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SPEARHEADING ICT4D KNOWLEDGE

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Bangladesh Institute of ICT in Development (BIID), being a distinctive ICT based initiative, intends to take the opportunity to host the paper. BIID is a private sector initiative to contribute to economic development of Bangladesh through integration of ICT in the provision of essential services primarily targeted to farmers, entrepreneurs and potential income generating groups in the rural areas. BIID's activities cover Research & Development, Knowledge and Skill development, Design Business Model for Telecenter (Rural Information Centre) to promote rural businesses specially the micro, small and medium enterprises. BIID is also working in Africa in the field of ICT4D. Strategically, being the sole specialized paper in ICT for development field, has the potential to serve a number of purposes.

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Focusing on ICT for Agricultural Development

Welcome to the fourth issue of the Working Paper Series on ICT for Development!

This is a special issue of our journal as it focuses specifically on ICT applications for agricultural development. We all know that a highly effective agricultural extension system is key to food security. For so many decades, government, corporate and non-government institutions involved in agriculture have been providing information and advice to farmers in the hope of improving production and productivity. At first, efforts focused on mass media to disseminate such information (influenced by the works of Schramm, Lerner and Rogers). Later, as the media centric models were considered too top-down in approach, participatory models became more acceptable. Farmers became both the senders and receivers of the information. However, with the coming of ICT, many development practitioners saw the potential of such a platform given its ability to be more interactive and put together (convergence) various types of data – pictures, texts, audio, video, animation, links, etc.

We have four very interesting articles in this issue. The first, Status of ICT for Agricultural Extension in Bangladesh (written by Malone, Akbar, Bell and Bohn) looks at the potential of ICT in agricultural extension work in making information from intermediaries reach farmers faster. The authors conducted a workshop in Dhaka City last December 2012 among various extension groups and their article is largely the results of the discussions – access of farmers to credible information, enabling two-way communication for demand-driven extension, blending ICT in existing extension approaches, affordability/sustainability of ICT in extension, and using ICT to improve coordination of extension work.

The second paper, A Futuristic Joint Plan Perspective in e-Agricultural Framework for India and Bangladesh: Need of the Time (written by Panda), made a comparison of the agricultural situations of the two primarily agricultural countries. Both countries are experiencing difficulties in agricultural development – some of these are due to the environment and others due to lack of knowledge or information. Since the two countries have similar problems, he suggested using e-agriculture and for e-agriculture to succeed, he recommended greater bilateral collaboration in terms of infrastructure development, farmer preparedness and government extension line department preparedness.

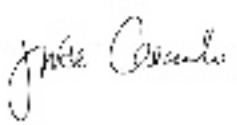
The next two papers focused on mobile phones, which has become a common device in rural Bangladesh. Given that many farmers cannot read or write and that

those who can prefer voice over sms, extension workers see the huge potential of m-agriculture (particularly interactive voice responses). The third paper, Providing Sustainable Solutions to Farmers through Agricultural Helpline: The Case of Bangladesh (written by Azam and Jalil) documented the agricultural helpline project of Katalyst that aims to bring timely, reliable and relevant information to farmers and small enterprises with the view of increasing their competitiveness. The authors explained the four phases of the project – innovation, improvement, broadening and deepening – as Katalyst collaborated with key players in the telecommunications industry. They conclude that the digital inclusion of the poor has a healthy effect on business as the customer base has expanded.

The final piece, Grow Mobile: Mobile Opportunities for Water Management and Food Security in Bangladesh (written by Wagemaker, Verkaik, Boortman and Davids), explored how mobile technology can help the Dutch agency for development cooperation project called "Blue Gold." The said project is designed to improve water management and food security of 150,000 households in the country's coastal districts. To do this, the researchers created an inventory of mobile application initiatives in development and conducted three group interviews about mobile phones in a rural village near Patuakhali. From these data, they identified inefficiencies relating to system, behaviour and market. After which, they made specific recommendations to the project management team about possible uses of mobile technology.

From these articles, we can get an idea of the range and complexity of agricultural development, particularly how important information is and how ICT can help in enabling farmers to access information. We do hope that these articles can shed light and improve the way we conduct agricultural extension.

On behalf of the entire editorial board,



Jude William Genilo
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Article

Status of ICT for Agricultural Extension in Bangladesh

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Abstract
ICT offers a means of delivery of agriculturally relevant content to rural areas. The enthusiasm surrounding ICT for extension stems from the expectation that information reach can become deeper and faster, reducing the need for costly personal interaction between farmers and intermediaries. For ICT-enabled extension to be effective, it will require a relationship of trust between client and messenger, good two-way communication, continuity of effort, and the opportunity for the client to see or test the recommendation. Bangladesh is well positioned to effectively start using ICT for agricultural extension.

Key Words
Agricultural Extension, Access to Information, ICT Tools, Network Development, Adaption

Introduction

ICT simply is the abbreviation for "information and communication technology." While some associate only the Internet or cell phone usage with ICT, the term really also encompasses traditional broadcasting tools such as radio and television. Communication happens through still or moving images, text, or voice. The devices that make these types of communication accessible are radio and television sets, various other sorts of video displays, stationary or portable computers, and cell phones – from simple to smart.

While there is no standard definition for extension, one can simply say that "extension is getting knowledge to farmers so that they will make a positive change."For extension to be successful, it needs to include credible content, effective delivery, as well as be relevant (to the client) and applicable (i.e. the client needs to be able to act on the advice).

Clearly, ICT offers a means of delivery of agriculturally relevant content to rural areas. The enthusiasm surrounding ICT for extension stems from the expectation that information reach can become deeper and faster than ever before, reducing the need for costly personal interaction between farmers and intermediaries (extension staff, input suppliers, buyers, processors, etc.).

Nonetheless, for ICT enabled extension to be effective, it will require a relationship of trust between client and messenger, good two-way communication (audience-centric, not sender-centric), continuity of effort, and the opportunity for the client to see or test the recommendation. Furthermore, the process of change requires more than just increasing access to information such as technical knowledge. If there is no market for the agricultural product to be sold profitably, or if production does not otherwise improve the household's livelihood, then the behaviour change does not benefit the client (G8 ICT Challenge Report, November 2012, https://communities.usaidallnet.gov/ictforag/node/335).

In Bangladesh, extension services are provided by the public sector (e.g. the Department of Agricultural Extension encompasses 13,000 staff[1]), field staff funded donors and NGOs (like BRAC, DAM) through development projects, and to some extent by the private sector (corporate input suppliers, service providers like BIID through e-Krishok).

