers net sales proceeds to the DDA of the individual farmer group.

The DrumNet Model



**DrumNet System automatically generates parallel activities
(SMSs & Emails)**





DrumNet's goals for the year 2008

- To enroll 5,000 Farmers in Western in 2008 and Roll out to Eastern and Rift Valley Provinces, through aggressive recruitment
- We plan to use FFS and/or other Farmer Organizations to recruit more groups
- To prove scalability of the model to improve farmer income& to prove ICT linkages really works

DrumNet's partners*Donors:*

- GATES Foundation
- IDRC

Farmer Organizations

- FFS NW
- Farmers Own Trading

Potentials Partners:

- WOCCU – World Council of Credit Union
- ADRA – Adventist Development and Relief Agency
- AGRA – Alliance for a Green Revolution in Africa
- AGMARK – Agricultural Market Development Trust
- KENFAP

DrumNet's 3 year plan

- Embedding the SCM model and create full sustenance
- Team will remain lean, fast and flexible!
- We will work through 3rd parties, stakeholders, and actors creating synergies from within and outside the group. This will give us scale
- We will continue to innovate through R&D
- Transform to a For-Profit within 24 months

Questions from plenary**KACE**

- How did KACE recover set up costs?
- Who manages and who pays for the information kiosks set up by KACE?
- How is verification of offers and bids done internationally?
- What research questions does KACE have regarding the use of ICTs in linking farmers to markets?

DrumNet

- Is DrumNet responding to an information problem or input problem?
- What happens where there is crop failure?
- Are farmers involved in price determination of sunflower for BIDCO?
- Can the sunflower model work for other commodities?
- Are there any defaults in DrumNet contracts?

Responses to plenary questions

KACE

- Verification of offers and bids across borders is done through partnerships and linkages, e.g. through the Uganda Commodity Exchange. There is on-going work to establish standards and rates for commodities in the COMESA region. This will ease verification across borders
- The private sector provides cost-effective ICT tools that enable their clients to save money
- Initial set up costs were recovered by KACE through revenue generated
- The key research question from KACE is:
 - ✓ Are ICT tools helping farmers to achieve market efficiency in terms of better bargaining power, integration, better prices, and poverty reduction?

DrumNet

- DrumNet addresses finance, markets and information problems
- DrumNet plans to widen its focus on Soya, Oyster Mushrooms and honey, besides sunflower
- The default rate in DrumNet contracts is about 35-40%. Side selling occurs even when immediate market price is lower than the contract/futures price

Comments raised in the plenary

- There is need to establish monthly/quarterly payment schemes for ICT services
- The focus should be on demand-driven approaches rather than push approaches
- The project should strive to build capacities and not building solutions
- Mediators should be incorporated in the interpretation and dissemination of research findings to farmers

Session V: Presentation of concept note & Draft Project Proposal

Presenter: Julius Okello, University of Nairobi

Introduction

- Most smallholder farmers are unable to commercialize due to poor/lack of access to markets
- Market access can increase marketable surplus, revenues, and hence livelihood
- A major contributor to poor market access is the lack Agric Market Information (AMI) on input and output prices, and input and output quality
- The consequences of lack of AMI are
 - ✓ Low returns as farmers are forced to accept low prices
 - ✓ Every exchange is based on visual inspection

- Both lead to:
 - ✓ Sale of undifferentiated products
 - ✓ High transaction costs and thin markets
 - ✓ Low equilibrium poverty trap
 - ✓ Thin input and output markets

Why is there poor access to AMI?

- Failure of the public agricultural extension services due to
 - ✓ Budget constraints
 - ✓ Donor exit
 - ✓ Reluctance by private sector to provide AMI due to public good nature of AMI

ICT for AMI and market linkage

- Recent efforts to tackle lack of access to AMI focus on use of ICT-based applications
- Notable examples in agriculture are
 - ✓ Internet/web-based applications
 - ✓ Mobile telephony
 - ✓ Interactive video and CD-ROM
 - ✓ Radio and Television
- ICT-based technologies have attracted attention due to feeling that they:
 - ✓ Are more effective in communicating knowledge to rural farmers
 - ✓ Are more cost-effective
 - ✓ Facilitate and strengthen networking smallholders
 - ✓ Hence can better link farmers to markets and improve rural livelihoods

Research issue

- A number of ICT-based technologies are currently being used in agriculture
- However there is still very little understanding of what impact they have had
- Only few studies have investigated the effects of such interventions
- However these studies have been context specific

General objective

- Evaluate the effectiveness of ICT based interventions in linking farmers to markets.
- To compare and contrast the various ICT-based interventions for linking farmers to markets in Africa in order to understand what works and what does not
- To do so in the broader context encompassing different cultures, commodity types & ICT project models

Specific Objectives

- Assess farmers' awareness of existing ICT interventions and perception of relevance of projects to their needs.
- Examine factors affecting participation of smallholder farmers in such projects
- Identify and critically assess the challenges these ICT projects have encountered and the success of strategies designed to address such challenges
- Formulate guiding principles/policy recommendations for strategies to increase smallholder participation in ICT-based projects and improve design of future projects.

- Enhance collaboration among African scientists and build research capacity of project partners and young scientists.

Research Questions

- What are the opportunities and prospects for using ICTs as a source of AMI for the smallholder farmer?
- What are the barriers and challenges faced by the smallholder farmer in accessing AMI through ICTs?
- What is the effectiveness of ICT based interventions in linking small farmers to markets?
- What is the level of collaboration between public and private sectors in accessing AMI to smallholder farmers through ICT interventions?
- To what extent do ICT interventions enhance market efficiency?
- To what extent do existing policies support or constrain the adoption of ICT interventions by the African farmer?
- What are the critical policy ingredients for adopting and scaling up ICTs as a source of AMI by the smallholder farmer?

Methodology

- The proposed research will use a combination of household surveys and case studies
- In each country household data will be collected from a stratified random sample of about 300 farmers giving 1800 in total
- The sample will be stratified by participation in a ICT for Market Linkage (ICT4ML) project
- Quantitative data will be collected through personal interviews
- The quantitative data collected will include:
 - ✓ Household characteristics
 - ✓ Information sources
 - ✓ Input and output markets used
 - ✓ Participation in collective action
 - ✓ Access to financial services
 - ✓ Assets owned
 - ✓ Income & Income sources
 - ✓ Crop and livestock production
 - ✓ Risk perceptions

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 - ✓ Access to financial services
 - ✓ Assets owned
 - ✓ Income & Income sources
 - ✓ Crop and livestock production
 - ✓ Risk perceptions

Household models

- The data will be analyzed using standard quantitative methods
- Instrumental and maximum likelihood approaches will be used to estimate probit/logit models for testing hypotheses relating to *Objectives 1 & 2*
- Double-hurdle models will be used to explain:
 - ✓ The factors affecting farmers decision to participate in ICT4ML projects
 - ✓ The number of services employed in doing so
- Non-separable farm household models will be used to analyze the effect of different ICT4ML projects on market access

Case Studies

- In each country a few ICT4ML projects will be selected for detailed case studies to understand:
 - ✓ The challenges encountered & benefits to smallholders (*Objectives 3 & 4*)
 - ✓ How challenges encountered & benefits to smallholders differ by gender (*Objective 5*)

Synthesis

- The results of the household models and case studies will be synthesized to:
 - ✓ Formulate guiding principles/policy recommendations
 - ✓ Formulate strategies for improving design of ICT4ML projects
 - ✓ Broadening the participation of various boundary partners in the project will be used to enhance collaboration
 - ✓ Training of partners & students for capacity building

SESSION VI: DEVELOPING CONSENSUS ON RESEARCH OBJECTIVES

Chair: Adrian Mukhebi, KACE

This was a brainstorming plenary session designed to have members discuss the objectives of the workshop presented by Julius Okello in the light of prior presentations of background studies and practical experiences. The outcome of this session were drafts of the general objective, specific research objectives and research questions reached through consensus by all the participants. At the end of the plenary session, a committee of four people was appointed to refine the draft objectives of the proposed study. The committee comprised of Mark Davies (BusyLab), Ramatu Al Hassan (University of Ghana), Narathius Asingwire (Makerere University) and Julius Okello (University of Nairobi). The research objectives presented by the committee are outline below.

Project Purpose

- To enhance collaboration among African researchers/scientists and to build research capacity of project partners and young researchers/scientists

General Objective

- To study the effectiveness of ICT-based interventions in linking African farmers to markets

Specific Objectives

- To analyze existing initiatives and the environments within which they are applied and select some for in-depth analysis.
- To examine the effects on key stakeholders
- To better understand which factors influence adoption
- To assess the challenges facing MIS providers
- To identify roles and partnership models for the public and private sectors (including NGOs)
- To enhance collaboration among African researchers and to build research capacity of project partners and young researchers.
- To formulate guiding principles and recommendations to inform policy and practice

Research Questions

- What are the opportunities and prospects for using ICTs as a source of AMI for the smallholder farmer?
- What are the barriers and challenges faced by the smallholder farmer in accessing AMI through ICTs?
- What is the effectiveness of ICT based interventions in linking small farmers to markets?
- What is the level of collaboration between public and private sectors in accessing AMI to smallholder farmers through ICT interventions?
- To what extent do ICT interventions enhance market efficiency?
- To what extent do existing policies support or constrain the adoption of ICT interventions by the African farmer?
- What are the critical policy ingredients for adopting and scaling up ICTs as a source of AMI by the smallholder farmer?

DAY TWO, JUNE 13TH 2008

SESSION V: RESEARCH DESIGN AND METHODOLOGY

Chair: Edith Adera, IDRC

This was break out session during which country teams joined with practitioners and policy makers in the workshop sat together to develop the methods they will use to address the project objectives in the context of their country.

BREAKOUT SESSION GUIDELINES

The breakout session will afford participants an opportunity for in-depth discussions on the research design and methodology for carrying out the research at the country-level (adopting and adapting the general research framework at the country level) and forge a common understanding on the research design and methodological approach.

Step 1: Appoint a group Chair and Rapporteur, who will report back to plenary

Step 2: Based on draft research design and methodological approach presented, discuss and agree on details of carrying out the research at the country level – including the following:

- ongoing ICT/agriculture interventions to study;
- research issues and questions that could be specific to your country, but aligned to the overall research questions
- Research methodology to use – data to collect & source, methods, tools, sampling and sample size;
- Data analysis
- Outputs/Outcomes
- Stakeholders who should receive research results and communication for influence strategies (processes and medium to inform and influence policy and practice);
- Gender considerations

This template might be useful to organize the discussions and reporting:

Main Research Issue	Sub Research Issues	Research Questions	Objectives	Data to Collect	Sources of Data (Key Informants)	Methods of Data Collection	Outputs and outcomes	Users of Research Results

Step 3: Summarize the group's discussion into a concise piece – refined concept for the country study - for feedback.

OBJECTIVES	DATA	SOURCE OF DATA	METHODS
To identify and characterize existing initiatives and the environments within which they are applied, and select some for in-depth analysis	• Inventory of initiatives • Policy context • Key or relevant infrastructure • Geography • Farmer systems • Market systems • Key stakeholders in value chains		
To examine the effects on key stakeholders			
To assess the factors that influence adoption			
To assess the challenges facing MIS providers			
To identify roles and partnership models for the public and private sectors (including NGOs)			
To enhance collaboration among African researchers and to build research capacity of project partners and young researchers.			
To formulate guiding principles and recommendations to inform policy and practice			

SESSION SIX: GROUP PRESENTATIONS ON COUNTRY RESEARCH DESIGN

During this session country presented its research design drawn following the matrix above. The data matrix is presented in Appendix 9.

SESSION SEVEN: e-AGRICULTURE PROJECT – RESEARCH OUTPUTS, OUTCOMES AND COMMUNICATION FOR INFLUENCE

Some of the identified outputs and means of dissemination both within and among the country teams and with other stakeholders of the project are:

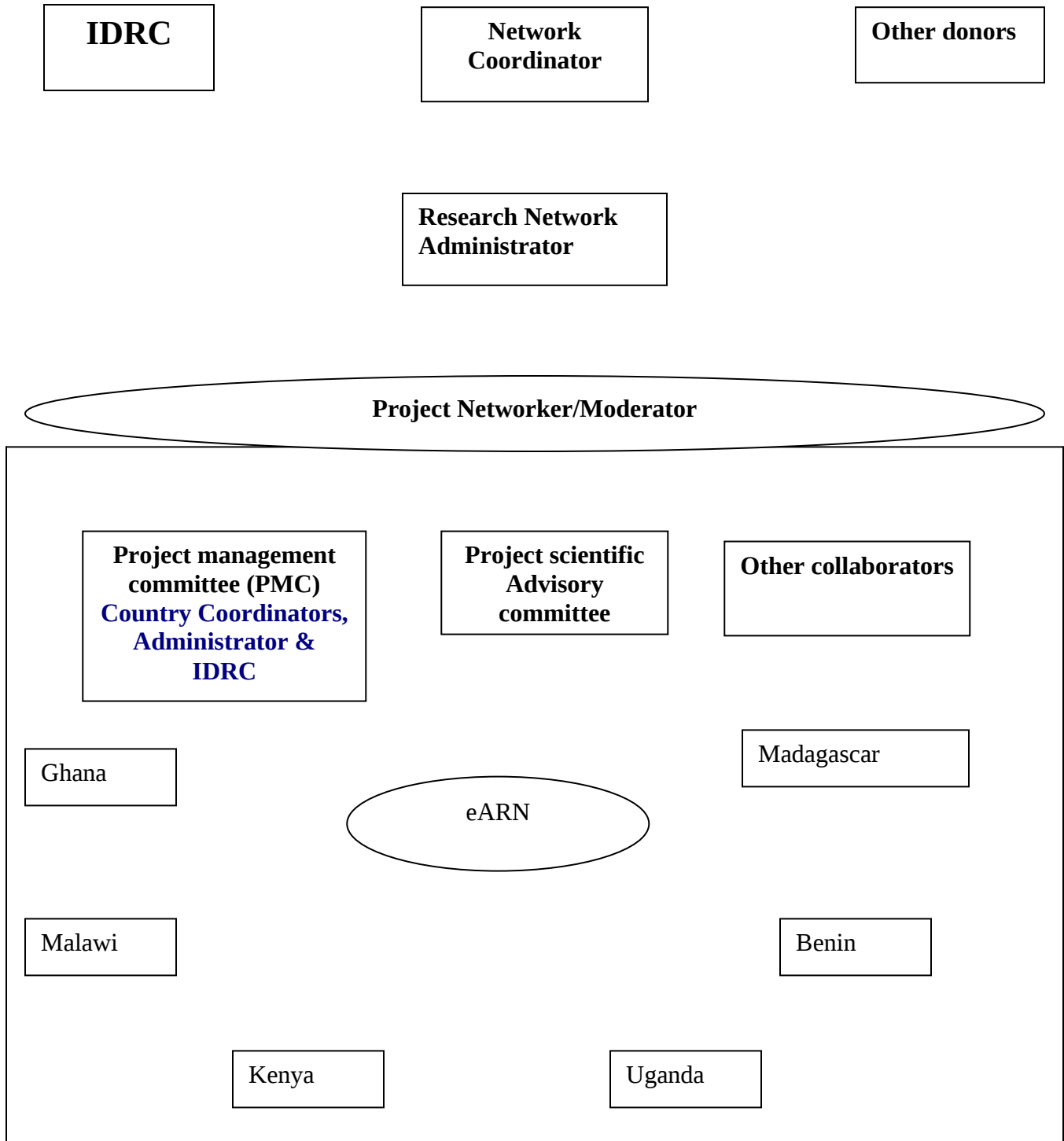
- Research tools – each country will develop research tools (questionnaires) for use in data collection.
- Research Bulletins: A Research Bulletin will be published every 4 months. The goal of the bulletin is to update the team, partner, and stakeholders of activities & other issues happening around that time. It will catch changes in context i.e. policies, gossiping, & fun and will short and easy read.
- Country reports – each country will prepare end-of project report
- M.Sc student theses/dissertations – Each country will have at least one student complete a thesis under the project. Thesis shall address at least one of the objectives of the project.
- Policy briefs- the team will produce policy brief from the research outputs as part of the communication for influence. In addition, non-traditional strategies of targeting audiences i.e. cocktails, project launches, award ceremonies, will be pursued to develop and maintain interest in the project and its future outputs
- Posters- each country team will prepare at least one poster per country.
- Discussion forums/wiki- The team will conduct country discussion forums to discuss preliminary findings and for the purpose of sustaining interest by stakeholders in the project
- E-Group- Will be done for ease of communication among and team members, with partner, practitioners and other stakeholders
- Joint/synthesized reports – synthesized from country reports
- Journal publications- the project will produce seven (7) journal papers. Each country study will be packaged into at least one journal paper. A summary of combined report highlighted crosscutting issues will also be published as a journal.
- Workshops – Each country will hold a workshop targeting various stakeholders as a means of presenting its findings for dissemination and feedback purposes. The team will also organize an international workshop to present and receive feedback on project findings
- Book- The team intends to published its final findings in form of a book

The following were identified as the target group (audience) of the project outputs:

- Policy makers
- Researchers
- MIS service providers
- Donors
- Media
- Private sector
- Teaching and research institutions

SESSION EIGHT: ORGANIZATIONAL FRAMEWORK AND CAPACITY BUILDING FOR THE e-AGRICULTURE PROJECT

i. Governance Structure of the eARN Project



ii. Training/capacity building

The workshop proposed a series of training activities to build the skills of research partners in various areas. In addition, it was felt that the research team should take advantage of the project to train some students. It was also agreed that each participating country should consider training at least one student. The aspects of the training should include the following:

- Skills to write to influence the target for the project partners
- IT collaborative tools- to enhance communication & dialoguing among partners
- Research that can fit into policy formulation
- Research that can influence policy
- Visible/tangible capacity
- Gender capacity building for students and researchers
- Have awards which are gender balanced
- Target masters students (this is a 2 year project). Best to target students who have completed coursework and have interest in the research area

iii. Monitoring and Evaluation

The workshop highlighted the inadequacy of scientists in the field of monitoring and evaluation (M&E). It was therefore agreed that project partners be trained in aspects of M&E to build their capacity. It was suggested that the project team should identify and pick the best practitioners to implement the M&E training program. I was further suggested that the team leadership should encourage sharing of information.

iv. Next Steps

- Draft proposal(s) will be done
- Get the proposal to IDRC soon enough to meet the deadline (September).
- Time scheduling-we need to get working when real work starts
- Produce a thorough job before submitting on the deadline

Terms of Reference

Team Leader

- Be responsible for coordination, monitoring and support for the scientific component of the Country Project teams' activities
- Design the Inception and Methodology Workshop and the management of its training and methodology development components and the preparation of an integrated set of methods as an output;
- Identification of research training needs at the country level, lead the management of appropriate training activities and assist with capacity building and training in each of the country teams in close collaboration with TL and Scientific Advisory Committee;
- Monitor gender issues as an element in research activities and analyses;
- Facilitate the development of a set of ethical guidelines for the country research activities;
- Establish, chair and work with the Scientific Review Committee including identification of participants, management of meeting agendas and so on with the approval of the Project Management Committee;
- Provide overall consultation and representation of the research component and activities at both the Country and Project levels to the Project Management Committee, the Country Project Teams including field visits, and to external bodies as may be required;
- Assist with the research design and implementation of the research in each of the countries, commenting on the sampling, instruments and first drafts produced by the country teams in close collaboration with the TL;
- Participate at a mid-project information Preliminary Findings workshop at which the country teams will be expected to present preliminary empirical findings;
- Assist the TL in the preparation of a synthesis report drawing on the case study reports. This report will be reviewed by external peers;
- Participate in end-project information Dissemination workshop at which the country teams and TL will be expected to present final findings.
- Assist the country teams, potentially as a co-author; prepare a paper for submission to the 2009 Global Development Network conference.

Country Project Teams

Each Country Project Team will:

- Complete a comprehensive review of literature on poverty and ICTs in the country context in order to compile information that will lead to a good understanding of existing theories and concepts of poverty and ICTs, and methodological aspects of measuring the impacts of ICTs on various aspects of poverty. This will be undertaken in close collaboration with the TL;
- Prepare appropriate instruments for data collection in consultation with the TL and Research Director, and then collect primary data mostly through qualitative methodologies, though supplemented by quantitative data collection in the case of Kenya, on ICT usage and impact;

- Complete the qualitative and quantitative research activities described above.
- Participate in the mid-project information Preliminary Findings workshop and submit preliminary reports on the empirical findings completed;
- Complete draft research reports to be peer reviewed by the Research Director and Scientific Advisory Committee, and revise and resubmit these reports as required;
- Comment on the synthesis report prepared by the TL and Research Director;
- Prepare working papers, journal articles, policy discussions in local and international workshops and papers for conferences;
- Participate in the end-project information Dissemination workshop;
- Jointly prepare a paper to be submitted to the 2009 Global Development Network conference with the assistance of the Research Director.

CLOSING SESSION

Chair: Lydia Ndirangu, KIPPRA

Comments by Rose Nyikal, University of Nairobi

- Malagasy hospitality commended
- Workshop provided great opportunity for practitioners and researchers to share experiences
- The next step is to finalize the proposal and begin the project
- A vote of thanks extended to Hotel Panorama, local organizing committee and all participants

Remarks by Edith Adera, IDRC

- Observed that there was commitment from all participants
- Consensus was reached on many issues discussed
- The ICT project is one of IDRC's flagship projects, and the first one in which Madagascar has been involved as a collaborator
- Malagasy team hailed for its hospitality

ANNEX 1: WORKSHOP PARTICIPANTS

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ANNEX 2: WORKSHOP EVALUATION

Evaluation Sheet

eARN Project Development Workshop, Antananarivo, Madagascar

12-13th June 2008

The thing I **liked most** about the eARN Workshop was?

2.0 The thing I **liked least** about the eARN **Workshop** was?

3.0 On a scale of 10 (with 10 being the highest score) I would rank (eARN Workshop sessions) as:

LIST the sessions here

I Would -X-- Would Not_____ want to participate in the next eARN **Workshop**?
Why?

5.0 The most important **change** I'd make in the next eARN **Workshop would be?**

6.0 If the eARN **Workshop** was to happen again, the element that would be most important **to maintain** would be?

7.0 The most important next steps (concrete) for this **eARN PROJECT to** pursue following this workshop should be:

8.0 The 3 most compelling ideas or lessons I will come away with from the eARN **Workshop** are:

9.0 **On a scale out of 10**, I would give the overall experience of the eARN **Workshop** a (10 is the highest score).

10.0 Other Comments:

ANNEX 3: WORKSHOP PROGRAMME (needs further revision)

Wednesday June 11, 2008 – Arrival and registration at Hotel Panorama

Thursday June 12, 2008

Session I: Introduction and setting the pace

Chairperson: Henri Abel-Ratovo, University of Antananarivo

08h30 to 08h50 Welcome and Introductory Remarks by University of Antananarivo

08h50 to 09h10 Opening Remarks University of IDRC

09h10 to 9h30 Introduction of the objectives of the Workshop, by Julius J. Okello

9h30 to 10h00 Coffee Break

Session II: Background Studies of the Use of ICT in Agriculture in Participating Countries

Chair: Julius Mangisoni

10h00 to 10h15 Introduction to the use of ICT in agriculture, by Mike Jensen (followed by facilitated presentations to address issues of):

- current status of ICTs in agriculture in Western Africa;
- highlight some of existing project(s);
- research issues/methodology.

10h15 to 10h30 Ghana

10h30 to 10h45 Benin

10h45 to 11h00 Uganda

11h00 to 11h30 Discussion & session summary by Chair

Session III: Background studies of the application of ICT in agriculture, (cont'd)

Chair: Julius Mangisoni

11h30 to 11h45 Introduction to Research Priority, by Mike Robson, followed by facilitated presentations to address issues of:

- current status of ICT in agriculture in ESA;
- existing project(s) (local or global);
- research issues/methodology

11h45 to 12h00 Malawi

12h00 to 12h15 Kenya

12h15 to 12h30 Madagascar

12h30 to 13h00 Discussions & session summary by Chair

13h00 to 14h00 Lunch

Session IV: The e-Agriculture project: draft outline of project proposal

Chairperson: Edith Adera

14h00 to 14h30 Introduction of the draft outline of the proposal to be prepared, by Julius Okello

14h30 to 15h00 Discussion focusing on research problems, questions, objectives and design

15h00 to 16h00 Concurrent breakout sessions: country teams to discuss and adapt research questions, objectives, design to their countries

16h00 to 16h30 Coffee break

16h30 to 17h30 Consensus on research questions, objectives & summary of Day 1 by the Chair

19h00 Conference dinner

Friday June 14, 2008

Session IV: e-Agriculture project: Research design, cont'd

Chairperson: Adrian Mukhebi

08h30 to 08h45 Review of research problem, questions and objectives adopted in Day 1

08h45 to 09h45 Discussion of research design revisited

- ✓ conceptual and theoretical framework
- ✓ data needs, data collection, & data analysis
- ✓ gender and boundary partners/interest groups

09h45 to 10h00 Session summary by Moderator

10h00 to 10h30 Coffee Break

Session V: e-Agriculture Research Network project

Chairperson: Edith Adera

- 10h30 to 11h30** Concurrent breakout sessions: country teams adapt research design to their country needs
- 11h30 to 12h30** Facilitated discussion on country specific research design by Moderator
- 12h30 to 13h00** Session summary by Moderator
- 13h00 to 14h00** Lunch

Session VI: Organizational framework, capacity building and research to policy influence in e-Agriculture project

Chairperson: Ramata Thioune

- 14h00 to 14h15** Introduction to organizational framework, capacity building and policy influence by Julius Okello
- 14h15 to 15h00** Discussion on individual items viz:
- ✓ research management
 - ✓ participations organizations
 - ✓ training
 - ✓ research to practice influence/dissemination of findings
 - ✓ Timelines
 - ✓ Project assesment/monitoring/evaluation
- 15h00 to 15h30** Coffee Break
- 15h30 to 16h00** Workshop summary and next steps by Julius Okello
- 16h00 to 16h30** Meeting of country project coordinators

Closing Session

Chairperson: Rose Nyikal

- 16h30 to 17h00** Thank yous and wrap up from University of Nairobi and IDRC

ANNEX 4: POSITION PAPER ON ICT POLICY ENVIRONMENT AND THE USE OF ICT- BASED INTERVENTIONS IN AGRICULTURE: THE CASE OF UGANDA.

Narathius Asingwire¹ and Patrick B. Birungi²

1.0 INTRODUCTION

1.1 Overview and Approach

This Position Country Paper provides a detailed situation analysis of ICTs-Based Technologies and Agriculture in Uganda. It provides an overview on the agricultural sector in Uganda examines the background and setting with regard to the policy environment within which ICT initiatives are implemented and identifies constraints, opportunities and impact of ICT-based technologies use in agricultural development.

The paper predominantly relied on secondary sources—i.e., a desk review of documents. Data was collected on a number of ICT initiatives in the country with a view of selecting at least three for in-depth analysis during the main survey. Appendix 5a shows a few of the initiatives that were covered from which at least three Case Studies will be selected. In-depth interviews were conducted with few informants involved in dissemination of agricultural related information using both traditional and modern ICT-based technologies.

1.2 Role of Agriculture in Uganda

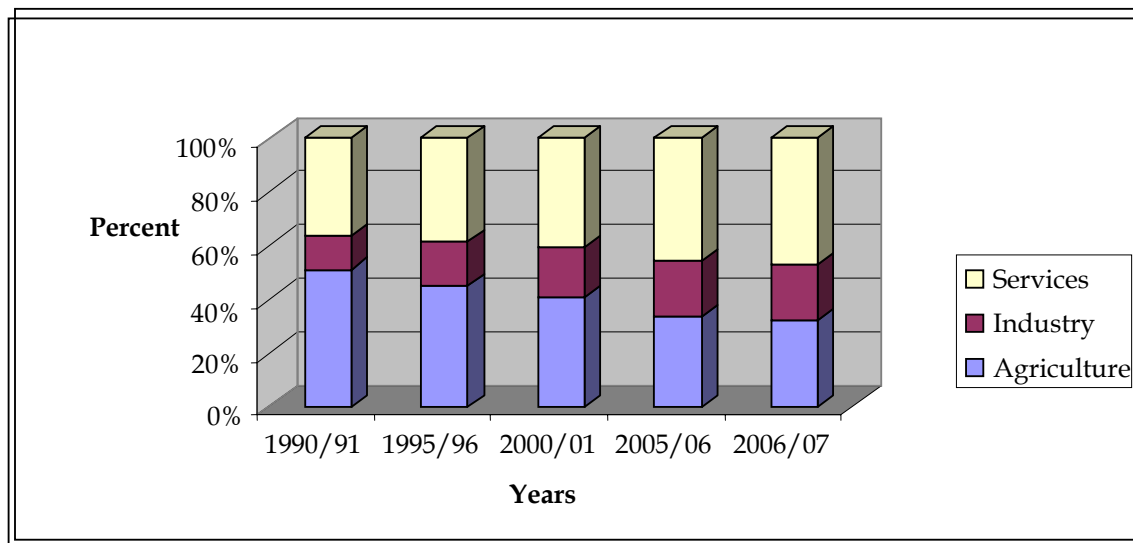
The Ugandan economy is dominated by the agricultural sector. For the past two decades, agriculture has been the largest contributor to the country's Gross Domestic Product (GDP); however, its contribution has been declining over time due to faster growth in other sectors especially the service sector. See Figure 1.

¹ Senior Lecturer & Head, SWSA Dept. Makerere Univeristy

² Lecturer, Faculty of Economics and Management, Makerere University

The authors acknowledge the contribution of Mr. Zepha Muzira and Mr. Edward Jjuko for their tireless effort to have this report out.

Figure 1: Sectoral contribution to GDP in Uganda



Source: *Background to the Budget 2006/07*

Figure 1 shows that the contribution of agriculture to GDP has declined from 51.2 percent in 1990/91 to 31.9 percent in 2006/07 representing a 19.3 percent decline. Although its contribution to GDP is declining, agriculture still remains a key sector in the economy. It accounts for 85 percent of the country's export earnings, 80 percent of employment, and provides most of the raw materials to the mainly agro-industrial sector comprising of coffee hauling, cotton ginning, tea processing, sugar production, soap industries, edible oil, textile mills, cigarette manufacturing, grain milling, meat processing, and leather manufacturing (GOU, 2000). Eighty five percent of Uganda's population resides in rural areas and depends mainly on agriculture for its livelihood (GOU, 2000; Ellis and Bahigwa, 2003). Being the leading sector of the Ugandan economy, agriculture is an engine and major source of future growth. As a result, there are a number of government policies in place aimed at developing the agricultural sector so as to transform the mainly subsistence agricultural farmers to market-oriented farm producing units.

1.3 Government Policy on Agricultural Development

Development and sustainable growth of the agriculture sector depends on existence of a favorable policy environment. The Plan for Modernization of Agriculture (PMA) is the Uganda government's economic development policy for the operationalization of the Poverty Eradication Action Plan (PEAP) framework in as far as modernizing agriculture is concerned. Within the PMA framework, the major focus is to transform subsistence agriculture to commercial agriculture, and to this effect, government established the National Agricultural Advisory Services (NAADS) in 2001 to empower farmers with information critical to modernizing the sector.

NAADS is a Uganda government program put in place to increase efficiency and effectiveness of agricultural extension services. It is a semi-autonomous body formed under NAADS Act of June 2001, with a mandate to develop a demand-driven, farmer-led agricultural service delivery system targeting the poor subsistence farmers, with emphasis to women, youth, and people with disabilities. Its development goal is to enhance rural livelihoods by increasing agricultural productivity and profitability in a sustainable manner. NAADS overall supervision is vested in the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF). NAADS aims to increase

farmers' access to information, knowledge and technology through a decentralized, farmer owned and private sector service extension delivery system. NAADS empowers farmers to access fee-based agricultural advisory services and market information.

1.4 The Role of Smallholder Farmers in Agriculture in Uganda

In Uganda, about 80 percent of the population lives in rural areas; and is engaged mainly in agriculture. In addition, about 90 percent are basically smallholder farmers (GOU, 2000). Small landholdings (less than three hectares), semi or complete illiteracy, minimal access to information on potential markets for farm produce, minimal access to information to technologies that can boost production, are some of the defining characteristics of smallholder farmers in Uganda. Although largely disadvantaged, the farmers' contribution to total agricultural output is significant. Three quarters of the total agricultural output in Uganda is generated by smallholder farmers. Despite being the largest contributors to agricultural output, many smallholder farmers live under conditions of poverty; only one third of their crop output is marketed compared to two thirds of livestock output marketed, and this negatively affects their income earnings (GOU, 2000). There are a number of constraints the farmers need to overcome if they are to enhance and diversify their livelihoods, including access to production inputs, transportation links, and market information.

Limited access to production inputs is one of the constraints facing farmers in Uganda. Smallholder farmers in Uganda are faced with a problem of access to production inputs, such as implements (hoes, ploughs), fertilizers, pesticides, spraying equipment, animal drugs, high yield and resistant seeds, improved breeds, and a variety of improved plant cuttings and seeds. Particular barriers to access and utilization include: high cost, unavailability in near markets, poor quality, and lack of advice.

In addition to limited access to production inputs, smallholder farmers in Uganda are largely constrained by poor transportation links. Most rural areas in Uganda are faced with poor roads and transport networks. Lack of all-weather feeder roads does not only hinder community development but largely constrains marketing of agricultural produce and investment in the rural areas. A poor road network only means that poor farmers can not reach markets. Inadequacy of feeder roads therefore, is one of the factors responsible for the high market transaction costs.

More so, the lack of market information and/or existence of information asymmetry have denied small-scale producers access to information they need for their decision-making processes. They lack information on the commodity and input prices, quality of output produced, and sources of credit. As a result, opportunistic traders, input dealers and lending institutions have exploited small-scale producers by offering them understated output prices and overstated input prices, and unfavorable credit terms. Therefore, lack of information is one of the major constraints that farmers need to be addressed if farmers are to enhance their livelihoods.

Since improved access to markets and market information in Uganda is essential to the mission of the PMA in transforming subsistence agriculture to commercial agriculture, the lack of it implies the farmers have been denied an opportunity to access information they need for their decision-making processes. They lack information on the commodity and input prices, quality of output produced, and sources of credit. As a result, opportunistic traders, input dealers and lending institutions have exploited small-scale producers by offering them understated output prices and overstated input prices, and unfavorable credit terms. Initiatives to resolve the problem of poor access to agricultural information by small-scale producers and its consequences have spurred efforts to use ICT-based technologies to disseminate relevant and timely agricultural information to the producers.

There are various initiatives by government, NGOs, and donors to disseminate agricultural information to smallholder farmers in rural Uganda. The information basically empowers smallholder farmers to make vital decisions concerning their activities. With this information, the farmers are able to decide what to produce and when to produce, what to sell and when to sell, negotiate for better prices, and check on prices they are getting. In essence, the information aids the farmers in making production, processing, and marketing decisions.

2.0 BACKGROUND AND SETTING

Improving smallholder farmers' access to agricultural services in Uganda has always been a central challenge facing the government; especially because her direct role was greatly reduced following structural adjustment and commitment to market-based agriculture. In the 1990s, farmer cooperation, especially among those with commercial potential was widely perceived by donors and international NGOs as one mechanism of improving their access to agricultural services. The argument was that by working together, farmers would realize the scale economies of bulk acquisition and enter into more stable relationships with suppliers or traders. By pooling resources to invest in transport or processing operations, they would become more active participants in the marketing system, adding value to their production. Such views influenced the design of many programs of assistance to smallholder farmers in Uganda. However, evidence emerged that projects promoting farmer cooperation did not always lead to emergence of viable farmer groups. Project evaluations indicated that groups were often formed hastily and with little reference to underlying patterns of social and economic organization or commitment to cooperative action. As a result, many did not survive long, and in the worst situation, members' negative experiences contributed to undermining future self-help initiatives.

On the other hand, the government undertook a unified extension approach to integrate and harmonize the use of scarce resources. It trained and supported extension workers, who were responsible for transferring knowledge and technologies in all fields to groups of farmers in a given geographical area. Farmers were taught as to how and why they ought to undertake better farming methods using government schemes such as demonstrations, farmer field days and trials. However, because the workers were not adequately facilitated, especially in terms of transport, and yet their areas of operation were so expansive, their impact on smallholder farmers was so minimal.

In addition to the work done by extension workers, government-owned radio and television broadcasted programs that were meant to provide agricultural information to the farmers. Because there was only one Radio station and one Television station (Radio Uganda and Uganda Television) owned by the government, the multiplicity of programs to be aired meant that there was little time allocated to agricultural programs. Many farmers could also not afford Television sets and radios, and this meant that information largely was confined to urban centers at the expense of rural areas that needed it most. Farmers in rural areas therefore, largely remained unable to access vital agricultural information. It is perhaps this dilemma that has spurred the use of ICT-based technologies to disseminate relevant and timely agricultural information to the producers, and thus necessitating the need of an ICT policy.

2.1 The National ICT Policy Framework

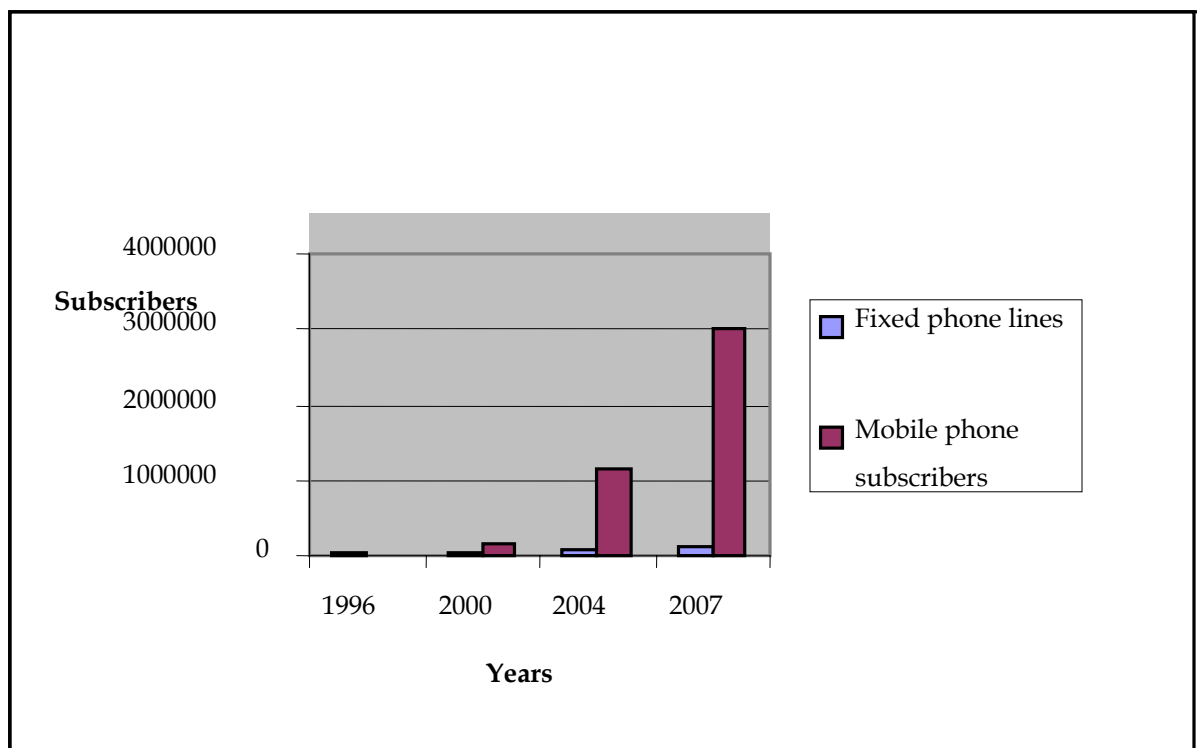
Uganda has made progress in the ICT policy; it has established a functioning framework in terms of legislation and an institutional arrangement in terms of a ministry of ICT development, and other institutions established according to the law such as the Uganda Communications Commission (UCC).

The National ICT policy document covers: information as a resource for development, mechanisms for accessing information, and ICT as an industry including e-business, software development and manufacturing. The National ICT policy identified fourteen key objectives which include: improving connectivity and human capacity, sensitizing society about the role of ICT in development, promoting local and foreign direct investment in ICT, working out an enabling legal framework and establishing innovative financial schemes to promote ICT. Other objectives included improving access, encouraging use of ICT to improve efficiency in organizations, enhancing local content, and ensuring gender and linguistic quality of opportunities. The ICT policy also aims at ensuring respect for intellectual property, encouraging research in ICT and enhancing collaboration in various fields of ICT. The policy provides for a number of laws, statutes, and acts that are pertinent to the agricultural sector. Prominent among them is the Communications Act, 1997 and the Rural Communications Development Policy (RCDP).

2.1.1 *The Communications Act 1997*

Following the privatization and liberalization of the telecommunications sector, the government formulated Communications Act of 1997 whose main objective is to increase the penetration and level of telecommunication services in the country through private sector investment rather than government intervention. As a result, it formed a regulatory body, the Uganda Communications Commission (UCC) to regulate and promote the sustainable development of communication services that are universally accessible. Using the following regulations, radio communications, fair competition, licensing, interconnection, and practice and procedure regulations, UCC is credited for overseeing the rapid development of the telecommunications market in Uganda. Fixed and mobile phone subscribers registered impressive growth rates as reflected in figure 2 below.

Figure 2: Fixed and Mobile phone subscribers



Mobile phone subscribers have since then increased from 3,500 in 1996 to 3,015,493 in 2007 representing about 86,000 percent growth. Fixed phone subscribers increased from 46,000 in 1996 to 137,916 in 2007 representing about 199 percent growth. Table 1 shows other market performance indicators including private televisions, FM radios, and internet service operators among others.

From Table 1 (and Figure 1), Mobile and/or fixed phone providers have increased from one in 1996 to five in 2007. Major players in this sector are Mobile Telephone Network (MTN), Celtel Uganda, Uganda Telecom Limited (UTL), Warid Telecom and Hits Telecom. The last two are the latest entrants in the market. Private FM radio stations have increased from 14 in 1996 to 158 in 2007 representing about 1028 percent growth. Private televisions have also increased from 4 in 1996 to 32 in 2007. Overall, the telecommunications market has registered impressive performances over time. All these changes have had a significant impact on the agricultural sector in Uganda.

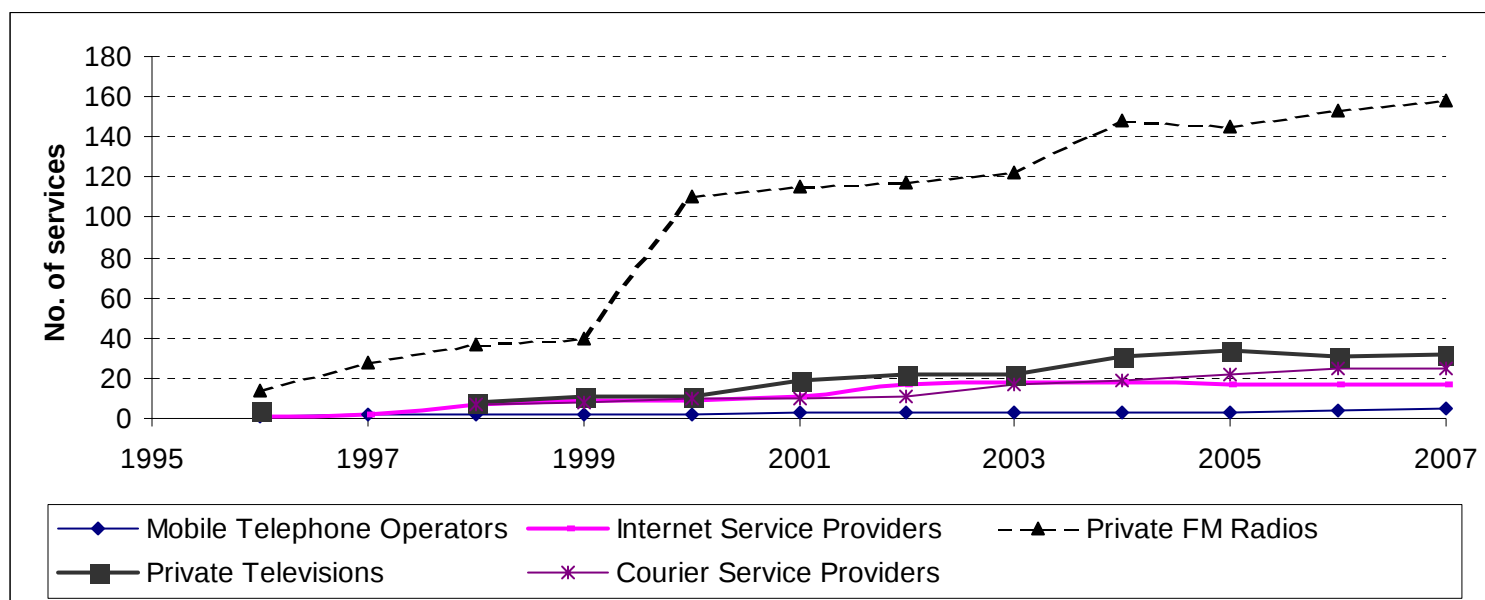
Although there was impressive growth in telecommunications as a whole, it is also clear that a large part of rural Uganda does not enjoy the same success in the growth of the telecommunication infrastructure. This meant that rural areas where majority of the population lives hardly benefit from such impressive growth in these technologies. In an effort to improve the access and utilization of ICTs among the rural communities, the government formulated the Rural Communication Development Policy in 2001. A Rural Communications Development Fund (RCDF) was set up to provide subsidies to facilitate access to basic communication services such as telephone, computer and internet.

Table 1: Uganda Communications and Technologies Infrastructure 1996 to 2005

Service Provided/Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Mobile Telephone Operators	1	2	2	2	2	3	3	3	3	3	4	5
Internet Service Providers	1	2	7	9	9	11	17	18	18	17	17	17
Private FM Radios	14	28	37	40	110	115	117	122	148	145	153	158
Private Televisions	4		8	11	11	19	22	22	31	34	31	32
Courier Service Providers			7	8	10	10	11	17	19	22	25	25

Source: Uganda Communications Commission, 2005. <http://www.ucc.co.ug>

Figure 3 : Uganda Communication Infrastructure (1996-2005)



2.1.2 Rural Communications Development Fund (RCDF)

In accordance with the provisions of the Communications Act of 1997, the Universal Service Fund (USF) is mainly referred to as the Rural Communications Development Fund (RCDF) and its main objectives are to: provide access to basic communications services within a reasonable distance to all people in Uganda, leverage investments into rural communications development, and promote ICT usage in Uganda. RCDF was started in the year 2003, and its activities are guided by the RCDF policy of 2001, which was rolled over for the five year period 2003 to 2007. The RCDF policy program defined by the policy for the five year period is as follows.

Table 2: RCDF Policy Program (2003 – 2007)

Program Area	Target
Internet Point of Presence	At every district headquarters
Internet Café	At every district headquarters
ICT Training Centers	At every district headquarters
Web Portals	For every district
Public Pay Phones	For every 2500 inhabitants/every parish
Research Projects	To guide rural communications development
Postal Support Projects	Strategic rural areas
Multi-purpose Community Telecenters	Strategic rural areas
School ICT Facilities	In line with National ICT policy
Health Care ICT Facilities	In line with National ICT policy
Call Centers	Strategic undeserved locations

Source: UCC, 2007

The RCDF project roll out strategy is such that the district centers are the main starting points of penetration of ICT services. Roll out starts at the district level and then into lower administrative units of the district namely: counties, sub-counties, parishes, and individuals respectively. This roll out strategy allows for services to start where they are most needed, where they are most sustainable, and allows for awareness into remote areas to take effect before services get there.

The implementation of RCDF policy program is a sequential and cyclic process. UCC defines undeserved areas in line with the RCDF program. Projects that can deliver sustainable communication services to the undeserved areas are then developed. Implementers of the projects are sought through a competitive bidding process. Financial subsidies are extended to project implementers. Implementation of the projects is governed by contractual terms which ensure that the objectives of RCDF are realized. The projects are designed in such a way that they stimulate similar projects to be started in the undeserved areas without further intervention from RCDF.

RCDF sources of funding include the following: money appropriated by parliament through the National budget, donations and grants from development partners, money from UCC, and loans and grants acceptable to the Minister of ICT and Minister responsible for finance. The funds and program at large are directed by a seven member of Board of Directors.

The performance of the RCDF overall program is primarily pegged against its achievements in line with the RCDF policy program. Many targets that are contained in the original RCDF policy program and whose implementation started in the year 2003 were achieved around the year 2005. New targets were then redefined for the period up to the end of the year 2007. Table 3 shows the achievements of RCDF as at 31st December, 2007. Projects that were still under development as at 31st December 2007 were in very advanced stages of completion. All projects were expected to be completed by 30th July, 2008, and a new RCDF policy for the period 2008 to 2012 is expected

is expected to be in force by 1st July, 2008. At the moment the UCC is reviewing the performance of the previous policy framework in order to enhance the planned RCDF activities 2008 – 2012.

Table 3: RCDF Achievements as at 31st December, 2007

Program area	Commissioned projects	Projects under Development
Internet Point of Presence	52	24
Internet Café	55	44
ICT Training Centers	55	24
Web Portals	78	0
Public Pay Phone	316	2283
Research Projects	3	3
Postal Support Projects	8	27
Multi-purpose Community Centers	4	20
School ICT Laboratories	8	87
Health Care ICT Facilities	0	43
Call Centers	8	1

Source: UCC, 2007. <http://www.ucc.co.ug>

Overall, by facilitating access to telecommunications in the rural areas of Uganda, the RCDF facilitates the delivery of information required for improving rural livelihoods, and agriculture is one of the sectors targeted by this information.

2.2 ICT and Agriculture in Uganda

As already noted, the lack of agricultural information is one of the major factors constraining smallholder farmers' access to markets. ICTs have been identified by government agencies, NGOs, and International and/or donor agencies as one of the mechanisms for disseminating the needed information to the producers. There are different forms of ICT interventions in Uganda's agriculture including creating a conducive policy environment, establishing price information systems, establishing a market information system, and thus increasing market access, increasing production efficiency, and empowering farmers (IICD, 2006).

2.2.1 Creating a conducive policy environment

Development and sustainable growth of the agriculture sector depends on existence of a favorable policy environment. The government has made reforms in the areas of agricultural extension, research and rural services, investment in physical infrastructure (roads, energy, and telecommunications) and markets to stimulate agricultural growth. The Poverty Eradication Action Plan (PEAP) provides a comprehensive development framework that hinges on creating a framework for rapid economic growth and structural transformation. All sector-wide plans in Uganda such as the Plans for Modernization of Agriculture (PMA) are derived from PEAP. The policy direction is to encourage a shift from subsistence to market –oriented and commercial farming, and to this effect, government established NAADS in 2001 to empower farmers to modernize agriculture. NAADS empowers farmers to access fee-based agricultural advisory services and market information. Internet, e-mail, video, radio, and print are some of the ICTs used to share and disseminate agricultural information and advisory services.

The ICT policy in Uganda recognizes the need for ICT to play a greater role in rural agricultural development and to provide the necessary framework to support application of ICTs. As already noted, the UCC set up a Rural Communications Development Fund (RCDF) to improve the ICT infrastructure in rural areas, and to make telecommunications services accessible. Government removed taxes on imported ICTs to stimulate higher adoption and application in development.

The reforms activities have led to reductions in telecommunication costs, and enhanced the sharing of agricultural information, knowledge, and related services.

2.2.2 Establishing a price information system

The existence of information asymmetry means that farmers in rural areas are often exploited by middlemen who offer them understated prices for their output and overstated prices for inputs. Providing farmers with accurate and up-to-date price information may elevate farmers' negotiating position, and ICTs can play a vital role. A number of NGOs such as Women of Uganda Network (WOUGNET), Busoga Rural Open Source Development Initiative (BROSDI), and government agencies such as Uganda Commodity Exchange (UCE) have set up price information systems, in which they collect prices from various regional markets, and store it in databases. The information is published on their websites, and made accessible to local farmers through various information centers that are usually equipped with computer and internet facilities. For a much wider audience the information is usually broadcast on radios in various local languages.

2.2.3 Establishing agricultural information systems

National agricultural information systems can contribute to a conducive environment for agricultural development if agricultural research information is made easily accessible to all end-users, and ICTs can play an important role to this end. Using email and internet, UCE operates a Rural Information System project that provides market information and services to buyers and sellers of agricultural commodities. Beneficiaries targeted are mainly organized rural farmer organizations, and information provided to them includes commodity profile, current prices and trends, accepted quality standards of commodities, best practices among others.

2.2.4 Increasing market access

One of the ways in which ICTs can improve the farmers' livelihoods is by increasing their access to potential markets. There are a number of projects in Uganda working in this area and use ICT to facilitate contact between sellers and buyers, promote agricultural exports, facilitate on-line trading, and make producers aware of potential market opportunities. The UCE project is an online resource for commodity traders; facilitating trade of graded produce such as maize, beans, rice, soya, sesame, coffee, among others. The project has a warehouse facility with an ICT-crop marketing bureau that focuses on improving access to available commodities for buyers. It also provides technical information to farmers to assist them in meeting quality standards.

2.2.5 Increasing production efficiency

Small-scale farmers need to increase their farms' level of productivity and efficiency; and ICTs can be of importance to this end. ICTs can facilitate access to information and expertise about effective traditional and modern production methods. In Uganda, access to extension visits is very limited. Birungi (2007) shows that access to extension visits is as low as 20 percent of the population involved in agriculture. Access therefore can be enhanced through use of other channels that are ICT supported like radios, phone services among many others. Access to extension visits in Uganda is very low.

In Uganda, the Agricultural Research Extension Network (ARENET), under the joint effort of National Agricultural Research Organization (NARO) and NAADS aims at improving sharing of information between research and extension. ICTs are one of the options used to create the infrastructure for improving interaction with private sector providers, local governments, farmers, and Civil Society Organizations (CSO) about farmer problems. Through the Information and Communications Network, ARENET uses web technology (internet) to create space for interaction between extension agents in the villages, researchers, and apex centers of NARO and

NAADS. Like ARENET, Busoga Rural Open Source and Development Initiative (BROSDI) reach a large share of its rural clientele through SMS on mobile phones. Collecting & Exchange of Local Agricultural Content (CELAC) has a website, which seeks to stimulate exchange on the crop and animal farming practices that have worked for Uganda's farmers.

2.2.6 Increasing profitability of small farms

In most rural parts of Uganda, farmers are often exploited by middlemen who normally understate the price of their commodities and overstate the transaction costs. Because farmers are unaware of the value of their crops, they are not able to negotiate for favorable prices. There are a number of initiatives in Uganda aimed at availing farmers with timely and appropriate price information for their products. Organizations such as Women of Uganda Network (WOUGNET), Food-Net, and Council for Economic Empowerment for Women of Africa (CEEWA) are using mobile phone to disseminate timely market information to farmers. Callers can receive market information regarding who is selling, what price, who is buying, place of advertisement to buy or sell agricultural commodities.

3.0 THE UPSURGE ICT-BASED STRATEGIES

There are a number of initiatives by government, NGOs, and donors aimed at promoting the use of ICTs to develop agriculture in Uganda. Although their roles vary, it is important to note that they work in partnership through participatory approaches, and use a combination of media to disseminate vital information to the farmers.

Radio is an important mechanism for disseminating knowledge and information to farmers in different languages and formats. The privatization and liberalization of the communication industry in Uganda has seen the mushrooming of various FM radio stations. The number of FM radio stations has increased tremendously from 14 in 1996 to over 100 in 2007 (UCC, 2007). A number of organizations promoting the use of ICTs in improving livelihoods use radio primarily because it has been rated by far the most effective information dissemination method in rural areas. Many radio stations have designated time for specific human development issues including agriculture, and have Question and Answer sessions, in which farmers use phones to call and have their questions responded to. Unfortunately, many of these radios have limited aerial coverage making it costly to air a program on all local radio stations. Most of the radios use batteries (dry cells) that are costly to the rural population, and therefore, remains a challenge to accessing information.