The key challenges for agricultural extension, not just in Bangladesh, are how to:

- improve the linkage between research and extension;
- make research and extension more responsive to farmers' needs and priorities and improve the linkage of farmers back to research and extension;
- provide more site for technical/production information concerning more diversified production systems (plant, animal, fish-based) for heterogeneous agro-ecological conditions;
- better integrate farmers into markets via the provision of market-related information (e.g. prices in various local and national markets, market quality requirements such as size, taste, colour, hygiene, etc.).

ICT interventions can be designed to specifically address these challenges (e.g. use ICTs to collect farmer input into research needs), but without improvements throughout the agricultural innovation system[2] in Bangladesh, the relevant

[1] Source: IFPRI Worldwide Extension Study, 2011. www.worldwide-extension.org/asia/bangladesh. (Staff data is available only for DAE)

[2] More about Agricultural Innovation Systems: World Bank Agricultural Innovation Sourcebook http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTARD/0,,contentMDK:23129039~pagePK:148956~piPK:216618~theSitePK:336682,00.html)

information will simply not be available for sharing through ICT.

The expansion of ICT in extension needs to meet at least three criteria in order to be successful:

1. *Cost Effectiveness* – The goal will be to expand the access to the greatest amount of information at the least possible cost. The recipient must also review initiatives already tried in other countries and examine questions of technology placement such as mobile technologies carried by extension agents or fixed locations such as telecenters.
2. *User Friendliness* – The extension agents and farmers who will be the principal users of these technologies are not expected to be specialists in ICTs; but rather functional users. The overdependence on Bangla and high levels of illiteracy are issues to be considered as well.
3. *Adaptation to Local Conditions* – Constraints include poor availability of electricity, the danger of power surges, and the need for phone/Internet network connectivity.

Executive Summary[3]

Opportunities

- Digital Bangladesh as a visionary initiative from the Prime Minister
- Leadership through Access to Information
- New national agricultural extension policy close to completion
- Enabling environment for mobile telephone network development (including data for Internet access)

Bangladesh is well positioned to effectively start using ICT for agricultural extension. Notably, the National Agricultural Extension Policy is currently under revision. Unlike the old one that dates back to 1996, the new version of e-agriculture has been added as one of the nine principles of the policy. The policy includes improving the Public Private Partnerships in extension, improving the research-extension-farmer linkage and developing a one-stop-shop approach with Farmers' Information and Advice Centres (FIAC), which should be based at every Union Parishad.

Furthermore, the Prime Minister's Office is spearheading the Digital Bangladesh concept, to link up each Union Parishad by Internet to give better access to information and services.

Coverage by the mobile phone networks reaches 97% of the population. There are 98.3 million active phone lines. In the rural areas, the vast majority of phones are basic models with pre-paid scratch cards used to pay for airtime and the main feature used are voice calls. Mobile providers and banks are now rolling out

[3] The full report is available at http://www.meas-extension.org/meas-offers/country_studies/country-overview/bangladesh

"Mobile Money", which is expected to make a big difference in money flows from urban to rural areas and thus impact agricultural production as well.

Internet usage in Bangladesh is on the rise. From 2008 to 2011, Internet usage per 100 people increased from 2.5 to 5. According to the Bangladesh Telecommunication Regulatory Commission (BTRC), total Internet usage as of July 2012 reached 29.4 million, and this done mainly through mobile based Internet access. Bandwidth in Bangladesh is limited to one optical fibre cable of about 10GB/s but a new cable with 100GB/s is scheduled to be connected by 2014. Broadband connections are still rare outside of major urban areas. Rather, in rural areas, Internet is accessed predominantly through USB modems connecting to the mobile phone network.

Much of the agricultural programing on national TV and radio is prepared by a dedicated team in AIS. Recently AIS started to produce material for regional and community radio stations in local dialects. These are new initiatives and therefore assessing their impacts is not yet possible.

The low literacy rate, particularly among the rural population (72%, Source: CIA Website), is a major limitation for connecting directly with farmers using ICT text-based solutions such as SMS or web-based written information. Organisations involved with ICT in extension are aware that text-based solutions may best work through the use of educated intermediaries such as an extension worker. Direct contact with farmers may be more effective through either audio or visual means of communication.

The Ministry of Agriculture, through its Department of Agricultural Extension, employs 13,000 such extension workers, with around 2,400 field officers for department of livestock. The task of these staff should be to make agricultural information more accessible to producers; but they do not have access to modern communication devices apart from their personal mobile phones or perhaps their own laptop computers. To the best of the authors' knowledge, there is no plan to equip them with devices. However, they may benefit from the Digital Bangladesh provision of internet links to each Union Information Service Centre.

Some organisations are making inroads in using ICT. For example, the Ministry's own Soil Resources Development Institute provides accurate soil analysis data linked to GPS data online.

From this, fertilization recommendations can be derived (by educated producers accessing the site directly or through call centre staff accessing the site on behalf of callers).This is potentially a very valuable service, but has not been widely advertised and marketed.

A big challenge is how to make information on production, marketing, nutrition, health, etc. accessible to rural women. Organizations like Katalyst and D-Net are addressing the need for women to obtain agricultural advice and also for other services. D-Net started in the early 2000's with a door-to-door service on a mobile phone, which has now developed into a service with a laptop computer (pre-loaded

with video, photos and other tips), printer, USB modem and health check kit. The person who provides this service is called an "InfoLady". Katalyst has been facilitating different initiatives like e-Krishok from private sector partners like BIID to reach women farmers in a sustainable approach.

One initiative which has made use of the physical access points,i.e. information centres, and mobile phones to link farmers with quality advice is the e-Krishok (meaning "e-farmer") initiative of BIID and partners.The call centre can be reached by using a short code 16250. E-krishok helps with advice on disease identification and is now working with 350 Grameenphone Community Information Centres. This can be expanded to include market information.

Another initiative which has been developed by BIID and Sher-E-Bangla Agricultural University is the eXtension.org.bd platform for agricultural extension. This will be a link between research and the field for use by extension staff, NGO's, policymakers, etc. This will help all relevant stakeholders to be aware of the recent developments in extension domain and share with wider audiences for feedback and comments. BIID will facilitate more discussions on the availability of existing contents (research findings), modality and tools of extension service than content, and special focus will be given on usage of ICT enabled media. All discussions will be made available on the web and circulated through emails.

Rural Info is linked with WIN Incorporate offering an information service for the mobile phone companies.

The Bangladesh Rice Knowledge Bank is an Internet-based agriculture knowledge repository. BRKB works closely with 15 Union Information and Service Centres. BRKB is mobilizing farmer feedback on BRRI produced materials of BRKB to develop it further.

Practical Action Bangladesh is working on the Village Information Centre concept in 22 unions in the country. They are also working closely with AIS of MoA.

A daylong workshop on ICT in Agriculture Extension was organized at Dhaka. All major stakeholders attended as well as contributed to map out all the ongoing initiatives during the workshop.

Key Findings from the ICT for Extension Workshop

On December 3, 2012, the MEAS[4] team hosted a workshop on ICT for Extension at Rigs Inn, Dhaka. The lively discussions resulted in the identification of the key factors that are necessary for the utilization of ICT for extension to be successful:

- The information that is communicated must by timely, reliable, and available at low cost.
- The potential users must be aware of the ICT tools available to them. Just designing a tool is not enough; it must also be promoted.

[4] The MEAS team consists of Shahid Akbar of BIID, Andrea Bohn from the University of Illinois at Urbana Champaign, Mark Bell from the University of California at Davis, and Phil Malone of Access Agriculture.

- The ICT infrastructure must be inclusive, meaning that even poor farmers and those in remote parts of the country must have access to it.
- The provision of the ICT services must be based on solid needs assessments.
- The literacy level of the clients must be taken into account.
- The various players in the ICT sector must be networked and collaborate well.
- Available technologies should be used. Duplication of efforts should be avoided.
- The backbone of the ICT has to be based on good knowledge management and strong linkages between research and extension (the intermediary).
- A clear strategy should be pursued (targeted information, message, and format), taking into account whether the immediate client is the farmer or an intermediary.
- There must be incentives for the farmer or intermediary to use the tool.
- There must be incentives for the provider of the information to make that information available in a format, etc. that is suited to the user. Sustainable funding/revenue models should be considered.
- The client must have confidence in the message and the messenger (intermediary, tool).
- The message(s) and delivery technology must be adapted to local conditions.
- Using community radio, folk songs, and theatrical productions, if popular in the target region, must also be considered.

In Bangladesh, particular challenges are associated with:

- securing of government resources and uncertainty about long term commitment (sustainability);
- difficulties for the private sector to establish sustainable (financially sound) business model for provision of ICT services to agricultural sector;
- coordinating or integrating different information sources and actors (public, private, NGO);
- continuously updating and ensuring high quality, validated content;
- improving the motivation of staff towards ICT, improving their access, and training them in the utilization of ICT and creation of content;
- reliable Internet access, reliable electric power;
- addressing challenges of literacy, language and format;
- achieving relevance for (all) farmers and addressing gender equity;
- lack of direct communication with the farmers, and too little effort of obtaining systematic feedback from the farmers.

From these findings, five questions emerged as particularly relevant for improving the utilization of ICT for extension in Bangladesh:

1. Where and how can farmers or those who serve them as intermediaries (extension staff) access credible information?

The participants rated the information made available by AIS, SRDI, BARC, BRRI, and other public research institutions in Bangladesh as generally credible but probably not sufficient. Most of the service providers in extension depend on the government sources and private sector for reliable and latest information. The major limitations of the existing information platforms has multiple dimensions which includes lack of regular update, only text-based (no animation or video) information and readiness in digital format as well as quality. Especially, most of the government contents are still in traditional format i.e. print version. However, AIS is working to digitize different contents. Access to government sources is free but official endorsement and partnership is still a big challenge for the non-government (both private and NGO) organizations to ensure proper validation. In addition, awareness on existing information platforms is very low and ICT fear (use of Internet) among the farmers is very high which lead to low usage of the contents. Another shortcoming of the existing information platform is the absence of business model. So many project-based donor-driven initiatives are popping up and dying or running at low scale when the project life is over.

It is not known how adequate the existing repositories are:

- Is all the information presented validated, accurate, up to date, reliable and relevant? Which institutions are generating the content?
- Which, if any, farmers and intermediaries are using these resources? What are the barriers to usage (Internet access, literacy, language, relevance, action ability, etc.)? Is the content even relevant for marginal farmers?
- Is it easy for farmers or intermediaries to find answers to the questions they have?
- Is the degree of localization of information appropriate?
- Are the existing repositories being sufficiently promoted through public/private/NGO's/ international organization/donors?
- Is material being used across different ICTs (e.g. are videos accessible in various formats and easily up- and downloadable? scripts for radio)
- Are the farmers' perspectives sufficiently taken into account (or this research generated content relevant only for researchers)? Are there mechanisms for two-way feedback?
- Can the private sector, including innovative farmers, post content on the existing sites?
- How supportive or inhibitive is the enabling environment, i.e. are the technologies (seeds, fertilizer, pesticides, treatments, etc.) that are recommended even available at the right time in the right amounts?
- Is there too much emphasis on production technology and too little information on process innovation, e.g. marketing?
- Is there sufficient proof of concept for the recommendations? Can the farmers visit demonstration plots or can they identify other farmers in the region already using the recommendations?

2. How can ICT Improve Two-way Communications for Extension to be Demand-driven?

In principle, ICT approaches can be designed to improve two-way communication between the providers of content, intermediaries (extension staff), and users (farmers). For example, radio shows can offer a call in section or promote listener groups. There should be systematic tracking of the type of questions asked by farmers when they use services like e-krishok. It is also a matter of mindset whether a project really first listens to the communities they are trying to serve and not impose preconceived decisions and understanding. In principle, private sector, for profit service providers, should be well positioned to tailor their services to the actual needs of the clients because otherwise they cannot be successful and sustainable.

Thus, improved two-way communication begins with designing a demand driven, holistic approach. Identify the needs of the community/clients and match the approach. Be clear on who is supposed to be communicating with whom and where and secure potential sources of credible, localized information (to respond to questions/needs that are identified). Use multimedia approaches and pictorial depictions to lower literacy barriers. Take into account the level of understanding and education of client and service provider. Improve responsiveness and timeliness so that the client does not lose interest in the relationship.

Figure 1: Needs for Successful Extension

3. How does ICT in extension need to be blended with existing approaches to help move farmers from accessing information to adopting a practice?