In addition to radios, mobile telephony (SMS) is one of the ICT applications used as information dissemination tools to the farmers. Many organizations such as BROSDI, CEEWA, and FICOM use SMS to send agricultural information to farmers on a weekly basis. This is done every Monday, and the information is also uploaded on the project websites for other people and organizations involved in similar work to access. The organizations have designed databases composed of phone numbers from persons involved in community development work, individual farmers, organizations and even government agencies. The challenge faced by this method however, is that most mobile phones are limited to sending not more than 140 words. Secondly lack of supportive infrastructure such as electricity that can be used for phone charging remains a major challenge in the rural areas. Secondly, lack of supportive infrastructure such as electricity that can be used for phone charging remains a major challenge in the rural areas.

Also, music, dance and drama are one of the traditional ICT methodologies used to disseminate information to both adult and the younger population. The CELAC project uses music, dance and drama to portray information from the knowledge sharing forums. Information portrayed includes farming practices and challenges; it is recorded on video and burned onto DVDs for use by

farmers who can access computer or video facilities. Ndere Troup in Uganda is a drama and theatre organization disseminating information on more efficient and effective production methods through a network of hundreds of rural-based drama and community groups across the country. It captures performances on videos and distributes the material on CD/DVD to small rural information centers to reach wider audience.

Publications are also used to disseminate information on agricultural commodity prices and improved farming practices by sending out monthly newsletters and information brochures. Text books and reports are also provided at various information centers, and all these are printed in English and the most widely spoken local languages. However, some organizations such as BROSDI and CEEWA report that the method is expensive since it requires huge amounts of printing paper and toner, and at the same time, it is not a preferred format by the community, because of the lack of reading culture and high illiteracy rates in some areas. Government investments and programs in supporting the Universal Primary Education (UPE) and Universal Secondary Education (USE) will go a long way to reduce the problems of illiteracy and reading culture because of the high illiteracy rates.

Geographical Information System (GIS) and/or Decision Support Systems in addition to the above is one of the recent ICT applications in the agricultural sector in Uganda. GIS is a mapping system that uses computers to collect, store, manipulate, analyze, and display data. It is an information technology that links activities in the field and the office, and allows for comparison between different types of agricultural data. In collaboration with Uganda Commodity Exchange, BROSDI is using GIS to portray commodity/seasonal patterns. For example, map of the country showing seasonality of different crop, what are being produced, geographical coverage, e.t.c. GIS estimates supply and expectations, and prepares markets before harvests. The supply forecast and market potential help forecast prices and plan for exports and local market sales. The GIS output generally reflects information concerning what to produce, when to produce, where to sell based on forecasted prices, and this information is passed on to the farmers via community radio programs or through SMS.

Internet and e-mail (web-based applications) are among the ICTs that are increasingly becoming important for sharing and disseminating agricultural information. In Uganda, a number of telecenters including Nabweru, Buwama, and Nakaseke have been established, equipped with computers that are connected to the internet, and act as one-stop-centers for farmers to access agricultural information market prices and improved farming practices from the net. In addition to placing orders for their products online, the farmers are also able to use email to send questions to experts on agricultural issues. For instance, Collecting & Exchange of Local Agricultural Content (CELAC) under BROSDI has a website, which seeks to stimulate exchange of information on the crop and animal farming practices that have worked for Uganda's farmers. However, the telecentres seem not to have had significant impact as most of the smallholder farmers do not have direct access to the internet. Besides the telecentres being located far from many of the farmers, farmers' willingness to pay access fees is very low, and the widespread use of English on the internet even when the majority farmers are illiterate, compounds the problem of low utilization of telecentres.

Lastly, worldspace radio, although not fully developed, is one of the most recent ICT applications in the agricultural sector of Uganda. World space radio is considered appropriate for disadvantaged rural areas in that it enables rural communities to download development content where there is no internet connectivity. A simple satellite radio is used to disseminate information to a large number of people in different geographic locations for wider dissemination to local communities. BROSDI has connected a worldspace radio to computers at their resource and

information centre, and is helping farmers who visit the information centre to access web-based information concerning regional market prices and improved agricultural practices using local content, without having to use the usual method of accessing information from the internet.

All the above ICT applications mainly target particular stakeholders including farmers, community development workers, agricultural extension workers/knowledge brokers, farmers' associations and cooperatives, (e.g., Uganda Cooperative Alliance, Uganda Coffee Trade Federation, Uganda Farmers' Federation, Commercial Farmers' Association), traders, credit institutions, Non-governmental organizations (NGOs), district technical staff and sub-county representatives, Research Organizations, (e.g., NARO), Super market chains, and Government departments such as line ministries and UCC, among others.

4.0 CONSTRAINTS, OPPORTUNITIES, AND IMPACT

4.1 Constraints

Experience with the various ICT initiatives in the agricultural sector of Uganda reveals the following limitations and constraints that need to be addressed if ICTs are to contribute positively to food security, increased agricultural production and to rural development in general.

Lack of infrastructure is one of the major constraints to access and utilization of ICTs for agricultural development. Electricity to power ICTs is obviously the primary constraint to developing ICTs. Although there are generators and dry cells as alternative sources of power, these are expensive and cannot be afforded by the rural community dwellers that are largely poverty stricken. In addition, rural areas commonly lack communication (telephone) lines. The teledensity (main telephone lines per 1000 inhabitants) is less than 0.1 in rural areas compared to a worldwide average of 11 and 9.5 for South Africa (Communication for Development Group, 1998). Low bandwidth, congestion and high costs for international calls further constrain telecommunications in Uganda. Therefore, new ICTs may not be such a cheap means of expanding rural information systems (Munyua, 2003).

Besides lack of infrastructure, illiteracy is frequently sighted as one of the major constraints to access and utilization of ICTs. Although efforts are being made to integrate the use of local languages in the various projects, English is still the dominant media of transmission used in particularly web-based ICTs. A large section of the farmers in rural areas are illiterate and are therefore uncomfortable with using English as a medium of knowledge transmission. The text therefore needs to be translated into local vernacular before presentation to be most effective.

Related to illiteracy, lack of information skills is another factor constraining use of ICTs in agriculture. Computer-based information systems assume a minimal level of competency of their users, but the technological skills and information literacy to make effective use of sophisticated ICTs are particularly low in rural communities of Uganda. It is difficult to find information on the Internet, even for computer literate users, as information on the Internet is not indexed systematically. Skills are needed to interrogate the system and to effectively use the information found to meet an information need, assuming even that this need has been identified and clearly articulated. Information intermediaries are therefore crucial to assist and train ICT users.

Inappropriate modes of information transfer also limit the use of ICTs in agriculture. Provision of information via the internet is largely one-way, from the source to a passive receiver, offering little or no feedback to the users. This amounts to an electronic form of the outdated and ineffective 'top-down transfer of knowledge' model for agricultural information systems. There

is a danger that information delivered in such a manner may assume an “aura of truth” in the mind of the user (similar to printed material) so that he/she will not question its validity or applicability. Efforts need to be intensified to develop software that allow the user to interact with the information system, by, for example, adding content (local knowledge) or giving feedback to the developer or provider.

Lastly, inequitable information provision has been identified as one of the factors limiting access and utilization of ICTs in agriculture. Because effective use of ICTs requires farmers’ awareness of their information needs, and a minimum level of computer and information literacy; there is a danger of ICTs reaching only the most progressive and skilled farmers who know their needs and invest time in learning how to use the new technology. The poorest and most destitute especially women can be completely missed (Munyua 2000). Information could become “power” for information gatekeepers in certain communities, and information workers therefore need to be aware of the power dimensions of knowledge utilization (Rolling, 1988) that might impede information diffusion. However, in many Ugandan communities, traditional means of sharing information have existed for time immemorial; these should be harnessed to ensure that information provided via an electronic medium eventually reaches the whole community.

4.2 Existing Opportunities for Use of ICTs in Agriculture

Based on the lessons learned from the various ICT initiatives in agriculture, ICTs offer a number of opportunities for further agricultural development.

The provision of greater access to information as envisaged by the government will create the market drive necessary to make ICT implementation in the different sectors affordable and sustainable. Without affordability and sustainability, the information and technological revolution will evade the country. For effective agricultural development, it is therefore necessary to examine exactly which technologies will offer both of these key ingredients.

Uganda is slowly moving towards the objective of universal access to information and communication services. The end of the telecommunication monopoly and the emergence of a vibrant cellular market should create competition necessary to drive telecom growth in this direction. Regulation by UCC as an independent telecom regulator cannot be overemphasized, and co-operation between both the public and private sectors is crucial.

Uganda is still in the development path of providing universal access to information and communication technologies including broadband internet. However, broadband initiatives are hardly given any priority in Uganda. With the majority of the population needing basic voice services, it is evident that the market for broadband internet is highly underdeveloped, and yet it is impossible to ignore the benefits broadband internet has to offer.

4.3 Impact of Existing ICT interventions in Uganda’s Agricultural Sector

Although no systematic study has been undertaken to study the impact of ICT-based interventions on agriculture in Uganda, a number of organizations through their internal monitoring and evaluation mechanisms point out that ICT initiatives in agriculture have generated a number of positive outcomes; both economic and institutional in nature. This is gray area that needs to be studied, by carrying out household surveys to evaluate the impacts of the different advances discussed in the paper.

4.3.1 Economic Effect

According to FICOM, the farmers themselves have maximized the use of mobile phones to access market information from any part of Uganda. They use locally developed SMS services to

send and automatically receive updates on market prices. Because of this, farmers no longer have to for buyers and middle men who often exploited them by offering them deceptive prices.

They have eliminated unnecessary transport costs. Instead of paying money to look for buyers or be paid with a lot of uncertainties, farmers now first make a call to ascertain payments and other related activities.

According to Information Communication Technologies for Africa Rural Development, (ICTARD) the new solutions have improved the farmers' external relations. Farmers, groups have been able to communicate internally and externally, some have managed to get development funds and other related benefits. They also now have accessible contact addresses for easy communication.

In Kayunga, village phones supplied by FICOM have helped farmers widen their income base. In addition to income from agricultural activities, farmer groups are now realizing additional income from village phones through charging for phone calls made. The village phones are also offering employment opportunities for telephone operators.

The rural farmer associations are now being empowered with basic computer, business support and management training for sustainability purposes. This includes: basic computer knowledge, downloading and viewing of information from the worldspace channel, business support training, book keeping, customer care, marketing and business planning, conflict management, avoidance and resolution. This has enhanced their decision-making.

4.3.2 Institution/or sector Effects

ICTs especially mobile/or village phones have enhanced improvements in communication. The Uganda National Farmers' Federation (UNFFE) has installed a wireless network, creating an environment of easy and fast communication internally and externally. The UNFFE website gives it wider exposure to national and international audiences. Districts without internet connection formerly now have access to updated information from the UNFFE website. Several farmers have been trained on accessing and using information accessed from the world space radio/channel.

4.4 Best-practice ICT Interventions in Uganda's Agricultural Sector

Although there are various ICT options that have been employed in the agricultural sector in Uganda, the mobile phone and radio have been identified as best-practice ICT interventions in Uganda's agricultural sector. These ICT options have been largely considered effective because compared to other options, they are more readily accessible especially in terms of cost, easy to use, and are largely applicable in farmers' livelihoods.

4.4.1 Mobile phone (SMS)

Beside radio technology, no other form of ICT has penetrated the rural communities of Uganda like the mobile phone. The mobile phone represents one of the best practice ICT interventions in the agricultural sector. It is not surprising that the mobile market is the biggest and fastest growing market in Uganda in the recent past. The mobile cellular subscribers have grown from 3500 in 1996 to 3,015,493 by March 2007. Various organizations such as CELAC, WOUUNET have placed mobile phones as one of the most effective tools for community mobilization and dissemination of information to farmers concerning market prices and market opportunities. The widespread use of the mobile phone by farmers in rural areas has proved worthy investing their money, time and effort. The phones are easy to use, affordable, and can be carried anywhere. With mobile phones, farmers automatically receive updates on market conditions. Phones have

eliminated unnecessary transport costs since farmers first make a call to ascertain payments and, they have supplemented their incomes through charging calls made in the case of village phones.

4.4.2 Community radio

The spread of mobile phones has created a synergy with the spread of private FM radio stations. Private Radio stations in Uganda have grown from 14 in 1996 to 158 by March 2007. The radio stations provide nearly total national coverage in local languages. Where radio used to be a passive tool for development information dissemination, it has become an interactive public tool and discussion forum through the popular phone-in programs. Daily programs range from topical issues on agriculture, health, education to political debates. Women in rural Apac, for instance, have established women listeners' group and gather to listen to the radio. Each of these groups has a mobile phone through which they receive information on market prices and with which they can phone into radio into Radio Apac for Question and Answer sessions. The women enthusiasm about both the radio and the mobile phones is high, as they are easy to use, create a sense of community belonging and does not require them to travel or to acquire complex technical skills. The user threshold and level of investment is relatively small and well balanced with the perceived gains.

5.0 CONCLUSIONS

Like in many African countries, improving the productivity of agriculture is a priority of Uganda. This is well articulated in the country's PMA and (PEAP). Experience in Uganda suggests that ICTs can play this role and reverse the declining per capita food production and increasing food insecurity facing Uganda agricultural sector. Research suggests that farmers need to access critical agricultural information. Ideal ICTs should be those owned by the government and driven by farmers, civil society, private sectors, and agribusiness in order in order to facilitate agricultural development.

Uganda, like many other African countries still lags behind developed countries in terms of technological developments in what has been referred to as an existing 'digital divide'. If it is true that ICTs are of instrumental value and possess enormous benefits, then this intra and inter technological gap is something that needs to be addressed. Uganda has adopted ICT policies that not only support the agricultural sector but also specifically target rural communities that are engaged mainly in agriculture. The RCDF Policy is testimony to this.

The development in technological infrastructure in Uganda like in other African countries is still lagging behind. The value of technology, however, has both intrinsic and instrumental benefits. The instrumental values of these technological developments have implications for agricultural productivity and poverty reduction. Intrinsically, ICT literacy is a must in the information society. The government needs to provide an enabling environment through providing the necessary resources, infrastructure and policy framework. The Uganda Communications Commission should work hard with appropriate line ministries and departments to allocate costs and invest in ICTs to bridge the technological gap.

In Uganda, ICTs are more available in the urban than in the rural areas. Access to ICTs across geographical areas of the country is mediated by the social constructs and boundaries of gender, class, and generation so that the men have better access than women, high income class than the low income class, and young than the old. Although Uganda has made considerable progress in the ICT sector, access to ICTs remains limited.

The government should pay serious attention to developing a better enabling environment for small ICT businesses – through training, incentive schemes, incubator centers, access to venture

capital and increased selection criteria for local participation in government procurement contracts. The present climate tends to support larger corporations and multinationals, leaving the local entrepreneurs at a disadvantage. This is unlikely for succeed in growing the ICT sector in the future.

Sustainability of ICT-centers, for example, Nakaseke multi-purpose center, Buwama and Nabweru telecenters, is important for the development of the ICT sector, and consequently the agricultural sector. Key factors in sustainability may include internal management and leadership, internal assets—the buildings, equipment and available services, local market—awareness levels, income levels, perceived relevancy, effective demand, local technical support, and equipment supplies.

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LIST OF ACRONYMS AND ABBREVIATIONS

ARENET	Agricultural Research Extension Network
BROSDI	Busoga Rural Open Source Development Initiative
CEEWA	Council for Economic Empowerment for Women of Africa
CELAC	Collecting and Exchange of Local Agricultural Content
CSO	Civil Society Organization
FICOM	Farmer Information Communication
GDP	Gross Domestic Product
GIS	Geographical Information System
GOU	Government of Uganda
ICT	Information and Communication Technologies
IICD	International Institute for Communication and Development
MTN	Mobile Telephone Network
NAADS	National Agricultural Advisory Services
NARO	National Agricultural Research Organization
NGO	Non Government Organizations
PEAP	Poverty Eradication Action Plan
PMA	Plan for Modernization of Agriculture
RCDF	Rural Communications Development Fund
UCC	Uganda Communications Commission
UCE	Uganda Commodity Exchange
UNFFE	Uganda National Farmers Federation
USF	Universal Service Fund
WOUGNET	Women of Uganda Network

Appendix 5a: Sample of initiatives for Selection of case studies for in-depth analysis

NAME OF ORGANISATION	AREA OF OPERATION	SERVICES OFFERED
WOUGNET	Apac district through Kubere Information Centre, mainly concentrate in Apac town council, Akokoro, Akalo and Balo Sub-Counties.	●Build capacity of women beneficiaries to enable them participate in agricultural radio talk shows. ●Training women farmers on the various functions of the mobile phone, which include retrieving agricultural short messages (SMS), information alerts from Celac project of BROSDI ●Organizes agricultural radio talk shows and encourages women farmers to ask questions using mobile phones ●Provides agricultural information to women farmers down loaded from the world space receiver which the centre acquired through collaboration between department of meteology and WOUGNET. Inside the centre, the receiver is connected to a computer which enables it through the receiver to receive data from space. The soft ware has two components which include the audio and multimedia.
FOODNET	The FOODNET project is a new type of regional agricultural research and development network focusing on market-oriented research and sales of value added agricultural products. FoodNet project works in ten countries which include Uganda, Kenya, Eritrea, Ethiopia, Burundi, Madagascar, DRC Congo and Sudan	●Identify market opportunities for increased sales of value added products. ●Identify varieties with specific nutritional / processing qualities for germ plasm enhancement. ●Identify, adapt and promote improved post harvest technologies with private sector partners ●Diversify product range from locally available crops for market expansion and improved Provide training to strengthen the capacity of the Network to deliver profitable agro-enterprises ●Develop postharvest information systems for increased access and

		exchange of information ●Catalyse the process of change from production to market oriented research in partnership with the ASARECA networks and private sector partners ●Enhance local, regional, Inter-centre and International co-operation in postharvest activities ●nutrition
INetWork	INetWork is a Non Governmental Organization working in all the regions and districts of Uganda to promote Knowledge Sharing, linking people, ideas and organizations to enable information exchange and networking activities. It is doing that through focused group meetings, seminars, physical and online publications, research etc.	● It organizes public debates, topical and regular seminars and online discussion group list to identify common constraints for which joint solutions are sought and hence contributing to sustainability of the projects. ●established and operates online and physical agricultural knowledge bank and an online discussion forum through a members only access website. Here members receive seminar and public debate presentations, research papers, the resource centre and electronic newsletters. ●INetWork brings together all IICD project partners to network and improve their initiatives through exchange of ideas and plans. It also facilitates resources optimisation through out the IICD projects in Uganda
BROSDI	The project has representation in all the four regions in Uganda, and promotes adoption of use of indigenous farming knowledge to particularly grassroot farmers that cannot afford modern farming inputs in order to realize a fruitful harvest. BROSDI works in the	● Use SMS as one of the ICT methods to disseminate and share knowledge in the CELAC project. ●Collecting and Exchange of Local Agricultural Content, is one of the BROSDI Project. It targets improving rural farmers' livelihoods

	districts of Mayuge, Luwero, Apac, Masaka, Palisa, Kamuli, and Iganga	and food security through engaging the government and the civil society in knowledge sharing and information management using ICT methods ● Use other ICT methods for sharing indigenous knowledge (local content) such as informational website, radio cassettes, telephone calls and SMS, newsletters, brochures, knowledge sharing forums and fairs. ● Established Village Knowledge Brokers who send local content in form of SMS to the CELAC Staff, which is in turn forwarded to all other farmers attached to the project and others that may request for it. ● Rural credit and rural financial services - improvements in access, reach and flexibility through ICTs. ● “Louder” rural and agricultural stakeholder voices using ICTs to yield improved access to decision makers to influence policies, regulations and procedures that directly impact rural livelihoods.
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APPENDIX 5: BACKGROUND PAPER ON ICT POLICY ENVIRONMENT AND THE USE OF ICT-BASED INTERVENTIONS IN AGRICULTURE: THE CASE OF MALAWI

Julius H. Mangisoni³

ABSTRACT

Agriculture is a key sector in the economy of Malawi. However, agricultural marketing is constrained by high transaction costs, high risk, missing markets and lack of social capital or collective action. Given the high transaction costs, the costs for organizing and effecting the exchange of goods and services increase the cost of marketing agricultural products and create artificial barriers to smallholder participation in a number of agricultural ventures. Agricultural marketing information system can transmit timely and efficient market and price information to both buyers and sellers. Relevant information on the prices and available markets can equip smallholder farmers' ability to be organized and to negotiate for higher prices for their produce.

IDEAA MACE is a project underway in Malawi that harnesses the power of ICT to provide such information to farmers and buyers and is based on a market information system encompassing market information centers, market information points, short messaging, a website and radio programs. Despite constraints associate with cost of electricity, telecommunication and transport, initial indications are that the use of ICT has potential reduced transaction costs, marketing risks and increased returns to participating farmers.

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1.1 Prominent/symbolic role of agriculture

Agriculture is the most important sector of the Malawian economy. It contributes 45 percent of the Gross Domestic Product (GDP), 87 percent of the total employment, 64 percent of total income for rural people, supplies 65% of raw materials to agro-industry and accounts for 90 percent of the foreign exchange earnings (Mloza-Banda, 2006; Chinsinga, 2007).

The agricultural sector has two main sub-sectors-the smallholder sub-sectors that contribute more than 70 percent and the estate sub-sector that contributes less than 30 percent to GDP originating from the agricultural sector. The smallholder agricultural sub-sector in Malawi cultivates mainly maize, the main staple grain, to meet subsistence requirements while the estate sub-sector focuses on high value cash (export) crops such as tobacco, tea, sugar and coffee. Additional crops grown by smallholder farmers are rice, cotton, tea, sugarcane, coffee, sorghum, millet, cassava, sweet and Irish potato, groundnuts and vegetables (Mloza-Banda, 2006).

Smallholder farmers cultivate on small and fragmented land holdings under customary tenure where yields are comparatively lower than in the estate sub-sector. Farming is done on arable land where 85% of the total is under cultivation. The average land holding size is 0.5 hectares for more than 45% of the smallholder farmers. Indeed, Malawi Government (2001; 2006) noted that owing to population pressure, resulting in the fragmentation of land, the national mean land holding size has fallen from 1.53 ha per household in 1968 to 0.80 ha per household in 2000.

1.2 Government policy on agricultural development

Development strategies and policies in Malawi since independence have been heavily biased towards agricultural development, but the implementation of these policies has not yielded sustainable outcomes. Substantial resources have been devoted to the agricultural sector for the development of both estate and smallholder agriculture. Today, Malawi continues to suffer from some food insecurity at household level with many of the problems being structural and economic in nature. Agricultural exports remain undiversified and there has been little value addition. Malawians remain poor with 44 percent of the population living below the poverty line and 22.4 percent barely surviving (National Statistical Office (NSO), 2005). Most of the socio-economic indicators illustrate the depth and intractability of poverty. For example, the levels of malnutrition remain high, with 43.2 percent of under five children being stunted and 22 percent being underweight in 2004 (NSO, 2005).

The Malawi Growth and Development Strategy (MGDS) is a medium-term strategy (2006/07-2010/2011) of the Malawi Government to attain the nation's Vision 2020. The main thrust of the MGDS is to create wealth through sustainable economic growth and infrastructure development as a means of achieving poverty reduction. This is expected to transform the country from being a predominantly importing and consuming economy to a predominantly manufacturing and exporting economy. The MGDS represent a policy shift from social consumption to sustainable economic growth and infrastructure development and places emphasis on six key priority areas including agriculture and food security; irrigation and water development; prevention and management of nutrition disorders; and HIV/AIDS. These six key priority areas are expected to accelerate the attainment of the Millennium Development Goals (MDGs) in the areas of health, education, gender, environment, and governance. The integrated rural development is expected to rejuvenate the rural economies and transform them into potential engines for economic growth that translate into increased redistribution of wealth countrywide. The MGDS also identifies five thematic areas in which progress must be made if the overall strategy is to be successful. These thematic components of the MGDS are sustainable economic growth, social protection, social development, infrastructure development, and improved governance. The emphasis on agriculture in the MGDS is to increase the contribution of the agricultural sector to economic growth through production of food crops and value addition for domestic and export markets. The MGDS identifies four areas of emphasis in agriculture: increasing agricultural productivity and food varieties; increasing value addition to agricultural products by smallholder farmers and orienting smallholder farmers to greater commercialization; strengthening the linkages of farmers to markets through infrastructure development; and enhancing irrigation and water development (Malawi Government, 2006).

In an attempt to harmonize policies, the Malawi Government has recently reviewed the various national development strategies, agricultural strategies and agricultural-related legislations and policies, and produced an Agricultural Policy Framework (APF) that summarizes the objectives of agricultural development, strategies and policies that will be pursued to achieve both stated and commonly perceived agricultural objectives (Malawi Government, 2006). The APF identifies five broad areas of focus as priority pillars in achieving sustainable agricultural growth and development. These pillars include food security and risk management; agri-business and market development; land and water management; research, technology and dissemination; institutional development; capacity building including gender; HIV and AIDS; and information technology development.

In the 1980s Malawi developed an agricultural credit, input and extension policy. This policy involved the selling of a fixed input package of maize and fertilizer to smallholder farmers at a lower price and interest rate. The selling of this package was administered through the Smallholder Agriculture Credit Administration (SACA). The aim of the policy was to increase the production of high yielding maize varieties in order to ensure food security. The achievement of the policy was increased share of high yielding hybrid maize land, which was 8% in 1985 to 25% in 1992 (Zeller, Diagne and Mataya, 1997). Over the years Malawi has adopted a number of strategies. Currently, Malawi is pursuing an agricultural strategy that aims to enhance agricultural productivity, promote food

security and facilitate agro processing for both domestic and international markets (Malawi Government, 2006).

1.3 General constraints to smallholder access to high-value markets and market information

In Malawi, markets can be grouped into local, regional and international. Local markets embrace unregulated transactions between farmers, from farmers directly to consumers or from farmers to private traders and marketing boards. Regional markets have come in the wake of increased recognition of the importance of regional integration to override the problem of small market size in Malawi and to achieve economies of scale and efficiency in production and marketing. These markets are regulated with clearly defined grades and quality standards. International or overseas markets are much more complicated with exacting marketing regulations including grades and standards, quality manufacturing processes and safety regulations. Such markets are much more difficult to penetrate.

In Malawi, agricultural marketing is constrained by high transaction costs, high risk, missing markets and lack of social capital or collective action. Transaction costs are linked to problems of licensing; absence of grades and standards, lack of marketing information, poor access to markets, weak entrepreneurial skills and high marketing margins. High risk, on the other hand, embraces weak policy environment, lack of legal framework and high price volatility, while missing markets includes lack of value adding or agro-processing, weak infrastructure and lack of credit. Lack of social capital relates to weak farmer organization. These marketing problems are discussed individually and in more detail below.

1.3.1 Transaction costs

Marketing of agricultural products has over the years been the monopoly and monopsony of the Agricultural Development and Marketing Corporation (ADMARC), a parastatal marketing board. From the advent of agricultural market liberalization in 1987, private traders have been allowed to engage in marketing of both inputs and agricultural products. However, unlike marketing boards, private traders are required to acquire licenses in order to engage in buying and selling of the smallholder products. The Ministry of Agriculture or Trade and Industry often issues the licenses and the process sometimes takes weeks or months, especially when the private traders aspire to export agricultural products or to import agricultural inputs. This adversely increases the transaction costs to prospective traders. In other words, the complex regulatory system acts to exclude any new entrepreneurs, discourage innovations and increase prices paid by consumers. This is contrary to the argument that regulations should be introduced to augment markets other than replacing them (Cadwell, 2002). Because of lack of organized markets for horticultural products in Malawi, the issue of licenses is not relevant. Horticultural products are typically traded without much regulation from the government.

With the exception of crops such as tobacco, tea and coffee, which are sold using an auction system, most smallholder crops have no clearly defined grades and standards. Horticultural crops in rural and even in urban areas are mostly sold using bunch or heap

method, while cereals are sold using either the heap method or plateful method without adhering to any weights and measures. However, for those smallholder crops such as maize and grain legumes, which may be sold via marketing boards, some form of rudimentary grades and standards are instituted but no regulatory body exists to ensure that the grades and standards available for some of the commodities are adhered to. The absence of well-defined grades and standards mean that smallholder farmers just like consumers do not get a fair value for the commodities they trade in.

Labelling is virtually not done for raw agricultural products sold in rural markets in Malawi. Some form of labelling is done for processed agricultural products but even for such processed products, there is not much information on the nutritional content or the means to verify any claims made on the product packaging.

Acquisition of marketing information is a serious handicap to smallholder agricultural development in Malawi. Farmers rely on friends, relatives and extension agents for market information. Because such individuals may not have up to date and reliable market information, the usefulness of the information is doubtful. Market information needs to be accurate and timely to benefit all the participants in the market. As part of the market liberalization program, the Ministry of Agriculture of Malawi in the early 1990s instituted a mechanism under a World Bank-supported Agricultural Marketing and Estate Development Project to collect and disseminate market information for the consumption of farmers and traders. This initiative was limited to the collection and dissemination of agricultural commodity prices through the radio and the major print media.

The mechanics of implementation involved Extension Planning Area personnel. These were mandated to collect weekly price data on selected agricultural commodities including maize, cassava, sweet potatoes, beans, sorghum, rice and groundnuts. The prices were then transmitted to the Planning Division of the Ministry of Agriculture Headquarters in Lilongwe. The Marketing Section of the Planning Division in turn summarized all the price information from all the markets throughout the country. The information was then passed on to the Malawi Broadcasting Corporation and Daily News Papers for announcement/dissemination to the whole country. It was hoped that this would reduce search costs and the price differentials would assist traders to go where prices were lower to effect arbitrage to high cost areas. The impact of this initiative was limited because it not only relied on limited channels of information dissemination but it also had limited focus. It appears that no attempt was made in the planning stages to assess the type of information that would be useful to farmers, traders and consumers and also the best ways to disseminate such market information for it to have maximum effect.

Education levels are quite low in Malawi such that assimilation of technical and market information is impaired (World Bank, 2008). For example, farmers lack entrepreneurial or business management skills especially in areas of financial, marketing and production management. Such information requires that an individual attains a critical mass of education, has requisite knowledge of market opportunities, has greater work experience and has good management capabilities (Henson, *et al.*, 2008). The supply of individuals with such caliber is limited in the rural areas of Malawi. Furthermore, access to services

is poorly distributed within communities and the massive poor infrastructure and low effective demand make the introduction of institutions a necessity for risk sharing and for achievement of economies of scale in the provision of the agricultural services in the rural areas.

Good roads, transportation and communication are prerequisites to market access particularly to those potential market participants who reside in rural areas. In Malawi, lack of good rural infrastructure constrains farmers' supply response to any incentives in both agricultural production and marketing. Deterioration of rural roads and inadequate telecommunication networks in the rural areas compound poor access to markets. This development has made traders to operate over short distances, thereby restricting inter-regional arbitrage of commodities. As a result, transportation costs are too high for farmers and traders to get any meaningful benefits from their trading activities (Kheralla *et al.*, 2008; Kherallah and Minot, 2001).

High marketing margins are a serious marketing problem in Malawi. Average producer prices expressed as a percentage of the consumer price are as high as 75-90 percent in Asia while in Malawi; the range is from 30-60 percent (Longwe, 2003). The high marketing margins in Malawi are blamed on transport costs, government restrictions and poor communication network. The low marketing margins in Asia are due to greater market integration on the continent (Harrigan *et al.*, 1992).

1.3.2 Agricultural risk

Issues of high risk in the marketing of maize, legumes, oilseeds and horticultural products are linked closely to the weak policy environment, lack of legal framework and high price volatility, which conspire to weaken agricultural markets and in turn agricultural production in Malawi. Studies indicate that government trade restrictions, rules and regulations including licensing, which private traders face, help to increase transaction costs by as much as 20 percent of the marketing margin (Longwe, 2003).

Faced with these constraints, private traders are not able to benefit much from economies of scale because they individually use trains or trucks to transport their produce instead of collectively hired trucks. In addition, licensing requirements increase the risk of investing in capital such as trucks and storage facilities. This is particularly so if the traders feel that there are high chances that the license can easily be revoked.

Under such circumstances, privatization with suffocating regulations may not yield benefits that are significantly different from the public system it is expected to overthrow. Related to risk are the problems of property theft, poor quality, payment problems, and disagreements over measures and ex post renegotiation with suppliers. Furthermore, many elements of market transactions farmers in Malawi engage in are unenforceable and sometimes not known.

High price volatility is linked to the nature of agricultural commodities. The agricultural commodities are seasonal but consumption is all year round. Farmers, due to immediate cash needs and lack of storage facilities, often sell their produce soon after harvest. This

practice floods the market with products leading to unwelcome further reductions in prices, much to the detriment of the farmers' profitability position.

Lack of regular output markets every year can be traced from subsistence requirements and the geographical isolation of the farmers. In Malawi, supply and demand functions often move in opposite directions in years of plenty and years of scarcity, which increases the variability of food prices compared to a situation where only one of the functions shifts (Goetz, 1993). This makes Malawian markets not only highly unreliable but also highly unpredictable and provides very little information useful for coordination and incentive signals to entrepreneurs. The research question therefore is how can regulations be fine-tuned to enhance marketing activities? Another question is what incentives should there be for farmers to engage in storage and agroprocessing in order to reduce market risk? (Goetz, 1993).

1.3.3 Missing markets

Lack of agro-processing is part and parcel of missing markets. Other components of missing markets include lack of credit/financial services and weak infrastructure.

Although cereals, grain legumes, root crops, oil seeds and horticultural products are important and widely grown in Malawi, their potential has not been fully realized because of the rudimentary technology used, especially in production and agro-processing at the rural/farm level. This state of affairs leads to significant losses of the products during traditional harvesting, drying, storage, processing, and marketing. If the technology was improved and the farmers were better organized, most of the post-harvest losses could be significantly reduced and in the process enhance the quality of the products.

The need for transforming the current smallholder agriculture from its current status of being a subsistence way of life into smallholder farm enterprises has not been aggressively pursued. There is also lack of emphasis on adding value to primary products in a local resource-based industrialization approach. The development of agriculture as a provider of raw materials for the food processing industry has also not been fully exploited.

When confronted with situations of missing markets, Malawian farmers have tended to rely on extended family relationships and on engagement of labourers for the entire duration of the growing season or longer periods. Due to unreliability of the markets, the extended family relationship acts as an important insurance policy for the farmers to both spread the noncovariant risk and to allow some form of specialization in the different agricultural tasks that are performed on the farms.

Farmers are able to get cash crop inputs in a number of ways: purchase from the market; carryover seed and borrowing from marketing boards. Parastatal marketing boards have historically been used as the key conduit for introduction of new crop varieties to farmers as well as for the thorough distribution of inputs either on cash or credit basis to the farmers. The credit, which was channeled through the parastatals, greatly helped to reduce liquidity constraints among farmers.

The credit was most important because it was provided just before planting. If the credit was provided immediately after harvest, when rural cash balances were quite high, it would have been of much less consequence to farmers. Although parastatals have often been accused of opportunistic behaviour, they assured farmers of crop buying points and a guaranteed price for each crop.

Despite ADMARC, in collaboration with the Malawi Rural Finance Company (MRFC), being involved in credit disbursement, the majority of the smallholders in Malawi do not have access to credit. It is estimated that less than 20 percent of input purchases in Malawi are on credit. The most common form of borrowing in Malawi is from friends or relatives and usually this is for handling short-term emergencies. Credit is mostly available to cash crop farmers. Thus, available credit institutions have only managed to service a small segment of the population (Kherallah and Minot, 2001).

The problem still exists in Malawi on how to services the large majority of the poor rural people who have no collateral. Studies to critically examine how credit can effectively be made available for firm expansion and for securing economies of scale in trading activities of farmers and traders are lacking. For instance, it should be useful to study how contract farming and out-growers schemes can effectively help to link the supply of input credit and the purchase of both export and non-tradable domestic crops. It should also be useful to assess how the private and public sectors can be used to increase supply of rural credit to farmers on a sustainable basis.

On the input side, no market exists for wage labour, and no regular market exists for output every year. Under the prevailing situations of low technology, the implication of this is that the marginal product of the employer and the employee are equal to each other to the extent that the employer gets no remuneration for supervising his/her labourers. Private credit markets do not exist because land is owned by the community and not by individuals. As such, the land can neither be sold nor be used as collateral to get a loan (Goetz, 1993).

In the face of missing markets, particularly food and labour markets, when cash crops are introduced into the farming community, intrahousehold specialization takes place where transactions take place within a household as opposed to across markets. Consequently, dominant relationships develop between factor and labor markets.

Introduction of cash crops helps to reduce cash constraints at planting time because such crops usually come with a credit input package. In addition, the price risk as opposed to yield risk is removed because cash crops come with a regular marketing system.

A last advantage of cash crops is that they are often accompanied by modern technology that may help to improve yields on limited amount of land. With the emergency of cash crops and equipment such as treadle pumps and ploughs that may come with it, access to private credit may be possible since such equipment may be used as collateral. However, private credit continues to be an extreme constraint both from the demand point of view

and the supply point of view. This is often due to the absence of land market and the yield uncertainty associated with rainfed agriculture.

Food crops grown locally do not have reliable or regular markets. Insurance markets in the smallholder sector are often non-existent. Under such situations, households are forced to store their own food. Because of the very high transaction costs between uncertain food crop production and households, it is often imperative that farmers choose to produce a large variety of crops as opposed to specialization. Specialization only occurs internally in terms of labour, other inputs and food.

1.3.4 Institutional constraints

The institutional constraint of lack of social capital often has the underlying problem of weak farmer organizations. Farmer organizations empower farmers to effectively manage their farming business, including processing. On the production side, the organizations would work out cost-effective ways of procuring inputs in bulk in order to enjoy economies of scale in both procurement and transportation. On the marketing side, farmers in an organization have a stronger bargaining position, which minimizes exploitative tendencies of unscrupulous traders. This also allows farmers to get better prices at the market leading to higher profits and better standards of living.

In Malawi, there is limited social capital or collective action. As a result, farmers have reduced marketing power and are much more vulnerable to exploitation by unscrupulous businesspersons. Problems of access to capital and markets as well as high transaction costs are intimately linked to lack of social capital or collective action. For example, about ten percent of markets in Malawi have trader associations (Kherallah and Minot, 2001).

Given the very high transaction costs, the costs for organizing and effecting the exchange of goods and services increase the cost of marketing agricultural products and create artificial barriers to smallholder participation in a number of agricultural ventures such as dairy production. In Africa, apart from high marketing costs, markets are often scattered and there is a definite risk of engaging in marketing of time constrained perishable agricultural products such as milk, fruits and vegetables (Holloway *et al.*, 2000). For such commodities, farmer cooperatives would reduce the marketing costs (Longwe, 2003).

1.4 Role of agricultural information in resolving market failure

Despite low prices in developing countries, the prices at the international market have relatively been high and the prices of agricultural commodities have been varying spatially. This is a case of market failure. To solve the problem of market failure, agricultural information is believed to be one of the solutions (Initiative for Development and Equity in African Agriculture (IDEAA), 2007).

Agricultural marketing information can transmit timely and efficient market and price information to both parties-buyers and sellers. Relevant information on the prices and available markets can equip farmers' ability to be organized and to negotiate for higher prices for their produce. For example, if the advantages of forming a cooperative are

presented to farmers, they may choose to form one, which will then help the farmers to have a collective voice that may stand against low prices offered by buyers.

2. Background and setting

2.1 Past /initial response to constraints

The Malawi Government pursued a policy of promoting private sector participation; providing incentives through market and price liberalization; increasing producer prices for export crops and rehabilitating rural infrastructure. The smallholder sector from 1964 to about 1983 enjoyed subsidized fertilizer and hybrid maize seed prices. However, Government policy from 1993 was to remove subsidies on all inputs. The time profile for phasing out the program was to bring overall subsidy rate for fertilizer to not more than 30 percent in 1990/91, 25 percent in 1991/92 and 20 percent in 1992/93. Total subvention as a proportion of government expenditures was planned to be equal to or less than 2 percent in 1990/91, 1.6 percent in 1991/92; and 1.3 percent in 1992/93. These targets were closely followed by government except in 1992/93 season when adverse weather and other circumstances forced government to negotiate for an allocation of MK25 million in subvention for fertilizer. This raised government subvention expenditure to 1.4 percent from 1.3 percent of total government expenditure (Ng'ong'ola, 1995).

High analysis fertilizers (urea and di-ammonium phosphate) continued to be subsidized but on a declining scale. The 1993/94 subsidy rate was 11 percent; 5 percent in 1994/95 and completely phased out in 1995/96 (World Bank, 1994). In the 1994/95 season, the government completely phased out all subsidies on hybrid maize seed. However, core poor farmers were provided with free seed and fertilizer through a Drought Recovery Program (Ng'ong'ola, 1995).

The production and marketing of hybrid maize seeds were liberalized in 1993/94. As a result, both the estate and smallholder subsectors purchase seeds and agro-chemicals from the private sector.

In 1998/99 the Ministry of Agriculture in Malawi launched a free input program called Starter Pack Scheme (SPS). The purpose of the SPS was to increase fertilizer and other input accessibility to resource-poor farmers. About 2.86 million smallholder farm families benefited from this initiative. The SPS involved free inputs consisting of sufficient fertilizer and seeds (cereals and legumes) to plant 0.1 hectare. Total production in each year of SPS was 2.5 million tons, representing almost 0.5 million tons increase in production. Two years later, the SPS was changed to Targeted Input Program (TIP). The TIP was implemented until the 2004/05 agricultural season. The Malawi Government, the United Kingdom, the European Union and the World Bank supported the two initiatives (Mangisoni, *et al.*, 2007).

In 2005/06 the Malawi Government introduced and continues to implement a fertilizer subsidy program using the voucher (coupon) system where eligible poor households are issued input coupons to purchase fertilizer, mostly for maize production (Urea and 23:21:0+4S) and for tobacco production (CAN and D-compound). This program has

allowed the participation of the private sector because the coupons are redeemable at eligible shops (Mangisoni, *et al.*, 2007).

The voucher system in Malawi was first tested in 1999 alongside the starter pack program. The pilot voucher project distributed two different types of vouchers in a test to see whether a voucher distribution system was more effective than distribution of a bulky package of free inputs, and if so, which kind of vouchers was most effective. Thus, the study evaluated and examined the differences between three distribution systems, i.e., the starter pack, starter pack voucher, and flexi vouchers. The analysis also looked at how the three alternative grant distribution systems impacted rural households and whether the impacts depended on particular household characteristics such as gender and marital status (Gough *et al.*, 2002). The results showed that the most economically enhancing tool for smallholder farmers, especially the poorest, were flexi vouchers. Distribution of flexi-vouchers or similar tools allowed households to have freedom in the selection of goods. Furthermore, flexi-vouchers increased cooperation from retailers and this in turn increased smallholder farmers' access to fertilizers (Mangisoni, *et al.*, 2007).

The Malawi Government liberalized pricing and marketing policies for smallholder crops in 1987. This move allowed the entry of private traders into smallholder crop trade, except tobacco and cotton. The restriction on cotton was removed in 1991 (World Bank 1993). This was done to force ADMARC to focus attention on price stabilization and management of strategic grain reserves (World Bank, 1993).

In 1994, the marketing of all tobacco was liberalized. This opened up alternative markets for farmers: selling directly to auction floors and selling to ADMARC or any other intermediary buyer. Prior to 1994, ADMARC was required to purchase all sun-air cured and fire-cured tobacco offered for sale by smallholders (Ng'ong'ola, 1995).

The Malawi Government no longer offers food subsidies to consumers in Malawi. However, since ADMARC sets breakeven prices, local market prices to consumers were higher than ADMARC's. In this way ADMARC continued to indirectly subsidize consumers (Ng'ong'ola, 1995).

The government continued to set floor and ceiling prices for smallholder maize because of its importance for food security. The prices of maize were set with the purpose of stimulating production in order to achieve food security for the country. Before the price decontrol was effected, the prices of the other crops were supposed to be set according to export parity price calculations. However, Ng'ong'ola (1995) observed that this had never been the case. He reports "For instance, nominal protection coefficients show that smallholder producer prices for rice, groundnuts and cotton were far from their export parity levels in 1991/92 than they were in 1987/88 and that although the situation had improved with respect to tobacco, producer prices were still some way from the export parity levels".

Apart from setting minimum prices for some crops, the Government of Malawi, through the Ministry of Agriculture and Food Security is promoting the culture of business among

farmers by encouraging them to take farming as a business. Government has agribusiness officers in most District Rural Development Project offices (DRDPs). The agribusiness officers encourage farmers to form associations and cooperatives.

Radio stations are being used to provide technical advisory services and information about alternative market opportunities to farmers. Currently, the Ministry of Agriculture and Food Security has 41 field assistants who collect agricultural prices in different markets. The market prices are then sent to the Ministry Headquarters and later to the radio stations for dissemination to users (IDEAA, 2007).

Several farmer organizations have been born that are encouraging farmers to be in groups and to sell as a group. Such farmer organizations are National Smallholder Farmers Association of Malawi (NASFAM) and Farmers Union of Malawi (FUM). Under FUM there are a number of associations such as Paprika Association of Malawi, Tobacco Association of Malawi, Grain and Legumes Association, Zipatso Association and Mzuzu Smallholders Coffee Association. Both FUM and NASFAM encourage farmers to form associations and cooperatives in order to increase their bargaining power. Some associations have access to high-value international markets. For example, an association in Mchinji District exports groundnuts to the United Kingdom (NASFAM, 2008).

The mission of FUM is to promote the advancement of farmers in Malawi. FUM is committed to achieve its mission through promoting and protecting farmers' interests; lobbying for favourable policies; facilitating the dissemination of market information; providing technical skills for improved production and quality of produce and creating linkages and networking with other relevant organizations (FUM, 2006).

Other than promoting the formation of farmer groups, NASFAM has a branch called NASCOMEX that is directly involved in the purchase of farm produce. It is believed that NASCOMEX buys agricultural commodities at higher prices than other buyers.

2.2 Government Policy on ICT

Realizing the role of ICT, the Government of Malawi formulated its ICT policy in 2003 and 2006. The overall goals of the policy statement are:

- To address Malawi's developmental challenges and accelerate the nation's socio-economic development process to improve the socio-economic well-being of its people, through the development, deployment and exploitation of ICTs within the society and economy;
- To implement within a given time-frame an ICT-led socio-economic development policy on which to base a number of rolling Action Plans set within the wider socio-economic development objectives, and priorities of the Vision 2020 and other socio-economic development frameworks of Malawi;
- To engineer an ICT-led socio-economic development process with the potential to transform Malawi into a middle income, information-rich, knowledge-based and technology driven economy and society.

Some of the objectives of the ICT policy are:

- To develop the Malawi economy into a middle-income economy through trading in ICT products and services.
- To develop an export- oriented ICT industry.
- To transform Malawi into an ICT aware and literate nation.
- To transform the Malawi economy into an e-economy.
- To develop an e-government, in order to modernize and pick up the efficiency of the Public Service.
- To develop a highly competitive ICT-driven value-added services sector.
- To transform the Malawi educational system using ICTs.
- To strengthen national information and documentation.
- To improve the ICT human resource capacity of Malawi to meet the changing demands of the economy.
- To develop the legal, institutional and regulatory framework and structures required for supporting the development and utilization of ICT in Malawi.
- To promote research and development in ICTs in Malawi.
- To promote ICT standards and best practices.

The ICT policy has 8 thematic areas, which are:

- Strategic leadership for ICT for development.
- Human capital.
- Governance.
- ICT Industry.
- ICT Infrastructure.
- Growth Sectors.
- Community.
- Legal and Regulatory Framework.

The Government, through the ICT policy, has outlined specific targets to achieve in agriculture. The government has committed itself to promote ICT in agriculture in order to, specifically, promote the utilization of ICT in agro-business industry; support and promote research in agricultural production and processing; strengthen agricultural extension and promote the deployment and exploitation of ICTs to support different activities. Some of the support activities include production, processing, marketing and distribution of agricultural products and services (Government of Malawi, 2006).

Some of these commitments are not exclusively new in Malawi. The Ministry of Agriculture and Food Security uses computers in its day-to-day business such as analysis and dissemination of agricultural data. The Ministry also used to announce prices of different commodities through the radio and print media. Currently, the Ministry produces pamphlets, newsletters and leaflets to disseminate market information.

3. The upsurge of ICT-based strategies

Of late private players seem to have very good ICT innovations in agriculture. Some of them are IDEAA, Celtel and Telekom Networks Malawi. Towards the end of 2007,

Celtel Malawi, a network provider, introduced cheap cell phones aimed at enabling farmers access them in order to facilitate the marketing of their produce. A similar initiative was followed by Telekom Networks Malawi.

Farmers and buyers obtain prices of different commodities from market information centers, which were established by IDEAA. The process works in this way. A farmer leaves the details of a commodity and other relevant specifications at the market information centre, where an interested buyer obtains market information and follows up on the farmer who supplied the information. Alternatively, buyers leave their desired characteristics of a specific commodity they demand. Farmers then get the information from the market information centre and s/he follows up on the buyer (IDEAA, 2008).

IDEAA's mission is to enhance farm gate prices, incomes, and food security, reduce poverty and enhance wealth creation in the agricultural sector for the benefit of the resource poor farmers in Malawi. Its objectives are to: (a) ensure that agribusiness opportunities available under the liberalized market environment contribute to the creation of wealth in the agricultural sector for the resource poor farmers in Malawi and eventually lead to reduced poverty; (b) make agriculture markets work better for the resource poor farmers and lower the market risks and transaction costs that hinder market development in Malawi; and (c) enhance farm productivity, farm gate prices, incomes, food security, and reduce poverty in the agricultural sector and the national economy at large. IDEAA is guaranteed by the University of Malawi's Bunda College of Agriculture but is currently undergoing registration as a Non Governmental Organization.

The background to IDEAA is that between 1981 and 1994, Malawi implemented several adjustment programs supported by the International Monetary Fund (IMF) and the World Bank. Given that Malawi is an agro-based economy, many of the reforms were focused on the agricultural sector. The first key reform was price decontrol, which was aimed at allowing market forces to drive resource allocation in production. Second, market liberalization was intended to foster competition and ensure that smallholder farmers get good input and producer prices. In the process ADMARC, a parastatal got restructured several times to allow freer markets under the liberalized environment. The degree of smallholder farmer dependence on ADMARC for the purchase of inputs and marketing of crops declined steadily and private sector participation increased. However, the impact of these reforms on the smallholder farmers has not been very clear because of inefficiencies in both input and output markets due to lack of market information.

To develop agricultural markets, the liberalized markets must be strengthened by undertaking activities in a number of areas including development of sustainable functional agricultural marketing information system, which would transmit timely and efficient market and price information to both buyers and sellers. Recognizing the marketing challenges, IDEAA embarked on implementation of Malawi Agriculture Commodity Exchange (MACE) project as public/private sector led initiative with funding from the Rockefeller Foundation.

The overall goal of MACE is to make markets work better for the resource poor farmers, which would then lead to poverty reduction and economic growth. The specific objectives include the following: (1) facilitate linkages between sellers and buyers, exporters and importers of agricultural commodities; (2) empower farmers with relevant and timely market information and intelligence to enhance their bargaining power and competitiveness in the market place; (3) provide a transparent and competitive price discovery mechanism through the operation of the exchange trading floor; and (4) harness and apply the power of ICTs as a strategic tool for rural value addition and empowerment.

In conceptualizing MACE, cognizance was taken of past government efforts on market information, address their weaknesses but also in doing so recognize the development challenge that faces Malawi under the current poverty levels. MACE project is therefore based on three principles: (1) implemented as a public/private sector initiative in order to ensure that the resource poor farmers get access to the service; (2) cost recovery mechanisms based on gradual introduction for sustainability; and (3) commodity neutral agricultural marketing information system. Various channels are used among them harnessing the power of ICTs, Marketing Information Centres (MICs) and Points to ensure that the target beneficiaries get reached.

Marketing Information System (MIS) with various components has been established which harnesses the power of ICTs as a means of providing relevant and timely market information and intelligence targeted at smallholder farmers but also serving other market intermediaries in the commodity value chains who represent market outlets for the farmers. The system components include a central Hub based at IDEAA Malawi office in Lilongwe; MICs and Market information points (MIPs); a Short Messaging Service (SMS); a website and a radio program. The use of various communication channels or system components is aimed at ensuring that the farmer is linked to market outlets at various levels, from local, countrywide, regional and international markets.

The project beneficiaries are all smallholder farmers in the country but specifically the project targets traders and smallholder farmers who trade in the following markets: Mzuzu, Jenda, Ekwendeni, Lilongwe, Mitundu, Chimbiya, Limbe, Lunzu and Bvumbwe. Other beneficiaries are IDEAA staff, who are benefiting from capacity building while farmers are benefiting from both capacity building and the agricultural marketing service. In addition, the Ministry of Agriculture and Food Security extension workers benefit from capacity building as they assist the farmers.

MACE is being implemented in collaboration with a number of stakeholders through various partnerships. Some of the stakeholders are:

- i. Ministry of Agriculture and Food Security (MOA &FS): IDEAA MACE has an agreement with MOA&FS Joint Technical Secretariat in which the retail prices collected by MOA&FS enumerators from 45 markets across the country get disseminated through IDEAA MACE SMS system to all interested users and in turn the MOA&FS Joint Secretariat disseminates, through e-mail, trade opportunity information from MACE to all interested

NGOs. United States Agency for International Development (USAID) is supporting the activity through a project called Improving Agriculture Price Data, which aims at ensuring that the prices being disseminated are reliable and get disseminated in a timely manner.

- ii. Telekom Networks Malawi (TNM): IDEA MACE is in partnership with TNM in which MACE is a content provider for agricultural information while TNM has provided the communications link between the network's SMS to channel information and services to TNM's subscribers.
- iii. ICRISAT: IDEAA MACE has a partnership agreement with ICRISAT in which ICRISAT has been running a weekly agriculture information radio program comprising messages on groundnuts and pigeon pea production, which get aired together with price and trade opportunity information from MACE. The program also airs letters from listeners including responses to listeners' letters. IDEAA coordinates the program while ICRISAT provides funding for the program.
- iv. Global Sasakawa 2000: Follows a similar arrangement like that of ICRISAT for the radio program but Global Sasakawa 2000 provides messages on maize production.
- v. Farmer organizations and individuals: Deliberate effort is made to bring on board farmer organizations such as NASFAM in the use of ICT for agriculture information. In addition, through promotional activities, more individual farmers are able to use ICT for agriculture communication.

4. Constraints, opportunities and impact of ICT in Malawi

4.1 Constraints to ICT Development

MACE is still in its infancy stage. As such, despite the positive progress, MACE still faces a lot of challenges and weaknesses. Some of the main weaknesses include:

- i. Smallholder farmers need to be mobilized in groups/associations/cooperatives in order to effectively make use of the system. As individuals, smallholder farmers are too limited in scale of operation to benefit from the system in a financially meaningful manner.
- ii. The system has not been sufficiently promoted for access and use by potential users, especially smallholder farmers. Training, demonstration and awareness creation are required for widespread usage to be achieved.
- iii. Additional communication channels most applicable to the rural farmers need to be developed.

The effect of the above challenges are that ICT products developed by MACE such as SMS, telephones at the centers, and e-mail experience low usage by farmers who are the target beneficiaries.

At the national level, ICT development remains low in Malawi. Some of the statistics are given in Table 1 and they depict low usage of modern ICT interventions in the country.

Table 1: Some ICT statistics for Malawi

Description	Statistic	Year
Telephone main lines (per 1000 people)	8	2005
Mobile subscribers (per 1000 people)	33	2005
Internet users per 1000 people	4	2005
Personal computer per 1000 people	2	2005
Household with television (%)	3	2005
Price basket for fixed line (US\$ per month, residential)	5.8	2005
Price basket for mobile (US\$ per month, residential)	10.2	2006
Price basket for internet (US\$ per month, residential)	41.9	2005
Schools connected to the internet (%)	1	2005

Source: Malawi Government 2006

Several factors have contributed to the low ICT levels in Malawi. Some of these are:

- High cost structures in the economy including transport, telecommunications and electricity. Website, and e-mail need electricity. Access to electricity in rural areas is still limited. The cost of the cellphone itself is still beyond the economic reach of most farmers in the rural areas. This therefore calls for a deliberate policy or effort to have poor people access the phones, probably through a targeted cellphone voucher program.
- Lack of awareness of the value of ICT for development. Most people in Malawi still view the mobile phone as a device for talking to friends and family and not for serious business.
- Inadequate resources including human, financial, material, technological and capacity to train personnel.
- Tax burden on computers and other ICT products and services.
- Brain drain in the ICT sector due to low remuneration packages. Essentially, the brain-drain is at two levels, namely; from Malawi to other countries within the Southern African Development Community (SADC) region and from the public to the private sector.
- Proliferation of sub standard ICT schools, syllabi and service delivery.
- Underdeveloped research and development capacity in ICTs.
- Underdeveloped ICT private sector.
- Over-dependence on donor aid.
- Poor allocation and utilization of available resources.
- A low level of education resulting in high illiteracy levels that limit implementation of ICT programs. Adult literacy rate is at 64% for the ages 15 and above (Malawi Government, 2005).