The process of change requires more than just increasing access to information such as technical knowledge. If there is no market for the agricultural product to be sold profitably, or if production does not otherwise improve the household's livelihood, then the behavior change does not benefit the client (Figures 1 and 2).

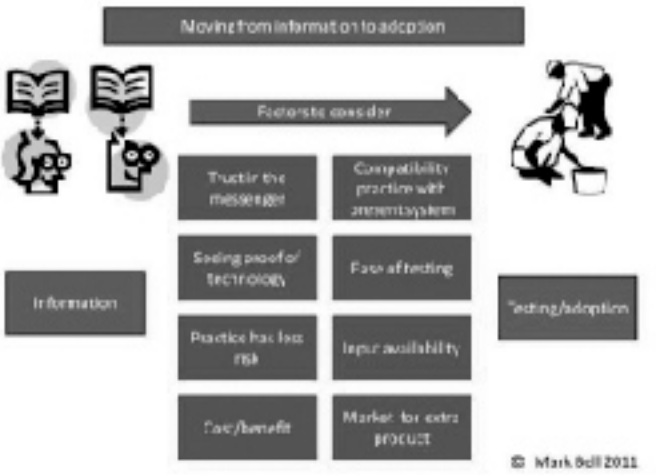

Figure 2: Moving from Information to Adoption

Here are some practical ideas discussed during the workshop:

- Identify enthusiastic farmers to motivate others.
- Work with advanced farmers and facilitate their access to information, which they can then and pass on.
- Empower extension agents e.g. by providing them with business phones and tablet computers.
- Develop videos in local dialect, picture drama.
- Make sure that recommended practices can be observed at demonstration plots, farmer field schools, model farmers, community plots. Offer exposure visits.
- Strengthen farmer groups and associations, improving their bargaining power in the marketplace (for inputs, outputs, but also advisory services).

4. How can ICT in extension be made affordable and sustainable?

It is not the absolute cost of an extension service, whether provided in a traditional approach (person-to-person or group, demonstration plots, farm days, etc.) or in an ICT enabled fashion, but rather the relationship between cost and benefit. A service can be very affordable, but if it is not valuable, then it is worthless.

A basic cost saving measure is to build on existing resources, channels, and modes of communication. For example, lots of different centers like UISCs, FIACs, etc. are being established throughout the country by the public sector and also by entrepreneurs and through projects. This may very well lead to duplication of effort, and over-supply in some parts of the country but too few centers in others.

Similarly, use existing data available from different platforms to design programs (while making sure that locally relevant content is available). Engage local TV operators. Make information available at tea stalls (brochures, DVDs, Internet

access). Use mobile units (e.g. for showing films) rather than invest in stationary equipment. Consider involving the private sector by providing the right incentives and removing barriers (the government should create an enabling environment for private service providers). Perhaps input retailers could play a role in facilitating ICT enabled access to information relevant for farmers. Pursue cost sharing options between public and private sector. Allow for the generation of revenue through advertising rather than charging clients.

5. How can coordination and perhaps even integration of services be improved?
First off, there has to be a value proposition/reward for coordination because it is difficult, time consuming, and costly. Coordination is not an end in itself and the various stakeholders (e.g. the ICT actors described in the section above but also the various groups of agricultural producers, processors, extension staff, etc.) need to benefit from it, i.e. there needs to be a positive incentive for it. The whole must be bigger than the sum of its parts. While the government could take on a controlling function or mandate some form of coordination, real collaboration will only happen if the relationship is beneficial for all involved. Typically, it takes one or two actors to take on leadership responsibility and to facilitate coordination.
During the workshop, no recommendation was made as to who could take on that role but it was suggested that the DAE considers taking that on or empowering another organization to do so. Also, it was agreed that informal opportunities for networking should be pursued and that having the contact information of the participants at this workshop will facilitate such efforts.
Furthermore, it was pointed out that the real benefit of coordination may arise at the local rather than the national level and that such coordination is probably already happening in some parts of the country. Perhaps greater autonomy should be granted to local actors.
Many rural development projects are (co-)funded by donors. It would pose a strong incentive for collaboration, if the monitoring and evaluation of such projects were to include indicators that track effective collaboration. For example, in the Feed the Future projects USAID could consider adding an indicator that assesses the extent to which USAID projects meaningfully link to and work with other USAID, other donor projects as well as public sector initiatives.

Major Lessons Learned From the Workshop and Subsequent Field Visits
There are many ICT initiatives in Bangladesh and the workshop was an excellent opportunity to map out present activities and collect information on keys for success. The workshop brought together 45 representatives from the government, non-profit and private sectors and represented a wide cross section of those working in agriculture. The observations below are drawn from the workshop and the subsequent two days of village visits by the MEAS team near Jessore.
Needs. Discussions highlighted successful programs that did address problems

farmers face. Many farmers and feedback from e-Krishok and others indicated that pests and diseases and their control were the major type of information requested by farmers. Farmers were also interested in seed, improved marketing and better prices.

Content. Farmers and others repeatedly stressed the need for a source of trusted credible relevant information. A central, readily available source of proven content is not presently available. Different organizations have access to different sources. The Bangladesh Rice Knowledge Bank is considered a fairly good example (although it seems some updating would make it even stronger). It appears that the linkages between information intermediaries and users with information providers could be strengthened to ensure needs-driven research agendas.

Trust. The need for both a trusted source of information and a trusted messenger was constantly emphasized. A key question for the use of ICT options is how do to build this trust while using ICT. In this respect, existing extension systems where farmers get to directly see technology applied and its impact are still considered extremely important in the adoption process.

Intermediaries.The present principal sources of information for farmers were given as other farmers, input suppliers and extension officers and NGOs (for farmers served by an NGO-run project). Extension workers seemed quite active in many areas. It was noted that there are many more input suppliers than extension workers – and farmers are repeatedly visiting the input suppliers.

Use of ICT. See box below for an overview. Note that in one village, farmers indicated they receive "push" text messages to notify them of agricultural events, etc.. The general sense is that this has become a bit like spam and tends to be ignored.

Information and communication tools such as cellular phones, the Internet, radio, and television can dramatically improve farmers' and intermediaries' access to information relevant for rural households, agricultural production and agribusinesses. The tools can be used to raise awareness or to provide specific information in response to questions about agricultural technologies, markets, prices, etc. However, these tools are just a part of the extension process and are most effective if combined with established good extension practice.