Despite the constraints, some ICT programs have survived the test of time. Media communication has been the mostly used and successful program. Most smallholder farmers still rely on radio stations for agriculture information (Jha, 2008). In fact, radio communication forms more than 70 percent of mass communication in Malawi (Kaonga, 2008). Radio programs offer farmers market information and some technical advice. The Ministry of Agriculture and Food Security and of late the private sector use radio stations to disseminate their agricultural information. There are 19 radio stations with FM outlet in Malawi (Kaonga, 2008).

4.2 Opportunities for the use of ICT in agriculture

There are many opportunities for the use of ICT in agriculture in Malawi. The government's ICT policy will help farmers realize the need for the ICT in farming. The environment is therefore quite favorable due to this government interest in ICT. Government specifically intends to first, promote the exploitation and utilization of ICTs in the production and processing of non-traditional export commodities to enhance the foreign exchange earning power of the country. Second, the government plans to promote the establishment of electronic agriculture information systems to provide support for the planning, production, storage and distribution of crops, livestock and fisheries products. Third, the government intends to encourage market research through the use of ICTs to improve access to established foreign markets and to break into new markets for both traditional and non-traditional exports (Malawi Government, 2006). Smallscale operators in the ICT are mushrooming in Malawi. Several shops have been opened who supply computers and computer accessories. An example of these is iT Centre. It sells desktops, notebooks and personal computers, monitors, projectors, printers, networks, digital cameras, power protection equipments and software. The future for iT Centre is promising as it is already a partner of HP, Microsoft and Sun Microsystems iForce and it has an official warranty center for Dell computers (Business mail, 2007).

Another point to note is the liberalization of the telecommunications industry in Malawi. Although there are only two mobile phone service providers in Malawi, Celtel and TNM, the country is soon going to have two more. The Malawi Communications Regulatory Authority (MACRA) has already started processing the certificate for the fourth mobile phone service provider. The third one was already issued a certificate but it has not yet started its operations. MACRA is also processing the certificate for a second fixed phone service provider in addition to the Malawi Telecommunication Limited (MTL).

In radio transmission, as already stated, Malawi has 19 radio stations now from 2 in 1998 (Kaonga, 2008). This is a good growth in the radio transmission. There are prospects that more radio stations will be opened in Malawi especially in the rural areas.

The Government is also making efforts to ensure that computer lessons are taught in secondary schools. Some secondary schools are given computers, which students can use. Later the program will be extended to all schools in the country.

The general macroeconomic environment suggests, with no doubt, that the economy is good for investment. The inflation rate has been falling since 2000 from 37 percent to

8.6 in 2007 (Business mail, 2007). It is now at 8.4%. The exchange rate has been stable for some years now. Now it is at MK140 per US dollar. All these are happening amidst the falling interest rate. The central bank of Malawi has been cutting the base-lending rate for the commercial banks, which have translated to lower interest rates for borrowers of capital. The current interest rate is at 20% from over 40 percent in 2004.

For a long time commercial banks and other lending financial institutions showed little interest in rural communities in Malawi. But now this has changed. More financial institutions are opening their branches in rural areas (Business mail, 2007). Such commercial banks are the International Opportunity Bank of Malawi, which is exclusively targeting farmers. Such banks have also introduced Malswitch card, *Makwacha* card that helps farmers to get their money easily from the banks. The Government has also proposed a Development Bank to be called Malawi Development Bank. This will go a long way in helping farmers to access loans.

4.3 Research issue

The main research issue in Malawi is “*Understanding how ICT based interventions can make markets work better for smallholder farmers*”. The sub-research issue to be investigated is “*The effect of ICT based initiatives on marketing efficiency of smallholder farmers in Malawi*”. The underlying hypothesis is that “*The use of ICT will improve the efficiency of agricultural markets and enhance the bargaining power of farmers in the market place leading to higher prices, and farm incomes*”.

The key research questions are

1. ***What ICT based initiatives exist in Malawi?***
2. How do ICT based initiatives contribute to marketing efficiency?
3. How do these ICT interventions contribute to economic empowerment of smallholder farmers?
4. What challenges do MIS providers face in the execution of their activities?

The study will focus on mobile phones (SMS) and radio (phone-in programs) as the target ICT-based interventions. The proposed study crops are maize, beans and rice.

5. Conclusion

The Malawi Government is geared to the use of ICT in its development activities. The Government developed an ICT policy in 2003 and 2006 and through this policy the Government has outlined specific targets to promote ICT in agriculture. Specifically, the policy focuses on promoting the utilization of ICT in agro-processing industry, agricultural production and extension and promoting the deployment and exploitation of ICTs to support activities such as marketing and distribution of agricultural products and services.

Of late several private players such as IDEAA, TNM and Celtel Malawi have good ICT innovations in agriculture. Celtel Malawi and TNM introduced cheap cellphones that enable farmers access market information. In addition, a Marketing Information System

with various components which harnesses the power of ICTs as a means of providing relevant and timely market information and intelligence targeted at smallholder farmers while serving other market intermediaries in the commodity value chain has been established by IDEAA MACE in Malawi. The system components include a central hub at IDEAA Head office; Market Information Centers and Market Information Points; a Short Messaging Service, a website and a radio program. The use of various communication channels is aimed at ensuring that the farmer is linked to market outlets at various levels, from local to international markets. Although the target beneficiaries are smallholder farmers and traders in 9 markets in Malawi, through the website and radio programs the project is essentially covering the whole country.

Despite the success of the project, a number of challenges are experienced. First, smallholder farmers have limited scale of operations that cannot meet the needs of big buyers. It is therefore imperative that the farmers be mobilized into groups to exploit such market opportunities. Second, the cost of the cellphone is still beyond the economic reach of most smallholder farmers in the rural areas. This therefore calls for a deliberate policy or effort such as targeted cellphone vouchers for poor rural farmers. Other challenges include high cost of transport, telecommunication and electricity in Malawi that undermine the potential of ICT. The key research issue therefore is “*The Effect of ICT-based initiatives on marketing efficiency of smallholder farmers in Malawi*”.

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ABBREVIATIONS AND ACRONYMS

ADMARC	Agricultural Development and Marketing Corporation
APF	Agricultural Policy Framework
CAN	Calcium Ammonium Nitrate
FUM	Farmers Union of Malawi
GDP	Gross Domestic Product
ICT	Information and Communication Technology
IMF	International monetary Fund
IDEAA	Initiative for Development and Equity in African Agriculture
MACE	Malawi Agricultural Commodity Exchange
MACRA	Malawi Communications Regulatory Authority
MDG	Millennium Development Goals
MGDS	Malawi Growth and Development Strategy
MIC	Market Information Centers
MIPs	Market Information Points
MIS	Market Information System
MOA &FS	Ministry of Agriculture and Food Security
MTL	Malawi Telecommunication Limited
NASFAM	National Smallholder Farmers Association of Malawi
NSO	National Statistical Office
SACA	Smallholder Agricultural Credit Administration
SMS	Short Messaging Service
SPS	Starter Pack Scheme
TIP	Targeted Input Program
TNM	Telecom Networks Malawi

APPENDIX 6. BACKGROUND PAPER ON ICT POLICY ENVIRONMENT AND THE USE OF ICT-BASED INTERVENTIONS IN AGRICULTURE: THE CASE OF GHANA

Ramatu M Al-Hassan⁴, Irene Efua Egyir⁵ & Luke N. Abatania⁶

SUMMARY

Ghana's agriculture is dominated by smallholders who face constraints in access to information, technology, inputs and markets. Access of smallholders to markets has long been recognised as critical for their development; information and its effective delivery are essential for the development of efficient and profitable value chains which can open market access to smallholders. Traditional methods of field demonstrations, and one to one visits by extension agents have been used to deliver improved farming practices and technologies to farmers. This system is becoming inadequate because of increasing numbers of farmers, budgetary constraints on public extension system, and new information requirements of and about farmers. Interventions to improve access of farmers to information and improve management of smallholder systems now include the application of ICTs. This paper examines the nature of these initiatives, the success achieved and the challenges to be overcome. It is based on literature review and discussions with selected stakeholders. The initiatives emanate from government, donor development partners, civil society organizations and private sector and they usually involve an integrated service involving more than one partner, and targeting several aspects of the value chain (production to marketing). The types of ICT-based interventions used include more conventional ones such as radio, television, and videos and the more modern ones such as mobile telephony and SMSs, internet, and CD ROMs (for information storage). ICTs, such as GIS mapping and bar codes are also used by service providers to manage smallholder systems that are being developed for high value export horticulture. The opportunities for enhancing information by smallholders through ICTs are, rapid expansion and falling costs of mobile telephony, existing networks of service providers interested in promoting the application of ICTs in agricultural information delivery, rapidly expanding and popular community radios (which are often interlinked with use of the cell phone), and an ICT policy that recognises the information needs for modernising agriculture. However challenges of realising these opportunities are poor connectivity, unstable electricity supplies, sustainable funding mechanisms, and designing content that can have wide coverage and induce economies of scale.

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1. Introduction

ICT is a tool for improving the way that actors do what they do; it is a tool for improving the delivery of business/social services like advertising, extension services, and seller-to-buyer transactions. Information and its effective delivery are essential for the development of efficient and profitable value agricultural chains. Access of smallholders to markets has long been recognized as critical for their development; access to necessary information about product markets, production technologies, input markets and services is one of the challenges that constrain smallholders in accessing remunerative markets. Present initiatives to facilitate smallholder access to markets include use of ICTs. This paper examines the nature of these initiatives, the success achieved and the challenges to be overcome. The paper begins with an overview of agriculture in Ghana (including its role and the role of smallholders), the evolution of agricultural policy, the nature smallholder production and the challenges associated with smallholder production. This is followed by an overview of the ICT policy and the provisions in it for the modernisation of the agricultural sector. An inventory of ICT interventions from public sector and donor partners, Civil Society Organisations and the private sector is then presented and characterised according to areas of focus and loci, and the level of success achieved.

The paper is based on a review of literature and web-based resources, and discussions with, GAINS, GINKS, TradeNet, and GAPTO, the key organisations involved in delivery of ICT based interventions. There has been only limited research on the use of ICT in agriculture and in particular, smallholder interventions. Appendix 1 presents summary of studies identified. These are limited in scope, often addressing a specific issue on a commodity. The scoping study should lead to identification of a comprehensive action-type research on the application of ICTs in smallholder development.

1.1 Role of agriculture in Ghana

Agriculture is considered the mainstay of the Ghanaian economy. The traditional roles expected of the sector are employment, food security, raw materials for industry, source of foreign exchange. It employs between 50%-60% of the economically active population, in rural areas, the level of employment is more than 80%. Over the period 2000-2005, Agriculture contributed an average of about 40% to GDP over the period, 2000-2005 (Figure 1). Over the same period, agriculture contributed an average of 42.5% to the country's foreign exchange earnings (Table 1)

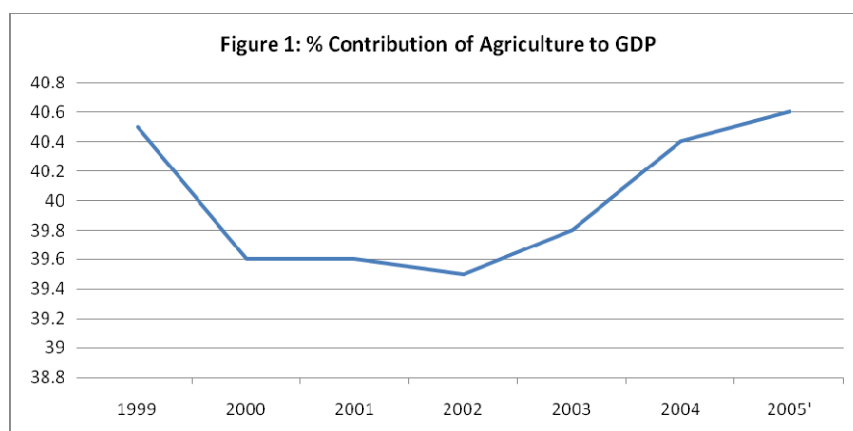


Table 1: Ghana Foreign exchange earnings (Mill USD)

Year	Total	Non-Agriculture	Agriculture	% Contribution of agriculture
1998	1830	1028	802	43.8
1999	2099	1290	809	38.5
2000	1941	1254	687	35.4
2001	1867	1235	632	33.9
2002	2064	1332	732	35.5
2003	2297	1182	1115	48.5
2004	2733	1290	1443	52.8
2005	2119	1077	1042	49.2
Average (2000-2005)				42.5

The poverty reduction role of agriculture has been a subject of recent research (for example, Al-Hassan and Jatoe, 2007, Al-Hassan and Diao, 2007; Aryeetey and McKay, 2004). This is because analyses of poverty patterns and trends since 1992 have shown high levels of poverty among farmers, especially food crop farmers. Poverty among food crop farmers is almost endemic with poverty reduction among this group lagging behind the rest of the country. In 1992, the national poverty level, based on head count ratio, was 52% compared to 64% and 68% among export crop farmers and food crop farmers respectively. By 2006, poverty levels had declined by 44% at the national level, and by 63% and 32% among export crop farmers and food crop farmers respectively; the poverty among food crop farmers has remained high at 46%. Al-Hassan and Jatoe estimate growth multipliers of about 2.46 from farm investments, and high poverty reduction elasticities in the range of 1.24 for poverty head count to 1.84 for poverty gap and 2.20 for severity of poverty index. They also estimate that agricultural productivity reduces food price escalation and is therefore a source of food security for net food buyers such as urban poor.

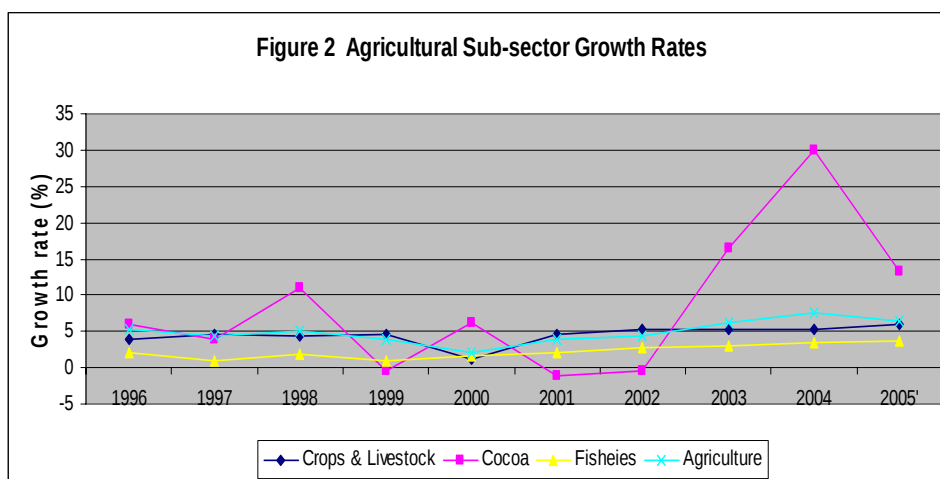
Other roles of agriculture recognised in the country are social stabilisation, buffer during economic shocks, support to environmental sustainability, and cultural values (Wilson et al., 2003) associated with farming. Agricultural sector has been seen as a source of social stabilization based on the country's recent history. The sector absorbed most of the population that was deported from Nigeria in the early 1980s and it is usually where people who have lost employment in the formal sector would return to (Asante et al. 2003).

1.2 Recent performance of the Agriculture Sector

The agriculture sector consists of crops, livestock, fisheries, forestry and cocoa. The combined crop and livestock sub-sector, but excluding cocoa, contributes about 68% of agricultural GDP. The contribution of cocoa production and marketing increased from 9% in 1999 to 13.5% in 2006 while that of fishing declined from 13% to 11% over the same period. The share of the crop sub-sector in the total crop and livestock contribution to agricultural GDP is about 90%. With the present structure, the performance of the food crop sub-sector is critical to the overall performance of the agricultural sector and the economy at large. Yet growth in the crop and livestock sub-sector seems to have levelled off at about 5.2% since 2000, with the cocoa sub-sector driving the growth trends in agricultural GDP (Figure 2).

Table 2: Sub-sector share in agriculture GDP

Sub-sector	1999	2000	2001	2002	2003	2004	2005
Crop & Livestock	0.68	0.68	0.68	0.69	0.68	0.67	0.66
Cocoa	0.09	0.10	0.09	0.09	0.10	0.11	0.12
Forestry & logging	0.09	0.10	0.10	0.10	0.10	0.10	0.10
Fishing	0.13	0.13	0.13	0.12	0.12	0.12	0.11



1.3 Government policy on Agriculture

Agricultural policy prior to the introduction of the Structural Adjustment Programme in 1984/85, was dominated by subsidies on inputs, guaranteed producer prices for major staple commodities such as rice and maize, and a mandatory 20% minimum on the allocation of credit by banks to agriculture. However, producers of cocoa, the major agricultural export commodity, received only about 50% of fob price, implying a high level of taxation on cocoa.

The introduction of policy reforms under Structural Adjustment set the stage for the rationalization of government expenditures and incentives to agricultural producers, particularly, of export commodities. Macroeconomic policy reforms were the liberalization of trade and exchange rates. Rationalisation of government expenditure meant the withdrawal of subsidies on agricultural inputs, and of parastals in the domestic marketing of staple crops. The introduction of a Financial Sector Adjustment Programme in the late 1980s meant that agriculture lost its preferred status for credit allocation. Trade liberalization introduced stiff competition for domestic production of commodities such as rice, cooking oil and meat products.

The Medium Term Agricultural Development Strategy of the 1990s (Ministry of Agriculture, 1990) propounded an export-led growth for the agriculture sector. Therefore export agriculture was supported with various incentives. Producer prices of cocoa were gradually increased; incentives such as duty drawback on imported inputs and retention of export revenue by exporters were introduced. Liberalisation of input markets was expected to engender competition in the distribution of inputs with benefits of improved access and lower prices for producers. Agricultural investors enjoy lower corporate tax rate of 8% compared to 20% for the non-agriculture sector; tax holidays are also longer for firms in the sector. However the private sector response to incentives tax and price incentives has been lower than expected and this has been attributed to poor rural infrastructure that limited the capacity of producers to respond (Nyanteng and ...).

The country's poverty reduction strategy papers since 2001 (Ghana Poverty Reduction Strategy: 2001 – 2005 and the Growth and Poverty Reduction Strategy: 2006 - 2009) recognize agriculture as central to poverty reduction and the country's development. It is stated in the GPRS II (Republic of Ghana, 2005 pg 23) that 'Economic growth and structural transformation is to be propelled by the agricultural sector in order to maximize the benefits of accelerated growth'. Since 2001, the modernisation of agriculture has become central in the country's development strategies. Expansion of irrigation, improved access to inputs, mechanisation, improved storage and better access to extension services, especially by smallholders, are strategies being promoted for this modernisation.

1.4 Role of smallholders in agriculture in Ghana

Agriculture in Ghana is dominated by smallholders cultivating between 2-4ha (PPMED, 2007). Large commercial farms operate mainly in the industrial crops (oil palm, rubber, and coconut) and pineapple sub-sectors. A poverty and social impact assessment of the

modernisation of agriculture strategy (Asuming-Brempong et al, 2004) estimates that smallholders constitute about 95% of the total agricultural population. The authors also note that smallholders are not a homogenous group and classify them into four groups (Small Commercial Farmers, Semi-Commercial (Semi-C), Non-Poor Complex Diverse Risk-Prone Farmers, Poor Complex Diverse Risk-Prone; Asuming-Brempong et al. 2004 pg27-28), based on production objective (commercial or subsistence), levels of diversification and asset levels including livestock numbers. Commercial farms, including those with small holding, practice modern production systems of mechanisation, and use of agrochemicals. Smallholder subsistence production is based on traditional production systems and technology. They practice intercropping with little use of modern inputs such as improved varieties, fertilisers and other agrochemicals, and use simple implements and hand tools. As a result, productivity is low; yield gaps (percentage difference between actual and achievable yield based on recommended inputs and practices) are very large, with several crops falling in the range of 50% to 60% (Bresinger et al, 2008).

The small scale commercial and semi-commercial farmers are often engaged as outgrowers of large scale commercial farmers in tree crop and high value export horticultural production. In general, crop production is highly rain-fed with only 12,000 ha, representing 0.5% of arable land under irrigation. Yields tend to be erratic because of the uncontrolled production environment.

Clearly, the needs of smallholders include not just access to information about technologies, but also access to inputs required to apply those technologies. They also require information on available markets as well as improved infrastructure to access those markets. In accessing export markets, especially for high value commodities, information on the markets includes where those markets are as well as the requirements of the markets. In high value export markets, where smallholders are outgrowers or produce for intermediary buyers, and in the context of a weak legal system governing production contracts, trust becomes the basis for engagement between producer and buyer. Access to information by both parties, and especially by the smallholder who is often the weaker party, is very important to the trust relations.

1.5 General constraints to smallholder access to high-value markets

Export horticulture is the most important high value market for Ghana. Commodities include pineapple, mango, papaya, chillies, and a range of exotic Asian vegetables (e.g. rava, aubergine, gourd, tinda). For the fruits, the export destination is the EU (Germany, UK, Italy Belgium). The other side of the horticulture market is domestic processors who produce for export.

The challenges that smallholders face in accessing high value horticulture markets may be classified as internal and external. The internal constraints are limited access to funds, information and technical knowhow and capability (e.g. irrigation, cold storage) to produce for the market. External constraints are the macro and meso level constraints such as high interest rates, poor rural infrastructure, thin credit markets, limited access to

extension services and poor communication infrastructure and the high quality standards of the external markets.

Compliance to private standards such as EurepGap, have been characterised as license to produce and license to deliver (World Bank, 2004) therefore a producer's inability to comply with the standards is a major constraint to market access. The production of high value produce is capital and knowledge intensive and requirements for meeting the standards add to the costs and information challenges. The first step to meeting the standards is being aware of them and having the knowledge on how to provide market requirements and access to information is paramount. Presently such information is obtained through traditional channels such as the government agricultural extension agents, and exporter buyers or export producing companies.

Access to working inputs is another constraint to smallholders' access to high value markets. Inputs are generally available because of the privatisation of input distribution but distribution networks tend not to extend beyond district capitals largely because of poor road infrastructure and the perception of low demand for inputs. Underdeveloped financial markets and farmers' inability to access credit contribute to the low input demand. Also lack of access to markets reduces the incentive to use productivity enhancing technologies and inputs.

The production systems of Ghanaian smallholders are everything that the new supply chains of global food trade do not want. These are scattered production of atomised production units (limit traceability and monitoring), producing variable quality of produce under minimal standards if any. Marketing is characterised by small volumes of sales and for staple grains, sometimes sales are made under duress when the farmer is in dire need for cash.

1.6 General constraints to smallholder access to market information

The factors that limit smallholder access to market information and raise transactions costs are:

- Atomistic nature of production and the wide geographical dispersion.
- Low literacy levels of smallholders
- Individual action (lack of cooperation among smallholders to bargain with traders who are better organised and better informed).
- Poor road and communication infrastructure in production areas.

Large numbers of small producers scattered over wide geographical areas increases the difficulty of service delivery, including extension advice and information about markets. The dispersed nature of production often requires agents that link producers to buyers, thereby lengthening the marketing chain and reducing margins to the farmer. Low literacy levels means that the options for information delivery are limited. Print media and higher levels of modern ICTs (e.g. internet) tend to be inappropriate for non-literate farmers to access. Poverty among smallholders also places mobile telephones, probably

the fastest growing communication technology, beyond the reach of poor categories of smallholders

Consolidation through group activity is a powerful strategy of overcoming smallness in the market. Yet producer organisations are not well developed in Ghana. In contrast, traders who normally travel from urban areas to producing areas to source produce, are well organised and share price information making them superior to smallholders in the trade relations. The Ministry of Food and Agriculture is presently in the process of supporting the development of such organisations to empower them to access services, including market information, by themselves.

Poor roads and communication infrastructure also raises the cost of accessing information. The Ministry of Food and Agriculture provides weekly price information on radio. However the timing of the information is usually late as prices can be very volatile. Farmers tend to depend on traders and fellow farmers in markets for price information. The MOFA information does not cover high value export markets. For this market, farmers depend on the magnanimity of buyers to get good price offers when they bargain.

1.7 Implications on agricultural development in Ghana

With over 95% of the country's producers being in the smallholder category, the impact of the market access and information problem on agricultural development is significant. The limited market access traps smallholders in the vicious circle of small production, low incentives, low use of inputs, low productivity, low incomes and small production. Government strategy of diversifying agricultural exports is achieving results but rather slowly. Due to limitations imposed by traditional land tenure systems on the expansion of plantation type of agriculture, smallholder production continues to serve as an important source of agricultural exports, both traditional (e.g. cocoa) and non-traditional (especially pineapple). Limitations on smallholder participation in production of export diversification crops also constrain the country's efforts at export diversification.

1.8 Role of agricultural information in resolving market failure

Market failure occurs when the market performance is judged to be less good than the best possible performance. This means that the best attainable outcome has not occurred (Lipsey, 1992). The market either fails to achieve efficiency in the allocation of scarce resources, or it fails to serve social goals such as a desired distribution of income.

Market failure can occur in any sector of the economy of a country. In the current discussion we are concerned with market failure in the agricultural sector, particularly smallholder agriculture in Ghana and the efforts that have been made to correct these failures. Market failure in smallholder agriculture has been the result of imperfect knowledge of producers about both the input and output markets in the agricultural sector. The thin markets including input and credit markets are signals of market failure. These in turn are a result of failure of institutions that govern the workings of the economy. In the case of inputs, poor road infrastructure limits distribution networks and because farmers have limited liquidity in an environment of limited credit, demand for

inputs is low justifying thin distribution networks. Lending to agriculture and smallholders in particular is not a preferred route for financial institutions because of the perception of rain-fed agriculture as a risky sector, and because financial institutions lack information on potential smallholder clients.

Output markets are also not competitive because of the asymmetry of access to information by producers and buyers whether for domestic or export markets. The lack of access to information about export markets, and lack of capital to produce for those markets essentially leads to allocation of resources by smallholders not being directed by market forces. Also, low productivity in farming in general means that smallholder households are more likely to be risk averse and allocate production resources in favour of subsistence over market-oriented production, a clear outcome of market failure.

At the centre of the market failures outlined above is access to information by producers and those who provide them with services. Agricultural information, including technology for producers, market prices and market requirements, smallholder client profiles for financial service providers, and demand points for inputs, will go a long way to ease the failures in the working of markets for smallholders.

1. Background and Setting

2.1 Previous responses to constraints

When market failures occur, interventions are required usually from the government to correct or remove the inefficiencies that exist in the allocation of resources. In Ghana, since the 1960s, government, the National Agricultural research System (NARS) and donors have had to take strategies to resolve market failure in smallholder agriculture. Government interventions at resolving market failure included price controls, encouraging cooperative marketing and processing and storage for value addition. The NARS has tried to address market failure through improvement in technical efficiency in production while donors have tried to improve access to inputs and markets for agricultural products.

In an attempt to operate a marketing system that benefited both producers and consumers, the government established the Ghana Food Distribution Corporation (GFDC). The GFDC bought and stored staple food stuff (especially maize) at guaranteed minimum prices to prevent a glut. It had market outlets throughout the major cities and towns for the sale of foodstuffs to consumers, using its stocks to influence the price of food stuffs to the benefit of consumers. The GFDC was however mismanaged and failed to serve the purpose for which it was established. Staff of the corporation profited from the funds released for the purchase of foodstuff at the expense of the national procurement programme. This, coupled with other problems made the GFDC dysfunctional. GFDC was therefore an inappropriate intervention for improving markets.

The government also encouraged smallholders to form production as well as marketing cooperatives. Production cooperatives helped smallholders to purchase inputs in bulk and

so obtain discounts on the purchase price as well as reduced per unit transport costs. On the marketing of their produce, the cooperative element allowed smallholders to sell in bulk, giving them better bargaining power and lower transaction costs per unit of produce sold. The Operation Feed Yourself programme embarked upon in the 1970s was yet another government response to address market failure. In the face of rising food prices, the government of the day encouraged workers to produce their own food using the weekends (for home consumption and cash income). The Operation Feed Yourself programme was largely successful in stabilising food prices in Ghana.

Another strategy adopted by the government to solve market failure was to embark on processing to add value and improve storability. In this case, two crops (rice and tomatoes) benefited from this strategy. Rice mills were established in major rice producing areas of the country while three tomato factories were established (one each at Kpalugu in the north, Wenchi in the middle belt and Nsawam in the south).

The NARS' strategy to market failure was to promote technical efficiency in production. In this regard, improved crop varieties (high yield potential drought tolerant and disease resistant) were developed for adoption by smallholder farmers. To fully realise the potential of these improved varieties, complementary technologies (fertiliser rates, pesticide use among others) were developed to be adopted in a package programme. However, production efficiency without a linkage to market potential in itself could lead to market failure. Improved crop varieties initially developed were Golden Crystal (for maize) and Rok 5 and Farrow 15 (for rice).

Donor strategy to market failure sought to improve smallholder access to production inputs while at the same time creating market avenues for the resulting output. Donors also supported infrastructural and capacity development in the NARS to be able to carry out client (smallholder) oriented research. The German Service for Technical Cooperation (GTZ) and the Canadian International Development Agency (CIDA) are two donor organisations that have played significant roles in this regard. The operation of inventory credit schemes was pioneered by Technoserve (a non-governmental organisation funded by USAID) for grain producers. The scheme entails a group of farmers storing their farm produce (usually staple grains) to speculate on prices. At the time of depositing their produce, each farmer receives an amount of cash equivalent to the current value of the produce deposited. The assumption being that future prices would be higher and the value of the produce would repay the advance received plus any storage costs incurred thereof. At any point in time, farmers can redeem some of their produce for home consumption but this would be surcharged against them at the time of final sale. One drawback of the scheme was that some farmers failed to dry grain to required moisture levels. This resulted in significant spoilage and the scheme incurred losses. Also farmers tended to hold grain for too long thereby missing the seasonal high prices that they were speculating on.

2.2 Government policy on ICT

2.2.1 General ICT policy

Ghana's ICT for development policy launched in 2004, dubbed ICT for Accelerated Development, has as its vision, to transform Ghana into an information rich knowledge-based society and economy through the development, deployment and exploitation of ICTs within the economy and society (Republic of Ghana, 2003; p. 21). The policy positions ICT as a broad-based enabler of the country's development goals. Its overall and specific objectives adequately supported the development of the food and agriculture subsector. The overall ICT policy objective is to engineer an ICT-led socio-economic development process with the potential to transform Ghana into a middle income, information-rich, knowledge based and technology-driven economy and society.

The creation of awareness in information access is recognised as being of prime importance. With respect to ICT usage and application, an information technology policy framework recognises that the dynamics of global economic growth are changing at a very fast pace. The role of the Internet as a pervasive phenomenon and its implications for accessing the traditional factors of production is taken into account. Economic potential is recognised as being increasingly linked to the ability to control and manipulate information. Within this policy context also, the need for an effective legal and regulatory framework is identified. A National Communication Authority is operational and a National Information Technology Agency is to be established as part of the regulatory and licensing environment. Also to be established is a national communications backbone facility to provide access throughout the country.

In the medium term, the intention is to support the development of electronic commerce to enhance production and productivity, and to facilitate business transactions. Government intends to establish Information Technology (IT) parks and incubator areas equipped with the necessary infrastructure for ICT related businesses and to develop human resources that support the deployment and rehabilitation of modern ICT.

2.2.2 ICT policy on agriculture

Modernisation of agriculture and development of an agro-based industry is one of the pillars of the ICT policy. The policy aims to use ICT to support production, processing, marketing and distribution in agriculture. Specifically, ICTs will be used to facilitate commercialisation of the key sub-sectors of the agricultural sector and industry to improve competitiveness. The strategies towards to achieve this goal can be categorised as, a) Developing ICT tools for managing the sector, and b) Using ICTs to improve access of stakeholders to information

The first category includes such strategies as

- Develop GIS applications to monitor and support sustainable environmental usage in area like land and water management, yield assessment and livestock management.

- Develop food insecurity and vulnerability information and mapping systems to assemble, analyse and disseminate information on who the food insecure are, where they are located and why they are food insecure.
- Revitalise agriculture extension services by empowering and equipping farm extension service workers with relevant ICT skills.

Strategies for improving access of stakeholders in agriculture to information are to:

- Establish an agriculture information system to provide support for the planning, production, usage and distribution of crops, livestock and fisheries products.
- Create ICT awareness among all types of farmers at all levels.
- Encourage market research through the use of ICTs.
- Utilise ICTs to link farmers and farmer groups and associations to resources and services that they need to improve their livelihoods through agriculture productivity, profitability and food security.
- Deliver real-time information and customised knowledge to improve farmers' decision making ability to align farm outputs with market demand.
- Establish clear forward and backward linkages between agriculture education, research and development farming, agro-industry, and marketing.

The ICT for modernisation pillar, and all other pillars, are complemented with the pillar to deploy and spread ICTs in the community. The policy recognises that success of the application of ICTs in development depends on the level and spread of ICT. The objective of this pillar is to promote equal and universal access to ICT services and resources to all communities. Government will intervene to promote community-based initiatives, and develop village information and communication infrastructure. A key strategy of this pillar is to include ICTs in the drive to reduce illiteracy both as a tool and as part of the curricula for functional literacy programmes.

2.3 Early Attempts to Use ICT

2.3.1 Government initiatives

Before the launching of the ICT policy in 2004, Government indirectly encouraged use of ICTs by allowing duty-free importation of computers into the country until recently. The government has a medium term plan with the intention to support the development of electronic commerce to enhance production, productivity and to facilitate business transactions. Government intends to establish Information Technology (IT) parks and incubator areas equipped with the necessary infrastructure for ICT related businesses and

to develop human resources that support the deployment and rehabilitation of modern ICT. Government has re-negotiated the existing telecommunications agreements to introduce more competition and this has accelerated access to telephones, internet and information technology in the country.

Early attempts by government agencies to use ICT were limited to traditional methods of communication. Traditional communication such as demonstration plots, cultural events, drama and song, market plays and puppets have been modified and used by some NGOs such as Ghana Information and knowledge Sharing network (GINKS) (GINKS, 2005).

2.3.2 Donor driven initiatives

Donor driven initiatives in the use of ICT have sought to provide funding for conventional and modern ICTs although some traditional communication methods were also supported (e.g. demonstration plots). Conventional and modern ICTs include technologies and media that capture, store and disseminate data and information. Conventional methods that have been in use in Ghana for over five decades include the community radio, television and telegram. Programmes such as AGROSCOPE on radio and AGRIMAG on TV were used to discuss agricultural issues and provide information to stakeholders in the sector

2.4 Recent Innovative ICT-based Strategies

The use of more innovative ICT-based strategies for agriculture in Ghana in recent times is mostly donor driven. The following are donor driven initiatives on the use of ICT in agriculture in Ghana

2.4.1 TEEAL (The Essential Electronic Agricultural Library)

TEEAL is a full-text and bibliographic CD-ROM library of more than 140 of the world's most important scientific journals in the field of agriculture. It is available well below cost to more than 100 of the lowest-income food-deficit countries, as listed in the World Bank's 1998-99 *World Development Report*. This service is provided by INSTI of the CSIR in Ghana.

2.4.2 Farm forums

Farm forums began in Canada in the 1940s and have been used to reach large audiences in e.g., India, Ghana, Tanzania, Botswana, Zambia, Benin, Niger and Senegal. Radio programs on farming issues are produced in collaboration with agricultural extension services and broadcast, using a 'listen-discuss-act' pattern of audience participation. A case in point in Ghana, is the radio programmes in agriculture that are produced by Radio Progress (a local radio station in the Upper West region of Ghana) and broadcast to farmers in the local language. Farmers know the time of the radio programme.

Individuals or groups of farmers listen to the programme and share their knowledge and experiences in the topical areas discussed during each programme broadcast.

2.4.3 Commonwealth of Learning Media Empowerment (COLME)

COLME (www.col.org) has set up a pilot project using digital video technology to produce instructional programs for farmers. It works in collaboration with in-country agencies, identifies rural community needs and provides training for extension workers in shooting and editing videos addressing regional concerns. The tapes are used by the extension officers and/or broadcast nationally. In Ghana, COLME aims at addressing the high rates of illiteracy among smallholders and lack of training for women smallholders, despite their traditional predominance in food production. The project is managed by the Women in Agricultural Development Directorate of the Ministry of Food and Agriculture.

2.4.4. AGRINET

AGRINET is the communication network of the Agricultural Services Sub-sector Investment Programme (AgSSIP) in Ghana. It is designed to improve the flow of information between Ministry of Food and Agriculture offices, agricultural researchers, extension officers, students and universities. A Web-based agricultural information system is being developed for smallholders, traders, researchers, and the general public.

2.4.5 Simli (Friendship) Radio

Simli (Friendship) Radio broadcasts throughout northern Ghana, with assistance from the Danish aid agency, Danida. It provides educational and extension services, using local agricultural information to support 'school for life' programmes for 8–12 year olds and adult learning programmes. Local schoolteachers are trained to integrate these programs into their classes to enable local people, including smallholders, to improve their skills and literacy. The agricultural extension programs are prepared by community radio extension officers who visit the smallholders to discuss their problems and priorities and then record discussions with local experts, interviews with smallholders, etc. The programs are broadcast in local languages, and are far more accessible to local smallholders because they can hear themselves or their neighbours discussing issues.

2.4.6 Farm Radio

Farm radio (www.farmradio.org) is an initiative in Ghana and West Africa supported by the University of Guelph, Canada and COL.

3. The Upsurge of ICT-based strategies

3.1 Inventory of More Recent and Current ICT-based Innovations in Agriculture in Ghana

3.1.1 Brief project descriptions

For whatever reason project personnel shy away from providing information on the ICT projects discussed in this paper, especially with regards to project funding. Only the E-Commerce for non-traditional exports project of the Ministry of Food and Agriculture (MOFA) lends itself to some analysis in so far as some order of magnitude of overall resource/funding commitments are concerned.

The objective of the project is to enable Ghanaian non-traditional producers and exporters to effectively promote their products in the global market. It has created a website with information on market prices, production, international trade, non-traditional producers and traders and agricultural information centres. Technical equipment required to support these services include: Windows NT server, MS Office 97, Oracle 8.0 work group, customised e-commerce software, and a file server, six PCs and two printers. Project costs were estimated at US\$ 151,000 of which donor funds amounted to US\$ 115,000. The Ghana Government contributed the remaining US\$ 36,000 as counterpart funds. Some other equally important ICT strategies although lacking in the kind of information provided for the e-commerce project are discussed below.

Another ICT-based innovation in agriculture is the establishment of Agricultural Information Centres in Ghana. The Agricultural Information Centre (AIC) is a concept promoted by the Directorate of Agricultural Extension Services of the Ministry of Food and Agriculture (MoFA). It makes use of a facility in a place that is heavily frequented, especially by farmers and other persons in agribusiness. The District Agriculture Development Units of MoFA operate this facility at present. It provides an avenue for actors to obtain expert advice on agricultural topics; a forum for farmers and various stakeholders to meet and exchange ideas, share experiences, make contacts and facilitate activities of mutual interest; a venue to motivate farmers through well organised demonstrations of locally relevant technologies and information exchange sessions; an opportunity for the exchange and/or delivery of related and relevant services such as finance, health and education. They provide an additional channel to reach out to farmers with agriculture and related information (Jatoo, 2003).

The Social Enterprise Foundation of West Africa (SEND) initiated the Eastern Corridor Agro-Market Information Centre (ECAMIC) project in 2003 to provide a market information facility for farm households in Ghana's northeastern corner. The project began by choosing two locations for the first centres. Set up in Kpandai and Salaga in the Northern region, both centres are manned by a cooperative marketing officer. These Market Information Centres are linked to a central database located at SEND's Head Office in Tamale. From there, the community information officer delivers the

information to the farming communities. This information is then disseminated throughout the community either through public addresses, group meetings, or via a community notice board. It uses a broad range of information and communication technologies (ICTs) to promote market access and equity for farming. The project utilises a broad range of tools including internet, websites and mobile phones to community notice boards (*chalkboards*) and public-address systems according to appropriateness to farmer and community needs and capabilities. Information is delivered through farmer cooperatives.

Following the introduction of mobile phone services in the project area in 2006, the ECAMIC project also introduced the SMS into their menu of tools for information delivery. The advantage of the SMS is that provides an avenue for accessing real time information and links to buyers, and is cost effective. Tradenet provides the platform for market information and for placing offers and bids. Farmers who sign up for the **tradenet** (www.tradenet.biz) service are able to make offers and receive the latest market prices 'on demand', as well as other market-related information.

Farmers are now able to bargain effectively with buyers because of their improved knowledge and awareness of current market trends. The mobile phone is much cheaper than the internet services available or the land-line phones. The simplicity of the mobile phone, when compared with computers, allows individuals to maintain their own mobile phones. The direct access to information also allows individuals to choose the information they wish to receive, and to share information with their families and the community at large.

Through its collaboration with Tradenet, ECAMIC's farmers are able to access, upload and engage in agricultural transactions and many more related ones in the future. The Tradenet service holds information on a whole array of products, thereby serving information needs of a wide cross-section of the farming population.

There are other strategies that have equally focused on market access by farmers as in the last two strategies discussed. The Geographical location and ICTs used by these strategies make the difference. Examples include Market Access Promotion Network (MAPRONET) Operating in Northern Ghana with its offices in Tamale and Market Access Support for Agricultural Partners initiated by TechnoServe Ghana. The aim of this project is to stimulate the flow of agricultural market information in Ghana through information centres run by NGOs and the Ministry of Food and Agriculture. The project will pilot the use of SMS for weekly price information collection and dissemination.

Yet other strategies recognize the need for researchers and technocrats to have access to information in their areas of expertise. It is in the light of this that the Ghana Agricultural Information Network Systems (GAINS) is a coalition of public sector institutions. The goal of GAINS is to link agricultural research institutions into a network to collect, process, share and repackage for dissemination, agricultural information generated in Ghana or elsewhere in any format to support agricultural research and development in the country.

The Ghana Information Network for Knowledge Sharing (GINKS) is a local NGO that was born out of collaboration between the IICD and its local partners in Ghana. The aim of this network is to streamline all the disjointed ICT projects, initiatives and programmes in Ghana, in a way that provides solutions to challenges and problems. GINKS provides the following services:

- Online and offline space for networking.
- Strengthening and facilitating strategic alliances among network members, to engender the development of an information and knowledge base.
- Providing a united front for advocacy on ICTs for development themes and issues.
- Serving as a conduit for capacity building, match making, skills development and upgrading.
- Commissioning research on ICTs and development themes.
- Disseminating research findings on ICTs for development.

Membership of GINKS is open to individuals and organizations who share in the vision and mission of GINKS and who at the same time are willing to take up the responsibilities that come with membership (www.ginks.org).

GIS details include maps and additional information associated with co-ordinates and time; University faculty members use GIS to map geographical areas of study. This technology is now being used widely in Ghana's horticulture industry to map out production areas. Maps of pineapple and citrus production areas have been produced. This mapping is valuable information for buyers of Ghanaian produce and policy makers alike because it easily gives the production areas and the opportunities for bulking and helps in planning logistics. It allows facilitates easy identification of smallholder farms for tracing requirements.

3.2 Private sector use of ICT in agriculture in Ghana

The Ghana Agricultural Producers and Traders Organisation (GAPTO) is an umbrella organisation of agricultural commodity-based (crops and livestock) associations, as well as other groups such as transporters. GAPTO has been in existence since 1992, providing market information services to traders, producers and transporters. Information provided includes product prices, infrastructure and services available in particular locations as well as the prevailing weather conditions. Areas of glut and scarcity are also reported for various products.

As a result of its achievements, GAPTO received a major boost in 2005 when it benefited from an equipment grant through the Market Information Systems and Traders' Organisation of West Africa (MISTOWA) project financed by USAID and implemented by the International Fertiliser Development Centre (IFDC). Although the amount of funding received was not stated when we visited GAPTO's headquarters during this review, the funds enabled it to train some staff in ICT and acquired a number of

computers and accessories for setting up an ICT secretariat at the headquarters. GAPTO also created a website and in collaboration with MISTOWA provides market information that can be accessed in remote areas via cellular phones. Price and product information is collected from various locations by trained enumerators and uploaded onto the website. Although GAPTO has no ICT centres besides the one at its headquarters, it makes use of ICT centres established by MOFA throughout the country to get market information. Funding constraints are responsible for the non-existence of GAPTO ICT centres in proposed areas of the country. The MISTOWA project which was supposed to facilitate the setting up of GAPTO ICT centres ended in 2007 instead of 2008 as USAID funds were cut short to provide aid in Afghanistan (www.gapto.org).

Another area in which the private sector makes use of ICTs in agriculture is in the export sector especially for non-traditional export. Exporters of non-traditional crops in Ghana have to look for potential buyers on the international markets, provide product information to such buyers and source international price information. All these they do through the use of ICTs, mainly via the internet.

The Trade and Investment Project for a Competitive Export Economy (TIPCEE) is at the helm of linking farmers to high value export markets. It has applied GIS technology to map pineapple and citrus farms as a strategy to improve traceability of production sources, especially in the for farmers that are certified for GLOBAL GAP, FAIR Trade or other certification systems. TIPCEE has also established an ICT-based monitoring system to improve quality of produce. Farmers are signed on to an SMS portal through which they receive information on the timing of key farm practices and how they should be carried out.

The use of mobile phones to gather agricultural information by the private sector is widespread. Itinerant traders mobilizing produce in remote production areas are able to get price information in major marketing centres via mobile phone. This puts the traders in a better position to bargain at the production centre, taking into account transactions costs and the price they expect to receive at the major marketing centres.

Tradenet however applies the SMS technology to provide market information in a systematic manner and has become the service provider in the SMS-based market information systems in the country. Tradenet collects and collates all sorts of market information, including a database of sellers and buyers, and provides a platform for the sellers and buyers to make offers and bids. Tradenet is the source of the technology for developing appropriate tools for the provision of market information. All service providers hook on to tradenet for the technology. Tradenet's services allow traders and producers from anywhere in the world to find each other online or via mobile phones and connect to do business. It is focused on raising revenues for small-scale farmers and traders by allowing them to cheaply and quickly distribute their offers to others. TradeNet also provides free customizable websites to any group that seeks an online presence and easy integration with the mobile networks.

A number of pipeline initiatives that plan to use Tradenet's services to deliver market information are the Root and Tuber Improvement and Marketing programme of the Ministry of Food and Agriculture, the Millennium Development Authority (MiDA), Agribusiness in Sustainable Natural African Plant Products (ASNAPP)⁷.

⁷

Personal communication with Mark Davies, CEO, Busylab, owners of Tradenet.

Table 3. ICT-based projects in Agriculture

ICT Project	Description
Eastern corridor agro-market information centre (ECAMIC) Social Enterprise Development Foundation of West Africa (SEND)	This project uses ICTs to help 5000 soybean-producing farmers in eastern Ghana gain access to markets. The project will provide connectivity to isolated communities as well as support to the development of specialised information and communication services to improve the livelihoods of the farmers involved in the SEND Food Security Project.
Ghana agricultural information network system (GAINS), Institute for Scientific and Technological Information (CSIR-INSTI)	The goal of GAINS is to link agricultural research institutions into a network to collect, process, share and repackage for dissemination, agricultural information generated in Ghana or elsewhere in any format to support agricultural research and development in the country.
E-Commerce for non-traditional exports Ministry of Food and Agriculture (MOFA)	Through this project the Ministry aims to enable Ghanaian non-traditional producers and exporters to effectively promote their products in the global market. It resulted in the creation of a website with information on market prices, production, international trade, non-traditional producers and traders and agricultural information centres.
ICT policy process in agriculture – Ghana Ministry of Food and Agriculture (MOFA)	At the request of the government, IICD provided strategic advice and process support to the Ministry of Food and Agriculture for the development of a strategy for implementing the relevant provisions of the Ghana ICT for Accelerated Development Policy within the agriculture sector.
Market Access Promotion Network (MAPRONET)	Formed in 2001 by agricultural producer groups and local and international NGOs, MAPRONET works to improve market access for farmers, enabling them to meet the requirements of local and international markets. IICD supports MAPRONET's use of ICTs for better communication across the network and with target groups.
Market access support for agricultural partners TechnoServe Ghana	The aim of this project is to stimulate the flow of agricultural market information in Ghana through information centres run by NGOs and the Ministry of Food and Agriculture. The project will pilot the use of SMS for weekly price information collection and dissemination.
The Ghana Information and Knowledge Sharing Network (GINKS)	The Ghana Information and Knowledge Sharing Network (GINKS) is a constitution of a broad range of people drawn from various fields of endeavour but mainly involved in Information Communication Technologies (ICTs) and sustainable Development (including agriculture). GINKS exist as a linchpin that streamlines all disjointed ICT projects, initiatives and programs in a way that provides solutions to challenges and problems in the ICT environment. This it undertakes through networking, information and Knowledge sharing among all stake holders; conducting research; publicity and advocacy.
Trade and Investment Project for Competitive Export Economy	Goal is to link Ghanaian farmers to high value markets. Uses GIS mapping to facilitate traceability and decision making. Also using ICT to monitor production systems so as to meet quality standards of international markets
Tradenet	Is the main source of SMS/internet technology for deployment of agricultural and market information by service providers to clients. It is at the forefront of innovation to meet needs of clients.

Source: International Institute for Communication and Development (2006). Impact and lessons learned from IICD supported activities; discussions with other service providers.

3.3 The stakeholders (boundary partners) in the past and current interventions

Stakeholders (boundary partners) in an intervention are the individuals that are impacted by the intervention, in our case ICT interventions. This may include farmers, traders, agriculture staff, credit institutions, etc, depending on the intervention. The intervention provides useful information for the proper functioning of the individuals/institutions impacted. The table below summarises some ICT interventions, their partners and the role of each partner in facilitating market access.

Partners in the above International Institute for Communication and Development (IICD) projects are:

Knowledge exchange network:

- Information Network on Knowledge Sharing (GINKS) – www.ginks.org

Capacity development partners:

- Kofi Annan Centre for Excellence in ICT – www.aitikace.org
- LaKe Consult Ltd.

Project partners:

- Women in Development Project (WADEP) / Jaskian District Diocesan Office
- Social Enterprise Development Foundation of West Africa (SEND)
- Institute for Scientific and Technological Information (CSIR-INSTI) - www.gains.org.gh
- Ministry of Food and Agriculture (MOFA) – www.ecomghana.org.gh
- Market Access Promotion Network (MAPRONET)
- TechnoServe, Ghana

3.4 ICT models and underlying objectives

The ICT interventions in Ghana reviewed in this paper can be classified under models of outreach, networking and market information systems. Each model has its underlying objectives. ICT interventions that use radio and television to reach out to their beneficiaries address general agricultural issues. In this sense the objective is normally to reach out to the masses. Most radio and television programmes (e.g. AGIMAG) are mass outreach programmes. There are however cases in which radio programmes focus on groups of farmers. Examples are the community radio programmes that focus on groups of farmers in particular localities.

Market information systems ICTs in Ghana focus on providing price information among others, on specific products to buyers and producers. As the products covered may be limited for some reasons, these programmes tend to focus on groups that deal in the products of choice. The ICT intervention may serve the needs of a single group or a number of groups. The Eastern Corridor Agricultural and Market Information Centre (ECAMIC) project has the objective of serving the market information needs of farmers in the eastern corridor of Northern Ghana. GAPTO on the other hand, although providing market information as ECAMIC serves the needs of traders, farmers and transporters alike.

GAINS and GINKS ICT interventions fall under models of networking. GAINS meets the information needs of individuals as well as organisations by providing printouts of journal articles and CD ROMs of relevant databases to scientists or research institutions on request. In similar manner, GINKS provides individuals and organisations with capacity building and training services.

3.5 Loci of interventions/targeting

In terms of targeting, the ICT interventions in agriculture in Ghana adopt an integrated approach (linking a number of issues, e.g. production, post-harvest, storage, processing and marketing) although some focus on a single issue. The table below gives a summary of ICT interventions in agriculture in Ghana in terms of targeting. The interventions from public sector tend to be more diverse or comprehensive in terms of targeting.

Table 5. Distribution of Loci of ICT Interventions

ICT intervention	Locus of intervention/targeting
MOFA e-commerce project	Production, marketing
GAPTO/MISTOWA project	Production, storage, processing, marketing
Agricultural Information Centres (AIC) project	Production, post-harvest, finance, health, education
Eastern Corridor Agricultural Marketing Information Centre (ECAMIC) project	Marketing
Market Access Promotion Network (MAPRONET)	Marketing
TIPCEE	Production, quality control, international trade

4. Constraints, success and opportunities of ICT-based interventions

4.1 Constraints

The following is a list of constraints faced by past and current ICT-based interventions in Ghana.

- Lack of electrical power or unreliable supply of such power is a major constraint to ICT-based interventions that depend on the internet or use computers for data/information storage, processing and dissemination.
- The literacy status of the population is another constraint faced by the ICT-based interventions. The agricultural population is located in rural areas where the illiteracy rate is very high. This limits the use of ICT interventions based on electronic and print media.
- Funding constraints affect the sustainability of a number of ICT-based interventions that are having positive impacts on the beneficiaries. These interventions are significantly funded by donors. It is doubtful that these projects would continue after the withdrawal of donor funding support unless they build in cost recovery measures.
- Cooperation among producers for training, access to technology and bulk pricing are issues that constrain ICT-based interventions. This is largely because producer-based organisations are not well developed in Ghana.
- Designing content of ICT interventions that is suitable for wide range of users so as to benefit from economies of scale remains a challenge.
- Intensive promotion to attract potential target groups means initial returns are likely to be very low and this may negatively affect the profitability of the interventions.
- Mobilising local level interests to achieve a critical mass of users of ICT services so as to achieve economies of scale for service providers.

4.2 Successful interventions

There are probably more success stories of ICT interventions for smallholder farms than for large holders in the case of Ghana. This may be because interventions were deliberately targeted at smallholder farms. GAPTO/MISTOWA, the Eastern corridor agro-market information centre (ECAMIC) and Agricultural Extension Information Centre (AEIC) projects are some of the success stories in Ghana. While the first two aim at providing market access for farmers, the third provides a range of information services (production, post-harvest, processing and marketing).

The GAPTO/MISTOWA project made a number of achievements that can be seen as a measure of its success. The project signed a trade deal with an organisation (SOCAMAD) in Burkina Faso for the purchase of onions worth US\$24,387. It further signed a standing agreement with SOCAMAD to supply 8,000 tons of onions to Ghana for the year 2007. GAPTO also clinched a trade deal with potato traders in Mali for the supply of US\$29,724 worth of potatoes to Ghana while another trade deal with traders in Kano, Nigeria was reached for the supply of cowpea worth US\$4,500 to Ghana. These trade deals were reached with the help of information obtained via internet using the MISTOWA website. Although the MISTOWA project has closed, GAPTO still maintains a website that provides the necessary information for the benefit of producers and traders mainly. At the time of visiting GAPTO's headquarters for purpose of gathering

information for this report, price information for a number of products and markets in Ghana were displayed on a notice board in front of the office.

Reports from the ECAMIC project indicate that farmers have now become reliable suppliers of products that were agreed to be included in a basket of products to benefit from market information and have profited from up-to-date information on market prices and an expanded market. According to surveys, large-scale buyers are also benefiting from the efficient organisation of supply and transport. One in particular - Bosbel, a large vegetable oil producer - stated that the project has 'been very beneficial for both sides.'

Even though the project is relatively new it already reaches over 10,000 people in 41 communities. According to one estimate, farmers' net income has increased by 20%. It is also very interesting that, with regard to income, some respondents stated that the increase in income they had experienced was secondary to the knowledge that they were no longer being 'cheated'. In addition, they were now able to forecast turnover for the coming year, allowing them to prepare more accurately. Others reported that their self esteem had improved, as a result of which they were now able to interact effectively with financial institutions from the formal sector to access services such as savings and loan facilities. Several respondents are sharing their knowledge and skills with others outside the project in order to spread the benefits of the project beyond the immediate target population. Access to mutual business networks has also increased in many cases. As one of the farmers remarked: "I know where and when to sell my farm produce. I have also bought a motorbike from the proceeds I made from selling my produce and have been the best soya bean farmer in the district two times in a row: in 2005 and in 2006."

4.3 Opportunities for use of ICT in agriculture and enhancing information access by small holder farmers

A number of opportunities exist for use of ICT in agriculture in Ghana. The review of ICT-based interventions suggests that they enhance smallholder farmers' access to information. The following are opportunities that exist for the use of ICT in Ghana.

- The use of SMS through mobile telephony is a real opportunity for the use of ICT in agriculture. The unit cost of mobile phones has become low enough for poor smallholder farmers to be able to afford mobile phone hand sets. The cost of SMS technology to access agricultural information compared to internet or other means is negligible.

A programme officer of the Eastern corridor agro-market information centre (ECAMIC) project had this to say about SMS technology: "the choice of the mobile phone (SMS) as an alternative is because it is much cheaper than the internet services available or the land-line phones." Enabling farmers to finance the services of the project was always a concern. Consequently, the marked reduction in the costs of mobile technology, particularly SMS, creates a significant step towards self-sufficiency.

The financial benefits are not the only positive outcomes that are predicted to arise from the conversion to the delivery of information via SMS as, clearly, mobile technology is cheaper

than computer technology. The simplicity of the mobile phone, when compared with computers, allows individuals to maintain their own mobile phones. Moreover, it allows the farmers to take their destiny into their own hands, which is a major component of the project approach.

- Another opportunity for the use of ICT in agriculture in Ghana is the existence of ICT networks, for example, the Ghana Information and Knowledge Sharing Network (GINKS). By streamlining all disjointed ICT projects, initiatives and programmes in a way that provides solutions to challenges and problems in the ICT environment, ICT interventions complement each other and create synergies that make agricultural and other information accessible to smallholder farmers. This GINKS undertakes through networking, information and Knowledge sharing among all stake holders; conducting research; publicity and advocacy.
- Apart from the above opportunities for the use of ICT in agriculture, the benefits of ICT in themselves create opportunity for its use. The following opportunities created by ICT indicate the benefits that are derived and hence the opportunities for its use in agriculture
 - Access to larger markets. Data on markets can be shared and compared across regions of the world. Once the stakeholders begin to realise the benefits of accessing these larger markets through ICT, the opportunity exists for more use of ICT.
 - Producers have better information about market trends. E.g. web-based price analyses over time and across commodities for more informed decision making.
 - More sales opportunities and fewer intermediaries. E.g. smallholders can text crop availability and price quotes to a customers. So in maize trade for example, the search agent will no longer be relevant in the marketing chain. The margin from this intermediary can then be shared between producer and actual buyer.
 - Better access to information enables farmers to make more informed decisions. Also as information becomes more widely available to market participants, markets become more transparent, new commercial relationships are built thereby promoting trade, investment and development.
 - In export trade, information tools that allow tracking of produce is invaluable to smallholder participation. GIS identifies where crop comes from, the quantities available in particular locality (attracts buyers if there is a concentration of produce), and what chemicals have been used (an effective means of verification of compliance for buyers).
- Community radio networks that broadcast to local communities in their own languages providing information on agricultural technologies, market information among others creates an opportunity for use of ICT in agriculture. Farmers and other stakeholders listen to the programmes, select what is suitable to their circumstances and through a process of feedback more relevant information is developed and broadcast.

- The ICT for development policy, includes key strategies for applying ICTs in the modernisation of agriculture and is therefore a major opportunity for creating the environment necessary for expanding the use of ICTs in agriculture information delivery.

5. Conclusion

The use of ICT in Ghana has evolved over the years. The use of traditional communication technologies dominated the post-independence era when agricultural policy in Ghana was characterised by the provision of input subsidies and guaranteed prices for selected staple farm products. Subsidies and guaranteed prices themselves introduced a lot of inefficiency in resource allocation in agriculture. Following the withdrawal of subsidies and market liberalisation in the middle 1980s, ICT interventions had to change, placing emphasis on efficient use of resources, creating market access information for agricultural producers and buyer alike.

A number of constraints have been faced in the use of ICT in agriculture in Ghana. Notable among these are poor connectivity for internet and other information access, lack of or poor electricity supply. The initial setup cost for most interventions is substantial and has often been financed by external donor support. Financial constraints therefore threaten the sustainability of ICT interventions in Ghana should donor funding support be withdrawn. The design of ICT products to meet the demands of different categories of clientele has been a major challenge.

Despite the constraints to ICT in agriculture, some successes have been chocked. Through ICT interventions, smallholder farmers now enjoy access to markets for their produce at competitive prices. E-commerce has opened up international markets for non-traditional agricultural crops produced by smallholder farmers in Ghana. Farmers are able to advertise their products on the web while using the same web to seek price information that helps them to bargain for their produce.

The use of ICT in agriculture has had significant impact on producers and traders of agricultural products alike. Making use of ICTs farmers are able to come together to sell in bulk or purchase inputs in bulk. By this they are able to take advantage of the economics of scale. In similar fashion, traders are able to source for produce, buy in bulk and make transport arrangements that reduce transactions cost.

There is however room for improving upon the use of ICT in agriculture in Ghana. There is a need for more awareness creation on the use of ICT in agriculture. The training of personnel in the manning of ICT facilities as well as training of beneficiaries in the use of ICT can enhance its use in agriculture.

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List of Acronyms

AISI	African Information Society Initiative
CIDA	Canadian International Development Agency
CTA	Technical Centre for Agricultural and Rural Cooperation
GAINS	Ghana Agricultural Information Network System
GAPTO	Ghana Agricultural Producers and Traders Organisation
GFDC	Ghana Food Distribution Corporation
GINKS	Ghana Information and Knowledge Sharing Network
GTZ	Gesellschaft für Technische Zusammenarbeit
ICT	Information and Communications Technology
IDRC	International Development Research Centre (Canadian)
IFAD	International Fund for Agricultural Development
IFDC	International Fertilizer Development Centre
IICD	International Institute for Communication and Development
INSTI	Institute for Scientific and Technological Information
MAPRONET	Market Promotion Network
MISTOWA	Market Information System and Trader Organisations in West Africa
MOFA	Ministry of Food and Agriculture
NARS	National Agricultural Research System
NGO	Non-Governmental Organization
PPMED	Policy Planning Monitoring and Evaluation Directorate
SEND	Social Enterprise Development Foundation of West Africa
TEEL	The Essential Electronic Agricultural Library
TIPCEE	Trade and investment programme for competitive export economy
UNESCO	United Nations Educational Scientific and Cultural Organisation
USAID	United States International Development Agency

APPENDIX 6a: SUMMARIES OF RESEARCH ON ICT INTERVENTIONS IN GHANIAN AGRICULTURE

There are few published studies on ICT and agriculture in Ghana. Unpublished student dissertations/thesis are available, mainly in the University of Ghana's School of Communication

Studies, Information Studies department and Department of Agricultural Economics and Agribusiness. Following are summaries of titles and findings.

1. Egyir, I. S.(2007). ICT policy and agricultural development in Ghana: Analysis of the Plantain ASTI system

The major objective of the study was to assess the adequacy of the ICT policy for the agricultural sector and examine its impact on the plantain subsector actors. The study's findings are as follows:

Is the ICT policy relevant for the agricultural sector?

Ghana's ICT policy was launched in 2004. Its overall and specific objectives adequately supported the development of the food and agriculture subsector. The overall ICT policy objective is to engineer an ICT-led socio-economic development process with the potential to transform Ghana into a middle income, information-rich, knowledge based and technology-driven economy and society. Its specific objectives emphasized among others: "To facilitate the development of the agriculture sector through the deployment and exploitation of ICTs to improve on its efficiency and productivity; to guide the development and implementation of electronic government and governance, as well as electronic commerce and business [including agribusiness] strategies and action plans; to accelerate the development of women and eliminate gender inequalities in education, employment, decision making through the deployment and exploitation of ICT by building capacities and providing opportunities for girls and women."

How has the plantain subsector responded to the policy?

There is a slow but steady response. All medium and large farmers, traders and processors (in the cities) use mobile phones and some (processors of FuFu powder) use computers for data processing. Small farmers, traders and processors' use of modern ICT formats is limited to the mobile phone and use of digital radio. The potential to use the computer and access the internet exist for those literates who live in the district capitals. Yet, none of the respondents used the internet; many thought that information retrieved from the internet could be useful but it would be in the English language where many do not comprehend adequately. The illiteracy rate reported in the survey was less than 20 percent; yet many respondents preferred to communicate in the vernacular. The use level of the mobile phone among the respondents was high (90%) although, none of the plantain farmers interviewed in the four (of six) regions of Ghana used a mobile phone. Only 7 and 10 of traders and processors (out of 152) used the mobile phone to facilitate trade (buying and selling of plantain inputs and products). Most (80%) acquired the phone in 2005 when the prices of used mobile phones ranged between GH¢30 and GH¢50.00. However, over 60 percent of the respondents acquired the phone mostly out of social rather than business need. Some (50%) had been acquired for them by relatives (especially wards) who lived in cities or abroad.

How has modern ICT enabled innovation adoption?

Community radio programmes that complement messages of Agricultural Extension agents has led to the adoption of herbicide (52%) use for zero tillage and weed control, inorganic fertilisers (8%) to enhance soil fertility and insecticides (19%) to control insect pests. Mobile phone use has led to reduced travel by Long-distance Wholesalers. Wholesalers are able to truck goods on wheels and understand causes of delays, or get new orders to be sent through truckers, reducing transaction costs. In time past wholesalers needed to accompany trucks that convey fresh plantain bunches from distance beyond 300 km most of the time.

What are the major challenges for sustained use?

The areas of challenge listed by both owners, users and non-users of the mobile phone included (in ascending order of importance): high cost of initial purchase, lack of access to network area all the time, unavailability of electricity to charge phone at any time, high cost of recharge of talk time, and unavailability of Repairers in community.

2. Sampong, D (2007) “The potential effect of modern Information and Communication Technologies (ICTs) on the income generating capacity of rural women food producers in the Mfantseman district of Ghana”. Unpublished MPhil. Dissertation. Department of Agricultural economics and Agribusiness University of Ghana, legon.

The study sought to investigate the following issues with respect to rural women food producers in the Mfantseman District of Ghana: the resource capacity that enhances adoption of modern ICTs; the agricultural information sources and needs; the modern ICTs perceived as appropriate for managing the needed information and the extent to which modern ICTs use improves their income generating capacity. The finding was that: women food producers have low human and capital resource capacity, limiting the adoption of modern ICTs. The major agricultural information sources for the women are in order of importance relatives and other farmers in the locality, agricultural extension agents, the radio, television and mobile phones are known among rural women food producers (albeit used by only a few). The ‘mobile phone’ was considered the most appropriate modern ICT for enhancing the information management of rural food producers although only 6 out of 91 respondents used it. Its income generating capacity was positive; the use of a mobile phone has the tendency of improving income by 15 units for rural women food producers.

3. Amponsah, B. H. (2008) An assessment of the extent of rural-urban dichotomy in mobile phone use for agricultural information management in Ghana. On-going BSc. Dissertation. Department of Agricultural economics and Agribusiness University of Ghana, legon.

The major objective of the study is to assess the extent of dichotomy in: factors determining mobile phone use, the information generated and disseminated and mobile phone use, for information management by rural and urban food producers. The preliminary findings are that certain socio-economic, technical and institutional factors are important; the information types generated and disseminated are mainly market prices, volumes, vehicle for trucking and new market location; the use of mobile phones among vegetable producers in Accra (Greater Accra Region) is 50 percent more than the use among rural based crop farmers in Mankessim (Central Region).

4. GINKS (2007) Generating and disseminating relevant local content using appropriate and acceptable ICT formats. A Handbook. Ghana Information Network for Knowledge Sharing, Accra. Sedyprint Ghana.

The objective of the hand book was to document fully all lessons learned in the course of the Mfantseman Research to guide others who want to assist communities to develop and disseminate local content through the use of modern ICT formats. The major lessons both on effective planning of the research team, capacity assessment of research team, agricultural content repackaging and language, appropriate traditional, conventional and modern ICTs and establishing the community resource centre

The traditional ICTs include face-to-face-for a; visits and demonstration by AEA and use of a Community intermediary (doubling as literacy class facilitator). The conventional ICTs that work are the media house programmes. The modern ICTs that are viable is the digital radio, computer with internet and mobile phone but the latter is the most preferred.

5. Fosu, K, (1992). *Audience Responses to the TV Programme “AGRIMAG” A Case study of Three Towns in Kade District (Kade, Kusi and Okumaning)*, Graduate Diploma Thesis, School of Communication Studies, University of Ghana, Legon.

The objectives of the study were to find out why viewers watch the programme AGRIMAG and ascertain whether viewers find the program comprehensive covering every category of farmers, the language used for the program is understood by viewers, viewers who own farms apply new ideas learnt from AGRIMAG and the programme motivates farmers who view the programme to work harder.

Findings

From a sample of 146 viewers in the selected towns the study showed that:

- audience found the use of the language for the programme appropriate. About 76% of them preferred the language used which was English.
- Most viewers (72.5%) found the programme comprehensive, covering all categories of farmers.
- The programme encouraged viewers who had farms to work hard. This was affirmed by 78.9% of the respondents.
- About 79% attested that in their bid to increase income they would expose themselves to messages from AGRIMAT that they believe could help them achieve this goal.
- Majority of viewers (83%) watched the programme for its new ideas in agriculture.

6. Kosiba, C. J., (1986). *The Role of Communication in Rural Development: A case study of the Agricultural Information Service Unit (Langbensi – UER)*, Graduate Diploma Thesis, School of Communication Studies, Univ. of Ghana, Legon.

The study was primarily to evaluate the communication strategy, activities and impact of the Agricultural Information Service Unit as an instrument for the dissemination of agricultural and health information in the development activities of the Church Agricultural Project Stations. Any ICT in the this information service? Little more information

Findings:

From a survey of 12 Church Agricultural Project (CAP) stations in the Upper East Region region and the Agricultural Information Service Unit at Langbensi, the study showed that:

- The Agricultural Information Service (AIS) has relied on written materials to get information to clients (CAP stations)
- There is no contact at the farmer level (i.e. direct contact between farmer and AIS)
- AIS relies on request of CAPs managers and the assumption of what is required at village-level which may not always be accurate.
- No evidence of linkages with other communication channels (formal and informal) e.g. village teachers, community workers etc.

The content Analysis of written materials also showed that:

- There wasn't much graphic illustration to compliment written material. Moreover the materials weren't more journalistic to make written materials acceptable, interesting and consumable to users.
- Contribution from stations managers and other resource people were limited.
- Information sources within the CAP were from a few old stations.
- No contributions came from farmers.

7. Nyako, S. (1978), *The Role of Communication in Influencing Innovation in the Cocoa Industry in Ghana*, Graduate Diploma Thesis, School of Communication Studies, Univ. of Ghana Legon.

Findings

From a sample of 261 cocoa farmers the study showed that:

- Decision processes with regard to adoption of the recommended farm practices were influenced by the sources of communication: interpersonal as represented by extension officers, the farmer's parent or peer.
- The **cinema (film shows)** also had a significant appreciation of sources of information among the other forms of mass media.
- Cocoa farmers tend to seek better information from others who are better informed than himself if he is illiterate, a rural dweller and therefore cut from the primary source of information.

- The information obtained from the extension office appeared to result in expectations which the farmer could not follow completely because of lack of resources and recommended material.
- With reference to the flow of information about hybrid seedling, 53.64% had then from Extension officer, 23.76% from fellow farmers and 7.66% from parents. Other sources occasionally involved in transmitting information about new ideas in farming to the cocoa farmers were **radio, news paper/publication** and agricultural shows.
- Services the farmer would like to receive were, increase supply of farm inputs (10%) insecticides, spraying machines etc., credit facilities (90.8%), increased cocoa producer price (71.26%), supply subsidized labour for hire to work on cocoa farms (63.22%) provision of transportation for carrying produce (40.61%), improve roads (37.55%), etc.

8. Owusu, T. O. (2000), *Perceptions of Agricultural Extension Agents of Their Effectiveness in Communicating Improved Agricultural Technologies to Farmers: A survey of six Districts in the Central Region of Ghana*. Post Graduate Diploma Thesis, School of Communication Studies, Univ. of Ghana, Legon.

The objectives of the study were to find out how AEAs perceive the appropriateness of communication methods used to reach farmers and identify the perceived competencies of AEAs with respect to communication method used to reach farmers.

Findings

From a survey of 119 random sample AEAs the following results were obtained:

- It was perceived that farm visits and demonstrations were the most appropriate communication methods, followed by visits to research stations and field trips. **Telephone calls however, were barely appropriate as a communication method.**
- Agents' competency in organizing village meetings was rated the highest with a mean of 3.89. This was followed by farm visits and speaking to individuals with a mean of 3.73. Most of the agents indicated above average competency for most of the communication methods. **This notwithstanding, most of the extension agents indicated very low competency (1.97) in the use of the still camera. Over half (54.7%) of the agents indicated a very low competency in the use of the tape recorder while over three-quarters in the use of the desk-top computer.** About half (48%) of the respondents indicated a very low competency in using Folk media, as a communication method ".....one aspect extension agents who operate in low technology rural areas to use these means more often. Indeed, if they are to make meaningful impact in agricultural productivity, they should be able to build bridges between folk media and modern technologies". Osei (2000).

9. Adjei-Kyere J. (2004). *Willingness to pay for market information on food crops: a case study of selected irrigation schemes in southern Ghana*. Unpublished MPhil. Thesis, Department of Agricultural Economics and Agribusiness, University of Ghana, Legon. The

study's key finding was that **traditional communication formats are still very important among small farmers.**

10. An assessment of strategic innovations in urban agriculture, food supply and livelihood support systems' performance in Accra. On-going MPhil. Thesis. Department of Agricultural Economics and Agribusiness University of Ghana, Legon. The primary objective of the study is to identify strategic innovations in urban agriculture, the contribution of UA to food supply and effect on livelihoods of producers in the city of Accra and its immediate environs.

The survey included 120 traders selling vegetables, live poultry bird and eggs from urban and peri-urban Accra. **The findings on ICT innovations suggest that the mobile phone is the only innovation in ICT employed by about 48 percent of traders to contact customers, share information, and check market trends.** Although, being literate may significantly influence ownership of the mobile phone, illiterates can also use the cell phone with little difficulty. **Gender and age differences may also not matter.**

APPENDIX 7. BACKGROUND PAPER ON THE ICT POLICY ENVIROMENT AND THE USE OF ICT-BASED INTERVENTIONS IN AGRICULTURE: THE CASE OF KENYA

Lydia K Ndirangu⁸ & Julius Okello Juma⁹

I. Introduction to Agriculture sector in Kenya

As in other African countries agriculture forms the backbone of Kenyan economy. Agriculture has remained the mainstay of the economy since independence in 1963. Its contribution to the GDP has however declined from 35 per cent in 1963 to 25 percent in 2007. Nevertheless, it still employs about 80 per cent of the labor force, provides most of the food requirements for the nation and earns the country about 60 per cent of the foreign exchange. Approximately 75% of the labor force in agricultural is contributed by women (Kenya, 1997). Despite the importance of the agricultural sector in Kenya, and in most sub-Saharan African countries, the performance of the sector has been poor for most years since 1970 (World Bank, 1981; Chibber, 1988; Mosley and Smith, 1989).

Generally, the agricultural sector performance in Kenya has exhibited 3 broad phases namely, rapid growth phase, stagnation and decline and, staggering recovery. In the early years following independence, agriculture sector enjoyed period of rapid growth owing to a combination of internal and external factors. The external factors included the coffee boom and the general good well-coordinated markets for traditional exports (mainly coffee and tea). The internal factors included policies that encouraged investment in agricultural productivity enhancement. The productivity enhancing policies included land reforms; investment in breeding high yielding crop and livestock varieties and breeds, respectively; provision of inexpensive credit; provision of subsidized fertilizer; and investment in improved infrastructure including marketing facilities and transport. One other factor that propelled growth in agriculture in this phase was the extensive government investment in provision of information to farmers. However, the focus was limited mainly to education/training of personnel that later worked as agricultural extension staff. Investment in radio programs that broadcast agricultural information was limited, perhaps due to the high levels of illiteracy during this period. This period lasted well into late 1970.

However, it was some of the policies pursued by the government in the first phase that brought about the slowdown in performance in phase two. The policies pursued by the government in the 1960s and 1970s emphasized government intervention in nearly all aspects of agricultural production and marketing. These policies were based on principles outlined in the *Sessional Paper No. 10* on “African Socialism and its Implications to Planning in Kenya” which emphasized political equality, social justice, and human dignity. These principles, following the example of the Soviet Union, were based on state control of the economy. The state was seen as the entity that maintains law and order and also outlines and implements social and economic programs in a bid to remedy historical and social inequalities. The principles were reinforced by the post-great depression failure of capitalism and markets on the one hand and apparent success of the state-intervention under the Marshal Plan and the Keynesian demand management regime.

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⁹ University of Nairobi

Under phase two, agriculture, just like the rest of the economy, registered both stagnation and decline. The stagnation and decline were caused by a mix of problem including inefficiencies in marketing, limited land expansion of small holder farming, limited development and use of new technologies, restriction on private trade and processing of commodities, and deteriorating infrastructure. These internal factors were compounded by the economic crisis caused by oil shocks of the 1970s and bad weather. Apparently, too much government involvement in agriculture stifled the private sector and forced the government to engage in activities that the private sector was better suited for. The parastatals, which enjoyed nation-wide monopoly, failed to achieve the objectives for which they were set namely, price and income stabilization for farmers, efficient and inexpensive nation-wide distribution of commodities to consumers without government subsidies and buyers of last resort (Swamy, 1994).

Phase two ushered in the era of reforms as it became evident that extensive government patronage of the agriculture sector was choking it. The reforms began in 1981 in principle but only became effective starting 1992. The intervening years were marked by a series of backslidings due to lack of good will and public controversy. In deed the 1981-1992 period was characterized by considerable official ambiguity as well as covert and overt resistance (Ikiara et al., 1993; Swamy, 1994). While the government gave the impression that it was not opposed to agricultural and other economic reforms, it made only half-hearted efforts to implement them. Growth in agricultural production suffered during this period averaging about 3.5 per cent per annum during the first period of implementation of the reforms (1980 to 1990), followed by a steady decline in the second phase ranging from minus 0.4 per cent in 1990-91 to the lowest level of minus 4.1 percent in 1992-93.

Phase three that followed the more serious implementation of reforms registered staggered growth. This phase can be further divided into two based on the political regime namely, the Moi and the Kibaki regime. Under the former, growth improved owing to the more serious reforms that ushered more private sector investment in agriculture and the better functioning markets. However growth was curtailed by, among others, corruption and poor infrastructure (especially poor transportation, frequent shortages in electricity, poorly function communication networks, etc). These deficiencies increased the transaction costs of doing business hence undermining agriculture. Hence although the era of reforms saw some improvement in agriculture, these were later overshadowed and even eliminated by the high transaction costs coupled with the weather shocks.

The Kibaki regime that commenced in 2002 was marked by more serious policies that targeted the revitalization of agriculture. The era pursued agricultural sector recovery using a number of policies. These include: Strategy for Revitalizing of Agriculture, National Food Policy, and National

Agricultural Extension Policy: These policies aimed at transforming the subsistence agriculture into commercial and profitable business enterprise by making it attractive for private sector to invest in agriculture and hence drive its growth. These implementation strategies for these policies have are outlined in two strategy paper namely, The Kenya Rural Development Strategy (KRDS) and Poverty Reduction Strategy Paper (PRSP). Overall, agriculture recovered during the

Kibaki regime. Growth increased from negative 3% in 2002 to 5.4% in 2006 (CBS, 2007). The major traditional sub-sectors notably tea and coffee grew by 6.4% and 19.1% respectively in the second quarter of 2007.

1.1. Agricultural Policy and the Smallholder Farmers

Kenyan agricultural sector has traditional been a dual sector consisting of small and large farmers. Depending on the subsector, the share of smallholders in agriculture ranges from 60% to 75%. In horticulture, for instance, 60% to 70% of French beans producers are smallholder farmers (Kimenye, 1993).

The policies pursued by the government over the years have certainly affected the smallholders. In the pre-independence years, the colonial government pursued policies that mainly focused on the large scale farmers. Hence agricultural information, especially extension services were mainly geared towards meeting the needs of the large scale farmers. Later the policy was revised with the adoption of the Swynerton plan of 1954. Even then, however, investment in agriculture was still biased towards the more progressive farmers. These biases were carried over into the post-independence era. Thus although investment in agricultural extension increased it was mainly the larger more progressive farmers that benefited.

Investment in R&D and transport network during 1963 -1979 period benefited small and large farmers alike and significantly reduced the transactions costs of producing and marketing smallholder crops. However these gains were eroded by the excessive government intervention in agriculture and exacerbated by increase in corruption and the deterioration of transport system during the Moi era. At the same time smallholders faced difficulties accessing productivity enhancing input namely credit and fertilizers.

The credit market failed for many smallholder farmers due to a number of factors. First, smallholders often lack collateral that most formal financial institutions demand. Second, even if they have collateral, lenders face higher transaction costs of servicing smallholder farmers with loans due to the small size of loans such farmers apply for. Third, smallholder farmers are often scattered over a wide geographical area making the cost of monitoring by the bank quite high. Fourth, most smallholder farmers, at least in the period immediately after independence, had low levels of education making it hard for them process the often complicated applications. The government intervened in the 1960s and 1970s by setting up the Agricultural Finance Corporation (AFC) to meet the needs of smallholder farmers. AFC was intended to be an inexpensive source of credit for smallholders. However mismanagement of the Corporation and poor loan recovery undermined its performance.

One of the major problems with agricultural credit in general was the high risk situation in agriculture. Risks associated with drought and pests/diseases are commonplace in agriculture. Such risks are covariate in nature, that is, they affect every farmer in a locality and can result in massive default in an area in turn leading to financial stress on the lender. Covariate risks are therefore one of the major reasons formal financial institutions have until recently¹⁰ kept off

¹⁰ In the last few years, Equity Bank has managed to hook into the smallholder market hitherto perceived to be risky. Other financial institutions have followed suit by expanding the lending to farmers.

agriculture in Kenya. During the colonial era, the government made credit available, even when banks had frozen credit to agriculture, through a Guaranteed Minimum Return (GMR). Under the scheme large-scale farmers were guaranteed a predetermined price for specific quantity of produce. The program also guaranteed protection against weather-induced crop failures. The scheme worked through interlinked credit scheme in which loans were extended for a crop marketed exclusively by the lender. The lender thus recovered the loan plus interest from the sale of the produce before remitting the rest of the earnings from crop sales to the farmer/borrower.

In the post globalization era, smallholder farmers have faced newer set challenges in accessing markets. The globalization and the quest for supplying high value better paying markets pose major problems to smallholder farmers. These problems relate to the demands of such markets especially in terms of food safety standards. Smallholder farmers face three distinct problems with regard to food safety standards: (1) how to produce safe and/or high-quality food, (2) how to be recognized as producing safe and/or high-quality food, and (3) how to identify cost-effective technologies for reducing risk and/or improving quality (Narrod et al, 2005)? Hence there have been concerns that smallholders that supplied discerning export markets will be marginalized by the food safety standards (Dolan and Humphrey, 2000; Okello et al 2008).

2. BACKGROUND AND SETTING

The government has responded to past constraints using many strategies. In this section, we limit ourselves to those strategies that have attempted to improve agriculture and hence farmer access to markets through provision of market information.

One of the strategies used by the government to input and output market failures in agriculture in Kenya was the creation agricultural marketing boards. These boards, as discussed above acted as sources of interlinked credit. In addition, the boards also served as sources of agricultural information through their marketing/procurement arm. These bodies provided information to farmers through their agricultural extensions programs that were often bundled together with the other inputs (notably seed, fertilizer and/or credit) extended to the farmer. Many government parastatals that served farmers in the pre-reform era extended such services to smallholder farmers. Notable examples include the Kenya Tea Development Authority and coffee cooperative societies. These organizations provided a bundle of services including agricultural information, fertilizer loan, and seed smallholder farmers often in kind.

The government and private sector have also tried the use of radio and television to disseminate agricultural information to farmers. In the case of the government, such programs covered daily broadcast of prices of major commodities in the main urban towns and also programs that are mounted by either Kenya Agricultural Research Institute or the Ministry of Agriculture and Livestock development targeting specific topics. The private sector, especially the input manufacturers have also used radio and television programs to pass agricultural information to farmers often as part of product promotion. Examples include the agrochemical companies and the seed manufacturers.

The problems with these strategies are often the timing of the programs and the coverage. Most radio and TV programs tend to be ill-timed. Majority of the agricultural programs are aired when the intended beneficiaries are off in the fields or attending to other activities. Part the reason for the inappropriate timing is the high cost of transmitting the information around news times (especially 7am, 1pm, and 7pm) when there are likely to be many farmers listening to or watching news. However, the more significant timing problem relates to the usability of the information being transmitted. Often agricultural prices transmitted by the media are dated and not a very useful indicator of the market prices. This relates to the difficulties of collecting price information, processing it and posting it which often takes time.

Poor coverage results from the inability of the target audience to understand the message (literacy) and the difficulty of accessing them. The former occurs when the target beneficiaries do not have the level of education needed to process and apply the message communicated. This has been the case of agricultural messages communicated in English language either. This problem has been overcome by airing or televising extension message in Kiswahili. However, there are still a large number of illiterate farmers that do not understand Kiswahili and hence remain locked out. Poor access to radio transmitted extension messages can arise when the target beneficiaries lack access to medium used (i.e., do not have radio or TV). This problem is common in most rural areas where majority do not own radios and/or TV.

In addition to the use of radios and TV and media transmitted agricultural market information, the government and private sector has also used a number of strategies. Some of the common strategies used by KARI, Ministry of Agriculture and input suppliers include posters, billboards, handouts and personal contacts (through field days and other public meetings- popularly known as *baraza* in Kenya). However, these often carry non-price information. The other common means of transmitting agricultural information has been the newspaper and magazines. In deed the major dailies often publish prices of major commodities in the major markets of Kenya.

2.1 Recent models provision of market information in Kenya

In recent years considerable attention has been given to the role market information play in linking farmers to markets. Recent studies indicate that lack of access to market information is one of the major causes of improper functioning of the market (Manyong et al, forthcoming; Barrett, forthcoming; Sartorius and Kirsten, 2007). Information asymmetry by one of the partners in an exchange process encourages the more informed partners to behave opportunistically. Under conditions of information asymmetry markets for essential inputs fail as has been the case with formal rural credit market. Information asymmetry also makes it difficult for commodity traders to engage in frictionless exchange. The buyer for lack of quality has to use physical inspection to verify quality or resort to buying from a network of trusted traders.

A number of ICT-based innovations have emerged in response to the constraint posed by poor access to agricultural market information. One of the newer models of providing agricultural market information to farmers has been the use of cell phone and internet based applications. These applications are mostly used by donor-funded NGOs. However, some private farms/firms, especially in the export business are using these applications without donor support. In Kenya, there have been a number of projects that apply the internet, cell phones and other innovative

means of transmitting information to farmers. Below we provide an inventory of Kenya- based projects that use reach farmers with agricultural market information.

3. INVENTORY OF ICT-BASED INNOVATIONS IN KENYA

Any ICT intervention that improves the livelihoods of the rural households will likely have significant impact on enhancing agricultural production, marketing and post-harvest activities even when such intervention is not specific to agriculture. For instance, provision of an accessible payphone can play a significant role in enhancing access to important information to households freeing up time for agricultural production and other household demand. However, many rural areas of poor countries lack telecommunication services that are key to growth of ICTs like telephone and the internet. Table 1 shows the number and proportion of people with access to various sources of ICT media in Kenya. Majority of the people have access to the radio and a almost a half of Kenyan population have access to a mobile phone. This is confirmed in Table 2 which shows usage of various media sources. Close to 80% recorded having listened to a radio in the most recent times, and 68% a mobile (short text message and calling). This suggests that for intervention to make quick impacts on peoples livelihoods, they should target the radio and mobile phones modes of communication and information delivery. The reading late is relatively low, with less that a quarter of the Kenyan's recording have read through a newspaper or a book the last one week.

Table 1: Access to various ICT media in Kenya

Media	Estimated Number ¹	Estimated proportion (%) ²
Radio**	-	89 own a radio
Mobile phone*	11,440,077	51
Fixed lines*	264,882	1 (4 in urban areas)
Fixed wireless*	193,064	-
Local Loop*	10,493	-
Internet*	1, 700,000	1 of urban dwellers have internet at home
Television**	1,386,000	42
Pay television**		1 of urban dwellers own pay TV
Newspaper		

Source: ¹Communications Commission of Kenya* (December, 2007), ²Steadman Research Services International

Table 2: Usage of various media¹ in Kenya

The responses are to a question: “Apart from today, when was the last time you..?”

	Yesterday	Past 7 days	Past 4 weeks	Long ago/DK
Listened to radio	79	12	3	6
Sent an SMS using a mobile phone	26	16	8	50
Made a call using a mobile phone	42	15	9	34
Watched TV	39	17	12	32
Read or paged through a newspaper	23	21	12	45
Used the internet	2	3	4	91
Used mail	2	3	3	92
Went to the mobile cinema (open air projected on a screen)	1	2	5	93
Made a call from a fixed line	2	4	7	87
Read or paged through a newspaper online (using the internet) ¹	1	1	1	97
Listened to radio through a mobile phone	4	4	3	89
Read or paged through a book	27	17	11	45

Source: Steadman Research Services International, 2007

1.2 Case studies ICT Innovations in Kenya

This section presents a summary of 30 case studies on ICT innovations in Kenya (Annex 1) and a summary review of 4 case studies on ICT for agriculture and rural development in Kenya (Annex 2). The summary of the 30 initiatives presents the type of innovation, the addressed problem and describes how ICT has been used in each case to overcome the problem. The implementing body and the boundary partners are also indicated, as well as the loci of intervention and targeted groups.

The 30 ICT innovations profiled in this study focus on a number of thematic areas: extension services, market access for inputs and outputs, financial services, advocacy and cross cutting rural development information and communication services. Figure 1 shows the number of ICT innovations focusing on these aspects. Close to 50% of the initiatives are on extension and market access. The crosscutting issues include: gender equality, community development, education and training, health and HIV/AIDS as they impact on rural livelihoods. Many more interventions have been on crop enterprises than on livestock (Table 3)

The thematic areas may also be indicative of the main loci of interventions. For instance, innovation focusing on extension will mainly target production and farming activities, while market access innovation target market and entrepreneurs. Post-harvest activities can be target of both. Financial ICTs are likely to combine with market access ICTs .

The interventions can also be categorized by modes of targeting; whether individual centered, group/community centered or mass out-reach. This is summarized in Figure 2 for the 30 case studies. Group and community targeting is the most utilized model of targeting intervention.

Figure 1: Thematic areas of ICT intervention

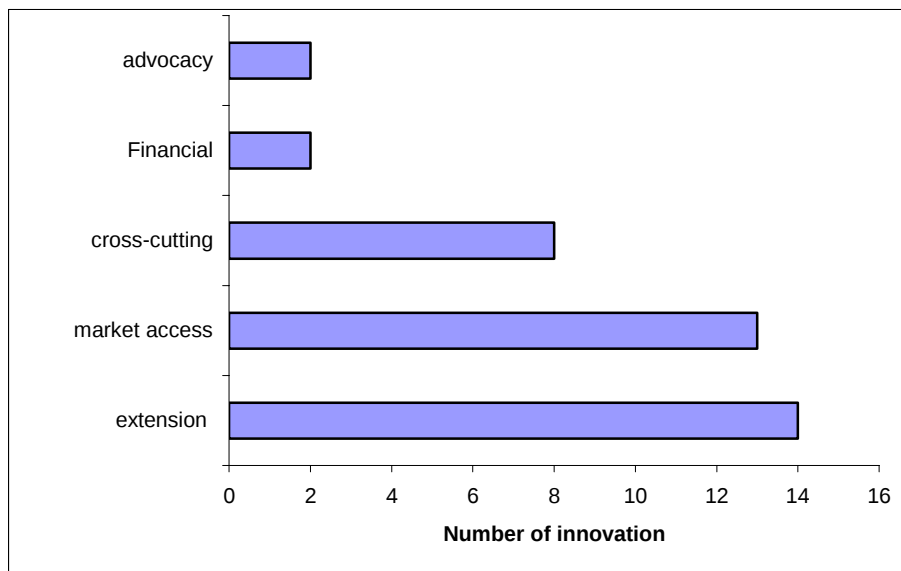


Figure 2: Model of intervention/targeting

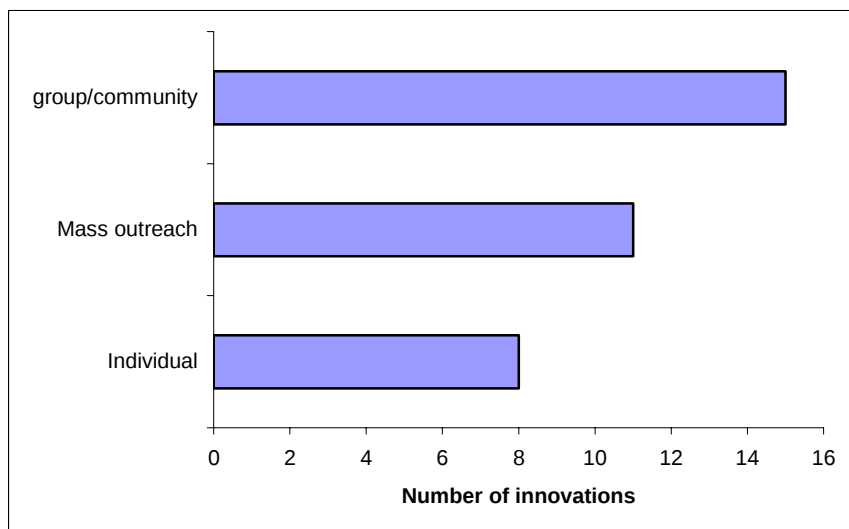


Table 3: SUMMARY OF EXISTING ICT-BASED INNOVATIONS.

	MARKET ACCESS	FINANCIAL ACCESS	EXTENSION ACCESS	INPUTS ACCESS
CROPS-BASED	• DRUMNET • SokoniSMS • Information and (Market) Linkage System (MILS) • Creating Wealth by Promoting Economic Value Added Interaction along the Agricultural Product Value Chain (APVC) • PENTSYS TECHNOLOGY KENYA. • DATA CORPS, GRAPHICS & SOCIAL AGENCY • Marketing services for small-scale entrepreneurs via the Internet • Electronic Tea Auction • A Health and Agriculture Community-Based Information and Communication System Project • Tele Flower Auction, The Netherlands • FOODNET project • Agricultural Information Centre • Digital Villages Project •	• DRUMNET • M-PESA Money transfer service •	• DRUMNET • Banana Information Line • Kyuso Community Information Supermarket. • The Kibwezi Farming and Technical Skills Resource center • DATA CORPS, GRAPHICS & SOCIAL AGENCY • The Africa Learning Channel (ALC) • ALIN: An information network for pastoralists and farmers • Radio Stations Bring New Skills to Farmers' Homes Initiative: • The Farm Radio Network (FRN), • MOBILE FOR GOOD • A Health and Agriculture Community-Based Information and Communication System Project • Poverty Alleviation Information and Knowledge System (PAIKS) • Agricultural Information Centre	• ADEA Agrovet
LIVESTOCK-BASED (Dairy and Beef)	• Livestock Information Network and Knowledge System (LINKS) Project • Agricultural Information Centre • Digital Villages Project	M-PESA Money transfer service	• ALIN: An information network for pastoralists and farmers • Agricultural Information Centre	

APPENDIX 7a: LIST OF ICT-BASED INTERVENTIONS IN AGRICULTURE AND RELATED INDUSTRIES

1. Agricultural Information Centre (Agricultural Information Centre -AIC)

INITIATIVE: Agricultural Information Resource Centre

Type of innovation: Extension and market access.

Implemented by: Ministry of Agriculture (MOA)

Boundary partners: Kenya Broadcasting Corporation (KBC), Kenya Agricultural Research Institute (KARI), Food and Agricultural Organization (FAO)

Funding or Funding model: Not for profit

Time frame: Established 1966

The problem/ obstacle addressed: Inadequate access to agricultural extension information by the rural farmers and agricultural extension agents

How ICT is used to overcome the problem: The AIC repackages extension material, both in print and electronic form, and also through the mass media. Its primary role is to use ICTs and mass media to complement the extension services of the MOA. The objective is to repackage agricultural information through the print and other media to suit the different needs of farmers, extension workers and other interested parties. Other activities of AIC include provision of training to extension workers to better their extension skills and the management of extension service. The AIC has various units including:

1) The radio Unit: Produces and translates into Kiswahili and other other local loanguages, radio programs including: Sikio la mkulima; Tembea na majira; Afya ya mifugo wetu; Wadudu wa nafaka; Mkulima na mazao; Bei ya mboga na matunda; Nipe habari; and Farmers corner 2. Video services unit: Producews documentaries, training videos, and videos on technical information. The unit collaborates with Kenya Agricultural Research Institute (KARI) and the KBC-the national broadcaster- in producing weekly TV program titled “Mkulima”. It also collaborates with a Non Governmental Organisation (NGO) called Regional reach in distributing and showing agricultural video programs at the village market centers, where television sets and video machines have been installed. The AIC has in addition installed TV sets and video machines in 20 farmers training centers where farmers can view the programs. Among its programs are: Zero grazing; a school without walls, runoff, a friend or foe, a sun will still rise, safari njema, mkulima, maziwa safi, and ufugaji wa ndizi. The last two are weekly TV programs shown through the national KBC TV station produced in collaboration with KARI. 3. Printing and publications services unit: Printing and publication unit undertakes the printing and publication of agricultural extension materials such as agricultural technical handbooks, brochures, leaflets, posters, magazines, and farmers’ journal. Printed materials are then distributed among researchers and extension workers who use them to disseminate agricultural information to the farming community. 4. The documentation services unit: The documentation centre acquires and stores unpublished agricultural documents and publications. These include various reports, conference proceedings, theses and dissertations, journals and articles, statistical and development materials as well as other scientific and technical information on Kenyan agriculture. The centre also keeps CDROM databases and is an inputting centre for International Information System for Agricultural Sciences and Technology (AGRIS) produced by FAO on agricultural information literature worldwide.

Loci of intervention: Production

Targeting: Mass outreach

Geographical area targeted: Whole country

Next stage: Ongoing

Contact information:

Ministry of Agriculture Headquarters,
Kilimo House
Nairobi

2. SMS-based commodity pricing systems

INITIATIVE: Sokoni SMS: Empowering farmers through SMS market price services

An initiative to facilitate linkage between sellers and buyers of agricultural commodities; provide relevant and timely marketing information and intelligence; provide a transparent and competitive market price discovery mechanism; and harness ICTs for rural value addition and empowerment. This is used for both crops and livestock.

Type of innovation: Market access innovation.

Implemented by: Kenya Agricultural Commodity Exchange

Boundary partners: Safaricom.

Funding or Funding model: for profit

Time frame: since 1997

The problem/ obstacle addressed: Exploitation of farmers by middlemen, who often charge below-market rates.

How ICT is used to overcome the problem: The [SMS-based commodity pricing system](#) allows farmers to bypass exploitative middlemen, who often charge below-market rates to farmers with few other options in terms of crop sales. The SokoniSMS service enables farmers to receive market prices in various market centers around the country through their mobile phones. Equipped with this information, the farmers are able to determine the most profitable market centre to transport products to and circumvent middlemen who usually offer to buy the products at much lower prices. In addition, the system helps farmers manage their trips to market, which can become expensive in terms of travel costs and lost time in the fields.

Loci of intervention: Marketing

Targeting: Individual/group centered

Geographical area targeted: Whole country

Next stage: Ongoing

Contact information: <http://www.kacekenya.com/KACE/AboutKACE.html>

3. Market Information and (Market) Linkage System (MILS)

INITIATIVE: Linking farmers to markets through modern information and Communication Technologies in Kenya

A market information and (market) linkage system (MILS) initiative designed to make agricultural markets work better (more efficiently) for farmers, especially targeting smallholder farmers.

Type of innovation: Market access innovation.

Implemented by: Kenya Agricultural Commodity Exchange

Boundary partners: have included the Rockefeller Foundation, the USAID Mission in Kenya, the Hans Seidal Foundation of Germany and the CTA in the Netherlands

Funding model: for profit

Time frame: Since 1997.

The problem/ obstacle addressed: Lack of reliable and timely market information as well as links farmers to better markets through matching commodity offers and bids.

How is ICT used to overcome the problem: MILS provides reliable and timely market information as well as links farmers to better markets through matching commodity offers and bids by developing a market information and (market) linkage system (MILS). The KACE MILS involves harnessing modern ICTs to empower farmers with low-cost reliable and timely market information to enhance the bargaining power of the farmer for a better price in the market place, and to link the farmer to markets more efficiently and profitably.

Loci of intervention: Marketing

Targeting: Individual/group centered

Geographical area targeted: Kenya

Next stage: Ongoing

Contact <http://www.kacekenya.com/KACE/AboutKACE.html> ; mail: info@stockholmchallenge.se

4.The Kibwezi Farming and Technical Skills Resource center

Initiative: The Kibwezi farming and Technical Skill resource center act as an information & education center that has established ICT (Computer based training) and Library services, for the youth and the larger community at large.

Type of innovation: Rural information services:

Implemented by/Boundary partners: International Relief Friendship Foundation (IRFF) - Urafiki Kenya

Funding or Funding method: Not for profit

Time frame: 2006

The problem obstacle addressed: The need for information dissemination center on good farming practices and methods.

How ICT is used to overcome the problem: Construction and equipping of a community resource center, in order to address the above problems through Information Technology / Library information services.

Loci of intervention: Production

Targeting: Community centered

Geographical area of target: The site is located in Kibwezi Division of Makueni division.

Next stage: Ongoing

Contact: HEADQUARTERS CONTACTS

The Executive Director Urafiki-Kenya
Dr. Christopher M. Nyamai,
University of Nairobi Chiromo Campus ,
Geology Department,
P.O. Box 33513 –00600,
Ngara Nairobi, Kenya.
Cell: 0722-813873 / 0722-889405
Landline: 020 – 4449004/ 4442016 Ext. 2096.
Email: cnyamai@uonbi.ac.ke

5. Kyuso Community Information Supermarket

Initiative: Kyuso Community Information Supermarket

Is a Farmers Resource Centre that is equipped with various appropriate Information and Communication Technologies (ICTs). These include a computer, a WorldSpace radio and a Digital Data Adapter, a printer, a mobile phone, and several data CD-ROMs.

Type of innovation: Extension - Information resource center'

Implemented by: ALIN-EA in partnership with the Ministry of Agriculture, Mwingi district.

Funding or Funding Model: not for profit

Time frame: Since January 2003 with official launch in July 1, 2004

The problem/obstacle addressed: Limited Access to practical information that is easy to read and understand, on the use of less hazardous pesticides through effective and ecologically sound pest management information.

How ICT is used to overcome the problem: The center provides a practical guide for trainers, extension workers and farmers on how to minimize pest damage in a safe, effective, and ecologically sound way. Through the center farmers have access to Online Information Service for Non-Chemical Pest Management in the Tropics (OISAT Info) CD-ROM among other disks with various development technologies and experiences.

Next stage: Provide access to the internet will be made possible through the General Packet Radio Service (GPRS) technology.

Loci of intervention: Production

Targeting: Community centred

Geographical area targeted: Mwingi district.

Contact:

Arid Lands Information Network-Eastern Africa (ALIN-EA),
P.O. Box 10098, 00100 G.P.O. Nairobi, Kenya,
AAYMCA Building, Along State House Crescent, Off State House Avenue.

Tel+254202731557
Telefax+254202737813
Cell Phone +254 722 561006

Email: info@alin.or.ke

6. Banana Information Line

Banana Information Line

Initiative Summary

The Banana Information Line is a text-to-speech (TTS) telephone line providing farmers in Kenya with information in either English or Kiswahili, related to how to plant, grow, and harvest bananas. The key strategy in the Banana Information Line is the use of its automated TTS system that allows users to access the information in either Kiswahili or English.

Type of innovation: Agricultural Extension based technology.

Implemented by: Local Language Speech Technology Initiative (LLSTI)

Boundary Partners: National Agriculture and Livestock Extension Program (NALEP) of the MOA

Funding or Funding model: not for profit

Time frame: Since 2006 as a pilot project.

The problem/ obstacle addressed: Limited access to agricultural information. Few extension staff or limited resource to cover area of jurisdiction

How ICT is used to overcome the problem: Farmers can call the line any time of day, every day, thereby allowing them to get information when they need it, and when it is most convenient for them.

Next stage: Full launch of the project.

Loci of intervention: Production

Targeting: Community level

Geographical area targeted: Kirinyaga district and other districts in the Mount Kenya region.

Contact information:

Roger Tucker

roger@outsideecho.com

website www.oisat.org

Website: www.stockholmchallenge.se/data/oisat_online_information

7. Drumnet

Initiative: An information exchange for rural entrepreneurs in East Africa through access points, or 'info-kiosks'.

Type of innovation: Market access, extension and financial services

Implemented by: PRIDE AFRICA

Boundary Partners: IDRC, SACCOs marketing cooperatives through the umbrella organizations the Kenya Union of Savings and Credit Cooperative (KUSCCO) and Kenya National Farmers Bureau (KENFAB), USAID, Princeton/Harvard University.

Funding or funding model: for profit.

Time frame: Since 2002

The problem/obstacle addressed: Farmer's lack key information or are unable to access the right market at the right time. These farmers are often forced into unprofitable transactions with local brokers and traders who take advantage of their lack of market information.

How ICT is used to overcome the problem: Combines the potential synergy of the African drum with the more efficient and sophisticated information technology to provide critical information to small business and for small-scale agricultural producers in East Africa. The project has support centers that cater for clients who require financial, market and technical information in order to make more profitable transactions.

Next stage: In the future, the project team envisages that its info-kiosks will be embedded into existing banks, savings and credit societies, and agricultural associations, and possibly even operated as independent franchises.

Loci of intervention: Marketing

Targeting: Community centred

Geographical area targeted: Central and Nairobi Provinces.

Contact:

School Lane
Behind Sarit Centre, Westlands
P. O. Box 39320
Post Code 00623
Nairobi, Kenya
Fax: (+254-20) 4458100
Tel: (+254-20) 4440666, 6752035/75
Email: info@prideafrica.com

8. Creating Wealth by Promoting Economic Value Added Interaction along the Agricultural Product Value Chain (APVC)

Initiative: This project seeks to create a value addition perspective to raw agri-produce and promote market linkages for wealth creation thereby creating the potential for access to other livelihoods benefits.

Type of innovation: Market access based innovation.

Implemented by: WillPower

Boundary partners: UNIDO and Ministry of Agriculture's Agricultural Training Centers.

Funding or Funding model: for profit

Time frame: (2007)

The problem/ obstacle addressed: Lack of linkage of value chain actors, providing them with knowledge and technology solutions and promoting a convergence of purpose through e-marketplace.

How ICT is used to overcome the problem: By providing a single point of contact for convergence of telecommunication services with the youth, agribusiness service providers, the government, and the community common interest groups who seek to exploit opportunities in the agricultural value chains.

Next stage: APVC hoped to introduce e-shillings to be the value of exchange that is convertible through our micro credit programme into real paper money and convertible to any currency.

Loci of intervention: marketing

Targeting: Community/ individual centred

Geographical area targeted: Kenya –urban and rural

Contact information: mail: info@stockholmchallenge.se; (www.willpower.co.ke)

9. PENTSYS TECHNOLOGY KENYA.

Initiative: PENTSYS TECHNOLOGY is rural based computer literacy training provider. They teach the communities around on basic computer concepts and skills so that people can use computer technology in everyday life to develop new social and economic opportunities for themselves, families, community and the entire country.

Type of innovation: Business development and market access.

Implemented by: PENTSYS TECHNOLOGY in collaboration with a local church.

Funding or Funding model: for profit

Time frame: Ongoing

The problem/ obstacle addressed: lack of IT skills.

How ICT is used to overcome the problem: PENTSYS TECHNOLOGY offer guidance to people who are already in businesses on how to use ICT and specifically computers to manage, enhance and market their services and products locally by use of databases management programs and the internet.

Next stage: To have internet access for the new trainees and to set a satellite dish that will use the VSAT technology or Wireless communications so that they can have full time access to the internet in an affordable and reliable means. PENTSYS TECHNOLOGY is looking forward to opening two new centers by the end of the year to cater for more clients.

Loci of intervention: Marketing

Targeting: Community based

Geographical area targeted: Kenya - rural areas of eastern province

Contact: mail: info@stockholmchallenge.se

10. **M-PESA Money transfer service**

Initiative: A product that allows customers to transfer money using their mobile phone. M-PESA is a Short Messaging System based service which makes it a cost effective means of money transfer.

Type of innovation: Finance based innovation.

Implemented by Safaricom

Funding or Funding model: for profit

Time frame: Since March 2007

The problem/ obstacle addressed: Lack of safe, affordable and convenient money transfer services to an ordinary person who may not have a bank account and therefore may not access money transfer services available to those with bank accounts. Other forms of electronic money transfer (e.g. Western Union and Money gram) are often expensive and may not be affordable to the majority of those engage in agriculture, especially the smallholders.

How ICT is used to overcome the problem: M-PESA provides a fast safe and affordable way to transfer money by SMS anywhere in Kenya. M-PESA makes money transfer affordable, accessible, secure, fast and convenient thus meeting the core objective of our organization.

Next stage: To add value to the product so that customers will be able to pay Utility bills, purchase goods and services as well as send money to other. The service provider, Safaricom, also plans to unveil the product to the other African countries.

Loci of intervention: Cuts across levels of the value chains

Targeting: Individual centred

Geographical area targeted: Kenya

Contact information:

Safaricom Limited
P.O.Box 46350, 00100 Nairobi.
Telephone: +254 20 427 3272
Website: www.safaricom.co.ke

11. AGRICULTURAL DEVELOPMENT EAST AFRICA AGROVET (ADEA)

Initiative: ADEA Agrovet is a social enterprise focusing on promotion of organic farming through provision of agricultural inputs products and services to farmers in Kenya by connecting the ADEA Agrovet with 100 ADEA Retails and the 10,000 farmers together.

Type of innovation: Input access

Implemented by: Agricultural Development East Africa Agrovet

Funding or Funding model: for profit

Time frame:

The problem/ obstacle addressed: Lack of personal interaction that could ensure cohesion and also increase customer loyalty.

How ICT is used to overcome the problem: To be able to manage this network and effectively communicate to them, the ADEA Agrovet has connected with 100 ADEA Retails and the 10,000 farmers together using both a web and short messaging systems (SMS) portals.

Next stage: process of developing a website and a point of sale program. After the systems and structures of the business become effective and achieve sustainability, plan to roll out an integrated MIS system that will be able to connect the stakeholders together, relay information right from the suppliers to the farmer and also integrate our partners

Loci of intervention: Production
Targeting: Youth / community centred
Geographical area targeted: Kakamega, Kenya.

Contact information: Stockholm Challenge Award 2007-2008
mail: info@stockholmchallenge.se

12. Marketing services for small-scale entrepreneurs via the Internet.

Initiative: *Marketing services for small-scale entrepreneurs via the Internet*

Type of innovation: Marketing services innovation.

Implemented by: Pride Africa a micro-finance based in Nairobi

Boundary Partners: USAID

Funding or Funding model: for profit.