For extension in general and for ICT in particular to be effective, the service has to be client focused and needs-driven, providing credible content and a relevant and actionable message through a trusted messenger. Furthermore, access to information is just part of the formula for success. Farmers have to see sufficient evidence that they are convinced to turn the new information received into (1) a willingness to test the approach, and then (2) if the test is successful, adopt. Success of an ICT tool or approach therefore also depends on the availability of required inputs, sufficient knowledge to test and use those inputs appropriately, and access to markets for them to profitably sell their outputs.

Sustainability. Many activities are project-driven and plans for sustainability are not always clear. A project or pilot based approach can be acceptable for proof of concept, but activities such as e-Krishok have sustainability elements incorporated from the start. Publically funded institutes have to define their ongoing roles to support the overall information programs.

Application. Successful programs link needs to intermediaries to farm level application to generate user driven programs. Some applications like e-Krishok are user pay and thus are directly linked to users.So they are collecting information on both content wanted and effectiveness of the system of providing such content.

The box shows present ICT and other media usage and their potential application in aiding extension. It is a preliminary assessment based on farmer focus group meetings from December 4-5 in Jessore. The findings provide a starting point for developing an ICT strategy but should not necessarily be seen as representative across regions.

Discussion

The ICT for Extension Workshop on December 3, 2012, was an opportunity to bring together various stakeholders with an interest in seeing ICT for extension succeed in Bangladesh and learn about a small subset of initiatives. Given that this was the first of its kind, the findings may seem quite general and not actionable enough. However, it is the start of knowledge sharing and closer collaboration among stakeholders that over time can address the issues raised.

Instead of writing our own discussion section, we will take the opportunity of quoting from an email received by Shaik Meera of IRRI on February 12, 2013, in response to having read the full report, to highlight what other questions should be addressed, to move from an "ICT centric approach of extension" to an "extension centric approach for ICTs".

"Agricultural extension, whether public or private, operates in a context that influences the organization, form, and content of transfer activities. The dominant characteristic of that context is change. Because the changes affect all aspects of extension, the context should be examined and understood so that extension can be better managed.

For example, what necessitates current extension/advisory organizations to integrate ICTs into their functional/structural components? The history and recent developments in Asia illustrate that ICT "prescriptions" are doomed to fail if they are not based on "farmers' needs." And it must be driven by learning about what works and what does not and by the nature of local circumstances and context.

An initiative in the CGIAR known as the "institutional learning and change initiative" is trying to do precisely the same thing for agricultural research. These types of approaches stem from the realization that improving the performance and capacity of a system concerns reflection, learning and incremental change.

Most of the ICT4D reports end up stating "what ICTs can do for extension". Seldom

they address the issue of "how extension can harness ICTs in existing contexts". For doing that - we require local/village level knowledge uptakes/value of ICT services/indicators for impact of ICT services on livelihoods, etc.
Content, trust, infomediaries and sustainability issues are very generic lessons that have been reported over the last 15 years."
What is needed now is establishing "practical ways of content development (who, how, processes, scale and depth)" and on how to empower infomediaries (What are their capacity building needs? What makes public extension workers to become an infomediary? Is there a scope for incentives for efficient performance?)
What indicators should be in place before NGOs/ private sectors integrate their work with that of other ICT service providers?
How to build farmers communities (such as radio rural fora [forums]) so that ICT services/contents are highly localized? Is there a scope for "zooming in and zooming out" farmers' learning/experiences using ICTs (take Digital Green for example)? While doing so what are the validation/credibility issues? How to overcome them?

Many call for improved linkage between Research and Extension.

- Why there are poor linkages?
- Is there an issue that could be addressed with ICTs?
- What other enabling factors should we consider?
- If BARC is considered major "reliable source of research outputs," then what constraints are there for organizations/individuals in sharing information?
- If storing/retrieval/re-writing/sharing/repackaging/uploading are the problems, then what activities can we plan for strengthening this?
- If DAE is a major extension body, then what constraints are there for the grassroots extension workers in accessing ICT-enabled services/content?
- What enabling factors should we consider?

If "access" alone is the problem, then rural ICT centres can help. But are we sure that "access" is the real problem or there are other problems we are not seeing?
If we want to bring all these research and extension organizations onto a common platform, what adjustments are needed to be made? What is the "level playing field for each of them?"Do their mandates allow them to do so?
For example, researchers would be inclined to publish research articles rather than contributing the content to ICT-extension. What would incentivize them to contribute immensely to ICT-enabled extension?
Only after having found answers to these questions can we can think of what ICT tools/platforms/processes can be worked out to strengthen the research-extension linkages.
Furthermore, the main direction of reform in agricultural extension is towards learning rather than teaching paradigm. This learning approach should incorporate

new methodologies and approaches that are demand-driven and increase the real, interactive participation of local people at all levels of decision making in an extension delivery network. Can we integrate ICTs for doing this? If yes, how?
While focusing ICTs, we tend to completely ignore basic extension work/methods that an extension worker uses. For example, if field demonstrations are conducted by extension workers, how ICTs would contribute to maximizing their impact? Whether "field days" can be captured in video format and then video shows arranged in neighbouring villages. There are "n" number of basic extension tools that could be blended effectively with ICTs. What are such lessons in Bangladesh? Can we list out such experiences to formulate a strategy?
The "Issue of content/knowledge" is perhaps that most neglected of all. (Even though we know the importance of it - we seldom know how to do?).
Over the years, ICT experts have over simplified the issue of agricultural content/knowledge. They have reported when all the ICT infrastructure is available. Within no time "knowledge can be generated/digitized/uploaded. Is this true?
And finally, when we think of modernizing extension in pluralistic environment, what strategies should be in place?

Annex A: Resources
ICT for Agriculture and Extension

ICT Resources Compiled by the MEAS Project:
http://www.meas-extension.org/resources/ict
http://measict.weebly.com/index.html

ICT in Agriculture:
http://www.ictinagriculture.org/ictinag/
Sponsored by the Agricultural and Rural Development unit of the World Bank
ICT for Ag Online Community:
https://communities.usaidallnet.gov/ictforag
Sponsored by USAID

ICT Update by CTA:
http://ictupdate.cta.int/en
Look into the many archived issues (come out on a bi-monthly basis) at http://ictupdate.cta.int/en/Issues/(issue)/69

The e-Agriculture Community:
www.e-agriculture.org
e-Agriculture is a global Community of Practice, where people from all over the world exchange information, ideas, and resources related to the use of information

and communication technologies (ICT) for sustainable agriculture and rural development.