Time frame: 1996

The problem/ obstacle addressed: High costs of communicating by telephone and the inefficiency and unreliability of sending information through the postal service.

How ICT is used to overcome the problem: The internet has facilitated timely communication with Pride Africa's partners to create a sustainable financial and information services network for small-scale entrepreneurs to increase incomes and employment and to stimulate business growth in Africa.

Next stage: Ongoing

Loci of intervention: Marketing

Targeting: Individual centred

Geographical area targeted: Kenya

Contact information:

Mailing Address, P.O Box 39320
Nairobi, Kenya

13. ALIN: An information network for pastoralists and farmers

The Arid Lands Information Network (ALIN) innovation to provide farmers and pastoralists in drought prone areas with information for sustainable livelihoods. It does so by promoting exchange of ideas and experiences among Community Development Workers (CDWs) in the Arid and Semi-arid Lands (ASALs) of Eastern Africa.

Type of innovation: extension based and early warning system.

Implemented by: Arid Lands Information Network (ALIN).

Boundary Partners: [FORD Foundation](#), [NOVIB](#), [Department for International Development \(DFID\)](#), [OXFAM-GB](#), [First Voice International](#), [One World International](#), [Practical Action](#), [Forest Action Network \(FAN\)](#), [Participatory Ecological Land Use Management \(PELUM\)](#), [Action Aid Kenya](#)

Funding or Funding model: not for profit.

Time frame: Since 1987 and on-going

The problem/ obstacle addressed: Limited sharing of experiences and ideas on good and bad practices in agriculture or pastoralism and development in the dry lands.

How ICT is used to overcome the problem: As part of the Open Knowledge Network (OKN) in Kenya, ALIN has set up access points in dry lands around the country where CDWs and community members can access information on sustainable farming practices and also provides early warning systems. ALIN also publishes newsletters.

Next stage: Ongoing

Loci of intervention: Production

Targeting: Community centred

Geographical area targeted: arid and semi-arid areas

Contact information:

Arid Lands Information Network-Eastern Africa (ALIN-EA),
P.O. Box 10098, 00100 G.P.O. Nairobi, Kenya,
AAYMCA Building, Along State House Crescent, Off State House Avenue.
Tel +254 20 2731557
Telefax +254 20 2737813
Cell Phone +254 722 561006
Email: info@alin.or.ke
Website: www.alin.or.ke

14. Livestock Information Network and Knowledge System (LINKS) Project

An innovation establishing communications infrastructure and technology, identifying and developing working relationships with key livestock marketing authorities, agencies and livestock marketing associations in Kenya, Ethiopia and Tanzania, acquiring livestock market information to support the need for market information and special modeling of pastoral livestock movement as well as design of potential output products and delivery systems.

Type of Innovation: Livestock market information.

Implemented by: Global Livestock Collaborative Research Support Program

Boundary Partners: USAID, Ministry of Livestock and Fisheries Development (MoLFD), Kenya Livestock Marketing Council (KLMC), Regional Agricultural Trade Intelligence Network (RATIN), Kenya Agricultural Commodity Exchange (KACE), Kenya Livestock Traders Association (KLTA), Food for the Hungry International (FHI), SNV Netherlands Development Organization, Kenya ICT Federation, Arid Lands Information Network (ALIN), Radio and Internet (RANET), University of Nairobi.

Funding or Funding model: not for profit

Time frame: Since 2003.

The problem/ obstacle addressed: Limited availability of information on livestock marketing.

How ICT is used to overcome the problem: LINKS has designed an information communication technology infrastructure for reporting and requesting information on livestock sales and prices from a network of different markets in Kenya.

Next stage: Designing a hybrid cell phone/web-based livestock information delivery system that is responsive to the real needs of the users in Eastern Africa

Loci of intervention: Marketing, production

Targeting: Group/individual centred

Geographical area targeted: Regional (Pastoral areas of Kenya, Ethiopia, Tanzania)

Contact information**Lead Researcher**

Scott Miller, Assistant Professor, University of Wyoming, Department of Renewable Resources, P.O. Box 3354, Laramie, Wyoming, USA 82071-3354, Tele: 307-766-3114, FAX 307-766-6403. Email: snmiller@uwyo.edu

15. Extension services through Radio Stations

A radio programme based innovation that is expected to reach more farmers by including those who do not listen to the regular programmes, partly because of difficulties understanding the Kiswahili/english language. Information is provided on need bases.

Type of innovation: extension based

Implemented by: Fit Resources

Boundary partners: DFID, KBC, Vernacular radio stations (Mbaitu FM, Radio Salaam, Kass FM, Coro FM)

Funding or Funding model: for profit

Time frame: Piloted in 2006 and currently ongoing

The problem/ obstacle addressed: lack of access to good husbandry information in languages understood by farmers. Few trained personnel in agriculture to offer advice on crop or animal husbandry in remote areas. Previous programmes were driven by advertisers, so more air-time spent advertisements rather than teaching.

How ICT is used to overcome the problem: The innovation involves integrating the radio stations, agriculture information content providers and farmers with the ultimate aim of enabling farmers to get better farming information through the radio. Short programme aired immediately after news e.g. Mali Shambani (Kiswahili for 'wealth in the farms'); 30 minutes.

Next stage: More vernacular radio stations joining a similar partnership.

Loci of intervention: Production

Target: Mass outreach

Geographical area targeted: The whole country

Contact information:

Executive director (Mr. Richard Isiaho)

Fit Resources

P.O. Box 61477, 00200 City Square, NAIROBI.

Tel: +254 20 2713473 Telefax: +254 20 2715900,.

E-mail: fit@wananchi.com

16. The Regional Agriculture Trade Expansion Support (RATES) program

INITIATIVE: RATES

Type of innovation: Advocacy on trade issues.

Implemented by: United States Agency for International Development (USAID)

Funding or Funding model: Not for profit

Time frame:

The problem/ obstacle addressed: Low regional agricultural trade flows/volumes. The initiative aims to expand and sustain regional agricultural trade flows through strengthened human and institutional capacities by: Expanding agricultural trade in selected sub-sectors; increasing institutional capacity to sustain agricultural trade; Expanding private sector contribution to regional trade initiatives

How ICT is used to overcome the problem: Through policy advocacy, lobbying, public relations and marketing, **RATES** is developing a regional dialogue regarding trade issues in East and Southern Africa. The program is designed to increase value/volume of agricultural trade within the East and Southern Africa region and between the region and the rest of the world. **RATES** focuses on developing commodity-specific regional trade initiatives through innovative private sector/public sector alliances and partnerships and works primarily through regional trade flow leaders such as regional trade associations, national-level trade organizations, private companies and individual entrepreneurs. **RATES** is currently supporting activities in specialty coffee, maize and pulses, cotton/textiles, livestock and dairy. One of the main tool used is the quarterly newsletter, the RATES REVIEW.

Next stage: Ongoing

Loci of focus: Marketing/trade

Target: Group/Institution centred

Geographical area targeted: East and Southern Africa.

Contact information:

USAID RATES

P.O Box 1555

Sarit Centre 00606

Nairobi, Kenya Tel +254-42112000; Fax: +254-4212271; Email: rates@ratescenter.org

17. The Farm Radio Network (FRN)

Initiative:

A radio network based in Harare, Zimbabwe, and which can be heard in Kenya through its partner Radio Mang'elele, Radio Simba, Rural Service Programme, and Straight Talk Radio Show

Type of innovation: Extension based

Implemented by: Farm Radio Network (FRN)

Funding or Funding model: Not for profit

Time frame: Ongoing

The problem/ obstacle addressed: Lack of radio program that pays particular attention to the needs of rural farmers.

How ICT is used to overcome the problem: FRN pays particular attention to the needs of rural farmers in East and southern Africa and provides up-to-date practical information on agriculture and health. The network also relies on "rural communicators," who translate current research findings into local languages and disseminate and broadcast them in response to the listeners' expressed needs. The challenges encountered include among others appropriate time to broadcast the programs, prohibitive production, airtime costs and lack of radio signals especially for rural radio stations

Loci of intervention: Production

Target: Mass target

Geographical area targeted: regional

Contact information: Livai Matarirano, Farm Radio Network, P.O. Box 308, Harare, Zimbabwe;

Tel: (263 4)42610 Fax: (263 4) 731901; email: Matarirano@mango.apc.org

18. **Electronic Tea Auction**

Initiative: Electronic Tea Auction (yet to be implemented)

East African Tea Trade Association is working on plans to introduce electronic tea auctions as a part of new strategies

Type of innovation: Market access based innovation.

Implemented by: East African Tea Trade Association

Funding or Funding model: for profit

Time frame: To be launched soon.

The problem/ obstacle addressed: To fight off the competition of the proposed Dubai Tea Trade Centre.

How ICT is used to overcome the problem: They have realized that the world has become a global village, and business is now moving to the internet.

Next stage: Rolling out the initiative.

Loci of intervention: Marketing

Target: Mombassa Tea Auction

Geographical area targeted: Kenya .

Contact information:

The East African Tea Trade Association (EATTA

info@eatta.com

19. **Initiative: A Health and Agriculture Community-Based Information and Communication System Project (KAIPPG)**

An innovation to build the capacity of rural communities in information processing, accessing and its dissemination for health improvement, nutritional and agricultural development, poverty alleviation, knowledge acquisition, gender equity, ICTs and general literacy. The KAIPPG focuses its work on improving the status of women, children and youth living in the rural areas through increased access to knowledge and information about the links between HIV/AIDS and general health; agriculture and nutrition; gender inequality and poverty--and fosters an approach of self-empowering activism, which in turn helps in the development of programs to address the identified community needs.

Type of technology: Agricultural extension and marketing initiative, HIV/AIDS education.

Implemented by: [KAIPPG \(Kenya AIDS Intervention Prevention Project Group\)](#)

Boundary Partners: Extension Workers MOA, officers from the local Community Radio Station—Sayare FM and trained community based volunteers

Funding or Funding model: not for profit.

Time frame: KAIPPG was founded in 1995 and registered in 1999.

The problem/ obstacle addressed: Lack of electricity and unavailability of modern communication facilities such as telephone, Internet and email has rendered the rural farmers unable to access information on modern farming technologies and access to market outlets where they can sell their farm products. With the high levels of understaffing and under-funding in most government departments, access of extension services to the farmers by the Ministry of Agriculture remains a perennial problem.

How ICT is used to overcome the problem: Through integration of ICTs in HIV/AIDS prevention, gender empowerment, and agricultural improvements through trainings and use of Community Radio Stations e.g. Sayare FM

Next stage: To develop more information themes, packaging them on tapes and CD-ROMS sharing them with other partners, radio stations as well as other like minded institutions.

Loci of intervention: Production and health

Target: Community centred especially youth and women

Geographical area targeted: Kakamega, Kenya

Contact information:

James Onyango, *Executive Director of KAIPPG*

P. O. Box 2448, Kakamega, 50100, Kenya; Telephone no. 254 56 641004 Fax No. 254 56 641004

20. Tele Flower Auction, The Netherlands

Initiative: Tele Flower Auction, The Netherlands

An innovation to market cut flowers through a remote cut flower auction, Tele Flower Auction (TFA), located in Amstelveen, the Netherlands. Flowers currently sourced primarily from Kenya, Tanzania, Uganda, Zambia and the Netherlands.

Type of innovation: A market access innovation.

Implemented by: Tele Flower Auction.

Boundary partners: Kenya Flower Council (KFC), Airflo

Funding or Funding model: For profit

Time frame: Since 1995

The problem/ obstacle addressed: High transaction costs and time taken before flowers are delivered to their final destinations

How ICT is used to overcome the problem: By availing an on-line flower auction facility.

Next stage: Full blown use of the facility to market flowers from Kenya

Loci of intervention: Marketing

Targeted: Flower farmers

Geographical area targeted: Kenya

Contact information: Tel: +31 (0)206569777; info@tfa.nl

21. FOODNET project

FOODNET is an **ASARECA** (Association for Strengthening Agricultural Research in Eastern and Central Africa) post harvest and market research program for East and Central Africa. FOODNET mainly focuses on market analysis studies, market information and agro enterprise development, and related business development support services.

Type of innovation: Market access.

Implemented by: ASARECA

Boundary partners: Agro-enterprises, farmers

Funding or Funding model: not for profit

Time frame: established in 1999.

The problem/ obstacle addressed: Limited market opportunities

How ICT is used to overcome the problem: Researchers working with FOODNET use market survey techniques to identify market opportunities and thereafter work in close collaboration with a range of public and private sector partners to develop agro-enterprise projects, using innovative post harvest technologies and products to supply both new and existing markets.

Next stage: Ongoing

Loci of intervention: Post harvest and marketing

Target: Individual/ group centered
Geographical area targeted: East and Central Africa
Contact information:

Plot 15, East Naguru Rd, (Opposite WBS-TV mast) Upper Naguru Hill,
P. O. Box 7878, Kampala, Uganda

Tel: 256-41-285060 / 285064, Fax: 256-41-285129

Website: www.fooodnet.cgiar.org

Email: mis@iita-uganda.org

22. [Kenya Agris pilot project: Kenya Agricultural Information Network \(KAINet\)](#)

INITIATIVE: Kenya Agris pilot project

Type of innovation: Extension and research

Implemented by: Kenya Agricultural Information Network

Boundary partners: DFID through FAO, CABI Africa and the Regional Agricultural Information Network (RAIN), Kenya Agricultural Research Institute (KARI), the Kenya Forestry Research Institute (KEFRI), MoA and Jomo Kenya University (JKU).

Funding or Funding model: Not for Profit

Time frame: 2006-2009

The problem/ obstacle addressed: The project is born out of a need to address issues critical to content development and information exchange between users, identified in several AGRIS activities in Kenya as well as the new AGRIS vision which emphasises the following: decentralized capacities to manage and exchange agricultural information; strengthen national and institutional capacities to manage, disseminate and exchange agricultural Information; availability of full text content and; promote use of standard tools and methodologies.

How ICT is used to overcome the problem: Project aims to establish systems that promote information exchange and access among researchers and other agricultural stakeholders through building capacity to manage information and through establishing institutional repositories of agricultural information.

Next stage: Its bigger vision is to establish a national forum for exchange of agricultural content through a national information network with essentials components such as national electronically repository.

Loci of intervention: Research

Target: Group/research institution centred

Geographical area targeted: Kenya

Contact information:

<http://agriscontent.wordpress.com/2007/03/15/kenya-agris-pilot-project-kenya-agricultural-information-network-kainet/>

23. Simu ya Jamii Community Phone Service

INITIATIVE: Simu ya Jamii

Type of innovation: Access to mobile phone by the poor

Implemented by: Safaricom

Boundary partners: entrepreneurs

Funding or Funding model: For Profit

Time frame: Continuous

The problem/ obstacle addressed: Lack of access to phones for low income people

How ICT is used to overcome the problem: Safaricom facilitated the ownership of branded mobile phone kiosks through a credit arrangement for small-scale entrepreneurs. This has resulted in improved access to telecommunications services for many Kenyans who do not already own mobile phones

Next stage: on-going

Loci of intervention: cross-cutting

Target: Individual entrepreneur/ poor people

Geographical area targeted: Kenya

Contact information: Safaricom

24. AIC Rural Communications project

INITIATIVE: AIC Rural Communications project - Kenya

Type of innovation: Extension

Implemented by: African Inland Church

Boundary partners: Agriculture Information Center (AIC) of MOA, KBC, Air-time sponsored by commercial companies e.g. East Africa Industries, The Media Trust, UK government

Funding or Funding model: Not for Profit

Time frame: Since 1993

The problem/ obstacle addressed: Lack of access to information (on farming methods, animal husbandry, horticulture, social and gender issues (including alcoholism and female circumcision), family planning, health/medicine (including AIDS), hygiene, cookery) in the rural areas

How ICT is used to overcome the problem: Is a radio project which uses two radio soap operas and two radio magazines to broadcast information on a range of important issues. There was a focus on reaching rural areas. The soap operas use entertainment to reach audiences, and the magazines are primarily focused on information. Inventive and professional programming based on extensive and careful Participatory Rural Appraisal research has resulted in a very effective campaign. Radio broadcasts of radio soap operas: Ndinga Nacio (in Kimeru), and Tembea Na Majira (in Kiswahili), and radio magazines: Mugi Ni Mwere (in Kimeru) and Sikizia Urevuke (in Kiswahili).

Next stage: Ongoing

Loci of intervention: Mainly production plus general social-economic issues

Target: Mass outreach

Geographical area targeted: Kenya

Contact information: UNEP Regional Office for Africa (ROA)

P.O. Box 30552

Nairobi 00100

Kenya

Tel: (254 2) 624 284

Fax: (254 2) 623 928

roainfo@unep.org

25. The Africa Learning Channel (ALC)

WSF's award-winning audio service. The ALC was launched in December 1999 as a forum for Africans to share ideas, experiences, and solutions to common problems, including topics such as HIV/AIDS prevention, conflict resolution, women's rights, and microenterprise development. It is a collective channel of 'first voice' programs developed from educational and social development content produced by African community groups and media organizations for an African audience. It is a powerful voice for populations whose ideas and concerns have previously been unheard.

Type of innovation: Extension based innovation.

Implemented by: First Voice Africa (FVA).

Boundary partners: UNESCO

Funding or Funding model: Not for profit.

Time frame: ALC launched 1999. First Voice Africa (FVA) is a regional office for First Voice International and was registered as a Kenyan NGO in December 2005.

The problem/ obstacle addressed: Information needs and means to communicate the needs in their own voice, by people living in poverty and remote places, to improve their lives.

How ICT is used to overcome the problem: FVI provides the technological capacity and know-how to deliver locally relevant - increasingly listener produced programming in - information to the world's most remote and underserved communities. FVI strive to reach the most people for the least cost by combining satellite and other technologies.

Loci of intervention: General development

Target: Mass outreach

Geographical area targeted: Most countries of Africa Kenya included.

Contact information:

Humphrey Mwaura, Africa Representative

Eden Square Business Center

7th Floor-Chiromo Road, Westlands

P.O. Box 856.000606, Nairobi, Kenya; Tel: 254-20-367-3671/2; Fax: 254-20-367-3231; Email:

hmwaura@firstvoiceint.org; fva@firstvoiceint.org

26. MOBILE FOR GOOD

Initiative: This is a social franchise project designed to use mobile phone technology to help alleviate poverty and improve the lives of people in the developing world. It delivers vital health, employment and community content via SMS on mobile phones in order to inform and empower disadvantaged individuals and help bridge the 'digital divide' – the widening technology gulf which exists between rich and poor countries.

Type of innovation: Information based technology.

Implemented by: Mobile4Good Kenya,

Boundary partners: Vodafone foundation, Accenture, Mobile Network Operator: Safaricom Ltd ; Internet Services Provider: Africa OnLine Ltd, Content Providers: Kenya Breast Health Programme, Pure Health Ltd , Occasions & Days, CBI Ltd , Hilton Hotel Nairobi Fitness Centre, Movement of Men Against Aids Kenya, National Aids and Sexual Transmitted Diseases Control Programme (NASCOP); Other Partners: Ministry of Labour, The Government Public Communications Office

Funding or Funding model: for profit

Time frame: was established in 2003

The problem/ obstacle addressed: The widening technology gulf which exists between the rich and poor.

How ICT is used to overcome the problem: offers innovative, seamless and flawless solutions that generate high traffic and revenue from SMS, mobile gaming and business tools on the mobile platform. Their content platform distributes content relevant to individual customers based upon different parameters, such as handset, location, time and business profile. In addition, they provide clients with trends and insights while identifying new opportunities through data analysis.

Next stage: The team is currently looking for potential franchisees and investors. Kenya success has driven plans to replicate the franchise in further countries across Africa and the rest of the developing world including Cameroon, Tanzania, Uganda, Nigeria and Nepal

Loci of intervention: Cross-cutting

Target: Individual centred

Geographical area targeted: Kenya

Contact information:

OneWorld Kenya

4th floor Kimathi House

P. O. Box 1021-00100

Nairobi; Tel.: +254 20 241 920 / 316800

Business Manager: Antony Mwaniki; Email: antony.mwaniki[[@](mailto:antony.mwaniki@gmail.com)]gmail.com ; Website: www.kazi560.co.ke

27. Poverty Alleviation Information and Knowledge System (PAIKS)

Initiative: An ICT innovation aimed at empowering communities to identify and understand poverty causes, extent and effects to devise means to reduce it. ICT plays a big and important role in this project as a means of organizing, storage, access and dissemination of relevant information, knowledge and technologies from research in a number of areas, including food and security, among others. The overall project objective is to disseminate poverty related information for human capacity development.

Type of technology: information dissemination.

Implemented by: African Institute for Capacity Development (AICAD)

Boundary partners: Japan International Cooperation Agency (JICA)

Funding or Funding model: Not for profit

Time frame: Ongoing

The problem/ obstacle addressed: Lack of electronic/digital data harnessed, processed, stored and easily accessed.

How ICT is used to overcome the problem: The project has made data available in electronic format which is easy to manipulate when repackaging for various needs like publishing pamphlets, brochures, fliers and multimedia copies. The web access to database contents provides the intermediaries engaged in interpreting research findings and repackaging them into relevant, applicable and practical technologies to access and use the information at will and own convenience. The contents of the database accessed on the web makes the work of intermediaries and other agents dealing with communities in poverty reduction easy in preparing relevant package for the communities to use.

Next stage: When later a portal is developed in the network connecting an a member partner institutions' databases will further enrich the resource

Target: Mass out reach

Geographical area targeted: Kenya, Uganda and Tanzania.

Contact information:

Stockholm Challenge Award 2007-2008

mail: info@stockholmchallenge.se

28. Rural Radio Resource Pack Network

Type of innovation: Extension

Implemented by: Technical Centre for Agricultural and Rural Cooperation ACP-EU (CTA)

Boundary partners: Agricultural Information Center (AIC), Kenya Agricultural Research Institute (KARI), Kenya Broadcasting Corporation (KBC), Across - Christian Organisation, Trans World Radio station, EcoNews Africa-Community Media

Funding or Funding model: Not for Profit

Time frame: From 1991

The problem/ obstacle addressed: Lack of access to information on agriculture and rural development in the rural areas

How ICT is used to overcome the problem: CTA produces, every year, 5 Rural Radio Resource Packs on a variety of topics related to agriculture and rural development to be re-packaged and broadcast by local radio stations in African, Caribbean and Pacific countries (ACP). Aimed at strengthening the links between extension workers and farmers, promoting knowledge-sharing between farmers, and addressing the problem of illiteracy, the packs are designed to encourage the use of rural radio to disseminate scientific and technical information.

Next stage: Ongoing

Loci of intervention: Production

Target: Mass outreach

Geographical area targeted: ACP countries

Contact information: cta@cta.int

29. RANET Kenya project

Type of innovation: Extension and early warning system

Implemented by: African Centre of Meteorological Applications for Development (ACMAD)

Boundary partners: Kenya Meteorological Department, MOA, KARI, Ministry of Livestock, Office of the president, Disaster Management Committee and NGOs that are already on the ground working on developmental projects with rural communities.

Funding or Funding model: Not for Profit

Time frame: Is on pilot basis in Kenya and in other countries, including Niger, Senegal, Mozambique, Chad, and Zambia.

The problem/ obstacle addressed: Lack of vital weather and climate information by rural communities

How ICT is used to overcome the problem: RANET transmits vital weather and climate information to rural communities in Africa, by exploiting the Internet, the WorldSpace multimedia system, solar powered radio transmitters and wind-up radios with a potential for reaching people, literally, anywhere in Africa even the remotest places.

Next stage: Scaling up

Loci of intervention: production

Target: Mass outreach; the rural communities

Geographical area targeted: Countrywide

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30. Digital Villages Project

Initiative: Digital Villages

Type of innovation: Market access and extension.

Implemented by: Government of Kenya through the Kenya ICT Board (a state corporation)

Boundary partners: CCK

Funding or Funding model: Not for profit

Time frame: Currently being rolled out

The problem/ obstacle addressed: In adequate ICT access and utilization

How ICT is used to overcome the problem: Through establishment of a network of information facilities across the country. The Digital Village Project (DVP) is an integral part of an innovative Public Private Partnership (PPP) for taking ICTs to the rural communities in Kenya. It seeks to harness the vast untapped potential of the rural sector by making ICTs more accessible and affordable to the wider population through the development and utilization of ICT facilities in the rural areas. The services include, but are not limited to: e-mail and Internet access; e-banking (e.g. money transfer services such as Posta Pay); e-government (e.g., police abstract forms, tax returns, P3 forms, and driving license applications); e-business (e.g., franchised postal and courier services); e-learning; e-health; **e-markets (e.g., agricultural commodity pricing and exchange)**; and e-monitoring (e.g., real-time local level monitoring of development funds and projects).

Next stage: Ongoing

Loci of intervention: Production, marketing, business development

Target: General rural development

Geographical area targeted: Mass outreach, whole country

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APPENDIX 7b: SUMMARY OF ACADEMIC STUDIES ON ICT IN KENYAN AGRICULTURE

Title	Objectives	Major findings and Recommendations
1. Does Agricultural Extension have a new beginning because of ICTs? Reflections on experience in Sub Saharan Africa (Kiplangat, J, 2003)	The paper analyses ICT models used to disseminate information to rural communities in sub-Saharan Africa with special emphasis on agricultural extension. The authors attempt to provide an overview and give background information on agricultural extension systems and services. An assessment of the use of ICTs is discussed with examples drawn from case studies of Kenya and South Africa. Theme: Extension	Sub-Saharan African countries have adopted a variety of ICTs models in dissemination of information to rural communities (print, electronic, among others), to ensure resource poor farmers access information to improve their livelihoods. This is however hampered by knowledge gaps, constraints and challenges. Impact: Due to the cited constraints, ICTs are yet to have a meaningful impact in the provision of extension services in Sub Saharan Africa. Identified areas of intervention: Poor infrastructure in terms of telecommunications facilities and electricity; High telecommunication tariffs; lack of physical access to ICTs; sustainability problem especially for donor funded projects; Obsolete ICTs; Lack of maintenance of equipments; inadequate funding; lack of awareness of ICTs tools and services; lack of technical know how; Lack of relevant content; Lack of supportive government policies and legislation on application; Lack of education to create awareness on the role and potential of ICTs and Lack of commitment and willingness by policy makers and stakeholders. For the already adopted ICTs in sub-Saharan Africa, many changes need to take place to address the mentioned knowledge gaps, constraints and challenges. • There is need to evaluate and identify ICT models that are appropriate for agricultural extension. • The needs for the people and the best means to satisfy them should determine ICTs to be adopted for use in agricultural extension.
2. Linking Farmers to Markets through Modern Information and Communication Technologies: The Case of KACE (Mukhebi A.W, 2007)	The study assessed the impact of market information and linkage system (MILS) developed and tested by the Kenya Agricultural Commodity Exchange Limited (KACE). The components of the KACE MILS assessed include: Rural based Market Information Points (MIPs) which are information kiosks located in rural markets, District-level Market Information Centres (MICs), Mobile Phone Short Messaging Service (SMS), Interactive Voice	The study findings indicate that that the proportion of farmers and traders that say their incomes have increased and their bargaining positions have improved is very high (75 farmers and 60 commodity traders). Further, the study concluded that market integration improved for two commodities (i.e. maize and beans) during the years in which the KACE MILS has been operational.

	Response (IVR), Internet based database system, rural FM radio and the Central Coordinating Hub in Nairobi.	
	Theme: Market access	
3. A study of agricultural knowledge and information systems (AKIS) undertaken by the Kenya Agricultural Research Institute and the Ministry of Agriculture. Field research was conducted in four districts of Kenya, including high-potential and pastoral areas, to document and assess the significance of different actors and organizations as potential uptake/dissemination pathways for agricultural technologies, and to consider ways to improve the performance of the knowledge and information systems in the study area.	To document and assess the significance of different actors and organizations as potential uptake/dissemination pathways for agricultural technologies, and to consider ways to improve the performance of the knowledge and information systems in the study area. Theme addressed: Extension	The AKIS of Kenya's smallholder farmers are diverse and complex, varying with agricultural enterprise, agro-ecology, and from district to district. Agribusiness plays a major role in the AKIS of areas near major towns (e.g. Kiambu near Nairobi), whilst government and non-government agencies are the major 'external' actors in remote areas (e.g. pastoral areas of West Pokot). NGOs and church organisations are particularly active in poor districts (e.g. Homa Bay), but their coverage is limited. Links between external institutions and organizations, for both government organizations and NGOs, are generally weak and poorly coordinated. The major sources of knowledge for smallholders are local (neighbours, family, markets and community based organisations). Between 40 and 70 per cent of respondents reported government extension as an important source of information, though both farmers and extension personnel themselves expressed dissatisfaction with the quality and frequency of their interactions. NGOs are also important sources of information in those areas where they are active. Churches, chief's barazas (community meetings) and agricultural companies are significant information sources in some locations. Most farmers considered that their most pressing information requirement which was not being adequately addressed was information on technical details of farming (e.g. chemical application rates, how to manage late blight in potatoes, where to get certified seed, the most appropriate varieties for a given location, housing and management of livestock, etc.). Inadequate human resources (government and non-government extension) and poor local leadership (particularly for CBOs) were seen as the most serious barriers to effective information flow by farmers, whereas government and NGO extensionists stressed lack of resources to mobilize communities, and poor communications with researchers leading to information distortion. Identified areas of intervention Potential delivery systems and entry points for knowledge dissemination were quite diverse – district-specific and commodity-specific strategies are needed.

		Increased use of networking and pluralism in provision of extension and research services are advocated to increase cost-effectiveness, equity and efficiency of agricultural development. The importance of participatory learning approaches was emphasized by many of the study participants. Government research institutes could capture a pivotal role in the AKIS of the future through increased emphasis on strategic alliances with other development agencies, the production of teaching materials designed for facilitating participatory learning, and the production of 'basket-of-options' information materials for farmers and extensionists.
4. Analysis of the opportunities for information technology in improving access, transfer and the use of agricultural information in the rural areas of Kenya (Kiplangat, J, 1999)	The study examined the opportunities of information technology (IT) in improving access, transfer and use of agricultural information in the rural areas of Kenya. The study adopted a case study approach to study organizations and institutions that use IT in disseminating agricultural information to the rural population in Kenya. The study was limited to agricultural information. The information technologies examined include CD-ROM, computer networks, video and desktop publishing. Theme addressed: Mainly Research and Extension, but with cross-cutting issues	The study highlighted the advantages and limitations of IT in disseminating information in the rural areas of Kenya. Among the factors that make IT relevant for rural development are vast storage, fast and inexpensive communication channels, links between different media, easy and enjoyable use at comparatively and steadily declining costs. Identified areas of intervention/recommendation: For IT to have more impact on rural development, it should be needs driven, rather than technology driven. This can only be achieved if the needs of the users are placed at the centre and appropriate technologies adopted.

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APPENDIX 8: BACKGROUND PAPER ON ICT POLICY ENVIRONMENT AND THE USE OF ICT-BASED INTERVENTIONS IN AGRICULTURE: THE CASE OF BENIN

1. INTRODUCTION

1.1 Prominent/symbolic role of agriculture in Benin

The Republic of Benin is a sub-Saharan country which economy is essentially based on agriculture. The country is differentiated in eight agro ecological zones within which are conducted diversified enterprises of crop productions, animal productions and fishery productions and forest productions. On the disposal 11 millions of hectares only 60% are suitable for agricultural purpose. The average size of the farm households with 7 persons' acreage holding is estimated to 1.7 ha. Meanwhile, 34% of farm households' acreages are below 1 ha; and only 5% of farm households in the South and 20% of those in the Northern part of the country are greater than 5 ha.

Indeed, this sector employs almost 70% of the working population, gets 80% of the export earnings of the country and takes part to a total value of 15% in the public revenue (MAEP, 2006). The main food crops produced are: maize, cassava, yam followed by millet/sorghum, rice, groundnuts beans, etc. The main cash crops are: cotton, pineapple, palm oil, mahogany, etc. The agricultural sector which includes approximately 450 000 agricultural producers is characterized by small-scale farming whose cultivate areas vary on average between 0.50 ha in the southern part of the country and 2 ha in the Northern part.

1.2 Brief discussion of government policy on agricultural development

Since 1990 the Government of Benin has been implementing a structural adjustment program intended to dramatically change the organization of most economic sectors. In the agricultural sector, reforms were implemented in food marketing, cotton marketing, input distribution, rural finance, and agricultural services. These reforms were defined in the document known under the name of the "Lettre de Déclaration de Politique de Développement Rural (LPDR)" in 1991. This political document was revised in 1999 in "Déclaration de Politique de Développement Rural" or Declaration of Policy of Rural Development) adopted in June 2000. This revision of the LPDR is accompanied by a "Schéma Directeur du Secteur de Développement Agricole et Rural" which was conceived in April 2000. But, the Operational Strategic Plan which translated the total strategy into action was done in August 2000.

Under this orientation, the agricultural services were restructured with the "Programme de Restructuration des Services Agricoles". The PRSA contains a number of elements according to Kerhallah and *al.* (2001):

- Withdraw public institutions from commercial activities that the private sector can undertake. Examples include agricultural processing, seed multiplication, veterinary services, importation of veterinary medicine;

- Improve the function of activities that the public sector must undertake through training and capacity building. These activities include agricultural research and extension, investment and maintenance of infrastructure, provision of agricultural market information, and control of contagious plant and animal disease;
- Reduce the fiscal burden of agricultural program. For example, the number of employees of the Ministère de Développement Rural and the CARDERs will be reduced by 61 percent relative to the 1991 level.

The reforms in the food market involved the official liberalization of marketing activities, the restructuring of the cereal marketing board (Office National d'Appui à la Sécurité Alimentaire, ONASA – former Office National des Céréales, ONC), and the establishment of a market information system (Badiane, 2000). This policy was expected to make the market more transparent, to strengthen competition, and to improve market integration. Also, the “Centres d'Action Régionale pour le Développement Rural” (CARDERs) have been relieved of all commercial activity. These organizations were restructured as “Centres Régionaux pour la Promotion Agricole” (CeRPA) which must promote the agricultural production on the level of all the communes of Benin by providing extension to farmers.

Recently, a New Agricultural Policy is defined over the period 2006-2011. The main objective of this plan is to improve the performances of agriculture to make it able to ensure in a durable way food security and to contribute to the economic and social development of Benin and to the reduction of poverty.

1.3 Role of smallholders in agriculture in Benin

Over 70% of the population of Benin depends on agriculture for their livelihoods. Agriculture is an important income source for rural households. Farmers are generally smallholders, geographically dispersed and they play a great role in agriculture. They produce many of food crops and cash crops. Most of them produce small marketable surpluses. They sell and purchase commodities (inputs and outputs) in rural markets that are typically thin and characterized by fragmented supply chains with many intermediaries. Without them, the food security can't be ensured in Benin. Also, farmers' organizations now increasingly voice the needs of their members in various fora on policy-making and orienting service provision. They are solicited by the private sector to enhance chain development, including those for new markets, and they play a role in local development planning. Farmers' organizations are more than ever, actively involved in agricultural development, which requires institutional, organizational and technological innovation in order to be successful. But, farmers are passively involved in commercial activities in the marketing channel. Indeed farmers' organizations are not active in the food market and, therefore, only a small population of large-scale farmers is able to develop more profitable commercial strategies (Lutz, 1994).

1.4 General constraints to smallholder access to high-value markets and market information in developing country context

Many producers in Benin are peasants who are to a large degree self-sufficient with regard to food. Often they buy and sell incidentally their deficit or surplus in the market.

The grain stock is perceived as a liquid source that may be used for urgently needed household necessities. The problem for the market is that many of these transactions concern small and highly variable quantities, scattered all over the country's territory. This fragmented structure inflates transaction costs: the assembly and distribution of cereals becomes a labour-intensive and costly activity. Another effect induced by these thin markets is that small marketable surpluses also restrict competition among traders (in particular wholesalers may profit from a local monopsony), as only a limited number of traders are sufficient to drain the surplus.

The multitude of units and techniques of measure used in the marketing channels limits the transparency of the market. Although at the local level, residents are more or less accustomed to the different techniques, however on the wholesale market where non-residents operate and trade flows across regions boundaries, the introduction of standard units can foster competition. But this must be supported by traders something which is still to come.

Moreover, multiple production conditions, as well as storage conditions and handling result in a large presentation (quality differences) of the products in the market. So the homogeneity of products is of great concern for market purpose; something which penalizes small-scale farmers.

In summary, the higher value market participation of smallholder farmers is severely constrained by a lot of factors in Benin:

- Farmers often lack information on demand and supply, prices, and quality of agricultural inputs and outputs. The lack of market information encourages opportunistic behaviour among traders. Consequently most smallholders face low prices for their produce and high prices for inputs. Lack of information on supply and demand conditions cause them to sell their produce at farm gate or local markets that offer low prices. The low atomistic output prices and the high input prices dampen incentives to commercialize production.
- Weak/inadequate rural transport infrastructure and noncompetitive/high cost transport services;
- Weak/inadequate storage infrastructure;
- Weak/limited availability of technical advisory services;
- Lack of access to competitively priced finance;
- Lack of standard units and techniques measure.

These factors highlight emphasize the need and share of market information among smallholder farmers.

2.0 Implications on agricultural development in Benin

These problems inflate the costs of market exchange and inhibit smallholder participation in higher value supply chains. The productivity remains weak, the farmers are poorest and agriculture remains underdeveloped. The rural poverty index raised from 25.2% in 1990 to 33% in 2000 in Benin.

A national diagnostic has been done on this sector of the economy from 1990 to nowadays. The outcomes can be listed below:

- The adequate measures to back the resolutions adopted for agriculture boosting have only been partially applied;
- All the investments made for agriculture have been captured by cotton production, while the other potential productions were neglected – mainly food crops;
- Also only cotton producers have been organized and nothing has been done for the professionalization of the others products; and
- The delay is taken in the application of the land tenure policy to secure farmers land holdings, water and forest resources management.

1.5 Role of agricultural information in resolving market failure

Agricultural information in less transparent markets can be considered as a merit good. It will make market segments more contestable and it will make farmers more eager to develop commercial activities if the information is adapted to their needs. The existence of reliable information on the prices, quality and on the supply and demand market conditions makes it possible to ensure a better environment of the market and to balance the capacities of the various actors.

Each exchange is to some extent unique because each party has barriers of time and distance between an alternative exchange party. Each party comes to the exchange with different knowledge about the characteristics of the underlying market forces for the item of exchange. Arrow (1982) argues that the party with relatively greater knowledge actually sets the initial price. The other party then decides whether to accept or reject the offered price. If little competition exists, there will be little pressure to set the posted price close to the actual costs of offering the product in that time, place and form. Heavy competition, however, improves the other party's knowledge of market conditions, and it forces an adjustment in posted price by either direct negotiation or the patronizing of alternative dealers. In such a framework of price formation, market knowledge is market power. One of the most important steps governments can take to improve the fairness of market price formation so that it discriminates less against the small farmer at one end and the consumer at the other is to provide these individuals with timely and accurate information about actual market conditions. In this respect, it is interesting to stress that an aspect of contestability must be the insignificance of 'shifting costs' (Siamwalla, 1978). He defines these as the costs a farmer would make by shifting his dealings to an alternative trader (financial ties or other interlinkages that may be interpreted as 'exit' barriers) and considers it one of the major factors determining a market structure.

2. BACKGROUND AND SETTING

2.1 Past/initial response to constraints

The main constraints concern food production. Adequate information on local market conditions is a prerequisite for successful traders and farmers, but difficult to obtain in Benin as the telecommunication infrastructure is imperfect and information depends on personal networks of individual traders or farmers. So, since 1992, the National Grain

Board named "Office National des Céréales" was relieved of its goal of controlling 25 percent of the food distribution in Benin and restructured as the "Office Nationale d'Appui à la Sécurité Alimentaire (ONASA). ONASA is responsible for collecting and disseminating information on food security. For this purpose, it publishes a monthly newsletter with information on weather, prices, production forecasts, and international trade. Also, to resolve the problem of poor access to information by smallholder farmers ONASA has focused on promoting information transfer through Radio and billboards on the spot market. In addition, ONASA is responsible for managing a strategic food security buffer stock, although funding constraints have made this a very limited activity. So the market information system is public. Private market information system for pay basis is absent in Benin. Cotton farmers are supported to develop collective marketing. But, policy to organize producers in order to develop collective marketing in food sector is absent or poorly developed. Curiously, since 1996, the national board for food security in Benin (ONASA) supports initiatives to organize food traders. But how really the Public Market Information in Benin works?

The data are collected by the investigators of the National Grain Board (ONASA) on the periodic markets and from market actors. At each day of the market of his locality, each investigator collects a certain number of agricultural products (maize, rice, bean, yam, cassava, etc.) at three periods of the day: morning (around 10 hours), semi-day (towards 12-13heures) and evening (around 18 hours). With each passage, it raises the prices on the level of three retailers and of three wholesalers whom it chooses randomly, that is to say 9 sets of data per market day per category of actors (retailers and wholesalers). Then, the price of this market day is the average of these 9 series of price. But, after a few years of this practice, the ONASA ended up understanding that the average of the prices of the day does not stick well with reality on the ground. It then decided to stick to the mode which is nothing other than the most frequent value of the price among the nine statements.

The prices collected on the level of the retailers are consumers prices and the prices collected on the level of the wholesalers are wholesalers prices. Data are collected in local units. The investigator sends then the data the Regional Centres for Agricultural Promotion (CeRPA). The whole of the data is then centralized with in ONASA at Cotonou for the data analysis.

For the processing of these data, the ONASA carries out the calibration of the local units of measurement twice per annum. Thus, the quantities of the local units are measured for the periods of abundance and scarcity of the agricultural product concerned. That makes it possible to determine the "standards" of conversion of the prices on local units into prices per Kg. The exploitation of these data is ensured by four principal methods: diffusion by the radio, billboards on the spot market, the Monthly Letter of Food Information and recently the service text by SMS (Shorts Message Service in English and Internet).

The diffusion of the prices is assured as well by the public radios as by commercial or community/rural radios which are proximity radios. The participation of the commercial

or community/rural radios dates from the beginning of the year 2000. The diffusion of the prices is weekly and the journalists are supposed to specify the date of collection of the prices, to give the last and current prices of selected agricultural products in local languages. The periods of diffusion should be those of great listening, the ideal moment to make pass publicities and the advices for farmers and traders (ONASA, 2004).

The display board installed in the markets by the ONASA makes it possible to show information of price diffused with the radio. It is about a table which presents three principal products (of which the maize at the head) with their prices in local unit and per Kg.

The Monthly Letter of Food Information is a document of eight pages which presents at the level of each department, the evolution of the crop year and the analysis of the level of price of maize in the South and the Center of the country, maize and the sorghum in the Northern part. Then, the monthly prices of ten food products (maize, sorghum, local and imported rice, yam, cassava, gari, bean, groundnut, etc.) are presented in kg from a sample of the markets and in "Tongolo" at the level of the markets in which this local unit is used. The size of this sample of markets moved from 16 markets at the beginning of the Nineties to 54 nowadays while passing by 25 at the beginning of the year 2000. Lastly, a short analysis is made on the evolution of the import-export trade of the food with their international prices. Currently, this news bulletin is published on Internet site of the office whose address Web is: <http://www.onasa.org>.

The major strength of the Market Information System in general is the growing demand and use of the information by policy makers and financial institutions. Information diffused through rural radio is generally more accessible to the farmers.

Recently, the ONASA publishes a lot of king of agricultural information on its Web site whose address is: <http://www.onasa.org>. The service text by SMS (Shorts Message Service in English) is recently introduced with the aim of facilitate access to information for the food marketing actors (producers, traders, consumers). This service comes in adequacy to the development of telecommunication infrastructure in Benin. Indeed, mobile telephony has been developed since 2000 with the only operator Libercom, first network GSM (Global System for Mobile Communication). At once, the country knew a telephone boom in the same year with the opening of the sector to competition. Thus, three private operators GSM (Moov or Telecel, Spacetel Benin or MTN, Bell Benin Communication) take part in this technological revival. That made it possible the populations to touch finger progress of Technologies of Information and Communication (TIC) as regards telephony.

At the end of July 2005, the number of subscribers to these four networks GSM rises with more than 400 000 with a population estimated at 6,7 million inhabitants against 70 000 subscribers with the fixed telephone network (Project UIT/CE, 2005)

3. THE UPSURGE ICT-BASED STRATEGIES

3.1 Inventory of more recent and current ICT-based innovations in agriculture in Benin (Strengthened Networks of Regional Market Information Systems and Traders' Organizations in West Africa (MISTOWA))

The recent ICT-based innovations include internet/web-based means and mobile telephony. These innovations were developed through MISTOWA project.

The MISTOWA project aims to increase regional agricultural trade and food security by improving and linking the existing regional efforts to generate, disseminate, and make commercial use of market information. To be effective, the project must be both focused and holistic. It is not sufficient to improve technically and harmonize existing systems to provide reliable market information to traders and producers. The project must also help regional MIS and trade partners to address other constraints, so that strong and dynamic commodity chains emerge that will use the information to enhance production, handling, credit, and trade; and value added services such as post-harvest, processing, packaging, and quality control. Effective MIS and TO will also heighten farmer awareness of opportunities and technologies to increase production, and will facilitate the demand-pull for higher value and quality agricultural products.

Working through regional organizations, the project will initially focus on the national partners and the noted commodities in Nigeria, Mali, Ghana, Senegal, Burkina Faso, and Benin. As resources and opportunities permit, and in the context of the commodity two categories, the project will work with as many of the other ECOWAS countries as possible.

The key activities of MISTOWA are to:

- set up the MISTOWA regional resource center, and develop the regional portal website, a regional market data warehouse and a technical service center;
- assist MIS partners to improve operational structures and networks at the regional and national levels;
- strengthen technical and material capacities of key MIS staff and structures;
- develop and promote private sector providers of regional market information.

This project is submitted to USAID West Africa Regional Program (WARP) in 2004 by An International Center for Soil Fertility and Agricultural Development (IFDC), www.ifdc.org. The total budget of this project is \$4,000,000.

To improve the access to agricultural commercial information in West Africa, project MISTOWA supports on the one hand the existing public Market Information Systems, in particular through their regional network (RESIMAO). MISTOWA encourages in addition the installation of Place of Agricultural Commercial Information (Points d'Information Commerciale Agricole, PICA in French) within the economic groups of operators' partners of the project: Traders' Organisations (TO), Producers' Organisations (PO), and other structures which support agricultural marketing. The Platform for the Agricultural Trade in West Africa (www.tradenet.biz/www.wa-agritrade.biz) gathers on

the Internet the majority of information collected. But this initiative was not durable for budgetary constraints reasons.

4. CONSTRAINTS, OPPORTUNITIES AND IMPACT

4.1 Constraints faced by past and current ICT-based interventions

In the past by the time of ONC and early ONASA, billboards on the spot market and the Monthly Letter of Food Information were the usual means used. The problems were mainly the utility of the information particularly price information as it's out of date and so little related to the information needs of the market participants. Adding to this, the bulletins when published are hardly attainable to the public. French language is not accessible to farmers as well as traders who are illiterate in majority. With the mean of radio, information is delivered in local languages but, it's still out of date because it takes some time for sending to headquarters and processing. All these facts put together gives impression that market information is concerned only with literate hampering participation of the main market actors something which results in an expensive and useless market information system that the government cannot afford. Donors are generally called upon but their aids are limited in time horizon as well as in amount. So the number of markets covered passed from 64 to 28 and from 18 to 5 radios. More over most local radios nowadays published prices on their own. Finally, till now the market information system has never covered the entire country nor all agricultural products. Then it is not a surprise to realize that no private has been interested to the system.

The recent ICT-based innovations include internet/web-based means and mobile telephony. These innovations were developed through MISTOWA project.

The MISTOWA project aims to increase regional agricultural trade and food security by improving and linking the existing regional efforts to generate, disseminate, and make commercial use of market information. As far as Benin is concerned, market information system was 'far' from being a preoccupation of real market actors. So at the local level there is no real concern about providing support to farmers or and traders.

To be effective, the project must be both focused and holistic. It is not sufficient to improve technically and harmonize existing systems to provide reliable market information to traders and producers. Although this is not a simple affair, there is a need to interest stake holders to develop strong professional associations. It is almost impossible and inefficient to deal separately with each stakeholder.

So it's time to find ways to bring actors together and this needs some time as we are dealing with habits, capacity building and investments in facilities to promote fair competition.

These facilities must enhance production, handling, credit, and trade; and value added services such as post-harvest, processing, packaging, and quality control. Then there is need to a joint or multidisciplinary approach with banks, extension services, processors and quality controllers and so forth.

Benin MIS has focused on TO (trade organizations) omitting farmers particularly. These organizations have established barriers to entry in most regional markets, reducing farmers' sales opportunities. So doing, TO prevent farmer awareness of opportunities and technologies to increase their productions.

Till the end of the project in 2007, no private sector providers of regional market information is functional.

Internet/web-based means are constrained by lack of electricity power and connection capacity and coverage of the country.

a) Highlight cases of “successful” interventions (i.e., best bet innovations/interventions) , if any, in agriculture:

- As mention above, the market information system in Benin was biased towards traders. And we can say it's big traders bias too. A good example is the one we visited and concerned vegetables traders' organization. This TO has extended its affairs all the ECOWAS region, importing onions from Niger
- Tomatoes from Niger and Nigeria and it is now on its own without any intervention of government. By this period their action succeeded to maintain even reduce onion prices due to their importation of this vegetable from Niger.

b) Brief discussion of the measures of “success” used in the best-bet (i.e., “successful”) interventions.

Vegetables traders' organization operates with mobile phones and sms. It's a well functioning organization with a steering committee headed by a president. All the members of the committee are literate and they have clear mandate: making market information (prices, quantities, qualities, transport facilities, etc.) on vegetables available among the organization members. The organization has an office where members meet equipped with internet facility. In fact the organization relies on mobile phones because MISTOWA site is not regularly actualized (once a week normally) as the project has been interrupted after two years instead of five.

Maize traders 'organization is also active at the local level and uses MISTOWA site too during the project. For local markets, the site is actualized three times a week, which will be difficult to do once the project incentives stops. Meanwhile, the trade organization turned to mobile phones and SMS for sharing market information.

c) Brief discussion opportunities that exist for use of ICT in agriculture and enhancing information access by small holder farmers

All these former projects or initiatives have hardly been concerned with producers. And if any farmers' association is worth to mention, it's just the one of

cotton producers. There were some attempts to organize producers of food crops or animal or fishery products. But they are so weak and project-specific and mostly dominated by big producers or former producers. And there is no place for small one.

So it means that the need to address smallholder farmers is still of concern. And it is not a surprise that agricultural development is still to be thought seriously. Opportunities exist as modern ICT means can help to reduce sharply the costs. The first one is the technical capacities got with former market information system (RESIMAO and MISTOWA). We can cite: market price and information surveyors, processors and analysts, computers manipulators and information specialists; etc.

The second is the experiences accumulated in organizing traders. These experiences can serve for farmers as the new Benin government is concentrating on agriculture mainly production to overcome the goal of food security. Food production is the sector in which operate most of the small holders.

The third opportunity is the improvement of the nation web infrastructure and phone capacity. There is an ECOWAS regional strategy of enlarging web power by sub-marine cable from Benin seacoast. And this is effective since January 2008.

Fourth, there is the diversification of electricity power sources and providers. Since last quarter of 2007, Benin electricity providers passed to two (Ghana and Nigeria) instead of one (Ghana). At the same time, many generators have been acquired and many others ordered. A new policy has been elaborated for the exploration of other sources of energy as solar, wind; etc.

Fifth, the emphasis puts on the promotion of local languages with the creation of a ministry devoted to it concern in the government. French the colonial language is only spoken by literate who are very few. Local languages promotion will help to increase the number of SMS-users as mobile phone call is relatively costly in Benin.

Finally, there is a great concern of the government to expand the use of ICT as a proof of information liberalization at the whole country level. The vision of the national policy stipulated that “the new ICT will be the boosters of the social and economy development in order to transform Benin in the time horizon of 2025 in an open society of information”. In fact, the fourth pillar among the five main pillars on which national ICT policy is structured, stipulates a policy for the development of sectorial applications for strengthening the material bases of the economy and the competitiveness of the economy among others. Briefly the five pillars are: (1) an institutional policy which guarantees a favorable statutory and legal environment for the development of the new ICT – (2) a policy of the development of the basic necessary infrastructure which can facilitate the penetration of these ICT in all of the spheres nationwide – (3) an policy of capacity building for providing sufficient national capabilities to handle the new information revolution - (4) a policy for the development of sectoral applications of the new ICT – (5)

a policy for a regional and international cooperation in order to back this national ambition.

5. CONCLUSION

In concluding remarks, we can say that initiatives exist within ONC - ONASA but they remained turned towards traders, researchers and policy makers, omitting farmers particularly. These initiatives were then too bureaucratic, heavy to manage and expensive with external financial support. National financial support was hardly available. Nonetheless, national capacity building in ICT has performed a lot although there is still much to do. Turning to the national environment, there is a national policy on ICT and a clearly elaborate vision. Elements of this policy are now being applied in an integrated regional and international cooperation. ICT basic infrastructure is expanding nationwide; the nation electrical power is being reinforced and diversified; a nationwide people empowerment program has been elaborated and local languages development strengthens. This is going to give a chance to a large participation of farmers, the voiceless since then. The experiences accumulated with traders and from cotton producers can also help to achieve this important goal as all the food surpluses come from these farmers.

Finally, the government ambition to make agriculture, the engine of the nation economic development is an advantage for improving the development and the application of ICT-based innovations in agriculture in general in Benin and in market information system in particular.

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APPENDIX 9: MATRIX OF COUNTRY DATA NEEDS

i) Benin

OBJECTIVES	DATA	SOURCE OF DATA	METHODS	OUTPUTS OUTCOMES	USERS OF RESEARCH RESULTS
To identify and characterize existing initiatives and the environments within which they are applied, and select some for in-depth analysis	- Inventory of initiatives - Policy context - Key or relevant infrastructure - Geography - Farmer systems - Market systems - Key stakeholders in value chains	- University researches - Government offices - Statistics bureau - Government national extension service - Chamber of commerce - Farmer organizations - Trader organizations	- Interviews - Literature reviews - Report reviews - Informed forums	- Exhaustive report on existing ICT initiatives - In-depth knowledge of selected ICT initiatives	- Research team - Universities - Potential fund providers
To examine the effects on key stakeholders	- Farmer systems - Income levels - Network reach - Customer base - Length of value chains - Cost base	- University researches - Ministry of commerce - Statistics bureau - Government national extension service - Chamber of commerce - Stakeholder records - Farmer organization records - Trader organization records	- Interviews - Document reviews - Report reviews - Inquiries - Informed forums	- Exhaustive matrix on stakeholders - Thorough knowledge of effects of ICT initiatives on key stakeholders	- Research team - Universities - Potential fund providers - Actors in the chain - Government
To assess the factors that influence adoption	- ICT vendor lists - Operating systems - Income levels - Cost of communication	- Chamber of commerce - Ministry of commerce - Statistics bureau - Government national	- Interviews - Document reviews - Report reviews - Inquiries	Report on the determinant of ICT adoption	- Stakeholders - Policy makers - MIS providers

	Area coverage Literacy level Demographics of farmers ICT literacy level Cost of hardware	extension service - Stakeholder records - Ministry of communication - Ministry of education - Vendor manuals	- Informed forums	Better understanding by all stakeholders on what influences adoption	
To assess the challenges facing MIS providers	Regulation and rules Customer base Tariff structure	- Statistics bureau - Ministry of communication - Provider records	- Interviews - Report reviews - Inquiries - Informed forums	Report on challenges Clarity on major challenges	- MIS providers - Government regulators - Main research institutions
To identify roles and partnership models for the public and private sectors (including NGOs)	Existing partnerships Communication policy NGO policy Regulation policy on partnerships	- Literature reviews - Ministry of legal affairs - Ministry of communication - Ministry of finance - Ministry of commerce - Ministry of internal affairs	- Interviews - Literature reviews - Report reviews - Informed forums - Inquiries	Report on roles and partnerships Clear understanding of partners and roles	- Public and private sectors Researchers
To enhance collaboration among African researchers and to build research capacity of project partners and young researchers.	Existing collaboration	- University research records - Proposals to/from donors	- Literature reviews - Report reviews - Proposal reviews	List of all projects shared Joint ventures	- Universities - Research organizations
To formulate guiding principles and recommendations to inform policy and practice	Current policy Current practice	- Government five year plan - Annual budget - Stakeholder manuals	- Inquiries - Informed forums	Proposal document Adoption of appropriate policy to support ICT	- Government - Policy makers

ii) Uganda

OBJECTIVES	DATA	SOURCE OF DATA	METHODS	OUTPUTS OUTCOMES	USERS OF RESEARCH RESULTS
To identify and characterize existing initiatives and the environments within which they are applied, and select some for in-depth analysis	Inventory of initiatives Policy context Key or relevant infrastructure Geography Farmer systems Market systems Key stakeholders in value chains	- University researches - Government offices - Statistics bureau - Government national extension service - Chamber of commerce - Farmer organizations - Trader organizations	- Interviews - Literature reviews - Report reviews - Informed forums	Exhaustive report on existing ICT initiatives In-depth knowledge of selected ICT initiatives	- Research team - Universities - Potential fund providers
To examine the effects on key stakeholders	Farmer systems Income levels Network reach Customer base Length of value chains Cost base	- University researches - Ministry of commerce - Statistics bureau - Government national extension service - Chamber of commerce - Stakeholder records - Farmer organization records - Trader organization records	- Interviews - Document reviews - Report reviews - Inquiries - Informed forums	Exhaustive matrix on stakeholders Thorough knowledge of effects of ICT initiatives on key stakeholders	- Research team - Universities - Potential fund providers - Actors in the chain - Government
To assess the factors that influence adoption	ICT vendor lists Operating systems Income levels Cost of communication Area coverage Literacy level Demographics of farmers	- Chamber of commerce - Ministry of commerce - Statistics bureau - Government national extension service - Stakeholder records - Ministry of communication	- Interviews - Document reviews - Report reviews - Inquiries - Informed forums	Report on the determinant of ICT adoption Better understanding by all stakeholders on what influences	Stakeholders Policy makers MIS providers

	ICT literacy level Cost of hardware	- Ministry of education - Vendor manuals		adoption	
To assess the challenges facing MIS providers	Regulation and rules Customer base Tariff structure	- Statistics bureau - Ministry of communication - Provider records	- Interviews - Report reviews - Inquiries - Informed forums	Report on challenges Clarity on major challenges	- MIS providers - Government regulators - Main research institutions
To identify roles and partnership models for the public and private sectors (including NGOs)	Existing partnerships Communication policy NGO policy Regulation policy on partnerships	- Literature reviews - Ministry of legal affairs - Ministry of communication - Ministry of finance - Ministry of commerce - Ministry of internal affairs	- Interviews - Literature reviews - Report reviews - Informed forums - Inquiries	Report on roles and partnerships Clear understanding of partners and roles	- Public and private sectors Researchers
To enhance collaboration among African researchers and to build research capacity of project partners and young researchers.	Existing collaboration	- University research records - Proposals to/from donors	- Literature reviews - Report reviews - Proposal reviews	List of all projects shared Joint ventures	- Universities - Research organizations
To formulate guiding principles and recommendations to inform policy and practice	Current policy Current practice	- Government five year plan - Annual budget - Stakeholder manuals	- Inquiries - Informed forums	Proposal document Adoption of appropriate policy to support ICT	- Government - Policy makers

iii) Kenya

OBJECTIVES	DATA	SOURCE OF DATA	METHODS	OUTPUTS AND OUTCOMES	USES OF RESEARCH RESULTS
1. To identify and characterize existing initiatives and the environments within which they are applied, and select some for in-depth analysis	Inventory of initiatives Environment • Policy context (ICT policy, policy statements in MOA MTP and vision 2030) • Key or relevant infrastructure • Geography • Farming systems • Market systems • Key stakeholders in value chains	CCK Internet Umbrella farmer organization e.g KENFAP, KUSCO Key informants e.g. MIS providers, MOA, MOLD, MOCD, KARI National council of NGO • CCK, Ministry of Information, Existing literature • CCK, MIS providers • MIS providers, CCK, key informants • MIS providers, participating agents • MIS providers, farmers, traders • Key informants, farmers, MIS providers	Interviews, literature review, key informants, using a checklist as the tool.	An inventory report of ICT intervention with detailed profiles, policy environment, geography of coverage and farming and marketing systems	Inventory used for selecting a few for in depth study. Results used for objective 7
2. To examine the effects on key stakeholders	• Farmers • Traders • Quantities and prices	• MIS providers, MOA extension staff, NGOs, FO	• Interviews formal and informal, literature review	Report highlighting changes or lack of it, of activities/incomes of stakeholders	Results feed into objective 7
3. To assess the factors that	• Farmer and	• Farmers	• Household survey,	Report showing important	Results feed to

influence adoption	household characteristics • Farm physical environment • Types of input and output markets • Characteristic of traders	• Key informants e.g. extension staff	stratified sampling • Key informants discussions	factors influencing adoption of ICT by farmers and other agents in the VC	objective 7. Results communicated to MIS providers
4. To assess the challenges facing MIS providers	• From objective one, List of MIS providers - o Their profiles - o Linkages with other institutions - o Policy, geography, Farming systems, - o Sources of funds, costs and revenues - o Number of users overtime - o Changes in partnerships if any and reasons for changes	CCK, MIS providers, Ministry of information	Key informants discussions and interviews		
5. To identify roles and partnership models for the public and private sectors (including NGOs)	• From objective 1, information on existing partnerships and roles of each player	• MIS providers, other existing partners (e.g. NGOs, FO), farmer	• Key informants • Case studies		
6. To enhance collaboration among African researchers and to build research capacity of project partners and young researchers.	• Profile of researchers and affiliated institutions • Information on young prospective	• Country team members and their affiliated institutions	• Structured questionnaires through email		

7. To formulate guiding principles and recommendations to inform policy and practice	• Synthesized data on objective 1,2,3,4 and 5.	• Information from objective 1,2,3,4 and 5.	• Feedback workshop on country findings - o Country level - o Project level	•	•
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iv) Ghana

OBJECTIVES	DATA	SOURCE OF DATA	METHODS	OUTPUT & OUTCOMES	USERS OF RESEARCH RESULTS
To identify and characterize existing initiatives and the environments within which they are applied, and select some for in-depth analysis	Inventory of initiatives Policy context Key or relevant infrastructure Geography Farmer systems Market systems Key stakeholders in value chains Access (mobile, PCs, radio, TV) Data usage statistics	Tradenet, TIPCEE, MOFA, RTIM, ASNAP, SEND, GAPTO, SIMLI RADIO, Literature review NCA, Ministries, Mobile operators, NGOs, traders and exporters, NAFF, Development Partners, GPTRU, existing projects agro-projects (WATH), Cell phone networks, ISPs	Informal interviews, review of data usage statistics	Report on existing initiatives compiled and those selected for in-depth study Database on existing initiatives built	Researchers, policy makers, farmers, traders, service providers as well as other stakeholders
To examine the effects on key stakeholders	Incomes, yields, market access/linkages, prices (time series), % collective sales, transaction costs, access to inputs, quality of goods sold, size of transaction, timing of sales, elections (political)	Farmers, traders, processors, transporters, banks, input suppliers, associations, cooperatives, extension officers, MOFA	Structured surveys, informal interviews; purposeful random sampling; 300 farmers (min), 50 traders.	Effect of selected ICT interventions on stakeholders documented Assessment report Database on the effect of ICT on key stakeholders built	Researchers, policy makers, farmers, service providers, other stakeholders
To assess the factors that influence adoption	Literacy, education, training, infrastructure, type of markets, commodities involved, existence of opinion leaders, ownership of communication equipment, legislation/regulations language/translation	MOFA, NGOs, projects, stakeholders, Ministries, individual interviews	Structured surveys, informal interviews; purposeful random sampling; 300 farmers (min), 150 traders. Literature review	Journal article, policy briefs, news letters Database on factors affecting adoption of ICT technologies created	Researchers, policy makers, farmers, NGOs, other stakeholders

To assess the challenges facing MIS providers	Language, infrastructure, transport, cell phone network coverage, funding, staffing, policy, penetration, cost of communication, technology choice	MIS providers, Ministries, Communications providers	Informal interviews with all MIS providers and communications providers.	Assessment report, policy briefs, working papers, database created Challenges facing MIS providers understood	Researchers, policy makers, service providers, farmers, NGOs, other stakeholders
To identify roles and partnership models for the public and private sectors (including NGOs)	Existing (past & present) roles and partnerships	Service providers (public, private)	Informal interviews with providers and ministries, NGOs	Roles and partnership models identified, policy briefs, public-private collaboration strengthened	Researchers, policy makers, NGOs, farmers, other stakeholders
To enhance collaboration among African researchers and to build research capacity of project partners and young researchers.	Existing capacities	Country teams	Joint researches, supervised student research, joint journal publications	Research reports, student dissertations/thesis, published journal articles	Researchers, policy makers, NGOs, other stakeholders
To formulate guiding principles and recommendations to inform policy and practice		Results of analysis			Researchers, [policy makers

v) Madagascar

OBJECTIVES	DATA	DATA SOURCES	METHODS	OUTPUTS AND OUTCOMES	USERS OF RESEARCH RESULTS
To identify and characterize existing initiatives and the environments within which they are applied, and select some for in-depth analysis	-Inventory of initiatives -Policy context -Key or relevant infrastructure -Geography (ICT coverage and penetration) -Farmer systems (household characteristics, input, production, and marketing ways and means, etc) -Market systems -Key stakeholders in value chains	-Relevant public (Ministries) and private institutions (NGOs and Projects) -Existing studies, reports, etc. -Actors in ICT value chains, from suppliers to consumers.	-Documentation -Surveys and interviews -Stakeholders analysis	Report on: -Identified and selected initiatives for in depth analysis. -Database of existing ICT initiatives and their characteristics.	-Policy makers -Actors in ICT value chain, from suppliers to consumers, including among others service providers and farmers -NGOs, Projects -Researchers and other stake holders.
To examine the effects on key stakeholders, especially smallholder farmers	-Changes in activities in terms of investments, input use, production processes, output yields and prices, expenses and revenues, transaction and marketing costs, bargaining power, transparency, range of markets, degree of farmers' integration into markets.	-Selected Stakeholders in ICT value chains, from suppliers to consumers including farmer households -Existing studies, reports, etc.	-Documentation -Surveys and interviews -Impacts analyses and Econometric models	-Report on assessment of the effects of ICT interventions. -Policy briefs, newsletters, working papers.	-Policy makers -Actors in ICT value chain, from suppliers to consumers, including among others service providers and farmers -NGOs, Projects -Researchers and other stake holders.
To assess the factors that influence adoption	Socioeconomic, technological and environment (policy, infrastructure, physical, etc) data that are incitating or limiting factors (pertinence and utility and costs of information available, required proximity infrastructures, etc.) to ICT adoption	-Selected ICT users and providers in ICT value chains, from suppliers to consumers including farmer households -Existing studies, reports, etc	-Documentation -Surveys and interviews -SWOT analyses and Econometric models	-Report on assessment of the factors that influence adoption. -Policy briefs, newsletters, working papers.	-Policy makers -Actors in ICT value chain, from suppliers to consumers, including among others service providers and farmers -NGOs, Projects -Researchers and other stake holders.
To assess the challenges facing ICT providers	Socioeconomic, technological and environment (policy, infrastructure, physical, etc) data that are challenging on: -	-Selected ICT users and providers in ICT value chains, from suppliers to consumers	-Documentation -Surveys and interviews -SWOT analyses	-Report on assessment of the challenges facing ICT providers. -Policy briefs,	-Policy makers -Actors in ICT value chain, from suppliers to consumers, including among others

OBJECTIVES	DATA	DATA SOURCES	METHODS	OUTPUTS AND OUTCOMES	USERS OF RESEARCH RESULTS
	Objectives (geographic / products coverage and penetration, etc) -Limitations (availability, accuracy and costs of information, proximity to information users, costs of dissemination, etc.)	including farmer households -Existing studies, reports, etc		newsletters, working papers.	service providers and farmers -NGOs, Projects -Researchers and other stake holders.
To identify roles and partnership models for the public and private sectors (including NGOs)	-Existing ICT initiatives -Roles of actors in ICT value chains -Partnership practices	-Relevant public and private institutions, NGOs and Projects, economic operators, farmers	-Documentation -Surveys and interviews -Comparison with existing (successful) partnerships in other countries -Modeling	-Identify successful and unsuccessful models -Contribute to enhancement of private and public partnership and collaboration	-Policy makers -Actors in ICT value chain, from suppliers to consumers, including among others service providers and farmers -NGOs, Projects -Researchers and other stake holders.
To enhance collaboration among African researchers and to build research capacity of project partners and young researchers.	Study results of other country teams of the project (and of other countries if available)	-Research institutions involved in the project -Relevant regional and international institutions	-Exchange (periodical “bulletin” of the project, exchanging workshops, etc) -Topical training sessions -Grants for selected students (PhD or MSc)	-Periodical “bulletin” of the project -Exchanging workshops -Topical training sessions -Grants	-Policy makers -Actors in ICT value chain, from suppliers to consumers, including among others service providers and farmers -NGOs, Projects -Researchers and other stake holders.
To formulate guiding principles and recommendations to inform policy and practice	All study results and syntheses Final project report Dissemination procedures	Research institutions involved in the project Project coordination	National workshops Global final workshop		

vi) Malawi

OBJECTIVES	DATA	SOURCE OF DATA	METHODS	OUTPUT & OUTCOMES	USERS OF RESEARCH RESULTS
To identify and characterize existing initiatives and the environments within which they are applied, and select some for in-depth analysis	Inventory of initiatives Policy context Key or relevant infrastructure Geography Farmer systems (size of the farm, range of products they produce, scale of operation, technology used, education, gender structure etc.) Market systems (farm gate, assembly, regional/district, international, etc.) Key stakeholders in value chains	Government ICT policy paper, the Agriculture Policy, MACE baseline and M & E documents Telecommunication Service Providers, websites, newsletters, farmers organizations, NGO, input suppliers (stockists), Agricultural Communication Services Small holder farmers, Traders, processors, service providers, retailers, consumers, Malawi Agricultural Commodity Exchange (MACE), transporters, financial institutions (banks)	Desk review, interviews, focus group discussions, stakeholder analysis (analysis of linkages to help characterize existing interventions),	Report on identified and selected initiatives for in depth analysis. Database of existing ICT initiatives and their characteristics.	Policy makers, farmers, service providers, NGOs, researchers and other stake holders.
To examine the effects on key stakeholders	Input and output Price, Input and output volume, incomes (revenues) and expenses, marketing costs, investments, bargaining power, transparency, range of markets, integration of markets.	Household and other key informants, secondary data sources (MACE, Min. of Agriculture, ICT intervention databases and documents,	Household survey, survey of other key players in the value chain (individual interviews, focus group discussions, at different levels of marketing chain.	Report on assessment of effects of ICT interventions. Data collection tools, database,	Policy makers, farmers, service providers, NGOs, researchers and other stake holders
To assess the factors that	Socio-economic data,	Household and other key	Household survey,	Data collection tools,	Policy makers,

influence adoption	technological and environmental (policy, infrastructure, physical, etc)	informants, secondary data sources (MACE, Min. of Agriculture, ICT intervention databases and documents,	survey of other key players in the value chain (individual interviews, focus group discussions, at different levels of marketing chain.	database, policy briefs, newsletters, posters, working papers.	farmers, service providers, NGOs, researchers and other stake holders
To assess the challenges facing MIS providers	Socio-economic data, technological and environmental (policy, infrastructure, physical, etc)	Key informants, secondary data sources (MACE, Min. of Agriculture, ICT intervention databases and documents	Survey of other key players in the value chain (individual interviews, focus group discussions, at different levels of marketing chain, workshops.	Data collection tools, database, policy briefs, newsletters, posters, working papers. Outcome: to enhance understanding of challenges facing ICT providers and contribute to influence policy(ies)	Policy makers, farmers, service providers, NGOs, researchers and other stake holders
To identify roles and partnership models for the public and private sectors (including NGOs)	Actors, model of partnership, ICT initiative	Key informants, secondary data sources (MACE, Min. of Agriculture, ICT intervention databases and documents	Survey of other key players in the value chain (individual interviews, focus group discussions, at different levels of marketing chain.	Outcome: identify successful and unsuccessful models and to contribute to enhancement of private and public partnership and collaboration	Policy makers, farmers, service providers, NGOs, researchers and other stake holders
To enhance collaboration among African researchers and to build research capacity of project partners and young researchers.					
To formulate guiding principles and recommendations to inform policy and practice	From synthesis of the above objectives				

Annex 2: The eARN Research Proposal

eAgriculture Network for Africa (eARN Africa): Effectiveness of Electronic-Based Interventions in Linking African Farmers to Markets

A Research Proposal

Submitted To

International Development Research Centre (IDRC)

Final

December 7, 2008

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Executive Summary

Poor access to market information is a major impediment to the commercialization of smallholder agriculture in Africa. Smallholder producers form the majority of both the total and rural poor in many developing countries, especially Africa. Most of these farmers are engaged in subsistence and semi-subsistence agriculture with low productivity, low marketable surplus (hence returns) and low investment, a situation described as low equilibrium poverty trap. Enhancing returns from agricultural production through improved access to markets can therefore be a vital element of poverty alleviation strategy. Improved market access is a catalyst for commercialization of agriculture, which has short, medium, and long-term benefits to farmers.

Smallholder farmers' access to markets is constrained by, among others, the lack or asymmetry of information. Lack of information on the quantity and quality of produce traded, commodity and input prices, and credit sources results in opportunistic behavior by traders, input dealers and moneylenders. In the absence of information, smallholder producers face information asymmetry problems (such as moral hazard) that limit the performance of agricultural commodity and input markets, and in turn the participation of small producers in these markets. Under such circumstances, input and output markets are thin thus small quantities are traded and exchange is based on visual inspection.

Recent growth in ICT use in Africa has shifted attention to the role ICT applications can play in resolving the problem. A scoping study by IDRC found widespread use of ICT applications in agriculture. These applications include internet/web-based means, mobile telephony, and interactive video and CD-ROM programs as well as the more traditional ICT-based technologies namely the radio and television. The shift in focus to ICT-based methods of information provision is driven by the role they can play in communicating knowledge and information to rural farmers, improving smallholder farmers' access to markets and agricultural credit and empowering farmers to negotiate better prices.

Despite the increase in the use of ICT-based market information services in agriculture in many African countries, little is known about the effects of these interventions on the stakeholders, the factors that condition their adoption, factors that contribute to success or failure of ICT-based interventions, and the best-fit models for successful implementation. This proposed study aims at filling these gaps in the literature and supporting policy in the application of ICT in enhancing access to agricultural information by smallholders. Such knowledge is essential in the scaling-up and out of successful interventions and re-designing failed innovations. The general objective of this project is therefore to study the effectiveness of ICT-based intervention in linking African farmers to markets so as to inform policy decisions of African governments and stakeholders aimed at improving livelihood of smallholder farmers. The specific objectives are:

1. To analyze existing ICT-based initiatives and the environments within which they are applied.
2. To examine the factors influencing the awareness and adoption of ICT-based market information services
3. To assess the effects of participating in ICT-based market information projects on smallholder farmers

4. To examine the effect of participation in ICT-based market information service project on the performance of agricultural markets
5. To critically analyze the challenges encountered by the ICT-based market information service projects for linking smallholder farmers to markets
6. To use the findings to influence ICT policy and practice in each participating country
7. To enhance collaboration among African researchers and to build research capacity of project partners and young researchers.
8. To use the findings to influence ICT policy and practice in each participating country.

The primary focus of this proposed project is the smallholder farmers. The study will be undertaken in six countries (namely Benin, Ghana, Uganda, Kenya, Malawi and Madagascar) by a team of scientists and ICT-experts with complementary skills and capabilities. The countries have been selected to capture regional diversity and ensure regional balance. In each country 1-2 ICT-based projects for linking farmers to markets will be selected for in-depth analysis. The projects selected for analysis will have an overarching theme that cuts across them to expedite analysis and synthesis of findings and the teasing-out of implications for policy and practice. In each country the study will seek to address the above objectives by answering the following research questions:

- i. What are the existing ICT-based interventions for linking smallholder farmers to markets?
- ii. What influences smallholder farmers' awareness and adoption of ICT-based agricultural information services?
- iii. What are the opportunities and prospects of the use of ICT-based market information services by smallholder farmers?
- iv. How do ICT-based market information service interventions enhance market efficiency in Africa?
- v. What are the challenges faced by the boundary partners involved in ICT-based market information service projects?
- vi. What are the critical policy ingredients for scaling up and out ICT-based interventions for providing market information services to smallholder farmers?
- vii. How can the level of collaboration between public and private sectors be enhanced to facilitate smallholder farmer access to ICT-based agricultural market information?
- viii. How can collaboration and capacity building among African scientists in analyzing the role of ICT-based interventions in linking farmers to markets be enhanced?

In order to address the above objectives and research questions, qualitative and quantitative data will be collected in each country by a team of trained enumerators and through personal interviews. Qualitative information will be collected through in-depth case studies of 1-2 ICT-based market information service projects in each participating country. The information will be gathered via detailed interviews with various stakeholders using detailed qualitative questions that will be the same across the countries. The quantitative data will be collected through household surveys involving 340 households in each country hence amounting to 2040 households in total. The household surveys will be done through personal interviews using pre-tested questionnaires and well-trained enumerators. In addition, secondary data on historical market prices will be collected in three selected representative countries.

The data/information collected will be analyzed using both qualitative and quantitative methods. Case study approach based on Yin's (1998) method will be used to analyze the environment in which existing interventions exist, the challenges encountered and to identify best-bet model(s). Quantitative techniques with non-separable quantitative household models (such as the Probit and Logit regression analyses) will be used to examine factor-conditioning awareness of ICT-based projects and household commercialization. Other quantitative techniques will be used to assess the factors determining the decision to participate in ICT-based project and, contingent upon participation, how many ICT-based market information services are used. Similar quantitative/regression techniques (namely the Ordinary Least Squares) will be used to analyze the benefits of participation in ICT-based market information service projects. Degree of household commercialisation and improved household security will be used as proxies for household benefits from participation in ICT-based projects. Household commercialization will be measured by share of total production sold. On the other hand, household food security will be used by indicators such as giving away food as gifts to neighbours/family and as tithe. Quantitative market models will be estimated to test the effect of ICT-based projects on market efficiency. Findings from qualitative and quantitative analyses will be synthesized and evidence triangulated to draw policy lessons and guiding principles for the design of future interventions with greater odds of success.

Capacity building will be done in this project at two levels. First, at least one Master's student per country will be awarded an M.Sc. thesis award that will enable the student to receive training and exposure on research techniques and write a thesis using the data collected by the project. Second capacity of project partners will be built through interaction with each other, pairing up scientists with complementary skills (e.g. qualitative and quantitative skills) and policy dialogues. The partners will also be trained in project monitoring and evaluation techniques.

Project overview

Title

Effectiveness of ICT-based interventions in linking African farmers to markets: Impact, challenges, and lessons learned

Project Duration

The project will last twenty four (24) months, (2009-2011)

Estimated Total Budget

Canadian Dollars **1,635,600**

Countries in which the research activities will take place

The project will cover western, eastern, and southern Africa and is designed to cover the two main language groups (Anglophone and Francophone) and the geographic diversity of the continent. Project activities will however be concentrated in the following countries

- ✓ Benin
- ✓ Ghana
- ✓ Uganda
- ✓ Kenya
- ✓ Malawi
- ✓ Madagascar

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Principal Investigator (Network Coordinator) and contact person

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- ✓ Dr. Julius H. Mangisoni, Department of Agricultural & Applied Economics at Bunda College of Agriculture, University of Malawi
- ✓ Dr. Henri Abel-Ratovo, Research and Development Department, National Center of Applied Research to Rural Development ("FOFIFA") and University of Antananarivo, Madagascar

Proposing Organization

- ✓ University of Nairobi, Kenya

Participating Organizations

- ✓ University of Abomey-Calavi (UAC), Benin
- ✓ Bunda College of Agriculture, University of Malawi, Malawi
- ✓ University of Ghana, Ghana
- ✓ Makerere University, Uganda
- ✓ University of Antananarivo, Madagascar

Scientific Review Committee

Prof. Chris Ackello-Ogut, Department of Agricultural Economics, University of Nairobi, Kenya

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Dr. Colin Poulton, School of Oriental and African Studies, University of London

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1. Introduction and Research Problem

Market access is one of the most important factors influencing the performance of smallholder agriculture in developing countries, and in particular least developed countries. Access to new and better-paying markets for agricultural products is vital in enhancing and diversifying the livelihoods of poor subsistence or semi-subsistence farmers. Such markets can be local (including village markets), catering for the local populations, regional markets that serve regional consumers in counties/districts/provinces within one country or between countries, and international/export markets in both developed and developing countries.

Smallholder producers form the majority of both the total and rural poor in many developing countries, especially Africa. Most smallholder farmers are engaged in subsistence and semi-subsistence agriculture with low productivity, low marketable surplus (hence returns) and low investment, a situation described as low equilibrium poverty trap (Barrett and Swallow, 2006; Barrett, 2008). Enhancing returns from agricultural production through improved access to markets can therefore be a vital element of poverty alleviation strategy and livelihood improvement. Improved market access results in commercialization of agriculture, which has short, medium, and long-term benefits to farmers. In the short term, market access can result in the production of marketable surplus and hence gains in income from agriculture. In the medium to long run, the surplus from improved market access can result in higher revenues, savings and hence investment in productivity enhancing technologies. The effect of market access for smallholder farmers is even greater for high-value commodities (i.e., non-traditional, non-staple crops such as high-value fruits and vegetables and organic products). There is evidence that access to such markets have benefits to smallholder producers (Okello, 2005; Okello and Swinton, 2007). Such benefits include direct income for smallholder producers and the indirect impacts at both the household and community levels in terms of employment.

A key issue in developing smallholder agriculture in Africa has been how to improve smallholder farmers' access to markets. In the 1980s, there was strong feeling that smallholder farmers' access to markets was constrained by bad policies pursued by African governments. Therefore as part of the structural adjustment program, many countries in sub-Saharan Africa liberalized their markets and developed strategies for market-led commercialization of smallholder agriculture. However, market liberalization - intended to facilitate the functioning and effectiveness of rural markets - had mixed results. Successful cases were often characterized by the existence of good infrastructure, high agricultural potential and diversified commodity portfolio, and a more commercialized farming orientation. These conditions are atypical of many rural areas of Africa. At the same time, failure of market reforms to improve smallholder access to markets has been attributed to a number of factors. Kherallah et al (2000) argues that the disappointing failure of market reforms to spur commercialization in Africa is due to: i) frequent and arbitrary intervention by the state in markets leading to private sector's lack of confidence in the market, ii) the coincidence between market reforms and state budget declines that has in turn led to poor investment in infrastructure, research and extension, and iii) lack of policies that coordinate market activities and hence reduce transaction costs and risks. These factors can simply be summarized as incomplete reforms, lack of policies that reduce transaction costs and risks, policy reversals and absence of institutions that support market development (Poulton et al, 2006; Barrett, 2008). While incomplete reforms and inappropriate policies may explain the lack of transformation from subsistence to commercial agriculture in areas with well-functioning markets, there is consensus that making imperfect markets work for small producers requires new kinds of strategies (Barrett, 2008).

The literature suggests that smallholder farmers' access to markets is constrained by, among others, i) lack or asymmetry of information ii) lack of access to productive technologies¹¹, iii) poor access to public and private goods (Barrett, 2008). Lack of information on the quantity and

¹¹ While lack of access to productive technologies can constrain commercialization, we focus here only on poor technology access due to lack of information

quality of produce traded, commodity and input prices, and credit sources results in opportunistic behavior by traders, input dealers and moneylenders. In the absence of information, smallholder producers face problems of information asymmetry (such as moral hazard) that limit the performance of agricultural commodity and input markets, and in turn the participation of small producers in these markets. Studies in Africa indicate that under such circumstances, input and output markets are thin thus small quantities are traded and exchange is based on visual inspection (Fafchamps and Hill, 2005; Doward et al, 2005; Fafchamps and Gabre-Madhin, 2006). The high transaction costs of such exchange process impede access to better-paying markets and entrench poverty (Barrett, 2008). In addition, poor investment in public and private goods especially roads and telecommunication further increase the transaction costs and risks (Poulton et al, 2006). As a result smallholder farmers, especially those in remote areas, are poorly connected to efficient and competitive marketing channels. Therefore smallholder farmers, when and if they participate in markets, are often obliged to accept low prices for their produce (Shiferaw et al, 2007). Furthermore, processors and traders are constrained by low quality undifferentiated products, high cleaning costs and inadequate and unreliable supplies whereas market intermediaries in the supply chain face high assembly costs, high market risks and cash flow problems (Shiferaw et al, 2008). Lack of market information therefore reduces smallholder farmers' ability to produce high value differentiated products with desirable market traits in addition to their inability to penetrate high value niche markets. It exacerbates the problem of low-level equilibrium poverty trap that locks smallholder producers into subsistence production and imperfect markets where they typically trade in low volumes. Trading small quantities of produce denies smallholder producers an opportunity to exploit economies of scale and the bargaining power to negotiate prices, thereby reducing their ability to compete with well-established producers. Lack of information is compounded by the incentive structure facing the farmers and their capacity to gainfully use market information. Farmers may thus be unwilling to diversify out of "low value" staples into higher value crops if staples markets are too high cost or high risk to rely on for food purchase (Fafchamps 1992, Jayne 1994). Additionally, limited productive assets (land, animals, credit for inputs) may reduce marketable surplus and hence farmers' ability to participate in the market, even if they know that opportunities do so are available. The small and irregular surpluses also discourage the development of efficient private markets implying that the causality between market access and supply capability could be two-way.

The problem of farmer access to market information is an old one. Smallholder farmers were not the focus of colonial governments in many African countries. After independence, many governments still pursued extension methods that focused on larger progressive farmers. While large-farmer bias has to some extent reduced, public agricultural extension systems in most African countries lack the financial and human capacity to reach the huge population of geographically dispersed smallholder farmers. Most smallholder farmers have no access to electronic sources of information such as the internet and the television. While sizeable number of farmers has radios, radio broadcasts of agricultural information (especially commodity prices) do not meet the real needs of small farmers as they report aggregate/wholesale prices in major markets. At the same time changing consumer demand that is shifting the produce quality parameters from physical to credence¹² attributes make it difficult for government extension

¹² Credence attributes refer to quality parameters that cannot be assessed even upon consumption e.g., nutritional content, absence of unwanted pesticide residues or ethical conditions used in production.

systems to meet the information needs of the present day farmer. Most smallholder farmers are therefore not able to access information through public information sources.

Recent attempts to resolve the problem of poor access to information by smallholder farmers have focused on promoting information transfer through ICT-based innovations (Tollens, 2006; Aker, 2008). These innovations include mobile telephony, internet/web-based means, and interactive video and CD-ROM programs as well as older ICT-based technologies namely the radio and television (Munyua, 2007). The increased focus on modern ICT-based methods of information provision comes from the realization that they can play a major role in i) communicating knowledge and information to rural farmers, ii) delivering education and training modules to farmers at low cost, iii) improving smallholder farmers' access markets and agricultural credit, iv) empowering farmers to negotiate better prices, and v) facilitating and strengthening networking among smallholder farmers.

1.1. Project rationale

Africa has the world's highest concentrations of poor people. More than half the population lives in extreme poverty, with 75% residing in rural areas and deriving livelihoods directly or indirectly from agriculture. The incidence and severity of deprivation is highest in the low potential or risk-prone areas characterized by poor infrastructure, geographical isolation, poor market access and vulnerability to climatic variability all of which impact livelihoods. Achievement of the Millennium Development Goals and future growth and poverty reduction targets in Africa will therefore be especially challenging. As agriculture constitutes the main source of livelihoods and income, impacts on poverty can be maximized by targeting this sector. In deed the current search for "Africa's green revolution" arises from the recognition of the sector as an engine of growth and poverty alleviation among the smallholder farmers.

Smallholder farmers usually comprise the majority of the farming community. Most of them produce small marketable surplus and are geographically dispersed (Poulton et al, 2006). They sell and purchase commodities (inputs and outputs) in rural markets that are typically thin and characterized by fragmented supply chains with many intermediaries (i.e., the "brokers") (Shiferaw et al, 2008). Prices in these markets are often atomistic, varying with the crop season. Farmers usually lack information on demand and supply conditions, prices, and quality. The lack of market information encourages opportunistic behavior among traders (Shiferaw et al, 2008). Consequently most smallholders face high prices for inputs and low prices for their produce. Lack of information on supply and demand conditions cause them to sell their produce at farm gate or local markets that offer low prices. The tendency to sell at the farm gate rather than distant better paying markets is further driven by the high transaction costs and inability to meet the transfer costs to such markets (Fafchamps and Hill, 2005). The low atomistic output prices and the high input prices dampen incentives to commercialize production.

In response to the above problems and in order to spur commercialization of smallholder agriculture, new modern ICT technologies (e.g., mobile telephony and web-based applications) have been devised and old ones (e.g., use of television and FM radio) re-designed to facilitate the transfer of market information to farmers. Munyua (2007) documents the use of several ICT-based interventions in agriculture including the mobile telephony. Similarly, de Silva (2008) reviews the use of ICT in Asian agriculture and describes how ICT-based technology involving

mobile phones have been used to synchronize farm production and export market requirements for gherkins growers in Colombo. The development of the mobile telephony-based interventions has been motivated by the rapid penetration of mobile phones in rural Africa. The common applications in smallholder market linkage projects are the mobile SMS, web/internet-based resources and tele-centers. Applications of these ICT-based innovations have been promoted through donor-funded organizations/projects. Examples of such projects are the Kenya Agricultural Commodity Exchange and DrumNet in Kenya, Busoga Rural Open Source and Development Initiative and FoodNet in Uganda, Malawi Agricultural Commodity Exchange in Malawi, Manobi in Senegal, TradeNet in Ghana, and Kilosa Rural Services and Electronic Communication in Tanzania, among others¹³. Some of these modern ICT-based applications have been tried for the last ten years. Despite their high potential in improving smallholder agriculture, their usage and adoption by smallholder farmers has remained quite low. Evidence of their benefits and impacts in improving smallholder access to markets remains anecdotal.

A few studies have attempted to investigate the effects of ICT-based interventions on smallholder and market performance. Examples include studies that investigate the effects of use of internet-based technology to link horticultural farmers to input and output markets in Kenya (Ashraf et al, 2005), the use of mobile phones to obtain real-time prices of fish in India (Jensen, 2007), use of mobile phones to synchronize production practices with export market requirements in Colombo (de Silva, 2008), and the use of mobile phones by grain traders in Niger to obtain price information in other markets (Aker, 2008). Thus the literature on the effects of ICT-based interventions for linking smallholder farmers to markets remains thin and findings on the impact of such interventions patchy and context-specific. Moreover, none of the past studies systematically examines the effectiveness of ICT-based market information systems on smallholder market linkage in a broader context that encompasses, among others, the different cultures, commodities, and farmer types. There is therefore a dearth of knowledge on the effects of these interventions on the stakeholders, the factors that condition their adoption, factors that contribute to success or failure of ICT-based interventions, and the best-bet models for their successful implementation. This proposed study aims at filling these gaps in the literature. Such knowledge is essential in the scaling-up and out of successful interventions and re-designing failed innovations.

1.2 Project Objective

The general objective of this proposed project is to study the effectiveness of ICT-based intervention in linking African farmers to markets so as to inform policy decisions African governments and stakeholders aimed at improving livelihood of smallholder farmers. The specific objectives are:

1. To analyze existing ICT-based initiatives and the environments within which they are applied.
2. To examine the factors influencing the awareness and adoption of ICT-based market information services

¹³ There has been a surge in the number of ICT-based interventions in agriculture in some of the countries in Africa. For instance there were a total of 31 interventions in agriculture and related industries in Kenya in 2007.

3. To assess the effects of participating in ICT-based market information projects on smallholder farmers
4. To examine the effect of participation in ICT-based market information service project on the performance of agricultural markets
5. To critically analyze the challenges encountered by the ICT-based market information service projects for linking smallholder farmers to markets
6. To use the findings to influence ICT policy and practice in each participating country
7. To enhance collaboration among African researchers and to build research capacity of project partners and young researchers.
8. To use the findings to influence ICT policy and practice in each participating country

The primary focus of this proposed project in each study country will be the smallholder farmers. In each country, the study will target 1-2 past and/or present ICT-based market information service projects with common themes for in-depth analysis. It will seek to address the above objectives by answering the following research questions:

- i. What are the existing ICT-based interventions for linking smallholder farmers to markets?
- ii. What influences smallholder farmers' awareness and adoption of ICT-based agricultural information services?
- iii. What are the opportunities and prospects of the use of ICT-based market information services by smallholder farmers? That is, how do ICT-based market information service interventions affect performance of local and regional markets in Africa? Specifically, what is the impact on household commercialization and food security status of smallholder farmers?
- iv. What are the challenges faced by the boundary partners involved ICT-based market information service projects?
- v. What are the critical policy ingredients for scaling up and out ICT-based interventions for providing market information services to smallholder farmer?
- vi. How can the level of collaboration between public and private sectors be enhanced to facilitate smallholder farmer access to ICT-based agricultural market information?
- vii. How can greater collaboration and capacity building among African scientists in analyzing the role of ICT-based interventions in linking farmers to markets be enhanced?

1.3 Study context

This e-ARN project proposal is a culmination of a process that began at the International Association of Agricultural Economists (IAAE) Conference in Gold Coast, Australia in August 2006 with a brief meeting between Ms. Edith Ofwona Adera of IDRC and Dr. Julius Okello of University of Nairobi to discuss the possibility of developing a study on the role of ICT in linking African farmers to markets. This discussion was taken up again in Accra - Ghana at the African Association of Agricultural Economists meeting in August 2007. In Accra, a meeting by a team of economists from across Africa brainstormed the possibility of conducting an Africa-wide study of the effectiveness of ICT in linking smallholder farmers to markets. The meeting resulted in the formation of a network of researchers drawn from six countries (namely, Ghana, Benin, Kenya, Uganda, Malawi and Madagascar) to prepare a project proposal that will assess the effectiveness of ICT in linking smallholder farmers to markets. The countries were selected

to capture regional diversity, ensure regional balance with regard to major language groups (e.g. French and English), target cases where there are/have been ICT-based interventions for linking farmers to markets, and also build on the findings of Hilda Munyua's (2007) scoping study earlier funded by IDRC. In addition to Ghana, Kenya, Malawi and Uganda, which were highlighted by Munyua, the Accra meeting suggested that Madagascar be included because it has a number of new and yet-to-be deployed innovative ICT-based interventions in agriculture hence would enrich the lessons of experiences arising from the project and provide a regional balance.

2. Conceptual Framework

The problem of poor or lack of smallholder farmers' access to market can be analyzed at the micro and meso levels. At both levels the poor functioning of the markets is caused, in large part, by the high transaction costs (i.e., high of costs of doing business) between buyers and sellers which are typically exacerbated by lack of market information. At the micro-level, high transaction costs make markets for inputs fail for smallholder farmers causing them to rely on traditional production techniques with low returns. At the meso-level, the high transaction costs impede the efficient functioning of markets by retarding the flow of price information between local/village and regional markets. Studies indicate that up to 15% of costs incurred by farmers are transaction costs of which 70% arise from lack of market information (Financial Times, 2 March 2008). High transaction costs reduce the size of marketable surplus, margins earned by farmers and hence the ability to save and invest in commercial farming.

Linking farmers to better-paying markets through provision of market information can improve market efficiency which can in turn encourage farmers to expand production thus increasing marketable surplus, the margins earned, savings and hence investment. These can in turn fuel commercialization of smallholder agriculture. In order to understand the effectiveness of ICT in linking farmers to markets and the effects of such linkage on smallholder households we need to examine how ICT helps farmers overcome the problem high transactions thus enabling them earn higher margins and ultimately invest in the commercialization of agriculture. Our conceptual framework thus combines the transaction cost theory, theories of market efficiency and the concept of commercialization.

2.1 Transaction costs and market linkage

Transaction cost can loosely be defined as cost of doing business or cost of exchange between two trading partners, in our case farmers and buyers. Transaction cost theory has in the past few years been widely used to analyze market transactions. The theory originated with Coase's (1937) seminal paper "The Nature of The Firm" but it was not until the work of Williamson (1975; 1985) that it gained wide acceptance in mainstream economic analysis. Transaction cost theory is part of the New Institutional Economics (NIE) that upholds the significance of institutions¹⁴ in economic exchange (Coase, 2000; Williamson, 2000; Menard, 2005). Unlike the neoclassical economics, NIE maintains that economic agents are rational but within some bounds due to the uncertain nature of the choices that they are confronted with (Williamson, 1985; North, 1995; Hobbs, 1996). Transaction cost theory has been widely used in studying agricultural markets in developing countries (Jaffee, 1995, Jaffee, 2003; Fafchamps, 2004; Fafchamp and Hill, 2005; Okello and Swinton, 2007). It posits that difficulties in economic exchange between two partners arise because of three exchange related problems namely,

¹⁴ Under NIE, a market is considered as an institution or system that governs exchange between different partners.

asymmetric information, bounded rationality and opportunism. We explain these exchange related problem in the context of Africa smallholder agriculture.

In small farm situation, asymmetric information arises when either the farmer or buyer lacks essential information relating to the exchange. The more informed party therefore takes advantage of the exclusively available information to benefit him/herself, a situation referred to as opportunism and has been defined by Williamson (1985 p. 45) as “self-interest seeking with guile” (Miller, 2005). In most cases, the small farmers tend to be less informed than traders/buyers. Buyers and traders therefore use the exclusively available information (about price, supply condition, or quality) to their benefit. One way to deal with this problem is to agree on terms of exchange before hand. However, while the terms of the exchange can be specified *a priori* (i.e., through a contract), the uncertain nature of future outcomes makes it impractical to write complete contracts resulting instead in the use of informal agreements (i.e., incomplete contracts) (Williamson, 2000; Menard, 2005). That is, even though economic agents may be rational in their decision-making, they are bounded by the uncertainty of future outcomes. Under such circumstances, the buyer even with a priori agreement on terms of exchange can take advantage of the farmer by engaging actions that are contrary to the specifications of the agreement, a condition known as moral hazard. Alternatively, the buyer may claim ability to meet the terms of the agreement (e.g., buy the entire commodity from the farmer) only to fail to do so due to changes in the market, a situation called adverse selection. These conditions prevail in many farming environments in Africa where agricultural information is generally unavailable and has been one of the factors behind the push for ICT-based projects.

Lack of information between the seller (farmer) and the buyer make the exchange of goods (i.e., trade) more costly (Furubotn and Richter, 1997; Furubotn, 2001; Williamson, 2004). Coase (1937) argues that these costs exchange include search and screening costs, negotiation costs, costs of monitoring and enforcing terms of agreement, and costs of adapting to change in market environment (also known as maladaptation costs). Farmers who need to sell some produce must search for buyers and screen-off unreliable or opportunistic ones thus incurring search and screening costs. Once the buyer is identified, the farmer has to negotiate the terms of sale (i.e., price, quantity, quality, time of sale, frequency of sale, etc). The farmer thus incurs costs relating to time spent and financial outlays in negotiating the terms of exchange. A farmer may then have to engage in follow up activities (i.e., monitor) the buyer to ensure that the latter meets the terms of exchange and hence incurs monitoring costs. The farmer may also have to spend time and resources getting the buyer to honor the terms of agreement thus incur enforcement costs. Lastly, in the longer term agreements, changes in market condition may dictate adjustments in the terms of exchange such as the sales volume, quality, price, and frequency or time of sale. The farmer may thus incur monetary or time costs (i.e., mal-adaptation costs) during the renegotiation of the terms of exchange. These four categories of transaction costs are prevalent in both input and output markets in Africa. Poulton et al (2006), Fafchamps (2004), and Fafchamps and Gabre-Madhin (2006) for instance highlight some of these costs in relation to African farmers and traders.

The degree/size of transaction cost involved in an exchange process depends on a number of factors. In some cases, the farmer may require specialized assets to comply with the terms of the exchange, a condition referred to as asset specificity by Williamson (1985). For example, a farmer may i) be required to supply the produce at specific time (hence temporal asset

specificity), ii) need to use specialized/specific assets in the production and marketing process for example having to construct a collection point/center (hence physical asset specificity), iii) be constrained by agro-climate or location of processing facilities to grow the crop only in certain locations (hence geographical asset specificity) or iv) be required to have specific skills to meet the demands of the exchange agreement (hence knowledge/skill/human asset specificity) (Martinetz, 2005). The problem with high asset specificity in exchange relationship is that it can deny the farmer the flexibility to switch to another buyer (a situation called lock-in) or subject the farmer to an inflexible pricing situation that favors the buyer (also known as price “hold-up”) (Williamson, 1985).

High asset specificity becomes an especially serious problem under conditions of uncertainty. In a farm production and marketing setting, the farmer faces four main types of exchange-related uncertainties (Martinetz, 2005). First, the buyer may fail/refuse to disclose information relating to pertinent aspects of the transaction or disguise/distort such information resulting into behavioral uncertainty. Second demand volatility, lack of timely communication and inability to determine timely plans/decisions made by buyers/traders can lead to environmental uncertainty. Third, changes in technology needed to grow or market the crop can cause technological uncertainty. Fourth, farmer’s inability to verify, at low cost, the quality of the inputs required to grow a contracted crop and/or the tendency by the buyer to arbitrarily adjust quality parameters can cause quality uncertainty. These four types of uncertainty characterize most commodity exchange in Africa although the degree of prevalence differs. A combination of high asset specificity and uncertainty exacerbate the problem of opportunism in any exchange process (North, 1990). The complexity of the farming environment and the nature of transaction, which typically involves small volumes and information that is asymmetric to the farmer, can further complicate matters for the smallholder farmer. The farmer may for instance be forced to monitor the exchange process to ensure that the buyer fulfils its part of the terms of exchange (Hueth, 1999). However, monitoring the buyers becomes tricky when product attributes are not directly observable as in the case of credence or experience attributes. The buyer can thus wrongfully reject produce or dishonestly offer a lower price citing failure (by the farmer) to meet quality specifications or poor market outlook/conditions. In such a case, the farmer needs to increase the level of monitoring to detect cheating by the buyer (Olson, 1985; Bagetoft and Olesen, 2004). This is the reason availability of information to the farmer through ICT-based project can change the transaction/exchange landscape to the benefit of the farmers by reduce the level of uncertainty.

Transaction costs can be fixed or variable. Fixed transaction costs are the set up costs incurred in completing the exchange process (Furubotn and Richter, 2005, p 51). Such costs can include i) costs of building a storage unit or collection center or costs of investment in infrastructure (e.g., access roads) and information service (e.g., telecommunication), and ii) public and private institutions (e.g., public security systems, legal systems – such as contract enforcement laws – and, formal and informal associations (Larson, 2006)). Variable transaction costs on the other hand depend on the number or volume of transactions. Such costs include fees for transport services, employee costs associated with quality inspection, etc. Hence the greater the volume of produce transacted and the more frequent the transactions, the higher the variable transaction costs (Williamson, 1985; Key *et al.*, 2000). This study will mainly focus on variable transaction costs that characterize transaction/exchange process between farmers and buyers in Africa. It is typical for farmers and buyers to engage in practices that exacerbate variable transaction costs in

Africa. Gabre Madhin and Fafchamps (2006) for instance describe how farmers/traders engage in transaction cost-increasing activities (trading in small volumes, inspection, etc) in Africa.

The bottom-line is that lack of market information increases the costs of exchange between the farmer and buyer. Smallholder farmers are especially disadvantaged because they trade in small volumes usually in local markets hence are not able to take advantage of economies of scale to reduce the fixed transaction costs of exchange with buyers. At the same time, smallholder farmers due to their geographic dispersion incur higher variable transaction costs of accessing the inputs and selling their produce. The higher costs emanate from the higher costs of searching for and screening of exchange partners, negotiating the sale of output or purchase of inputs, monitoring and enforcing the terms of exchange and also adjusting to changes in market environment. Farmer access to market information has the advantage in that it reduces these fixed and variable costs of doing business. It therefore allows the farmers to increase net income by reducing the costs. The increased income is in turn expected to provide greater incentives to smallholder farmers to participate in the market. We therefore hypothesize that smallholder farmer access to market information reduces the costs of doing business and hence increases market linkage

2.2 Transaction costs and performance of spatially and temporally separated markets

High costs of doing business (i.e., high transaction costs) are also the cause of poor functioning of regional markets. Trade between any two markets is normally determined by the amount of transaction costs that traders have to incur to move commodities from one market to another (Barrett, 2008). In deed the law of one price maintains that trade between two spatially separated markets will occur if price in the “importing” market less the transfer costs exceeds the price in the “exporting” market. In the African context, these transfer costs include transportation costs, security costs etc which are essentially the transaction costs (Omamo, 1998). High cost of doing business contributes to lack of trade between spatially or temporally separated markets (Minot, 1999). It also affects the marketing strategy used by farmers. For instance Fafchamps and Hill (2005) find that smallholder farmers prefer to sell at the farm gate rather than in the market due to high transaction costs. Moser et al (2005) find that high cost of doing business in Africa is caused by, among other things, remoteness of the farms relative to marketing facilities/points, lack of infrastructure (i.e. roads), and lack of information and, high crime rate. These factors, they argue, impede competition between markets.

Studies of performance of spatially and temporally separated markets focus mainly on the efficiency with which prices are transmitted between such markets which in turn depends on the availability of and farmer/trader access to market information. Such studies have a long history dating back to von Thunen (1926) and build on studies by Samuelson (1952) and Takayama and Judge (1964). They measure the tendency for prices in two spatially or temporally separated markets to move together (i.e., integration) or of price shocks in one market to be transmitted into another (Moser et al, 2005). Recent studies of price transmission focus on the nature of relationship between price series at different levels of the value chain or at spatially separated markets (Abdulahi, 2007). Such studies use time series methods and in some cases lag structures on prices to analyze the relationship between prices in spatially separated markets. (See Fackler and Godwin (2001) for a review of such time series-based studies.)

The speed and degree of price transmission between markets can signal presence of market failures arising mainly from high transfer costs and the lack of market information (Abdulahi, 2007). The extent of adjustment and the speed with which price information is transmitted among various actors in the market reflects the behavior of actors. Slow transmission of price information following a shock may be indicative of the high marketing margins, price spread, mark-up and unfavorable pricing practices (i.e., opportunistic behavior). However previous studies suggest that lack of investment in market infrastructure (especially transport and communication) can exacerbate the problem of high transfer costs and hence impede efficient transmission of prices between spatially separated markets (Goletti and Babu, 1994; Chirwa, 1999).

Efficient transmission of price information between markets is important for inter-village/ interregional trade to occur. Given the limiting effect of lack of information on the performance of markets, provision of such information benefits smallholder farmers by, among others, i) improving smallholder farmers' access to markets and hence improving the price obtained, ii) improving the speed and efficiency of price adjustment between spatially separated markets through arbitrage, iii) making response to market shocks more rapid and complete and iv) making price discovery process by farmers, traders and consumers more efficient and rapid.

2.3. Transaction cost, marketing margins and market participation

The effect of information asymmetry (hence transaction) costs at the micro and meso levels can be understood by looking at simple stylized models relating the household and market price and prices between two markets. Following Minot (1999), Larson (2006) and Barrett (2008) we argue that transaction cost at the micro level causes a wedge between the exogenous market price and the price the household receives for its crop. As described above the costs of exchange (i.e., transaction costs) depend on the volume traded, household asset endowment (e.g., human, financial, physical, and social capital), quasi-fixed factors (e.g., the state of infrastructural development especially improvement in roads¹⁵), and the range of public and private market information services available to farmers/traders (e.g., agricultural extension services, TV and radio broadcasts, etc).

Since high costs of exchange reduces the net income earned by increasing the cost of exchange, lack of information can prohibit trade between markets and hence limit intervillage/regional trade. Efficiency in inter-village trade requires that the border price (i.e., price at border of two spatially separated or geographic markets) less the costs of moving the produce to destination (i.e., transfer cost) be equal the price at the source market. However, just as in the case of local trade within a village or between villages, the costs of transferring produce from one market to another is affected by the volume traded, state of infrastructure, and the availability of public and private market information services. As before, lack of market information increases the costs of exchange leading to a situation where price in the destination differs from that in the source market by more than the transfer costs. The high costs of moving the produce between markets dampens incentives for trade and can even eliminate trade altogether.

Transaction cost is assumed to be affected by the state of infrastructure especially the condition of the roads and distances to input and output markets. The costs of exchange can also be

¹⁵ See Omamo (1998a) for a discussion on the importance of transport system on costs facing farmers and its effects on market participation.

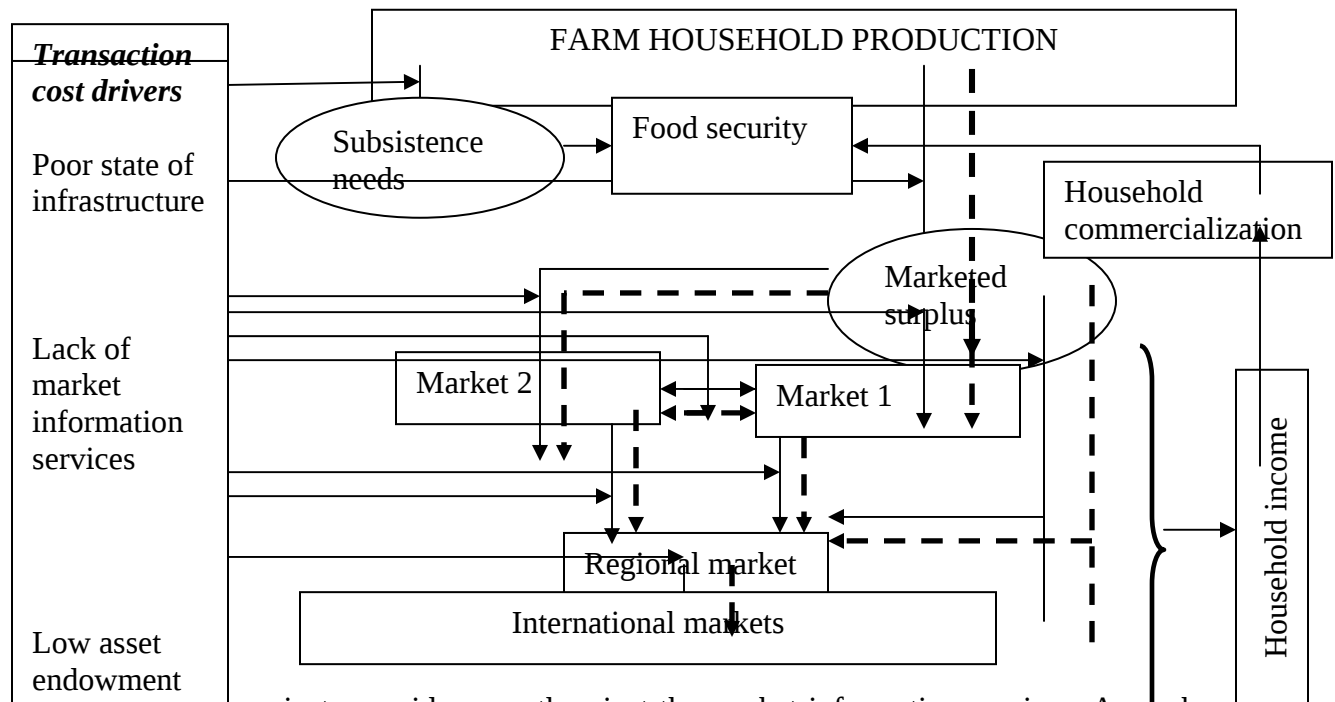
affected by market information service such as can be disseminated through an ICT-based market information service project. In addition, we argue that smallholder farmer's cost of doing business is affected by farmer/household asset endowment including possession of physical assets such as radio, TV, mobile phone, human capital assets such as skills and experience and social capital assets that can be in form of membership to a farmer organization. High transaction costs caused by difficulties in reaching input and/or output markets access increase input costs and reduce the net price earned by farmer/household thereby depressing the household's desire to participate in input and output markets. This in turn drives the household to produce only what is enough for its subsistence needs (i.e., become subsistence oriented). Such households stay out of the market. Similarly, poor state of infrastructure, lack of market information services and lack of needed assets can increase the costs of intervillage/interregional trade thus reducing or eliminating opportunities for trade between local and regional markets. The high costs of interregional trade can in turn cause different regions to focus on meeting food needs rather than pursuing trade.