USAID. 2012. G8 New Alliance expert consultation on ICT and Extension Services. Washington, D.C.
https://communities.usaidallnet.gov/ictforag/node/335

mFarmer and mAgri Initiative
http://www.gsma.com/mobilefordevelopment/programmes/magri/mfarmer-initiative/

Specific publications on Agricultural Value Added Services (agriVAS) using mobile phones

Chapter 1 on Market Entry Toolkit:
http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2012/04/agrivasmarketentrytoolkitgsmafinal-2.pdf

Chapter 2 on Market Assessment and User Design:
http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2012/04/marketingassessmentanduserneeds.pdf

Chapter 3 on Marketing:
http://www.gsma.com/mobilefordevelopment/programmes/magri/mfarmer-initiative/

Chapter 4 on Service Design:
http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2012/04/servicedesign.pdf

Chapter 5 on Commercial Model and Business Case:
http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2012/04/commercialmodelandbusinesscaseforagrivas.pdf

Article

A Futuristic Joint Plan Perspective in e-Agricultural Framework for India and Bangladesh: Need of the Time

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Abstract
After the United Nations referred to e-Agriculture as "an emerging field" in 2008, planners, policy makers, international organizations, donor agencies and countries started seeing its prospects as a field of study and application. Information and Communication Technology with its array of alternatives is now available for prosperous as well as poor farmers. E-Agriculture, equipped with ICT, strong enough to address the problems posed by natural calamities and market volatilities – factors that severely hamper farming. India and Bangladesh have their similarities in agricultural practices, food habits and cultivation. These two neighbours need to work together to reach the common goal of mitigating the sufferings of the underprivileged sections and create instances through benevolent application of e-Agriculture.

Key words
E-Agriculture, Information and Communication Technology, India, Bangladesh

Introduction
Bangladesh is a primarily agrarian economy. Agriculture is the single biggest production sector of the economy, comprising about 18.6% (data released on November 2010) of the country's GDP and employing around 45% of the total labor force. Although rice and jute are the primary crops, wheat is also gaining in importance. Tea is grown mainly in the country's northeast. Due to a number of factors, Bangladesh's labor-intensive agriculture has experienced steady rise in food grain production despite the often unfavorable weather conditions. Underemployment remains a serious problem. A growing concern for Bangladesh's agricultural sector will be its ability to absorb additional manpower. Finding alternative sources of employment will continue to be a daunting problem for the governments, particularly with the increasing numbers of landless peasants who

already account for about half of the rural labor force.[1]

Lands in Bangladesh are of three types: floodplains (80%), terraces (8%) and hills (12%). Crop cultivation is intense in the floodplain areas (Jahiruddin and Satter, 2010). 77% of the people live in rural areas. The rate of shrinkage of arable land is 1% per annum while urbanization is taking place at a 12% per annum rate. An annual population growth of about 1.48% has been posing great challenges for agriculture (Ahmed, 2010). The big rivers serve as the main sources of water for cultivation and as the principal arteries of commercial transportation. Flooding of the rivers during monsoon causes enormous hardship for the people and also hinders development. The rivers also drain excess monsoon rainfall into the Bay of Bengal. Thus, the great river system is at the same time the country's principal resource and also its greatest hazard.[2]

Present Problems of Agriculture in Bangladesh

Jahiruddin and Satter (2010) have identified the following problems with agriculture in Bangladesh:

1. There are a number of soil health related problems that affect crop production. These problems are: depletion of organic matter, and fertility; nutrient deficiency; salinity and acidity; topsoil erosion, degradation due to rice cultivation; sandy soils; drainage impedance, and water logging.
2. In the shoal areas, instability of land is another big problem. Other problems include coarse textured soils, low water holding capacity, low nutrient capacity, riverbank erosion and flooding. Crops are often lost due to active changes in river alignment and complete alteration of landscape at local levels.
3. In the Chittagong Hill Tracts, the major constraints are soil erosion due to heavy downpour in July-August, inadequate irrigation facilities, soil acidity, limited volume of soil for root anchorage, nutrient leaching and low organic matter content in soil. The hilly gradient and jum cultivation are main causes of soil erosion.
4. Coastal areas are relatively flatter and are often affected by salinity. Other environmental challenges include tidal surge, cyclone, acid-sulphate soils, and water logging in polder areas, riverbank erosion and unstable atolls.

Islam (2009) highlighted some present and future problems in Bangladesh's agriculture:

- Agriculture is dependent on the vagaries of nature and is risky.
- Availability of cultivable land is decreasing.
- Widespread poverty among the population engaged in agriculture.
- Shortage of required capital for expanding agricultural activities.
- Inability of farmers to avail suitable technology due to their soci-economic conditions.
- Zero guarantee that farmers would get fair prices for their produce because of

[1] en.wikipedia.org/wiki/Agriculture_in_Bangladesh, Accessed on August 18, 2013
[2] en.wikipedia.org/wiki/Geography_of_Bangladesh, Accessed on August 18, 2013

an underdeveloped market system.
- Agricultural commodities happen to be perishable and post-harvest losses are too high.
- Limited knowledge among common people about the nutritional values of agricultural commodities including vegetables and fruits.

At least in terms of soil, physical features, chemical characteristics, jhum cultivation in Northeast India, coastal inundation in West Bengal and Orissa, the problems in agriculture in India are similar to those in Bangladesh. Like Bangladesh, cultivation and soil management in the hilly areas are also big challenges for India. Reclamation of saline and acidic soil is also a challenge. Storage of agricultural produce and marketing are also matters of concern for both the countries. Forward and backward linkages of extension system are getting major thrust from the governments of both the countries. Agriculture's share in the India's economy has progressively declined to less than 15% of the Gross Domestic Product. Moreover, decline in dependence on agriculture as a source of livelihood and income is not praiseworthy either. Similar trends are to be seen Bangladesh as well. A majority of India's poor (some 770 million people or about 70 percent) are to be found in the rural areas. This is also similar to Bangladesh. The food securities of both India and Bangladesh depend on producing cereal crops, as well as on increasing the production of fruits, vegetables and milk, for meeting the demands of a growing population with rising incomes.

Indian farmers face a number of specific problems: limited availability of land and water exacerbated by depletion of natural resources; climate change; changes in demand and consumption patterns; move toward high-value agriculture; ever increasing pressure of population; and liberalization of trade (Lele et al. 2010). To do so, a productive, competitive, diversified and sustainable agricultural sector will be needed and that too at a fast pace.

Moreover, e-agriculture in the form of information and communication technology can play a holistic role for the development of agriculture in both the countries. In August 2003, the Overseas Development Institute (ODI), the UK Department for International Development (DFID) and the United Nations Food and Agricultural Organisation (FAO) launched a collaborative research project with an aim to combine the ideas of livelihoods and the concepts of information and communication for development, in order to improve the understanding of the role and importance of information and communication for supporting rural livelihoods. The policy recommendations included: [3]

- Building on existing systems, while encouraging integration of different technologies and information sharing.
- Determining who should pay, through consensus and based on a thorough

[3] en.wikipedia.org/wiki/E-agriculture, Accessed on August 12, 2013

analysis of the costs.

- Ensuring equitable access to marginalised groups and those in the agricultural sector.
- Promoting localised content, with decentralised and locally owned processes.
- Building capacity, through provision of training packages and maintaining a choice of information sources.
- Using realistic technologies that are suitable within the existing infrastructure. Building knowledge partnerships to ensure that knowledge gaps are filled and a two-way flow of information allows knowledge to originate from all levels of the network and community.
- The importance of ICT is also recognized in the 8th Millennium Development Goal, with the target to "make available the benefits of new technologies, especially information and communications technologies (ICTs)" to the fight against poverty.

Conceptualizing the terms

1. E-Agriculture

"E-Agriculture" is a global community of practice, where people from all over the world exchange information, ideas, and resources related to the use of information and communication technologies (ICT) for sustainable agriculture and rural development. Although "e-agriculture"-type activities and other initiatives to bridge the rural digital divide had already been underway around the world, the community (and the term "e-agriculture") came into being after the two World Summits on Information Society (WSIS) in 2003 and 2005. With WSIS participants identifying and naming "e-agriculture" as a key action line to address the Millennium Development Goals, the Food and Agriculture Organization of the United Nations (FAO) was assigned to lead the development and subsequent facilitation activities that would truly engage stakeholders at all.[4]

2. Information and Communication Technologies (ICTs)

ICT is a range of electronic technologies which when converged in new configurations are flexible, adaptable, enabling and capable of transforming organisations and redefining social relations. The range of technologies is increasing all the time and there is a convergence between the new technologies and conventional media (Michiels and Van Crowder, 2001). This rapid and ongoing convergence means that devices such as digital cameras, digital video cameras and players, personal digital assistants, slide projectors and mobile telephones are also compatible with more traditional media such as radio (digital, satellite), and television (cable, digital, satellite), so that most devices can now be

[4] www.e-agriculture.org/e-agriculture(Accessed on August 13,2013

linked to others to share and exchange information and allow it to be used in such a way that they can also be categorised under ICT. Even books are being incorporated into ICTs, either through the potential for informal web publishing or more formal digital book publishing with designated readers or e-books. ICTs, therefore, are an expanding assembly of technologies that can be used to collect, store and share information between people using multiple devices and multiple media levels (Chapman and Slaymaker, 2002).

3. E-Governance

According to the World Bank, "E-Government" refers to the use by government agencies of information technologies (such as wide area networks, the Internet, and mobile computing) that have the ability to transform relations with citizens, businesses, and other arms of government. These technologies can serve a variety of different ends: better delivery of government services to citizens, improved interactions with business and industry, citizen empowerment through access to information, or more efficient government management. The resulting benefits can be less corruption, increased transparency, greater convenience, revenue growth, and/or cost reductions.

4. Digital Divide

The digital divide refers to the difference between people who have easy access to the Internet and those who do not. A lack of access is believed to be a disadvantage to those on the disadvantaged side of the digital divide because of the huge knowledge base that can only be found online. The digital divide appears in a number of different contexts, including:

- Differences between rural and urban Internet access
- Socioeconomic differences between people of different races, income and education that affects their ability to access the Internet
- Differences between developed, developing and emerging nations in terms of the availability of Internet.[5]

Farmers' need for information

According to Kemp (1976) "information has been described as the fifth need of man ranking after air, water, food and shelter". Everyone needs information about everything in his everyday life. In agriculture, relevant and timely information helps the farming community to take the right decisions for achieving sustainable growth in agricultural activities. Use of information in agriculture enhances farming productivity in a number of ways. Availability of information on weather trends, best farming practices, and timely access to market information help farmers make correct decisions about what crops to plants and where to sell their products

[5] www.techopedia.com/definition/605/digital-divide, accessed on August 14, 2013

and buy inputs from (Bachhay, 2012). Farmers require the following information (Van den Ban, 1998):

- Most appropriate technological options
- Management of technologies, including optimal use of inputs
- Changing farm system options (mixed farming and diversification, animal
- husbandry, fisheries)
- Sourcing reputable input suppliers
- Collective action with other farmers
- Consumer and market demands for products
- Quality specifications for produce
- Time to buy inputs and sell produce
- Off-farm income-generation options
- Implications of changing policies (input subsidies, trade liberalization)
- Access to credit and loans
- Sustainable natural resource management and coping with climate change

The author conducted a study among the farmers of the district of West Tripura in the state of Tripura in India and observed that the respondents sought the following information on crop husbandry:

- Soil testing information: where to do the soil testing
- Availability of quality seeds
- Proper management of seedbeds and seed treatment techniques
- Selecting fertilizers and application methods
- Identifying pests and diseases and controlling measures
- Methods for harvesting
- Checking crop loss
- Proper storage methods for non-perishable food items

The Bangladesh chapter of Katalyst[6], an international advisory firm, in its report on "Making ICT work for Bangladesh's farmers" in 2012, came up with the following conclusions in terms of farmers' needs for and the available sources of supply of information:

1) Throughout the harvesting season, 83% of Bangladeshi farmers typically seek information on disease prevention, 57% on market price information, and 29% will try to get advice on how to make their farms more productive.
2) In the eyes of the farmer, the country's estimated 13,000 public agricultural extension officers remain one of the most trustworthy sources of information.
3) The private sector is becoming an increasingly trusted source of agricultural information, although as vendors of agricultural inputs and traders in farm produce, they are mostly sought out for advice on the usage of the inputs in

[6] www.katalyst.com.bd/.../Case%20Study%20Number%206_3rd%20versi.../Accessed on August 22, 2013

which they deal, or on market access issues concerning the particular goods they commercially trade in. Information given is largely product-specific and may still be somewhat "product-push" in the case of some input dealers.