The importance of farmer access to information is in reducing the transaction costs of exchange. ICT-based projects usually seek to provide access to agricultural information hence the presence of an ICT-based project in an area provides farmers with an easy access to market information. However, for farmers in an area with ICT-based project to benefit from the agriculture information service provided by the project, they need to be aware of the presence the project and use the services provided by it. Undoubtedly, farmers will use the services from the project if they find it profitable to so. The use of any technology entails a cost. In the case of ICT-based market information services, the cost may include the expenses on mobile phone calls to the project center to acquire information, the cost of buying a mobile phone handset, the fees levied on internet browsing, etc. The benefits of using market information services provided by an ICT-based project, on the other hand, include reduced cost of finding and selecting a trading/exchange partner (i.e., search and screening costs), the costs of negotiating and monitoring the terms of exchange and the costs of adjusting the terms of exchange. The reduction in these costs increase the margins earned by farmers and hence the revenues/income from participating in the output market. The increase in income can also be due to increase in the volume of produce sold which in turn may be caused by reduction in costs. Access to market information through ICT-based project can also reduce the costs of acquiring credit and other inputs by lowering search, negotiation and monitoring costs thus increasing the margins and revenues assuming constant output price. It is therefore important, in studying the effect of ICT-based information services in linking farmers to markets, to examine the farmer awareness and adoption of such services.

Theoretically, households that use market information services provided by ICT-based projects are expected face lower production and marketing transaction costs. The increased revenue earned by such households is expected to promote commercialization, and hence greater participation in local and eventually regional markets. As shown in Figure 1, households that increase production out of use of ICT-based market information services can participate in market through sale of surplus production to village Market 1, Market 2 or regional markets. Trade may occur between village markets, between village and regional markets, between regional markets (e.g., between market in two districts but one country) or between regional and international markets. We assume that households that do not use the services of ICT-based project have no or very little access to market information. Consequently, such households face

higher costs of doing business both in the input and output markets. Such households therefore either stay out of the market (are purely subsistence oriented) or sell little surplus hence the small arrows. On the other hand, farmers/households that use ICT-based market information services produce more marketable surplus hence sell more. Increased volume of sales increases household income which spurs commercialization. Such households, represented by the bigger broken arrows in Figure 1, engage in commercial farming compared to counterparts who are constrained by high costs of doing business. As shown in the figure, household commercialization could in turn improve the food security status as households use the more incomes earned to purchase food needs. However household food security is also affected by the volume home production for subsistence needs.

Figure 1: The effect of transaction on market participation



projects provide more than just the market information services. A number of projects also provide the infrastructure needed to facilitate access to such information while also enabling farmers to produce marketed surplus. Background studies indicate that a number of projects in Africa create the necessary infrastructure needed by farmers to participate in the market. These include creation of information kiosks, internet shops, or tele-centres. The strategic location of such infrastructure in close proximity to farmers thus enhances their access to market information. At the same time the background studies find that a number of ICT-based projects build the capacity of farmers to more effectively use the services they provide and/or provision of basic assets especially the mobile phone handsets on which such services are based. Other projects mount television sets or information billboards at strategic points in the market places for use by farmers. Provision of such infrastructure and assets enhances access to market information, reduces transaction costs facing the household by reducing search, screening, negotiation and monitoring costs, and increases price earned by the household from market participation hence revenues. It also increases reigning price in spatially separated markets linked through trade. In both cases reduction in transaction costs enhances the likelihood of participation in the market due to increased margin. In deed poor state of infrastructure and lack of assets (often referred to as asset poverty) are the major causes of poor access to market information (Barrett, 2008). Nonetheless, households face differential effects of the transaction costs (Omamo, 1998b; Key et al, 2000; Renkow et al, 2004). At the same time differences in costs of commerce may make geographic or spatially separated markets be differentially integrated (Godwin and Fackler, 2001; Barrett, 2008).

Increased participation in the market by smallholder farmers has several benefits including the revenue gains discussed above (Shepherd, 1997). Increased revenue and hence income can be used by households for short-term investment in agriculture (e.g., in the form of increased use of

fertilizers, improved seed) or medium to long-term investments (e.g., accumulation of productive assets including human, physical, financial and natural assets). There is however only anecdotal evidence that improved access to market information increases the incomes earned by smallholder farmers due to greater participation in markets through the sale of surplus production (see for example evidence from IFAD funded ICT-based First Mile Project at www.linkinglearners.net). ASNS (2007) reports similar experience among farmers in Tanzania while Stienen et al (2007) find that access to information may also increase the bargaining power of the farmers hence the price they receive. Second, increased participation in markets can result in increased household commercialization, which in turn increases adoption of better techniques of production (Shiferaw et al, 2006).

At the inter-village/regional level (i.e., meso level) access to market information that can come through participation in ICT-based project has the potential of reducing transaction costs by lowering the costs of agricultural exchange (i.e., search, negotiation costs, and commodity inspection costs) discussed above. Such market information access driven reduction in transactions costs has been reported by studies Sri Lanka and Colombo by De Silva (2008) and Financial Times (2008). Theoretically, for an exporting market, the reduction in costs of doing business benefits traders by increasing the net price earned and hence margins. Assuming efficient transmission of price to the farmers, access to information can hence raise the household shadow price and result in household asset/capital accumulation. In the medium to long-run, household capital accumulation can stimulate investment in agriculture, commercialization and thus increased market participation. As discussed above the empirical evidence that improved access to markets benefits farmers/traders is still scanty. However three studies give useful guide. Aker (2008) for instance finds that improved access to information by traders in Niger reduced the search costs resulting in less price volatility and price spread between trading-linked markets. Jensen (2007) finds that improved availability of information to Indian fishermen reduced price dispersion and wastes. De Silva (2008) on the other hand argue that access to market information improves the welfare of small export vegetable growers by reducing the losses they incur as rejects and uncollected produce in Columbia. These limited studies associated with ICT-use in Africa corroborate findings of Anderson et al (1998), which suggest that increased availability of information improves the process of price discovery (by reducing search, negotiation and policing costs) and thus improves marketing efficiency.

This study will focus on the production and marketing aspects only and will not go into value addition process such as processing. Thus it will target the farm to market segments of the value chain. The production aspects to be considered will include acquisition of inputs and how information access through ICT affects it, marketing of the produce (in particularly the exchange process) between farmer and buyer, and between one trader and another. The strategies used in the marketing of produce will also be investigated in this project. Such strategies include sale at the farm gate, sale in the village market, and sale in more distant (regional) markets. At the same time, the timing of sale (whether immediately or after a while) will be investigated. It is expected that when farmers have access information about prices in distant markets and the transfer costs, they will sell in a distant markets that earns them highest net price. Such trade will however continue until the margins are eliminated so that the price between regional market and farm gate or local market equal transfer costs in which case the markets are said to operate efficiently. It also expected that farmer access to information on likely future prices and costs of storage will

affect the timing of sale of the produce. We therefore hypothesize that farmers that participate in ICT-based projects will tend to sell in better paying distant markets and that they will also tend to sell their produce later in the season compared to those that don't.

3. Methodology

3.1 Overall research approach

A combination of quantitative and qualitative methods will be employed (see section 3.5) in undertaking this research. Combination of quantitative and qualitative methodological approaches is preferred due to the relative strengths of each of the two methods. This will provide a greater range of insights and perspectives in the area of ICTs in relation to market access by the smallholder farmers as well as permitting greater triangulation of data to improve the overall quality and validity of the study results. Combining both methodologies is envisaged to provide a comprehensive description of the effectiveness of ICT-based interventions in linking African farmers to markets in a way that can be easily appreciated and understood by a diverse body of stakeholders at all levels.

Quantitative methods will yield a large dataset, which will be summarized to facilitate comparisons within and across case studies. They will help explore, among others, the effects of smallholder farmer participation in ICT-based market information projects and the factors that influence the use or non-use of ICT-based information services. On the other hand, qualitative methods will help in exploring in a detail the context within which ICT-based interventions are introduced and implemented. Challenges and prospects for the smallholder farmers to utilize ICTs in their endeavor to improve their access markets will be explored. Qualitative data will further be used to provide meaning on the statistical data generated by the quantitative methods. Thus, whereas the quantitative methods will be helpful in describing the magnitude of the issue at hand in statistical terms—aiming at producing descriptions and generalizations about how ICT-based interventions have impacted on communities on smallholder farmer, the qualitative methods will be utilized to go deeper in helping to understand and explain the policy environment as well as the subjective reality of participants in a way that is meaningful to the participants themselves. Further, using both quantitative and qualitative methods in this study will allow for capturing all stakeholders involved in making policies and particularly the ICT sector at all levels of administration; central and local.

3.2 Case study countries, projects, and population

The case study countries will comprise of Kenya, Malawi, Uganda, Ghana, Benin, and Madagascar. These have been purposively selected in order to exploit essential experience in dealing with ICT and diversity in language (hence socio-cultural factors) and also informed by scoping study done for IDRC by Hilda Munyua. In each proposed country, the study population will primarily comprise of smallholder farm households. The study population for the household survey will target household farmers with knowledge of, and who participates in use of ICTs and those that do not. Depending on the experience in each proposed study country, the study will cover other secondary stakeholders involved in the agricultural and market chain. The stakeholders who were identified during the pre-proposal development workshop will include, among others, the following:

- ✓ Providers of market information services
- ✓ Key central and local government agencies
- ✓ Buyers
- ✓ Stockists (i.e., input dealers)
- ✓ Transporters
- ✓ Produce brokers and
- ✓ Credit institutions

Data will be collected in the six proposed study countries at project and household levels in two phases, namely, country background/scoping studies and detailed farmer and ICT-practitioner interviews. In each country we will conduct an in-depth study of 1-2 projects that are carefully selected based on their locus of intervention and the services they offer to smallholder farmers. In particular, the selected projects to be studied will be those that target small farmers and have a unifying theme of linking such farmers to market in order to improve their welfare. These cross-cutting theme will allow us synthesize cross-cutting non-context specific lessons for both policy and practice. The selection of countries has also been done to ensure diversity in language and culture. In order to draw lessons on challenges ICT-based projects encounter, the adaptive strategies employed (which are useful for both policy and practice), we shall conduct an in-depth study of at least two past (failed¹⁶/unsuccessful) projects. Based on the study objectives and the background studies (including Hilda Munyua's), this study has identified the following tentative ICT-based projects for detailed case study analysis in the respective countries:

- ✓ Benin – Sonhgaï Center & Resimao
- ✓ Ghana – TradeNet & MAPRONET
- ✓ Uganda – WOUGNET & BROSDI
- ✓ Kenya – KACE & DrumNet
- ✓ Malawi – MACE & FNSJ Taskforce
- ✓ Madagascar – MLMI & PPRR

All the above projects (described below in detail) target the provision of market information to smallholder farmers and aim at increasing the incomes of such farmers through their services. The projects proposed for case studies are described below.

1) Benin

Songhai Center is a non-governmental organization (NGO) devoted to promoting agricultural entrepreneurship among farmers. Farmers, assisted by Songhai, are able to search for information to improve crop yields, optimize the use of fertilizers, and find the best prices for their produce. Songhai has also established a network of telecenters in some towns in Benin where farmers can access agricultural information. These centers also serve other clients and partners of Songai Center.

Resimao is a regional market information network with a branch in Benin. With the support of the CTA, the Network disseminates price information through its database and internet site in

¹⁶ We define failure as inability to achieve the primary objectives of the project. A project may therefore be operational but is considered failed

rural and urban markets. The information disseminated covers all the agricultural products including cattle and the meat products.

2) Ghana

TradeNet allows traders and producers from anywhere in the world to find each other online or via mobile phones and connect to do business. It also runs market information shops from where farmers and buyers can obtain information on commodities of interest. Its goal is to raise revenues of small-scale farmers and traders by allowing them to find trading partners and carry out commodity exchange at low cost. TradeNet also provides free customizable websites to any group that seeks an online presence and easy integration with the mobile networks.

MAPRONET (Market Access Promotion Network) MAPRONET was formed in 2001 by agricultural producer groups and local and international NGOs. It aims at improving market access for farmers and enabling them to meet the requirements of local and international markets.

3) Uganda

WOUGNET (Women of Uganda Network) Provides agricultural information to women farmers downloaded from WorldSpace receiver, which the center acquired through collaboration between the Department of Meteorology and WOUGNET. Inside the center, the receiver is connected to a computer, which enables it receiver to receive data from WorldSpace. The software has two components, which include the audio and multimedia. The information is disseminated through mobile phones using SMS including agricultural market information.

BROSDI uses mobile phone SMS to disseminate agricultural information to farmers with the aim of improving rural farmers' livelihoods and food security through engaging the government and the civil society in knowledge sharing and information management using ICT methods. It also uses internet website, audio cassettes, telephone calls, newsletters, brochures, and information sharing forums and trade fairs to disseminate information to farmers/community. It also facilitates farmer access to rural/financial services - improvements in access, reach and flexibility through ICTs.

4) Kenya

DrumNet provides market access, extension and financial services to smallholder farmers. It is a project of Pride Africa (an NGO). Its goal is to provide small-scale farmers with efficient and sophisticated information needed to meet market requirements and access better markets. The project has support centers that cater for clients who require financial, market and technical information in order to make more profitable transactions.

KACE (Kenya Agricultural Commodity Exchange) is a private sector firm set up in 1997. It links farmers to input and output markets through provision of timely data and information. It collects, processes, and stores market information on commodity prices, transportation costs, etc and uses the information to link farmers to buyers through matching offers and bids. KACE operates marketing information points (information kiosks) where farmers get market information on notice boards. KACE also uses mobile phones, Internet and radio services to disseminate market information to farmers. One such initiatives is the *Soko Hewani* program where offers and bids are verified and radio program staff link buyers with respective sellers of various commodities

5) Malawi

MACE (Malawi Agricultural Commodity Exchange) provides commodity neutral agricultural marketing information to farmers. It uses various media including use of mobile phones, marketing information centers or kiosks. The major objectives of MACE are to 1) facilitate linkages between sellers and buyers, exporters and importers of agricultural commodities; (2) empower farmers with relevant and timely market information and intelligence to enhance their bargaining power and competitiveness in the market place; (3) provide a transparent and competitive price discovery mechanism through the operation of the exchange trading floor; and (4) harness and apply the power of ICTs as a strategic tool for rural value addition and empowerment.

FNSJ Taskforce (Food and Nutrition Security Joint Task Force) is a project based in Lilongwe. It supplies weekly market information on crops and livestock from all parts of Malawi through internet and bulletins. The information is also transmitted to government and non-governmental organizations that work with farmers. The aim of the project is to provide timely and accurate market information to farmers in order to enhance their decision-making.

Madagascar

MLMI (The Last Mile Initiative) is a global USAID initiative aimed to bring the benefits of the information age to rural populations by extending telecommunications infrastructure and access to the remote locations. Its strategy combines modern technological solutions and effective business models to extend connectivity (internet and telephone) from existing networks to isolated areas. Partnerships with the private sector enable efficient, affordable service costs. Community information centers are being created where local citizens can access telephone, photocopy, facsimile and the Internet. Additionally the centers organize public workshops and sessions on topics, such as the organizational and institutional development of local NGO and associations, development of the sales networks between the local farmers and consumers, and communications to improve quality of the health services.

PPRR (Projet de Promotion des Revenus Ruraux) (i.e., Promoting Rural Revenue Project). PPRR is located in the East coast of Madagascar. It makes extensive use of ICT technologies in its activities and aims at increasing the revenues of farmers. The project provides internet connectivity and local network and website through which farmers can access information. It uses also laptops computers and mobile phones to provide market information to farmers. It sets up what are called Access Centers to Markets (CAM) involving essentially Farmers' Organizations (FO) and through which farmers are able to access better market conditions.

3.3 Sampling process for households

A stratified random sampling technique will be used in survey. The main sampling units will be the local administrative units (district or province) although the unit of analysis will be the household. The administrative units will be sampled purposively and will be based on the location of ICT-based project to be studied. Following the selection of the district, lower administrative units leading the village and eventually the households will be selected using multistage cluster random sampling techniques. In all the six countries a total of 2,040 households will be sampled with each country covering a minimum sample of 340 households. The 340 households will therefore be stratified by participation in ICT-based project. A household will be defined as a participant if it is in the project area and uses at least one of the services provided under the project and non participant if does not use any of the services. The respondent in each sampled household will be the head of the household.

3.4 Key informants & focus group discussions

The study use both key informant and focus group discussions to obtain information needed in for preliminary understanding of, among others, environments within which ICT-projects operate, the project implementation aspects and challenges faced. Key informant interviews will also be essential in the initial preparation of the study to provide preliminary information that, together the already completed background studies, will help in shaping the quantitative study and provide an in-depth understanding and verification/validation of some data generated through household survey. Information from key informants will further help in understanding and appreciating the policy environment that facilitate or constrain adoption of ICT-based interventions by the smallholder African farmer.

Key informants will be purposively selected on the basis of their respective roles vis-à-vis agricultural market information and knowledge of the subject. In each country, both the key informants and focus group discussants will be recruited in the ICT-based project sites. Other relevant key informants such as government officials and donors will be met at the national level. Those recruited from field sites will include representatives of local agricultural office, local development agencies, farmer organizations, and farmers while the central government officials will include representatives of ministries of agriculture, information/communication, and local/regional development. Other sources of key informants will include project sponsors. In each proposed study country, the researchers will seek to develop clear understanding of key questions/issues from the informants of the selected case study project. Some of the questions each country team will seek answers for from the key informants are: When and by whom the project was implemented? What is the project supposed to achieve? Who are the target beneficiaries? What is the project's geographical coverage? How is the project perceived by the beneficiaries? To what extent has the project met its goals? Depending on the geographical coverage of selected ICT-based project, each country team will hold at least one focus group

discussion in the project hence a total of at least 6 focus group discussions will be held in this study. The focus group discussions will be based detailed structured questions encompassing the above questions.

3.5 Data collection and analytical methods by objective

As earlier indicated, both quantitative and qualitative methods of data collection will be used. Primary quantitative data will be collected in each country through personal interviews using structured questionnaires to be administered to selected member of the rural household. In-depth interviews with purposively selected key informants and focus group discussants will generate qualitative data. Gender disaggregated data will be collected to take account of the possibility that adoption and effects/benefits of interventions may differ for men and women. The information generated from these sources will be complemented by desk reviews of past studies and secondary data where available. See Annex 1 for the summary of each country's data sources and below for detailed data collection methods and types by study specific objective. The methods presented in the annexes are an adaptation by individual study countries of the overall project presented below by objective.

Objective 1: Analysis of current ICT-based initiatives and their environment

This objective coincides with Phase 1 of the project. This phase entailed analysis of agricultural and ICT policy environment in each participating country and identification of existing ICT interventions in agriculture and was intended to build on the findings of Hilda Munyua's background study. These studies were presented at the proposal development workshop in Antananarivo – Madagascar – in June 2008 to enable the team and practitioners to gain preliminary understanding of the existing ICT policy environment in each proposed case study country. Objective 1 has therefore been partially met through the preparation of Country Background Studies/Papers. However, because of time limitations, the background studies did not involve interviews with stakeholders such as government, ICT project practitioners, farmers, and field extension personnel. To complete the analysis under this objective, detailed interviews will be conducted with these and other relevant stakeholders to gain a thorough understanding of the environments (i.e., policy, legal, political, and social e.g., gender) within which the ICT-based projects operate.

In analyzing the ICT-based interventions aimed at improving access to market information, the discussions with stakeholders will address, among others, the following questions: Who introduced the intervention? That is, was the intervention introduced as private business or by government, civil society organization, or a farmer/trader association? What are the primary goals of the project? What are the costs (legal, operational, etc) of implementing and running the project? What services are provided along with market information? What is the locus of intervention of each project (i.e., who are the primary beneficiaries)? What are the terms of access to the services and the costs to beneficiaries of access? Is the ICT-based project commodity, locality, etc specific? What are the sources and duration of funding? What is the policy, legal and sociopolitical environment in which the project operates?

The information obtained from this activity will be used to assess and corroborate the usefulness of the selected country case projects in advancing the understanding of the effectiveness of ICT-based interventions linking farmers to markets. It will also form the basis of the case study analyses and the pooling and synthesis of information from all the various projects to draw cross-

cutting conclusions and recommendations for policy and practice. The synthesis information from all the six proposed study countries will therefore allow conclusions on what works and what does not and implications for both policy and practice to be drawn.

Objective 2: Conditioners of use of ICT-based market information services

This objective and the subsequent ones will form phase two of the project in which there will be detailed household (and ICT-practitioner) surveys. As in any technology adoption process, we expect varied response to introduction of ICT market information with some adopting the ICT-based market information services and others not adopting. In order to understand the factors conditioning smallholder farmers' adoption of ICT-based market information services, household level data in each country will be collected from a stratified random sample of approximately 2,040 households (i.e., about 340 in each country). The sample will be stratified by participation in ICT-based market information service project. That is, households selected for personal interview will be drawn from both the areas where a selected project is located and those where the project is not so as to obtain a "with" (i.e., treatment) and "without" (i.e., control) groups. The treatment group will be farmers reached by the selected ICT-based project. Once both groups are identified separate lists of farmers in the "treatment" and "control" groups will be drawn. Households to be interviewed will be sampled from the two lists using probability proportionate to size technique (i.e., the larger the number of households in a list the greater the sample drawn from it).

Household level data to be collected will include household characteristics, awareness of the existence of ICT-based market information services in the locality, number of ICT-based market information services used, other information sources used, participation in collective action, access to formal and informal financial services, endowments with various types of capital (i.e., human, financial, physical, social, and natural capital), crop and livestock production, participation in input and output markets, the types of markets used, sources of income, assessment of the role of risk on use of ICT-based information sources, etc. Full details of the data needs for this objective are provided in Annex 1.

Once collected, the quantitative data will be analyzed using standard quantitative methods. Econometric methods will be used to identify factors affecting smallholder farmers' adoption of existing ICT-based information sources in each participating country. In particular, simple binary variable models (e.g. probit or logit models) will be used to examine the factors driving the adoption of ICT-based market information services (MIS). Such models are useful in determining the factors that explain whether the farmer is aware of an ICT-based project or not. The double-hurdle method will be used to explain factors conditioning farmers' decision participate in ICT-based and, once decision to participate in such project is made, the number of services adopted. A farmer who wants to use services provided through an ICT-based project faces two hurdles. The first hurdle is whether or not to participate in an ICT-based project or not. Once she overcomes this hurdle (i.e., decides to participate), she faces the second hurdle namely the how many of the services provided through the project (e.g., text messaging, web-based, radio-disseminated information services) to use. The double-hurdle models will therefore be uses in this study because ICT-based projects offer multiple services from which target farmers select a few based on need and ability. Given that household commodity production and consumption/sales decisions are usually jointly made (i.e., non-separable) econometric models

that take such non-separability into account will be used to assess the effect of ICT-based MIS on market access and hence commercialization (Singh et al., 1986; de Janvry et al., 1991). Gender dimensions of ICT-based MIS will be investigated by including in the econometric models variable(s) that capture such effect.

The adoption studies undertaken in each country under this objective will be employed in identifying three categories of factors that condition the use of ICT-based market information services by smallholder farmers namely:

- ✓ Those that are related to the ICT-based project and/or ICT-based service itself
- ✓ Personal characteristics of the individual actor that determine their response behaviour
- ✓ Institutional factors that also influence capability of actors to respond (e.g., market conditions, organization of smallholder farmers, etc).

Findings of adoption studies of this nature are relevant for identifying suitable ICT policies and/or best bet interventions and also strategies for designing future projects with greater odds of success.

Objective 3: Assessment of the benefits of participation in ICT-based market information service initiatives

One of hypotheses of this study is that participation in ICT-based market information service projects has a number of benefits to farmers both at micro (i.e., individual actor) and meso (regional and market) levels. For instance participating in such projects can enhance information access and thus make the farmer more informed about input and output prices thus reduce the cost of purchased inputs and increase the output price. That is, farmers that use the ICT-based market information services are likely to face better prices, hence get higher incomes, than their counterpart. The benefit of higher farm income (i.e., financial capital) may be transformed by some of the farmers into others forms of capital namely human, social, physical, and natural). Secondly, use of ICT-based market information services can benefit the farmers by reducing the variability of input and output prices and hence market risk. Reduction in market risk promotes the adoption of better yielding technologies and hence improves productivity and consequently commercialization. Thirdly, market information services can increase the efficiency with which price information is transmitted between and among spatially and temporally separated markets. This can have the effect of reducing the price variability and/or dispersion among village, regional, national and international markets and increase the likelihood of participation in such markets by smallholder farmers.

This proposed study will investigate some of the above potential benefits of enhanced information provided by ICT-based projects in order to assess the effect that participation in such projects has of the household. In particular, the study will focus on the effect of participation on ICT-based project on household commercialization. It will focus on household commercialization because commercialization has been shown to drive (and may itself be driven by) increased market participation (Wambugu, 2008). Household commercialization is also interesting to study because it can influence household food security status. Household commercialization will be measured by share of total production sold. Annex 2 gives a matrix representation of the ways different information types is likely to affect household commercial orientation and that effect can be measured. On the other hand, household food security will be

used by indicators such as giving away food as gifts to neighbours/family and as tithe. Changes in household behavior such as commercial orientation (as opposed to subsistence orientation) will be monitored using longitudinal data. However, generating such data is often costly because it requires follow-up survey of households. Consequently, this study will generate and use longitudinal data to explore if participation in ICT-based project has affected household behavior with respect to commercialization and/or food security but will limit the study to 2-3 countries. The 2-3 countries selected for these longitudinal studies will be drawn from different language groups and regions so they capture regional and language diversity.

Information will be collected at two levels (i.e., micro and meso) in order to capture the above and other benefits of the ICT-based market information services. At the micro-level, data will be collected as part of the household survey described in *Objective 2* above for both ICT-based market information service project participating and non-participating farmers. Information gathered will include volume of produce harvested, consumed sold by the household, prices received for each commodity, level of risk and risk attitudes, access to inputs (especially credit), input prices paid and volumes traded. The information gathered will then be used to assess how farmers reached by an ICT-based project and those that are not differ with regard to the level of farm commercialization, input and output prices, agricultural incomes and levels of risk faced. In each category of farmers the gender analysis will also be done to assess whether gender influences the outcomes using the gender disaggregated data.

The micro-level data will be used to estimate quantitative/econometric models that will help identify the factors that explain the household behavior change from subsistence orientation to commercialization. This will be done by estimating an ordinary least square regression model in which the share of crop sold (i.e. commercialization) will be regressed against the vector explanatory variables which will include some proxies of use of ICT-based market assess and also gender variables.

Objective 4: Effect of participation in ICT-based project on market performance

As earlier discussed performance of agricultural markets can be gauged from the speed with which prices moves between markets separated by distance or time (i.e., spatially and temporally separated markets) or from the margins earned by various actors in the chain. Hence commodity prices movements between village/regional markets and marketing margins will be used to assess the effect of ICT-based MIS on the performance of markets in this study. Markets are said to perform efficiently if prices move efficiently between them, in which case the markets said to be co-integrated. Efficient movement in prices on the other hand requires availability of market information.

1) Testing for integration of markets of key commodities using cointegration tests

In testing for integration in markets within the project area, we will test if a) for different market prices in deficit and surplus markets tend to move together, and b) for the same market, there is little variation in inter seasonal prices. Two approaches will be used to analyze market integration namely i) inter-seasonal variations in target commodity prices (i.e., inter-seasonal price dispersion), and ii) the Granger causality test (Aker, 2007). Aker (ibid) uses these approaches to test integration of grain markets in Niger. Following Jensen (2007) we will use the coefficient of variation in prices and the difference between maximum price and minimum price

as measures of price dispersion (or inter-seasonal variations in prices). Granger causality is a technique used to determine whether one time series on market prices causes another. It will be used in this study because it is therefore a suitable method for assessing the extent to which price changes in one market, influences price changes in another (usually deficit and surplus markets). The tests can be used to determine whether price changes follow well-defined paths. These two approaches will be used to test two hypotheses: i) that commodity price dispersion is lower in areas covered by ICT-market information project and ii) that prices in any two markets covered by ICT-based project will tend to move together.

A test for tendency of prices to move together in spatially and temporally separated markets is often referred to as cointegration test. Cointegration tests require the use of time series price data which will be difficult to generate during the life of this study due to the short duration of this project. Consequently, the project will rely on existing data and will therefore conduct the tests only for countries where such data exists. These include Ghana, Kenya, and Uganda where at least one of the selected ICT-based projects have been operational for relatively longer period of time.

2) Testing for efficiency of marketing some key commodities using marketing margins

As discussed above, improved market performance implies that markets are more efficient and are operating efficiently. This is usually the case when the profits (marketing margins) are distributed fairly between different actors. Marketing margin is the difference between the seller's price and the buyer's price less marketing (transfer) costs, which consist of transport and transactions costs. Therefore if ICT-based market information access lowers transactions costs (and assuming similar per unit cost of transportation) marketing margins for all actors in the marketing chain will increase and there should be no reason for one actor to earn significantly higher margins than other actors. That is, the increase in marketing margins should be uniform across actors. We shall therefore use simple t-test of difference in mean marketing margins to test for efficiency in the marketing of target commodities. Marketing margins will also be compared across markets in a "with" and "without" ICT-based project framework.

Objective 5: Critical assessment of challenges encountered by ICT-based MIS projects

Many of the ICT-based market information service projects in Africa encounter serious challenges (Tollens, 2006). These challenges can arise from the policy, political, social, and economic environment within which the project operates. These challenges have driven some ICT-based projects to close down or cut back on their planned services. While it is probable that some projects closed down or shrunk their services due to these challenges, it is equally likely that the existing projects have developed adaptation strategies to overcome such challenges. Assessment of challenges encountered, the strategies used to adapt to or overcome them and the lessons learned, if any, can be helpful in designing and deploying future ICT-based interventions with greater odds of success. Under this objective, 1-2 ICT-based market information service projects will be selected for in-depth case study analysis using the case study analysis framework provided by Yin (1989). Yin specifies how data and information about a case or cases can be triangulated and used to analyze a case. As indicated earlier, projects to be selected will be those designed with the purpose of linking smallholder farmers to markets and improving their incomes. In order to cater for variability, some of the parameters to be used in the selection of case projects will be length of operation, geographical coverage, commodity focus. In each

selected case, in-depth interviews with implementer(s) (i.e., ICT-based market information service providers), donor(s) and government officials will be conducted to identify the project model, challenges the project has faced (including, among others, those related to political, financial, and policy) and adaptive strategies. The in-depth interviews will also be used to identify challenges the case project has encountered, the strategies the implementers used to address the challenges, and the lessons learned. Further details of the information to be collected are provided in Annex 1.

One of the key questions for many donors and policy makers is “what is the best model of public-private or private-private ICT-based project that has greater odds of success and will yield most benefits to target clientele”? Information from the detailed interviews in each country and case study projects will be collated and triangulated in order to identify best-bet public-private and/or private-private models of ICT-based interventions. Lessons from existing models will be drawn out in the process. Identification of the best-bet partnerships will be guided by achievement of desired results; e.g. household commercialization and food security, as well as views from key-informants and farmers on what works best.

Objective 6: Training and capacity building of research partners and young researchers

Training and capacity building will be an important component of this proposed project. Training will be offered at postgraduate level to at least one promising student per country. The students will be selected based on merit and interest in ICT studies. Female students will be especially encouraged to apply to ensure gender balance. Target students will be those who have successfully completed coursework in agricultural economics or applied sciences. The students will be offered grants to use the data collected by this project to write M.Sc theses under the supervision of project participating researchers and produce publishable papers from their theses. Research capacity of such students will be built through exposing them to qualitative and quantitative research methods and the preparation of research instruments.

Capacity building for research partners will be done through regular research meetings, on-line discussions and project workshops. The research capacity of younger scientist will be built by twining them with senior and more established researchers to facilitate sharing of skills during the research process. The multi-disciplinary nature of the research team will facilitate this capacity development process. Three approaches will be used. The first will involve training in qualitative and quantitative research methods. Members of the teams who are already grounded in quantitative research methods will learn from those in the partnership with qualitative skill so as to gain the skill needed to gather and analyze data qualitatively. Similarly, team members whose research strength lies in qualitative research will be given opportunities to sharpen their skills in survey research and quantitative data analysis techniques. The second approach involves training for all researchers in impact assessment methodologies, especially focused on the identification and measurement of parameters and indicators of improved market access and also on the effective use of ICT communication tools, for example, mobile telephones, internet etc. This training will be done by invited resource persons through seminars and/or round-table discussions with team members. Each country will hold at least one such discussion.

3.6 Data management

3.6.1 Quantitative data

Data will be entered in SPSS using pre-designed template that will be uniform across all the countries. Once entered, each country will use SPSS, Stata, or LimDep to analyse the data depending on abilities and availability of the package in the host organization.

3.6.2 Qualitative data

Thematic and content approaches will be used to analyze qualitative data. Collected data will be continuously processed in the field and out of the field. The first level of analysis of qualitative data will involve the transcription of the notes from the field—field materials. The second level of analysis will involve designing of the grid with themes along the study objectives. All the field materials will be fed into the grid, which makes it possible to formalize the materials into categories or codes. Each time Key Informants in different projects or communities make similar or different responses will be given similar codes. Fitting all responses into the grid form helps the researcher as Crang (2005: 223) puts it –“sifting and sorting: developing ideas”.

The original qualitative and quantitative data/ information files will need to be secured, stored and backed up and a copy submitted to the Network administrator for safe backup custody. Each country will be responsible for safe keeping of the questionnaires but must be careful to ensure that they are protected from damage. The data analysis will be decentralized with each country analyzing its own data and preparing the project documents and/or outputs proposed in the study.

3.6.3 Quality Control

Effort will be made to ensure that fieldwork implementation (individual household and key informant interviews) remains credible through the following procedures:

- Recruitment of the Research Assistant and Interviewers will carefully be done by the two country Senior Researchers based on strict criteria for knowledge and experience of applicants in the following skill areas:
 - ✓ Locating respondents involving clear interpretation of sampling guidelines
 - ✓ Obtaining an interview, including rapport building and gaining consent for study respondents
 - ✓ Asking questions, probing and prompting/moderating a discussion i.e. asking questions and probing
 - ✓ Accurate recording of verbatim answers/responses
 - ✓ Ethical conduct—observation of confidentiality of the respondents and anonymity of the responses generated.
 - ✓ Any other relevant competencies
- The Country Senior Researchers will not only participate in conducting in-depth interviews, but also train the Research Assistant and the Field Interviewers, and supervise them during data collection. Research Assistants and Interviewers will be trained with a specific focus on:
 - ✓ Understanding the key issues under investigation
 - ✓ Understanding the methodology
 - ✓ Using skip patterns in the structured household questionnaire
 - ✓ Any other pertinent areas

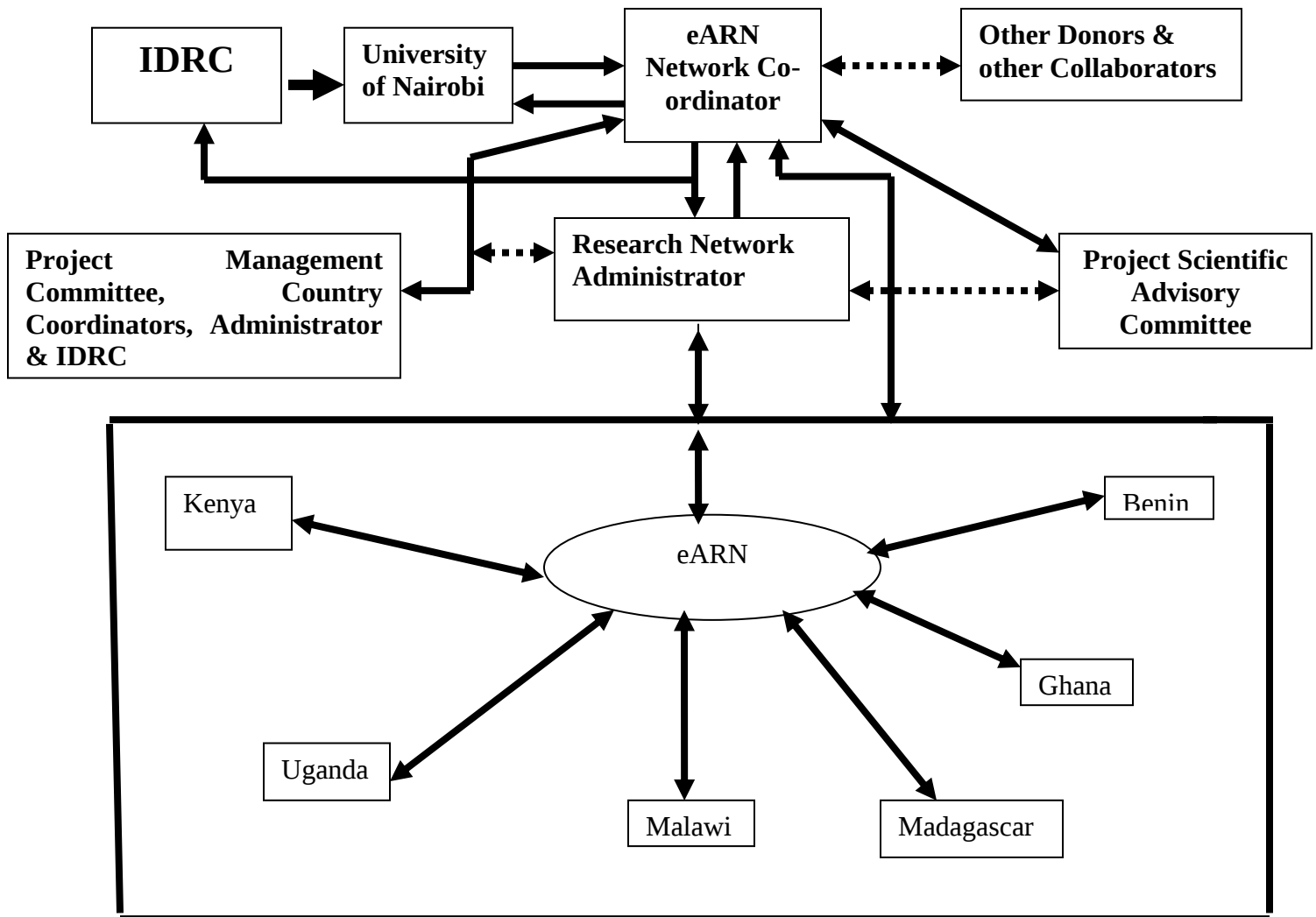
- While in the field, interviewers will be constantly supervised by the Senior Researchers assisted by Research Assistants. These will ensure that the agreed sampling procedure is followed.

4. Organization and Management of eARN

4.1 Organizational Framework

The eAgricultural Research Network (eARN) Project will be undertaken by Six Country Teams each led by a Principal Investigator, but under the overall Network Co-ordinator (NC), who will be responsible for synthesising the interim and final outputs. The overall Network Co-ordinator will be based at the University of Nairobi i.e., the institution to administer the grant. The NC will also be the Principal Investigator for the Kenya Country Team. The Network Co-ordinator will be assisted by the Network Administrator in executing day-to-day affairs of the Project. There shall be a Project Management Committee (PMC) and the Scientific Advisory Committee (SAC) charged with different responsibilities, but all aimed at enabling quality and smooth execution of the Project. Apart from these two committees there will be other organizational project arms. The eARN will be managed according to an “iterative model” of project execution and management as shown in Diagram 2.

Figure 2: eARN Organizational framework



4.1.1 International Development Research Centre (IDRC)

IDRC will sign the overall Memorandum of Understanding with the University of Nairobi; the grantee. Apart from providing the grant to execute the project, IDRC will be represented on the Project Management Committee, which will be a policy-organ body to oversee the implementation of the project.

4.1.2 University of Nairobi

The University of Nairobi will be responsible for the financial administration and management of the grant to execute the eARN. The University of Nairobi will sign a Memorandum of Grant Conditions (MGC) with each of the six participating institutions. The MGC will specifically detail the conditions and terms of the grant, clear milestones and deliverables.

4.1.3 eARN Network Co-ordinator

The Research Network Co-ordinator (NC), Dr. Julius Juma Okello of the Department of Agricultural Economics, University of Nairobi. He will have the overall responsibility of overseeing and coordinating the entire project. Specifically, the Research Network Co-ordinator will have the overall responsibility for project management; scientific content and scientific outputs of the project. He will work closely, liaise and collaborate with respective Country Team Leaders or Co-ordinators of Kenya, Uganda, Malawi, Madagascar, Ghana and Benin.

4.1.4 Project Management Committee (PMC)

The PMC will comprise representative of the funding body i.e., IDRC, the Research Network Co-ordinator, Country Co-ordinators or Team Leaders and the Network Administrator. The responsibility of the PMC will be to provide oversight for implementation of the Project activities and provide overall management. The responsibilities of the PMC will be to:

- Provide oversight and guidance for contractual arrangements, administrative procedures and research process issues;
- Review progress in terms of achieving goals set by the analytical framework, research questions and specific objectives;
- Review the financial status of the project and adherence to reporting requirements;
- Report on the performance of the overall project and the activities of Team Leader and Country Project Coordinators to the IDRC;
- Undertake review of the draft research reports from each of the country studies, providing detailed comments aimed at improving the reports;
- Deal with high-level problems emerging from the implementation of the project design or make crucial managerial decisions on country teams
- Advise the NC on the structure and writing [same comment] of the synthesis report;
- Undertake review of the draft synthesis report, providing comments on improving the report [definitely a management role];
- Liaise with the Scientific Advisory Committee and other external bodies as required;
- Review the capacity-building and dissemination activities being planned or undertaken.

For budgetary constraints, the PMC will meet at least twice during the duration of the project, and the rest of the interactions will be online. The Research Network Administrator will compile all the agreed on decisions and submit them to the Network Co-ordinator. In turn, the Network Co-ordinator will make a synthesis of decisions and present this to the PMC for approval and sharing with other team members. During the network workshops, the PMC will have its meetings slotted in the programme.

4.1.5 Project Scientific Advisory Committee

This will be a technical committee of eminent scholars and researchers purely meant to serve the function of quality assurance for the overall project as well as for the individual country teams. The Scientific Committee shall be composed of an external group of experts with experience in the various specialized research areas and disciplines that are of interest to e-Agricultural. The Scientific Committee will also provide linkages into international research networks including identification of resources and scholarly publishing and conference presentation opportunities among others. Members of the Scientific Committee may eventually be invited to participate in a

scientific colloquium alongside the Mid-Term Review Workshop of e-ARN. The Committee will:

- Assist the NC and County Teams in undertaking all the Phases of the study from commencement to completion;
- Provide capacity building advice to Country Study Teams as required;
- Participate as resource people in the mid-term Preliminary Findings Workshop at mid-point of the research project implementation;
- Participate as resource people in the end-of-project Dissemination Workshop to be held in 2010.

Although the Scientific Advisory Committee will meet at least twice during the course of the project, their contribution and input will always be sought through e-mail or telephone. The following experts are recommended and have accepted to participate in the project as advisors:

1. Prof. Chris Ackello-Ogututu is a **Professor of Agricultural Economics at the Department of Agricultural Economics, University of Nairobi, Kenya. He has extensive experience in regional trade in Africa and in the theory and practice of quantitative techniques in research. His specific interests include cross border trade in Africa, international trade, and development of commodity markets, especially livestock. (ackello@accesskenya.co.ke).**

2. Mr. Colin Poulton is a **Research Fellow in the Centre for Development, Environment and Policy (CeDEP), School of Oriental and African Studies, University of London. He is also the current editor of *Food Policy* journal. His research focuses on application of new institutional economics to a range of issues related to agricultural markets and pro-poor economic growth in rural Africa. His specific interests include the development of input markets in Africa, and the requirements for, and livelihood impacts of, sustainable intensification of smallholder agriculture. Colin has worked in Kenya, Ghana, South Africa, Tanzania and Zimbabwe (cp31@soas.ac.uk).**

3. **Dr. Adrian Mukhebi** is currently the Executive Director, Kenya Agricultural Commodity Exchange (KACE), Nairobi, Kenya. Adrian's experience spans both academic research and ICT practice. He has extensive experience in research in Africa where he worked for several years as an economist with International Livestock Research Institute and in commodity marketing and market outlook through his current work with KACE (amukhebi@kacekenya.com).

4. **Prof. Harsha De Silva** is currently the Lead Economist, LIRNEAsia & Director, AC Nielson Lanka, Sri Lanka. He has extensive experience in research focusing on the role of ICT on marketing performance and farmer welfare in Asia. He is also an ICT practitioner (desilva@lirne.net).

5. Prof. Julian May is **Head of School of Development Studies, Kwa Zulu Natal, South Africa. Prof May is well versed with ICT research. He is currently directing a study on the ICT and livelihoods. He has done extensive research in Africa focusing on poverty alleviation with various international organizations including the World Bank and IFPRI (mayj@ukzn.ac.za).**

4.1.6 Country Co-ordinators (CCs)/Team Leaders (TLs)

- Be responsible for the overall implementation of country studies by respective Country Teams;
- Participate in designing the overall project, prepare Country Methodologies, Design the Inception Report
- Participate and present the Inception Report with a detailed Research Design and Procedure, Sampling and Instruments to the Methodological Workshop to be held before primary data collection commences
- Incorporate relevant views and comments from the Methodological Workshop and submit it to the NC;
- Identify research training needs at the country level, lead the management of appropriate training activities and assist with capacity building and training in each of the country teams in close collaboration with NC and Scientific Advisory Committee;
- Monitor gender issues as an element in research activities and analyses;
- Facilitate the development of a set of ethical guidelines for the country research activities;
- Provide overall consultation and representation of the research component and activities at both the Country and Project levels to the Project Management Committee;
- Participate at a mid-project information Preliminary Findings workshop at which the country teams will be expected to present preliminary empirical findings;
- Spearhead and oversee Data Collection, Processing and Analysis and Prepare a Synthesis Report drawing on the Country case studies;
- Participate in end-project information Dissemination workshop at which the country teams will present final findings.
- Spearhead country teams in preparing papers for publication in refereed Journals.

4.1.7 The Country Research Teams

The Country Research Teams will include the Principal Investigator who will at the same time assume the role of Country Co-ordinator or Team Leader. The Country Coordinator will be assisted, in terms of technical aspects of the project, by a Co-investigator, but the day-to-day matters will be executed by a Research Assistant who will be recruited for duration of two years. The expertise of the country team will include experts in Agricultural Markets and ICTs. Where needed, a Country Team will get a Statistician on board to help with overseeing data entry, cleaning and analysis.

Under the co-ordination of the Country Coordinator/Team Leader, each Country Project Team will:

- Complete a comprehensive review of literature on Agricultural markets and ICTs in the country context in order to compile information that will lead to a good understanding of existing theories and concepts of markets and ICTs, and methodological aspects of measuring levels of accessibility to markets by small farmers through ICTs
- Develop appropriate instruments for data collection in consultation with the NC;
- Participate in the methodological workshop to be held at the beginning of data collection
- Collect primary data through quantitative and qualitative methodologies and complete all the research activities;
- Complete the qualitative and quantitative research activities described above.

- Participate in the mid-project information Preliminary Findings workshop and submit preliminary reports on the empirical findings completed;
- Complete draft research reports to be peer reviewed by the NC and Scientific Advisory Committee, and revise and resubmit these reports as required;
- Prepare working papers, journal articles, policy discussions in local and international workshops and papers for conferences;
- Participate in the end-project information Dissemination workshop;

4.1.8 Other Donors and Collaborators

Other donors and collaborating institutions may also be involved as part of the research network upon the establishment of specific “Memoranda of Understanding (MOU). The eARN will also be open to participation by other interested institutions, researchers and practitioners through the public eARN “e-Space”.

4.1.9 Research Network Administrator

The Research Network Administrator will run the day-to-day administrative responsibilities of the project. S/he will work under the Network Co-ordinator, and perform the following tasks:

- Administrative Management (including contracts with collaborating institutions/researchers);
- Following up financial matters with the University of Nairobi if need arises on the behalf of the Network Co-ordinator
- Establishment and management of a specific eARN website (English and French). This will involve the sub-contracting of certain activities to specialized service providers.
- Organization of workshops and other events or missions (all logistical aspects including interpretation English-French as required);
- Translation of identified documentation;

4.1.10 Country Research Assistants

Country Research Assistants will work under the Country Co-ordinators and will be in-charge of day-to-day administrative responsibilities of country projects. They will perform the following:

- Participate in the preparation of research tools as part of capacity building.
- Recruit enumerators with the guidance of country team leaders.
- Participate in the training of enumerators and field pre-testing of research tools.
- Manage contracts with enumerators.
- Supervise enumerators during field data collection
- Participate in data entry and analysis.
- Participate in the preparation country reports and other scientific outputs as part of capacity building.
- **Following up financial matters with the University of Nairobi if need arises on the behalf of the Country Co-ordinator**
- **Liaise with the Research Network Administrator on day-to-day management in case of any need.**

4.2 Information Management, Reporting and Quality Control

The National Research Teams will report to the eARN Co-ordinator and Project Management Committee and, through them, to University of Nairobi, and then onward transmission to IDRC. A specific contract will be established between each National Institution and University of Nairobi. The contract will detail the specific activities of the research to be undertaken and milestones for output assessment and quality control. For example, each Country Research Team will recruit a Research Assistant for the duration of the two years of the project to provide day-to-day administrative support to the National Team Leaders/Co-ordinators.

4.3 Risk Management

Among the risks or challenges anticipated for the Network are the following:

- 1. Maintaining and working at the same pace by the various national Research Teams and harmonization of broad methodological parameters. The challenge of enabling divergent perspectives and research methods to ensure a degree of convergence around common themes and outputs is highly envisaged. To minimize the effect of this, the Network will have to maintain active dialogue among countries/researchers while fostering learning, knowledge sharing and network building.**
- 2. Enabling coordination and research capacity building mainly through the use of ICTs. Face to face communication/interaction will be limited. Although there will be an intensive Methodology Workshop just after the start of the project, and two other workshops are envisaged (Mid-term and for Final Review workshops), personal interaction will be limited. The risk is that effectiveness in network communication and partner interaction may be lost especially if network coordination/management is not strong enough to attract and sustain interest and engagement by partners.**
- 3. Localization and maintenance of country specificities, as well as the complexity and diversity of stakeholders and political contexts at the local level. To ensure the maximization of the on-going influence of the outcomes of the project it will be crucial to support local stakeholders by integrating country research into the overall broader scope of the Research Network, in this way raising the profile of the local activity and ensuring that local research is not under-estimated and is placed in a position to influence national and regional policies.**
- 4. Managing the language diversity within the network. Given the limited resources, it has been decided that the “working language” for internal communication will be English (since it is a working language for all current participating research teams), but all official documentation and communication will be translated into French. This responsibility will be outsourced since the network does not have these capabilities.**

Many of the identified risks have already been considered and a significant purpose of the Pre-Project Activities of eARN was to begin responding to these. In particular, the Pre-Project workshop, in addition to providing the national researchers with “ownership” of the Project Proposal, began the development of a “network-spirit” as well as openly identifying and discussing the risks in managing such a diverse network.

4.4 Expected Outputs

In relation to the specific objectives of the eARN project, and considering the main activities to be conducted at the Research Network level, the immediate outputs of the Research can be summarized as follows:

- **ICT-based market information service projects in agricultural markets assessed**
- **What works and does not in the context of ICT-based market information service documented**
- **Information sharing and knowledge management developed**
- **Partnerships in conducting and sharing research information developed**
- **Capacity of both senior and young researchers built**
- **A common methodology of assessing ICT-based market information service projects in agricultural markets developed.**

The Research Network will have as direct outputs the following:

- **A pan-African “open” Research Network on ICT-based market information service and agricultural markets including the mobilization of Africa-wide expertise established;**
- **Comparative research and reports on the state of ICT-based market information service and agricultural markets in African countries compiled;**
- **A commonly accepted framework of measurement and methodologies and tools for assessment of ICT-based market information service and agricultural markets in African countries developed;**
- **Training tools for data collection developed;**
- **Peer-reviewed and other publications; policy briefs; and country papers/reports (e.g. case studies) prepared;**
- **Sensitization and increased awareness among citizens’ about use of ICT-based market information service in agricultural markets through the establishment of the eARN Africa website and its dissemination tools, as well as through the “field-work” research activities conducted at the local level by country research teams created.**

4.5 Expected Outcomes

The eARN will have the following outcomes:

- **Researchers’ capacities in the area of on ICT-based market information service and agricultural markets reinforced;**
- **Awareness of the potential of ICTs for enhancing accessibility to agricultural markets in Africa increased;**
- **Knowledge-base and experience-sharing in the area of ICT-based market information service for linking farmers agricultural markets improved;**
- **Policies of African governments in the area of ICT-based market information service projects and agricultural markets improved;**
- **Increased uptake of policy recommendations arising out of the action-oriented research**
- **International networking and funding opportunities enhanced.**

The Network is intended to contribute to improved project management and evaluation capabilities of the participating researchers and their organizations. In the longer term, in addition to reinforcing the research capacities of partner institutions in the area of ICTs and agricultural markets and facilitating the sharing of knowledge and experience, the Research Network will reinforce the capacities of organizations targeting smallholder farmers and grass-roots communities. In this way the project will potentially have an additional impact through building the skills of smallholder farmers and ICTs professionals, thus supporting the development of human resource capacity at the local level for the implementation of ICT projects and in turn stimulating economic growth.

4.6 Dissemination

eARN dissemination activities will include the following specific “targets” and “products” within and outside the community:

4.6.1 Within the academic community

- Scholarly publications particularly by research teams but also collaboratively between teams linked through the network, for relevant refereed academic and policy publications (e.g. The Electronic Journal of Information Systems in Developing Countries, Review of Agricultural Economics, Agricultural Economics, and World Development journals)
- The organization of thematic research workshops and consultative forums;
- Collaborative presentations for relevant academic conferences nationally and internationally in the areas of agricultural markets
- Publication of an edited and peer-reviewed volume of research papers.
- Publication of a book, which will be co-published with IDRC’s Publication Unit

4.6.2 Outside the academic community

- Collaborative presentations for policy, practitioner professional, and community development focused conferences nationally and internationally (e.g., African Crop Science, African Agricultural Economics Association, European Association of Agricultural Economics, International Association of Agricultural Economics);
- Outreach to new audiences, including, as applicable, local, national and international policy makers, practitioners and the general public through presentations at public forums, special briefings, and others as available;
- Contributions to email distribution lists and information sharing through the eARN Africa Website and the participation in relevant e-Forums (such as a wiki, email distribution list, and online chat (e.g., via skype)).
- Organization of a Pan-African Policy Conference on eARN Africa;
- A regular Web Newsletter on e-agricultural markets.

4.6.3 Innovation and integration of the dissemination plans

The eARN will systematically post its research findings, methods, workshop discussions and results to the web. This publicly accessible and indexed repository will enable the results of eARN research activities to be widely available to research and practitioner communities and

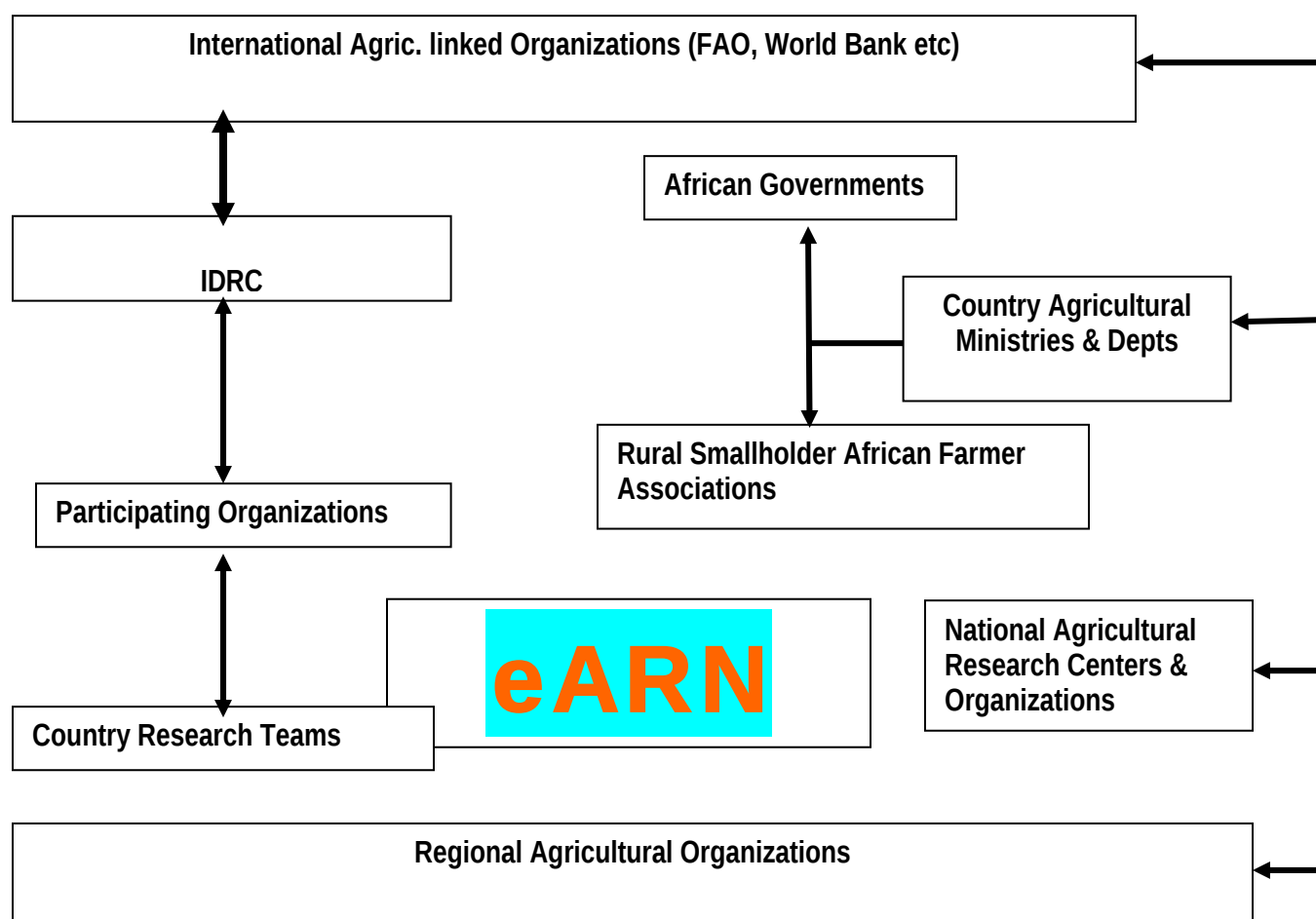
will provide a resource base for teaching and training materials in the area. Use of current and emerging technologies to index the information will allow for quick searching and easy reuse of information. The repository will seed construction of an emergent database that can be continually updated and expanded as other organizations use it. Refinements will reflect usefulness for a variety of audiences. Networking the sites and producing the online repository of good practices coupled with linkages among researchers in Africa and abroad will potentially encourage sustainability within the larger, emergent network of researchers and practitioners in the area and in this fashion will encourage an emergent community of practice to share information and knowledge across the Network and beyond.

The output of the main phases of the project will be provided to high-level policy makers, through presentations to Conferences and Workshops, both locally and internationally. National dissemination of research results will be central to the dissemination strategy adopted in this project. This will serve to inform and orient policies in the area of agricultural markets. All official documents in English will be translated into French for wider coverage.

The potential policy influence of the Project can be appreciated by analysing the various stakeholders and institutions that will be involved either directly or indirectly, and with different roles, in the eARN, as presented in the following diagram. A particular emphasis for eARN will be to “channel” the findings and results of the research undertaken at the local level and the aggregated results from regional level, to those players in Africa in particular such as the IGAD, African Development Bank and the specific agencies of the United Nations system, including the Food and Agricultural Organization, the World Bank, with a special interest in this area.

The Research Network will also disseminate information and provide opportunities for initiatives applying the results of the research that involve national agricultural institutions and the private sector (PS). The “web” relations and the networked-potential for policy influence of eARN is summarized in Figure 3.

Figure 3: eARN and Policy Influence:



5. Organizations and National Research Teams

5.1 Proposing Organizations

The proposing organizations are six African Universities/Higher Institutions of Learning, namely, University of Nairobi (Kenya), Makerere University (Uganda), Bunda College of Agriculture (Malawi), University of Ghana (Ghana), University of Antananarivo (Madagascar) and University of Abomey-Calavi (UAC), (Republic of Benin). The University of Nairobi through Department of Agricultural Economics of the College of Agriculture and Veterinary Sciences will administer the Grant from IDRC. Nairobi University is one of the leading universities in Africa with highly trained staff in market and development economics. It is endowed with highly skilled staff and recently attainment of ISO 9001-2000 certification indicating its compliance with high standards of academic and management standards. Nairobi University was also recently ranked the highest in Kenya and highly in East Africa as an institution of higher learning. The Department of Agricultural Economics, one of the oldest Departments in the University, has a strong history of commitment to applied research that generates local, regional and international knowledge on key issues affecting agriculture and development. The Department also has a long history of collaborating with national, regional and international research organizations in conducting crosscutting multidisciplinary research in many areas of agricultural development and policy including agricultural markets. The research is used in the development of policies and in actual

development practice. The generated knowledge influences development policy agenda nationally and internationally. In addition, The Department of Agricultural Economics has strong M.Sc Agricultural Economics program with strong and growing demand both nationally and regionally. The program admits students from several countries in the region including Tanzania, Zambia, and Rwanda. With respect to resources, the Department of Agricultural Economics has electronic and other resources for teaching and research. It therefore has good and adequate facilities including office space and computer facilities to host the project secretariat and train student(s). The research team in Kenya will comprise of

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5.2 National Research Teams

The national Research Teams represent a range of disciplinary competences. Each team is composed of at least, two main researchers—a Principal Investigator, Co-investigator and a Research Assistant. The Principal Investigators are leading individuals nationally in their areas of competence and have tremendous experience in the research area. Brief profiles of the Country Research Leaders are in Annex II. The Research Assistants to be identified in each National Research Team, will act as a Focal Point for administrative and research issues, (thus ensuring “real-time” linkages for communication), This will have the additional function of building the capacity of young researchers in this new and important field of activity.

The participating institutions are the ones mentioned above in 2.1. Each participating institution will have a Principal Investigator, a Co-investigator and a Research Assistant who will be responsible for the day-to-day implementation of the project. In the process of household data collection, each Country Team will recruit a team of Interviewers to conduct household interviews. Below is the bio-information of each of the proposed Country Principal Investigator.

5.2.1 Kenya

Dr. Julius J. Okello is Lecturer and Coordinator of Agribusiness Program and Student Industrial/Firm attachment in the Department of Agricultural Economics, University of Nairobi, Kenya. He earned his PhD in Agricultural Economics from Michigan State University with specializations in international agricultural development, agricultural marketing and resource and environmental economics. His current research focuses on the role of collective action, public-

private partnerships, and use of ICT in linking smallholder farmers to high value domestic and international markets. He has conducted several value chain studies and coordinated research surveys in several African countries in the last three years. His other research activities are on soil and water management and the management of beneficial and invasive animal species. His latest publications are “Compliance with international food safety standards in Kenya’s green bean industry: a paired case study of small and large family farms.” *Review of Agricultural Economics*, 29 (2007): 269-285, and “Impact of International Food Safety Standards on Smallholders: Evidence from three cases in Africa. In E. McCulloh, P. Pingali and K. Stamoulis (Eds) *The Transformation of Agrifood Systems: Globalization, Supply Chains, and Smallholder Farmers*, FAO, Rome (2008, 416 pages). Dr. Okello has also been research team leader in various projects funded by international organizations including the World Bank, Food and Agriculture Organization (FAO) and the Rockefeller Foundation. Julius will be the Network Coordinator.

Dr Lydia K. Ndirangu is a policy analyst in the Productive Sector Division of the Kenya Institute for Public Policy Research and Analysis (KIPPRA). She holds a PhD degree in Social Science (Development Economics) from Wageningen University at the Netherlands. She has considerable experience in quantitative research and substantial exposure to qualitative research. Her past and present research activities include: value-chain analysis for ex-ante and ex-post policy impact analysis and gender disaggregated impact analysis of shocks using household data; analysis of market-based farmer organisations and gender budget analysis (GRB) for the Ministry of Agriculture. The GRB work is on-going work commissioned by UNIFEM. Lydia is currently co-coordinating a capacity building project on value-chain analysis for ex-ante policy impact analysis for the Agricultural Sector Coordination Unit (ASCU) with support from United Nations Food and Agricultural Organisation (FAO). Lydia will be the Kenya country team leader.

5.2.2 Uganda

Dr. Narathius Asingwire is a Senior Lecturer and Head of Social Work and Social Administration Department, Faculty of Social Sciences at Makerere University, Kampala, Uganda. He holds a PhD in Social Policy from Makerere University. Dr. Asingwire is an experienced Social Policy Analyst and Researcher/Facilitator. He has 20 years experience in qualitative and quantitative research both in Uganda and outside, and university teaching. His main fields of expertise include socio-cultural and behavioural dimensions in adopting ICTs in developing countries, rural water, hygiene and sanitation; HIV and AIDS; policy reforms and the health sector generally. He has served as a Principal Researcher on several IDRC supported projects and a consultant for government ministries/departments, local and international agencies including The World Bank, UNDP, DANIDA, FAO, and UNICEF. Locally, Dr. Asingwire has worked as a Consultant for several NGOs and Government ministries. He has co-ordinated research projects covering Eastern and Southern Africa including some funded by IDRC.

5.2.3 Malawi

Dr. Julius H. Mangisoni is an Associate Professor of Agricultural and Applied Economics in the Department of Agricultural & Applied Economics at Bunda College of Agriculture, University of Malawi. Dr Mangisoni was awarded a PhD in Agricultural and Applied Economics by the University of Minnesota, USA in 1999. Dr Mangisoni who is a member of the University

of Malawi Senate; serves on the University of Pretoria's CEEPA Advisory Board and Academic Committee as well as on the Regional Agricultural and Environmental Initiatives Network Africa (RAEIN-Africa) Technical Advisory Committee. He worked as the Editor-In-Chief of the Bunda Journal of Agriculture, Environmental Science and Technology and as the Coordinator of Graduate Studies in the Rural Development Department at Bunda College of Agriculture from 2002-2004. He is currently serving as a member of the Editorial Board of the East African Journal of Rural Development. Dr Mangisoni has been involved in a number of professional assignments, e.g., Beneficiary Assessment of the World Bank-supported Community Sub-Project of MASAF in 2000, facilitator and Editor of Action-Aid International Workshop on Sustainable Agriculture in 2001, External Examiner of a PhD thesis in Environmental Economics from the Faculty of Natural and Environmental Sciences, University of Pretoria in 2004; and FAO-supported Economic Value of Agricultural Trade Preferences for Malawi. Dr Mangisoni is a recipient of four distinguished academic awards including the University of Minnesota, Department of Applied Economics Graduate Student Excellence in Writing Award and the National Bank of Malawi University of Malawi Student Achievement Award for the Faculty of Agriculture. Dr Mangisoni has written three book chapters and numerous journal articles focusing on natural resources and the environment, production economics and marketing.

5.2.4 Madagascar

Dr. Henri L. Abel-Ratovo holds a PhD in Food and Resource Economics from the University of Florida. He is a researcher at the National Center of Applied Research to Rural Development ("FOFIFA") of the Research and Development Department (DRD), Antananarivo with research focusing on rural development and the environment, and with an experience of 23 years. Abel-Ratovo has done several consultancies within Economics and Social Sciences, focusing on rural development and the environment over the last 13 years for various organizations including the World Bank-Madagascar, Competitive Grants to Agricultural Research (FCRA) of the Support Project to Rural Development (PSDR), ADRA, WWF, National Consultancy firms (BIODEV, CICO, Orgasys, etc.) for various donors and clients (World Bank, FAO, UNDP, Conservation International, USAID, ANGAP, etc.). Dr Abel-Ratovo also teaches Economics and Social Science courses in the areas of rural development and the environment at the University of Antananarivo's School of Agriculture and the Catholic Institute of Madagascar (ICM)'s Faculty of Applied Social Sciences and Development. He has held several professional positions including High Commissioner for Rural Development and Environment at the Office of the Governor for the Autonomous Province of Antananarivo (PAA) in 2001 – 2002 and an Elected Provincial Representative in 2000. Dr Abel-Ratovo has also done various translation works during his university and professional trainings years in various areas related to rural development, the environment, and food security with IRRI, IFPRI, TR&D Inc., University of Florida.

5.2.5 Ghana

Dr. Ramatu M. Al-Hassan is a Senior Lecturer and Head of the Department of Agricultural Economics & Agribusiness, University of Ghana. She obtained her PhD from Iowa State University where she held a Graduate Research Assistant position and was awarded the prestigious Premium for Academic Excellence (PACE) Award by Iowa State University. Dr

Ramatu Al-Hassan has taught at Department of Agricultural Economics, University of Ghana, since 1984 and done research in varied areas including farming systems research and development, farm and off-farm linkages for poverty reduction and food security improvement; privatization and the delivery of agricultural services to rural areas; gender issues in agriculture (access to resources and relative productivity of men and women). She has led several externally funded research projects, including the Collaborative Study of Cassava in Africa (Ghana component), Analysis of Farmer Strategies for Food Security, Equity Implications of Reforms in the Financing of Agricultural Extension (Ghana case study), Dynamics of Smallholder Agriculture in Northern Ghana, Growth linkage potential of cassava sub-sector in Ghana, Public Private Partnership in the Development of Bio-pesticides in Ghana and Benin, and the review of Ghana's Food and Agriculture Sector Policy. Dr. Al-Hassan has also provided technical services to various departments in the Ministry of Food and Agriculture, the Food and Agriculture Organization (FAO), the World Bank and other international organizations. She is currently leading the development of Ghana's Agriculture Sector Plan.

5.2.6 Benin

Dr. Anselme Adeniyi Adegbidi is a Senior Lecturer of Economics and Management at the Department of Rural Economy, Faculty of Agronomic Science (FSA) at the University of Abomey-Calavi (UAC), Benin. He earned his Ph. D in Economic Sciences from the University of Groningen, Netherlands in 2003. He is also the director of the Laboratory for the Study of Agricultural Performance and Poverty, University of Benin. Dr. Adegbidi's fields of specialization include development economics, welfare economics, household, and management economics. Some of his most recent publications include "Inequality profile in Benin" *Annales des sciences Agronomiques du Bénin* 8(1):55-70, 2006; "Partage du risqué en milieu rural au BENIN: cas des coopératives d'utilisation du matériel agricole dans le Borgou" *Rev. Sc. Env. Univ., Lomé (Togo)*, 2006, n° 001 ISSN 1812-1403; "Quality of farmers' varieties of sorghum and derived foods as perceived by consumers in Benin" *Ecology of Food and Nutrition*, 44 (2005): 271-294; "Circuits and actors of bred grass-cutters marketing in Mono and Couffo districts in south western Benin". *Bulletin de la recherche Agronomique du Bénin*, 46(2004), Dépôt légal N° 2776 du 25/03/2005, 2^{ème} trimestre 2005, Bibliothèque Nationale (BN) du Bénin ; and "Characterization of the marketing system of the bred grass-cutters in south-western Bénin" *Bulletin de la recherche Agronomique du Bénin*, 45(2004), Dépôt légal N° 2775 du 25/03/2005, 2^{ème} trimestre 2005, Bibliothèque Nationale (BN) du Bénin.

5.3 Host organizations

The project will be hosted in each proposed country by credible and accredited research organizations. Given that one of the goals of the project is advanced level professional training (i.e., an M.Sc level), care is taken to situate the project within an organization that offers at minimum an M.Sc degree in agricultural or applied sciences. An additional criteria used in selecting the host organization is the quality of academic/teaching staff in the department hosting the project. The organizations are especially selected if they have strong background in market linkage studies and the broader development fields. Below are the organizations that will host the project in each country

5.3.1. Bunda College, University of Malawi, Malawi

Bunda College of Agriculture is a constituent college of the University of Malawi that was established in 1967 to spearhead agricultural training and research for the development of

Malawi. The college has the highest concentration of PhDs in the country and has three faculties: Agriculture, Environmental Science and Development Studies. The Department of Agricultural and Applied Economics, to which the author belongs, is under the Faculty of Development Studies and is regarded as a leader in agricultural economics research and training in the country.

Bunda College is suited to host the project because of three key reasons. First, the college administration and accounts office have extensive experience in the management of big donor-funded research projects. Second, the college was instrumental in the establishment of Initiative for Development and Equity in African Agriculture (IDEAA) project. The IDEAA project is currently using ICT to assist farmers to gain access to markets. This therefore will generate excellent synergies with the proposed IDRC project.

In addition to the above, Bunda College has strong and highly qualified staff in the fields of market and development studies. The department has several staff with PhD in agricultural and applied economics. Many of the staff members conduct high-level research in the areas of agricultural market and supply chain as well as regional and international trade. The staff is also available to supervise students writing theses in different areas of market, development, resource economics and agribusiness management.

Third, Bunda College has a strong IT department with highly qualified staff. The college has good internet facilities and office space, which will enhance activities of the proposed project. This project will therefore get a partner responsible for IT issues in the project from Bunda College.

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5.3.2 School of Agriculture, University of Antananarivo, Madagascar

The University of Antananarivo is one of the leading universities in Madagascar. Its School of Agriculture is the sole graduate school in Madagascar that offers M.Sc degree in agriculture and related fields. The fields offered include crop and livestock production, food processing, forestry and environment and agribusiness management. The School of Agriculture is the only organization in Madagascar that possesses capacity to handle issues relating rural development. This is because:

- It possesses the resources, in terms of competences (human resources) and structural organization to address rural problems;
- It has qualified researchers with capacity to conduct research on problems facing farmers;
- It has more than 40 years of experience in conducting applied research in the various fields of rural development.

Indeed the School of Agriculture has supervised and examined more than 2000 thesis during the 45 years of the school both at Masters levels. The school has also recent conducted studies that focus on linking farmers and the rural populations in general to the market either through farmer organizations or in partnership with other national, regional and international research organizations. Hence the School of Agriculture has the needed experience and capacity to host a project that examines the project examines farmer linkage to the markets using ICT-based interventions.

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5.3.3 University of Ghana, Ghana

The University of Ghana is the premier University in Ghana and the largest of five public Universities in Ghana. It was founded in 1948 as the University College of the Gold Coast and became a fully-fledged university on October 1 1961 by Act 79. Presently the University has a student population of about 29,000 and about 800 faculty members.

The University of Ghana is a member of a wide network of associations and links, including the International Association of Universities (IAU), Association of Commonwealth Universities (ACU), the Association of African Universities (AAU) and the League of World Universities. It also has established links with several universities and research institutions worldwide, including the Norwegian Universities' Committee for Development Research and Education, the Council for International Educational exchange based in New York, International and Commonwealth Student Exchange programmes. Therefore the University of Ghana has a long history and wide experience in collaborative work with the global academic community. Faculty members interact with local community through extension activities, Inter-faculty, and Inaugural lectures, and Occasional Lectures to disseminate research findings.

The Department of Agricultural Economics & Agribusiness (DAEA) is one of six departments in the School of Agriculture of the College of Agriculture and Consumer Sciences. The department runs under-graduate and graduate (MA, MPhil, and PhD) programmes in Agricultural Economics, Agribusiness, and Agricultural Administration. The vision of DAEA is to develop capacity and provide leadership as a centre of excellence in training and in research in areas of Agricultural Economics, Agricultural Administration and Agribusiness.

Research in the Department has traditionally addressed a wide range of policy oriented issues in agricultural development, such as effects of macroeconomic policies on agricultural sector incentives and the agricultural sector as a whole. There has also been research on farm level productivity and constraints to adoption of technologies. Analysis of public sector investments in agriculture (e.g. irrigation schemes, and crop improvement) and efficiency of marketing systems have also featured well in the DAEA's research. The objective of DAEA's research is to generate information relevant for agricultural policy at the national, sector and institution (e.g. formal financial institutions) levels as well as engendering informed decisions by individual stakeholders.

Current research that is closely linked to the proposed research on ICT for improved access to agricultural market information is the research project on Smallholder Access to High Value Markets, which is being implemented in collaboration with the University of Guelph, with sponsorship from the Dutch Government and the World Bank. Access to information and the instrument for delivering that information are critical to smallholder access to export markets for high value commodities. With a large graduate student population, the research will support the department's mission of training Ghana's human resource.

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5.3.4 Makerere University, Uganda

Established in 1922 as a humble technical school, Makerere University is one of the oldest and most prestigious Universities in Africa. Makerere University is a very active centre for research and aims at providing quality teaching, carry out research and offering professional services to meet the changing needs of society. Despite the upheavals that befell Makerere University as a result of the political turbulence in the 1970s and 1980s, Makerere remained a strong academic and research institution and is recognized globally. It has had long partnerships with international funding agencies including an MoU with IDRC. Just recently, the Faculty of Social Sciences which is the parent faculty that will host this project at Makerere University successfully completed a country project under the auspices of Local Government in Africa (LOG-IN Africa) that brought together nine African countries. The focus of the project which was funded by IDRC focused on the role of ICTs in local governance. Today Makerere University has twenty-two faculties/institutes/schools including the Department of Agricultural Economics, Faculty of Computing, Information and Technology as well as that of Economics and Management. The expertise to undertake this project will therefore be drawn from a multiplicity of Makerere University Institutes, Departments and Faculties.

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5.3.5 Faculty of Agronomic Sciences, University of Abomey Calavi, Benin

The Faculty of Agronomic Sciences of the University of Abomey-Calavi was established in 1970. It serviced in accomplishment of its responsibilities by:

- Central administration (government),
- Decentralized structures, such as departments, sections and laboratories,
- Scientific and Pedagogic support structures (CBIG, BIDOC, FAEP)
- Service rendering structures (CAD),
- Administrative management entities: Dean's Committee (CODEC), Direction, Committee (CODIR), Counsel and Assembly of Faculty,
- Pedagogic Management entities.

University of Abomey-Calavi strives to provide continuous quality instruction, aiming at upgrading or retraining executives during their development on agronomic science and technology fields and related sciences; develop and implement agronomic research programs in relation to rural development policies of Benin; and facilitate or to ensure the publication of results of work carried out by professors and researchers of the Faculty. It also provides technical assistance to authorities and public or private institutions (i.e. participation on the formulation of rural development policies, master plan for agricultural research, and so on.), contributes to the assessment and recognition of foreign credentials through reference to similar diplomas issued in Benin, in conjunction with the National Commission of diploma equivalency. In addition the faculty provides various services for third parties through research contracts, consultancies, and laboratory tests. More information about the Faculty of Agronomic Sciences of the University of Abomey-Calavi is available at <http://www.fsa.bj.refer.org>.

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6. Project Timeframe

The project will be executed in two calendar years, commencing January 2009 to December 2010. The study will broadly be implemented under Seven Phases; Preparatory, Desk Review, Tools Development and Pre-testing, Primary data collection/Fieldwork, Data Processing and Management, Draft Country Report Writing and Sharing, Project Finalization and Dissemination. Table shows the Timeframe and expected specific Deliverables.

Table 6.4: Project Timeframe and Deliverables

Year One	Month	Activity	Deliverables
2009/10	PREPARATORY PHASE		
	Jan	Proposal submission and accepted by IDRC	Proposal
	Feb	Memorandum of Grant Conditions signed between IDRC and University of Nairobi	Signed MGCs
	Feb	Sub-contracts/Memorandum of Grant Conditions between country participating institutions and University of Nairobi signed.	Contractual arrangements completed
	Feb	First tranche of funds transferred	
	DESK REVIEW, DEVT. OF TOOLS, PRE-TESTING & HOUSEHOLD SURVEY		
	March	Inception Phase and Methodological Workshop held in one of participating countries	Country Inception and Workshop Reports
	Mar	Desk review of related literature and policy documents	Report on Content analysis
	Mar	Compilation of sampling frame	Sampling Frame
	Apr	Key informant interviews with ICT-based MIS providers, government field extension staff etc	Transcribed Notes
	Apr	Development of survey instruments, recruitment and training of Interviewers	Draft Survey Tools
	Apr	Pre-testing of survey instruments in all the six case study countries	Pre-test Report
	Apr	Market survey i.e., data collection on market prices for selected commodities within and outside ICT-based market information service project area	Raw data sets
	May	Commencement of training/supervision for six selected graduate students	Training Schedule
	May-Jun	Finalization of survey instruments and commencement of household surveys	Draft questionnaire and review paper
	PRIMARY DATA COLLECTION/FIELDWORK		
	May-Jun	Continued Household Survey and creation of databases for analysis	Data Entry templates
	Aug	Repeat market survey	Raw Data set
	Aug-Sept	In-depth Country Case Studies of selected ICT-based projects	Guidelines on conducting case studies
	Oct-Nov	Data editing, entry, cleaning and analysis; econometric estimation of model parameters	
	Oct – Nov	Students complete coursework, embark on data analysis and thesis writing	Progress reports, draft thesis proposal
	Dec	Project Mid-term Workshop to share country preliminary findings, experiences and challenges	Country Reports and Workshop proceedings

Year One	Month	Activity	Deliverables
2010/11	ANALYSIS, PAPER PUBLICATION AND DISSEMINATION		
	Jan	Repeat market survey	Raw data set
	Jan – Feb	Prepare and publish working country papers	Country Papers
	Mar – May	Analysis of country case studies and publication of Policy Briefs (PBs) on key policy issues emerging from the study	Country Case Studies Reports and policy briefs
	Apr	Final market survey	Raw data set
	May	Analysis of market survey data/information	Report
	Jun-Jul	Prepare and submit journal papers	Draft journal papers
	Aug	In-country dissemination workshops and validation of findings by policy-makers and country stakeholders	Workshop Reports
	Sept – Oct	Finalize a synthesis of country reports on effectiveness of ICTs in linking smallholder farmers to markets	A Synthesis Report
	Nov	Completion of training/supervision of students' theses	Completion Report/Thesis
	Dec	End of Project Workshop conducted in one of the participating countries.	Workshop Report

7.0 eARN Africa Estimated Budget

Budget Item		Estimated Cost (Kshs)		
Detail of the cost		1st Year	2 nd Year	Total
A) Country-Level Research				
1	Honoraria for 12 Senior Researchers	6,799,626	6,799,626	13,599,252
2	6 Research Assistant	3,279,820	3,279,820	6,559,639
3	36 Enumerators	1,151,937	-	1,151,937
4	Statistical input	479,974	319,982	799,956
6	Data collection (Field Transport)	2,551,824	1,620,081	4,171,905
7	Data collection (Researchers Field Allowance)	5,328,018	2,933,172	8,261,190
8	Data Analysis	799,956	79,996	879,952
9	Country Stakeholders' Roundtable Discussions/Working Sessions	1,215,000	1,215,000	2,430,000
10	Six (6) National Dissemination Workshops	-	2,999,835	2,999,835
11	Communication	599,967	599,967	1,199,934
12	Training/Supervision of 6 Graduate Students	2,999,835	2,999,835	5,999,670
	SUB-TOTAL A Research at national level	25,205,956	22,847,314	48,053,269
B) Network Management & Coordination				
1	Research Network Administrator	720,000	720,000	1,440,000
2	Network Coordination	1,323,000	1,323,000	2,646,000
3	Office Support	233,321	233,321	466,641
	SUB – TOTAL B - Network Management	2,276,321	2,276,321	4,552,642
C) External Expertise (Consultants)				
1	Resource Persons for Workshops	399,978	266,652	666,630
2	Scientific Advisors	1,933,227	2,066,553	3,999,780
	SUB - TOTAL C - External Expertise (Consultants)	2,333,205	2,333,205	4,666,410
D) Network Meetings and Workshops				
1	Inception & Methodological Workshop	5,756,670	-	5,756,670
2	Researchers' Training Workshop	5,756,670	-	5,756,670
2	Mid-Term Workshop	-	5,756,670	5,756,670
3	Dissemination Workshop	-	5,756,670	5,756,670

Budget Item		Estimated Cost (Kshs)		
4	Monitoring and site Visits and Management Meetings	1,458,000	810,000	2,268,000
	SUB – TOTAL D - Network Meetings and Workshops	12,971,340	12,323,340	25,294,680
E)	Network Evaluation			
1	Evaluation of eARN Project	-	1,575,000	1,575,000
	SUB TOTAL E - Network Evaluation	-	1,575,000	1,575,000
F)	Publication and Dissemination			
1	Publication/Dissemination	-	3,999,780	3,999,780
2	Radio and TV Talk shows, Production of Newsletters, Policy Briefs	405,000	405,000	810,000
2	Translation/Interpretation	-	999,945	999,945
	SUB TOTAL F – Publication and Dissemination	405,000	5,404,725	5,809,725
G)	Equipment & Software			
1	Six (6) Laptops for country teams & six (6) SPSS software	1,050,000	-	1,050,000
2	24 PDA	479,974	-	479,974
	SUB TOTAL G – Equipment	1,529,974	-	1,529,974
H)	Network Website Development & Management			
1	Establishment of eARN Web Site	283,500	-	283,500
2	Establishment of eARN specific interactive online discussion platform on Web Site	324,000	-	324,000
3	Management of the WebSite (provided by Network)	486,000	-	486,000
	SUB TOTAL G - Network Communication & Development	1,093,500	-	1,093,500
	TOTAL COST	45,815,297	46,759,905	88,852,455
I)	Administrative fees			
1	Administrative fees (12 % of total budget except item G)	5,314,240	5,611,190	-
	SUB - TOTAL H - Administrative fees	5,314,240	5,611,190	10,925,430
	TOTAL KSHS	51,129,537	52,371,095	103,500,632
	TOTAL CAD	808,000	827,500	1,635,600

Budget =

7.1 Notes on eARN Africa Estimated Budget

7.1.1 Country Research Projects

Expenses for country research projects include honoraria for two (2) senior researchers per country and salaries for six (6) Research Assistants (each per country) who will devote fulltime input to the project for two years. The honoraria for the two senior researchers per country are kept modest, as they will be earning a salary from their respective institutions, which is taken as a contribution to the project. One of the Senior Researchers will also be charged with the overall co-ordination of respective country effort. A little compensation has been put in the budget for this. The institutional contribution will also include space that will be used by the project team.

Six (6) interviewers/enumerators who will administer household questionnaires will assist each country team. These will spend a staggered period of 4 months on the project, which will attract a monthly salary. The quantitative aspects of the country projects require a Statistician's input who will design the data entry screen with controls and checks, supervise data entry and perform some analysis as required of each country teams. Because of this, a budgetary allocation has been made to cover statistical input and data entry.

Data collection will involve hiring transport, preferably 4-Wheel drive vehicles given the fact that country projects will be conducted largely in rural areas with difficult road networks. It is estimated that primary data collection in the field will last four (4) months. Each day in the field attracts a budgetary allocation on vehicle hire, driver, fuel and maintenance. Other consumables include stationery, pens/pencils, bags for questionnaire transportation and storage, cartridges etc.

The overall purpose of this project is to influence policy or input into policy-making of participating countries. To achieve this, throughout the study each team will involve stakeholders in the various processes through roundtable and working sessions that will bring together various stakeholders and researchers at the country level. Stakeholders will, among others, meet with country teams to input into the research tools, discuss the appropriateness of the methods to be used in the field, meet to discuss and validate preliminary findings before Mid-Term Workshop.

As part of capacity building, an allocation has been made for training. This will involve each country selecting a student pursuing a Masters degree with an interest in writing his/her dissertation on agricultural markets, smallholder farmer and ICTs. The student will be facilitated by the project at two levels. Level one includes the co-supervisory guidance by a senior member on the country research team, and level two will include financial support to the student to conduct fieldwork and writing of the dissertation.

7.1.2 Network Management & Coordination

Managing the network will be intensive and involving requiring maximum input of the Research Network Administrator. It is therefore necessary to have a budgetary allocation for the Research Network Administrator covering the two years of the project as well as a budget for office support.

Network coordination will entail travels by the Network Coordinator to the project countries and even sites, coordination and management of research activities and outreach/dissemination.

These activities are expected entail time and money expenses during the two years by the Network Coordinator. Hence it is necessary explicitly budget for these expenses.

7.1.3 External Expertise (Consultants)

Two Resource persons with proven competencies and expertise in agricultural market surveys and ICTs will be sourced to facilitate at least two of the four Network Workshops; (i) Inception and Methodological, (ii) Researchers' Training, (ii) Mid-Term, and (iv) Dissemination Workshop. A budgetary allocation is made to cover their travel, hotel and modest honoraria. On the other hand, an allocation is made to cover Scientific Advisors who will provide technical guidance to the teams, external expertise for peer review of articles that will be produced by country teams, research reports/papers and other publications. These will receive a modest honorarium of CAD 10,000 each for the two years. In addition, travel and per-diem will be provided to attend the Network Workshops.

7.1.4 Network Meetings and Workshops

Four (4) Workshops are planned for the duration of this project as indicated in 7.1.3. This item attracts a budgetary allocation to cover, among others, travel costs for the participants (researchers and facilitators/members of the scientific advisory committee), daily subsistence allowance, hotel, and visa and transit costs. A budgetary allocation has been made to cover monitoring and site visits especially by the Network Co-ordinator and at least two Management Meetings of the PMC.

7.1.5 Network Evaluation

As a control and quality assurance of the country teams' work, independent assessment of the entire network will be carried out at two points of the project's life span; at mid-point and during the completion of the project. An external consultant will be sourced to carry out the assessments, and hence the budgetary allocation will cover consultancy fees, travel costs, hotels and other related expenses. The overall network Coordinator will be responsible for working out the terms of reference for the consultant with input from the country leaders.

7.1.6 Publication and Dissemination

Each county team will be expected to publish and disseminate the project results in different ways throughout the duration of the project. It is expected that at least each country will producing News Letters and Policy Briefs, which can be shared within the Network and outside the Network especially policy-makers widely. The Network Work Website Manager will ensure that all publications are put on the web. To lobby and influence policy, an allocation has been made for radio and TV talk shows. Country reports as well as the synthesized Network Report will be professionally edited for form and content, and published. An external publisher will be identified to render this service. A budgetary allocation has been made to cover this item.

7.1.7 Equipment and Software

To expedite the process of collecting accurate data, each country team will have at least three Personal Digital Assessments (PDA). In interviewers will be trained in using PDA in data collection. Each country team will have a project laptop for the work of the Network that will be for daily use by Country Research Assistants. Software i.e., the Statistical Package for Social Scientist (SPSS) will be purchased. A Budget has been created to cover these items.

7.1.8 Network Website Development and Management

The allocation for this item includes consulting fees for the IT expert that will establish a professional and interactive website for the project.

7.1.9 Administrative Fees

Universities usually charge administrative fee for managing project funds. In this project 12% of the total project is allocated to these administrative costs as guided by IDRC rules on overhead. The other participating universities will also be allocated 12% of the total budget for their study components.

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9. Annex1: Country-Specific Methodological Matrix

Annex 1.1: Benin

OBJECTIVES	DATA	SOURCE OF DATA	METHODS	OUTPUTS OUTCOMES	USERS OF RESEARCH RESULTS
To identify and characterize existing initiatives and the environments within which they are applied	Inventory of initiatives Policy context Key or relevant infrastructure Geography Farmer systems Market systems Key stakeholders in value chains	- University researches - Government offices - Statistics bureau - Government national extension service - Chamber of commerce - Farmer organizations - Trader organizations	- Interviews - Literature reviews - Report reviews - Key informant discussions	Exhaustive report on existing ICT initiatives In-depth knowledge of selected ICT initiatives	- Research team - Universities - Potential donors
To investigate the effects of participation in ICT-based market information project on smallholder farmers	Farmer systems Income levels Network reach Customer base Length of value chains Cost base	- University researches - Ministry of commerce - Statistics bureau - Government national extension service - Chamber of commerce - Stakeholder records - Farmer organization records - Trader organization records	- Interviews - Document reviews - Report reviews - Inquiries - Key informant discussions	Exhaustive matrix on stakeholders Thorough knowledge of effects of ICT initiatives on key stakeholders	- Research team - Universities - Potential donors - Actors in the chain - Government
To examine the factors the influencing adoption of ICT-based market information services	ICT vendor lists Operating systems Income levels Cost of communication Area coverage Literacy level Demographics of farmers ICT literacy level Cost of hardware	- Chamber of commerce - Ministry of commerce - Statistics bureau - Government national extension service - Stakeholder records - Ministry of communication - Ministry of education - Vendor manuals	- Interviews - Document reviews - Report reviews - Inquiries - Informed forums	Report on the determinant of ICT adoption Better understanding by all stakeholders on what influences adoption	Stakeholders Policy makers MIS providers
To critically assess the challenges encountered	Regulation and rules Customer base	- Statistics bureau - Ministry of communication	- Interviews - Report reviews	Report on challenges	- MIS providers - Government

by the ICT-based MIS projects for linking farmers to markets	Tariff structure Existing partnerships Communication policy NGO policy Regulation policy on partnerships	- Provider records - Literature reviews - Ministry of legal affairs - Ministry of communication - Ministry of finance - Ministry of commerce - Ministry of internal affairs	- Inquiries - Informed forums - Interviews - Literature reviews - Report reviews - Informed forums - Inquiries	Clarity on major challenges Report on roles and partnerships Clear understanding of partners and roles	regulators - Main research institutions - Public and private sectors Researchers
To enhance collaboration among African researchers and to build research capacity of project partners and young researchers.	Existing collaboration	- University research records - Proposals to/from donors	- Literature reviews - Report reviews - Proposal reviews	List of all projects shared Joint ventures	- Universities - Research organizations
To formulate guiding principles and recommendations to inform policy and practice	Current policy Current practice	- Government five year plan - Annual budget - Stakeholder manuals	- Inquiries - Informed forums	Proposal document Adoption of appropriate policy to support ICT	- Government - Policy makers

Annex 1.2: Uganda

OBJECTIVES	DATA	SOURCE OF DATA	METHODS	OUTPUTS OUTCOMES	USERS OF RESEARCH RESULTS
To identify and characterize existing initiatives and the environments within which they are applied	Inventory of initiatives Policy context Key or relevant infrastructure Geography Farmer systems Market systems Key stakeholders in value chains	- University researches - Government offices - Statistics bureau - Government national extension service - Chamber of commerce - Farmer organizations - Trader organizations	- Interviews - Literature reviews - Report reviews - Informed forums	Exhaustive report on existing ICT initiatives In-depth knowledge of selected ICT initiatives	- Research team - Universities - Potential fund providers
To investigate the effects of participation in ICT-based market information project on smallholder farmers	Farmer systems Income levels Network reach Customer base Length of value chains Cost base	- University researches - Ministry of commerce - Statistics bureau - Government national extension service - Chamber of commerce - Stakeholder records - Farmer organization records - Trader organization records	- Interviews - Document reviews - Report reviews - Inquiries - Informed forums	Exhaustive matrix on stakeholders Thorough knowledge of effects of ICT initiatives on key stakeholders	- Research team - Universities - Potential fund providers - Actors in the chain - Government
To examine the factors the influencing adoption of ICT-based market information services	ICT vendor lists Operating systems Income levels Cost of communication Area coverage	- Chamber of commerce - Ministry of commerce - Statistics bureau - Government national extension service	- Interviews - Document reviews - Report reviews - Inquiries - Informed forums	Report on the determinant of ICT adoption Better understanding by all stakeholders on what influences	Stakeholders Policy makers MIS providers

	Literacy level Demographics of farmers ICT literacy level Cost of hardware	- Stakeholder records - Ministry of communication - Ministry of education - Vendor manuals		adoption	
To critically assess the challenges encountered by market information service projects for linking smallholder farmers to markets	Regulation and rules Customer base Tariff structure Existing partnerships Communication policy NGO policy Regulation policy on partnerships	- Statistics bureau - Ministry of communication - Provider records - Literature reviews - Ministry of Constitutional Affairs - Ministry of communication - Ministry of finance - Ministry of commerce - Ministry of internal affairs	- Interviews - Report reviews - Inquiries - Informed forums - Interviews - Literature reviews - Report reviews - Informed forums - Inquiries	Report on challenges Clarity on major challenges Report on roles and partnerships Clear understanding of partners and roles	- MIS providers - Government regulators - Main research institutions - Public and private sectors - Researchers
To enhance collaboration among African researchers and to build research capacity of project partners and young researchers.	Existing collaboration	- University research records - Proposals to/from donors	- Literature reviews - Report reviews - Proposal reviews	List of all projects shared Joint ventures	- Universities - Research organizations
To formulate guiding principles and recommendations to inform policy and practice	Current policy Current practice	- Government five year plan - Annual budget - Stakeholder manuals	- Inquiries - Informed forums	Proposal document Adoption of appropriate policy to support ICT	- Government - Policy makers

Annex 1.3: Kenya

OBJECTIVES	DATA	SOURCE OF DATA	METHODS	OUTPUTS AND OUTCOMES	USES OF RESEARCH RESULTS
To identify and characterize existing initiatives and the environments within which they are applied	Inventory of initiatives Environment - Policy context (ICT policy, policy statements in MOA MTP and vision 2030, SRA) - Key or relevant infrastructure - Geography - Farming systems - Market systems - Key stakeholders in value chains	CCK Internet Umbrella farmer organization e.g KENFAP, KUSCO Key informants e.g. MIS providers, MOA, MOLD, MOCD, KARI National council of NGO - CCK, Ministry of Information, Existing literature - CCK, MIS providers - MIS providers, CCK, key informants - MIS providers, participating agents - MIS providers, farmers, traders - Key informants, farmers, MIS providers	Interviews, literature review, key informants, using a checklist as the tool.	An inventory report of ICT intervention with detailed profiles, policy environment, geography of coverage and farming and marketing systems	Inventory used for several a few for in depth study Results used for formulation of principal and recommendation
To investigate the effects of participation in ICT-based market information project on smallholder farmers	- Gender differentiated farmer and household characteristics, Farm physical environment, assets and household enterprises, quantities and prices of input and output, participation in input and output markets, the types of markets used, number of ICT-based market information services used - Characteristic of traders - Altitude towards risk	- Farmers - Key informants e.g. extension staff	- Household survey, stratified sampling - Key informants discussions	Report showing important factors influencing adoption of ICT by farmers and other agents in the value chain	Results communicated to MIS providers

To examine the factors the influencing adoption of ICT-based market information services	As in objective 2 for adopters and non-adopters of ICT based innovations	MIS providers, MOA extension staff, NGOs, FO	As in objective 2	Report highlighting changes or lack of it, of activities/incomes of stakeholders	Results used formulation of principal and recommendation
To critically assess the challenges encountered by market information service projects for linking smallholder farmers to markets	- From objective one, list of MIS providers, detailed case studies of three - Their profiles, project model, locus of intervention, commodity and regional focus, target clientele - Linkages with other institutions - Sources of funds, costs and revenues - Number of users overtime - Challenges encountered and ways used to overcome them - Opportunities and how they may have been exploited to innovate - Potential future threats and strategies for dealing with them	- Communication Commission of Kenya - MIS providers - Ministry of information, - Donors - Farmers - Existing partners (NGOs, farmer organizations) -	- Key informant discussion - Structured interviews - Case studies	- Challenges encountered by ICT-based service providers identified - Best bet partnership model identified	Results communication development p Information ministry providers
To enhance collaboration among African researchers and to build research capacity of project partners and young researchers.	- Profile of researchers and affiliated institutions - ICT training needs	Country team members and their affiliated institutions	Structured questionnaires through email, regular reaserch meetings and project workshops	- M.Sc thesis - Project report derived from high quality qualitative and quantitative research methods	Trainees, resea affiliated institutions

Annex 1.4: Ghana

OBJECTIVES	DATA	SOURCE OF DATA	METHODS	OUTPUT & OUTCOMES	USERS OF RESEARCH RESULTS
To identify and characterize existing initiatives and the environments within which they are applied, and select some for in-depth analysis	Inventory of initiatives Policy context Key or relevant infrastructure Geography Farmer systems Market systems Key stakeholders in value chains Access (mobile, PCs, radio, TV) Data usage statistics	TradeNet, TIPCEE, MOFA, RTIM, ASNAP, SEND, GAPTO, SIMLI RADIO, Literature review NCA, Ministries, Mobile operators, NGOs, traders and exporters, NAFF, Development Partners, GPTRU, existing projects agro-projects (WATH), Cell phone networks, ISPs	Informal interviews, review of data usage statistics	Report on existing initiatives compiled and those selected for in-depth study Database on existing initiatives built	Researchers, policy makers, farmers, traders, service providers as well as other stakeholders
To examine the effects on key stakeholders	Incomes, yields, market access/linkages, prices (time series), % collective sales, transaction costs, access to inputs, quality of goods sold, size of transaction, timing of sales, elections (political)	Farmers, traders, processors, transporters, banks, input suppliers, associations, cooperatives, extension officers, MOFA	Structured surveys, informal interviews; purposeful random sampling; 300 farmers (min), 50 traders.	Effect of selected ICT interventions on stakeholders documented Assessment report Database on the effect of ICT on key stakeholders built	Researchers, policy makers, farmers, service providers, other stakeholders
To assess the factors that influence adoption	Literacy, education, training, infrastructure, type of markets, commodities involved, existence of opinion leaders, ownership of communication equipment,	MOFA, NGOs, projects, stakeholders, Ministries, individual interviews	Structured surveys, informal interviews; purposeful random sampling; 300 farmers (min), 150 traders. Literature	Journal article, policy briefs, news letters Database on factors affecting adoption of ICT technologies	Researchers, policy makers, farmers, NGOs, other stakeholders

	legislation/regulations language/translation		review	created	
To assess the challenges facing MIS providers	Language, infrastructure, transport, cell phone network coverage, funding, staffing, policy, penetration, cost of communication, technology choice	MIS providers, Ministries, Communications providers	Informal interviews with all MIS providers and communications providers.	Assessment report, policy briefs, working papers, database created Challenges facing MIS providers understood	Researchers, policy makers, service providers, farmers, NGOs, other stakeholders
To identify roles and partnership models for the public and private sectors (including NGOs)	Existing (past & present) roles and partnerships	Service providers (public, private)	Informal interviews with providers and ministries, NGOs	Roles and partnership models identified, policy briefs, public-private collaboration strengthened	Researchers, policy makers, NGOs, farmers, other stakeholders
To enhance collaboration among African researchers and to build research capacity of project partners and young researchers.	Existing capacities	Country teams	Joint researches, supervised student research, joint journal publications	Research reports, student dissertations/thesis, published journal articles	Researchers, policy makers, NGOs, other stakeholders
To formulate guiding principles and recommendations to inform policy and practice		Results of analysis			Researchers, [policy makers]

Annex 1.5: Madagascar

OBJECTIVES	DATA	DATA SOURCES	METHODS	OUTPUTS AND OUTCOMES	USERS OF RESEARCH RESULTS
To identify and characterize existing initiatives and the environments within which they are applied, and select some for in-depth analysis	-Inventory of initiatives -Policy context -Key or relevant infrastructure -Geography (ICT coverage and penetration) -Farmer systems (household characteristics, input, production, and marketing ways and means, etc) -Market systems -Key stakeholders in value chains	-Relevant public (Ministries) and private institutions (NGOs and Projects) -Existing studies, reports, etc. -Actors in ICT value chains, from suppliers to consumers.	-Documentation -Surveys and interviews -Stakeholders analysis	Report on: -Identified and selected initiatives for in depth analysis. -Database of existing ICT initiatives and their characteristics.	-Policy makers -Actors in ICT value chain, from suppliers to consumers, including among others service providers and farmers -NGOs, Projects -Researchers and other stake holders.
To examine the effects on key stakeholders, especially smallholder farmers	-Changes in activities in terms of investments, input use, production processes, output yields and prices, expenses and revenues, transaction and marketing costs, bargaining power, transparency, range of markets, degree of farmers' integration into markets.	-Selected Stakeholders in ICT value chains, from suppliers to consumers including farmer households -Existing studies, reports, etc.	-Documentation -Surveys and interviews -Impacts analyses and Econometric models	-Report on assessment of the effects of ICT interventions. -Policy briefs, newsletters, working papers.	-Policy makers -Actors in ICT value chain, from suppliers to consumers, including among others service providers and farmers -NGOs, Projects -Researchers and other stake holders.
To assess the factors that influence adoption	Socioeconomic, technological and environment (policy, infrastructure, physical, etc) data that are incitating or limiting factors (pertinence and utility and costs of information available, required proximity infrastructures, etc.) to ICT adoption	-Selected ICT users and providers in ICT value chains, from suppliers to consumers including farmer households -Existing studies, reports, etc	-Documentation -Surveys and interviews -SWOT analyses and Econometric models	-Report on assessment of the factors that influence adoption. -Policy briefs, newsletters, working papers.	-Policy makers -Actors in ICT value chain, from suppliers to consumers, including among others service providers and farmers -NGOs, Projects -Researchers and other stake holders.
To assess the challenges facing ICT providers	Socioeconomic, technological and environment (policy, infrastructure, physical, etc)	-Selected ICT users and providers in ICT value chains, from	-Documentation -Surveys and interviews	-Report on assessment of the challenges facing ICT providers.	-Policy makers -Actors in ICT value chain, from suppliers to

OBJECTIVES	DATA	DATA SOURCES	METHODS	OUTPUTS AND OUTCOMES	USERS OF RESEARCH RESULTS
	data that are challenging on: - Objectives (geographic / products coverage and penetration, etc) -Limitations (availability, accuracy and costs of information, proximity to information users, costs of dissemination, etc.)	suppliers to consumers including farmer households -Existing studies, reports, etc	-SWOT analyses	-Policy briefs, newsletters, working papers.	consumers, including among others service providers and farmers -NGOs, Projects -Researchers and other stake holders.
To identify roles and partnership models for the public and private sectors (including NGOs)	-Existing ICT initiatives -Roles of actors in ICT value chains -Partnership practices	-Relevant public and private institutions, NGOs and Projects, economic operators, farmers	-Documentation -Surveys and interviews -Comparison with existing (successful) partnerships in other countries -Modeling	-Identify successful and unsuccessful models -Contribute to enhancement of private and public partnership and collaboration	-Policy makers -Actors in ICT value chain, from suppliers to consumers, including among others service providers and farmers -NGOs, Projects -Researchers and other stake holders.
To enhance collaboration among African researchers and to build research capacity of project partners and young researchers.	Study results of other country teams of the project (and of other countries if available)	-Research institutions involved in the project -Relevant regional and international institutions	-Exchange (periodical “bulletin” of the project, exchanging workshops, etc) -Topical training sessions -Grants for selected students (PhD or MSc)	-Periodical “bulletin” of the project -Exchanging workshops -Topical training sessions -Grants	-Policy makers -Actors in ICT value chain, from suppliers to consumers, including among others service providers and farmers -NGOs, Projects -Researchers and other stake holders.
To formulate guiding principles/ recommendations to inform policy and practice	All study results and syntheses Final project report Dissemination procedures	Research institutions involved in the project Project coordination	National workshops Global final workshop		

Annex 1.6: Malawi

OBJECTIVES	DATA	SOURCE OF DATA	METHODS	OUTPUT & OUTCOMES	USERS OF RESEARCH RESULTS
To identify and characterize existing initiatives and the environments within which they are applied	Inventory of initiatives Policy context Key or relevant infrastructure Geography Farmer systems (size of the farm, range of products they produce, scale of operation, technology used, education, gender structure etc.) Market systems (farm gate, assembly, regional/district, international, etc.) Key stakeholders in value chains	Government ICT policy paper, the Agriculture Policy, MACE baseline and M & E documents Telecommunication Service Providers, websites, newsletters, farmers organizations, NGO, input suppliers (stockists), Agricultural Communication Services Small holder farmers, Traders, processors, service providers, retailers, consumers, Malawi Agricultural Commodity Exchange (MACE), transporters, financial institutions (banks)	Desk review, interviews, focus group discussions, stakeholder analysis (analysis of linkages to help characterize existing interventions),	Report on identified and selected initiatives for in depth analysis. Database of existing ICT initiatives and their characteristics.	Policy makers, farmers, service providers, NGOs, researchers and other stake holders.
To investigate the effects of participation in ICT-based market information project on smallholder	Input and output Price, Input and output volume, incomes (revenues) and expenses, marketing costs, investments, bargaining power, transparency, range of markets, integration of	Household and other key informants, secondary data sources (MACE, Min. of Agriculture, ICT intervention databases and documents,	Household survey, survey of other key players in the value chain (individual interviews, focus group discussions, at different levels of marketing chain.	Report on assessment of effects of ICT interventions. Data collection tools, database,	Policy makers, farmers, service providers, NGOs, researchers and other stake holders

farmers	markets.				
To examine the factors the influencing adoption of ICT-based market information services	Socio-economic data, technological and environmental (policy, infrastructure, physical, etc)	Household and other key informants, secondary data sources (MACE, Min. of Agriculture, ICT intervention databases and documents,	Household survey, survey of other key players in the value chain (individual interviews, focus group discussions, at different levels of marketing chain.	Data collection tools, database, policy briefs, newsletters, posters, working papers.	Policy makers, farmers, service providers, NGOs, researchers and other stake holders
To critically assess the challenges encountered by market information service projects for linking smallholder farmers to markets	-Socio-economic data, technological and environmental (policy, infrastructure, physical, etc) -Actors, model of partnership, ICT initiative	Key informants, secondary data sources (MACE, Min. of Agriculture, ICT intervention databases and documents	Survey of other key players in the value chain (individual interviews, focus group discussions, at different levels of marketing chain), workshops.	Data collection tools, database, policy briefs, newsletters, posters, working papers. Outcome: to enhance understanding of challenges facing ICT providers and contribute to influence policy(ies) Outcome: identify successful and unsuccessful models and to contribute to enhancement of private and public partnership and collaboration	Policy makers, farmers, service providers, NGOs, researchers and other stake holders
To enhance collaboration among African researchers and to build research capacity of project partners and young researchers.					

To formulate guiding principles and recommendations to inform policy and practice	From synthesis of the above objectives				
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Annex 2: Market information and smallholder commercialization¹⁷

Type of Information	Purpose	Is better information alone likely to increase market participation?	Implied extent of commercial orientation	Relevant outcome or performance indicator
Marketing information	Value addition	Also need capital for investment to satisfy higher value segments	***	Average returns per hectare (whole farm); share of total production that is sold
Historic (price)	Planning (crop and market channel choice)	Must expect surplus or be sufficiently confident of food markets to rely on buying in food	**	Average returns per hectare (whole farm); share of total production that is sold
Current (price)	Price negotiation	Farmers may still be constrained in negotiation, but even poor household with small quantity to sell can hope to avoid worst opportunism by traders	Any (* to ***)	Unit value (price) at which existing crops sold

Key:

* = produce primarily for own requirements and perhaps local markets, sell surplus

** = crop choice influenced by market considerations (perhaps also choice of market channel)

*** = full market orientation: all aspects of production influenced by commercial (profit) considerations

¹⁷ We acknowledge Dr. Colin Poulton for proposing this matrix categorization information types and commercial orientation of households

Commercialization progress:

- Moving from * to ** is big step: must *either* be confident of reasonable self-sufficiency in staples (which is in large part a function of land, capital and/or labor assets) or be sufficiently confident of food markets to specialize in production for market and rely on buying in food.
- Moving from ** to *** is likely to require capital as well as additional information.

Choosing new crops or markets (i.e. stages ** or *** above): the role of information in the contracting process (North, 1990; Williamson, 1985):

- Search – market information helps (current, historic, marketing may all be useful)
- Screen – personal follow up required?
- Negotiate – meet or on phone, market information helps
- Enforce – rely mainly on trust (ex ante) – phone calls help in building trust?
- Ex-post adjustment – market information helps (avoid opportunism)

Individual vs collective marketing activity:

- where marketing activity is collective, only one person needs to access the relevant information (assuming trust within the group) – market information as a fixed cost!
- For stage ***, capital investment to satisfy higher value segments may also be collective, which may permit poorer households to participate
- Critical assumption is intra-group dynamics and trust: if trust is weak, other members may also need to access same information to prevent abuse of asymmetric information by group representative.