4) Peer groups and lead farmers will always be a valuable information source to the smallholder. Farmers in Bangladesh typically share any new, relevant pieces of information with upwards of five others, be they neighbours, peers, or family members.
5) Print and broadcast media also carry stories and programmes of relevance to farmers, and television remains a supply-push medium, able to communicate agricultural news and raise awareness of common concerns, but unable to overcome a natural lack of interactivity, or cater to more specific individual needs.

Information search behaviour of farmers and its potential impacts on farm productivity, income and welfare depend on the interaction of a number of factors such as those that influence the behavior, context of search, content and source; and assess, use and act on information (Diekmann et al, 2009 and Wilson, 2006) (See Appendix-I, Figure-1).

One approach that is recommended is the use of an Agricultural Knowledge and Information System (AKIS) as an institutional framework that can be used in both vertical and horizontal technology transfer. The AKIS has been adopted by the FAO and the World Bank. Agricultural Knowledge and Information Systems for Rural Development (AKIS/RD) aims to establish the institutional framework and dynamic processes of information integration and exchange that are necessary to promote agricultural development (Chapman, Slaymaker and Young, 2002) (See Appendix-I, Figure-2).

Agricultural Extension System of Bangladesh and India

Extension needs to expand its role from technology transfer to include roles such as problem solving, education, and human development. To perform these roles, it needs an increasing level of skills (Van Beek, 1997). None of these four functions should be left out when designing or evaluating an extension project. To remain relevant and useful in the years to come, the public sector extension system has to strengthen its understanding on technology, markets, prices, and policies either by recruiting specialists or by contracting out these services (See Appendix-I, Figure-3).

In the present context, extension services in India are supported as follows: [7]

Public extension services:

- State government line departments operated extension (Departments of Agriculture, Horticulture & Livestock Development)
- State agriculture universities based extension (Directorates of Extension,

[7] http://agricoop.nic.in/policy_framework.htm#2, Accessed on August 22, 2013

- Krishi Vigyan Kendras [KVKs] and Krishi Gyan Kendras [KGKs])
- ICAR extension (Zonal Research Stations/Krishi Vigyan Kendras, Agriculture Technology Information Centres [ATICs], Institute Village Linkage Programme [IVLP] etc.)

Private extension services

- Community-based organizations (Farmers' Organizations, Farmers'
- Cooperatives, Self Help Groups, etc.)
- Para Extension Workers (contact farmers, link farmers, gopals, mitra kisans, mahila mitra kisans, etc.)
- Agri-Clinics & Agribusinesses
- Input Suppliers/Dealers (Pesticides, Seeds, Nutrients, Farm Implements, etc.)
- Corporate Sector (Commercial Crops – tobacco, tea, coffee, oilseeds [sunflower], vegetables, Seeds, Farm Implements – tractors, threshers, sprinklers, drip irrigation, etc.)

Mass Media & Information Technology

- Print media – vernacular press
- Radio, television, private cable channels, etc.
- Electronic connectivity through computers, NICNET, internet, V-SAT, etc.
- Farm Information and Advisory Centres (FIACs)
- Private web portals
- Public & private information shops

There are many public agencies and organizations that are providing extension services to the farmers of Bangladesh. These agencies, including government agencies, many non-government organizations (NGOs), commercial traders and input suppliers, are operating at both the rural and urban areas within the country. Together, all these partners comprise the National Agricultural Extension System (NAES). Each organization has its own operational strategy for providing extension services to farmers. The Department of Agricultural Extension (DAE) under the Ministry of Agriculture is the biggest agency employing nearly 14,000 personnel who are providing extension service to rural areas across the country. In addition, there are 14 agricultural training institutes (ATIs) and the universities specializing in agricultural education that train these front-line extension staff.[8]

The main policy findings drawing from the analysis of National Extension Coverage Survey (2003), Bangladesh are:

1. Most farmers, particularly women, do not have access to extension services. Services are generally less available for farmers who belong to the lower income categories and have less operating land.
2. The national agricultural extension system is not performing as envisaged in the New Agricultural Extension Policy (NAEP), and the system is not being managed

[8] http://www.worldwide-extension.org/asia/bangladesh/e-bangladesh, Accessed on August 22, 2013

in order to match supply with demand.

3. Those elements of the national agricultural extension system that are performing the best are the ones to whom the NAEP pays little attention - farmers themselves, private organizations and the mass media.

4. Reform in governmental service providers as envisaged in the NAEP has not occurred. In particular, the extension service providers (public goods and services) of the government organisations (GOs) continue to focus on male farmers with larger land holdings and higher incomes. Government organisation delivery has failed to take advantage of opportunities to work with farmer groups.

5. Despite a 12-year programme for institutional, strategic and service reform in the Department of Agricultural Extension (DAE), little has changed on the ground, and DAE itself has largely failed to implement its own Revised Extension Approach.

6. Where services are received by farmers, they seem to be of high quality, the use of advices was high, the results were good, and farmers in all categories (male and female) intended to repeat adoption. Quality is not necessarily a problem, but quantity is definitely a problem.

7. The system is biased towards field crop extension, followed by vegetable crop extension. Farmers are engaged in diverse agricultural practices and there are significant gaps in the delivery of advice on other sectors such as poultry.

8. Mass media appears to be supporting information dissemination on the subject of fruit cultivation and forest trees, which is positive.

9. The private sector is a significant player in the extension arena. The advices from the private sector is less correlated to income or farm size - equity of access is higher. The concept that extension service providers are broadly either GO or NGO is dis-proven.

10. NGO services, whilst tending to favor working with women, are diffuse, managed by a large number of organizations of variable sizes, have very low national coverage, and also tend to work with farmers in larger farm households with higher incomes.

11. The true role of the public sector in the Government of Bangladesh's extension services remains undefined - no incisive decisions have ever been made. GO service provision remains relatively "large" but pluralism has increased.

Uddin (2008) had identified the following specific problems in the extension work in Bangladesh:

a) Lack of definite criterion for group formation of farmers
b) Unavailability of the Sub Assistant Agricultural Officers (SAAOs)
c) Inefficiency of the Sub Assistant Agricultural Officers (SAAOs)
d) Inadequate Provision for rewarding the devoted workers and punishing the negligent ones

e) Administrative weaknesses
f) Insufficient cooperation and coordination among different agencies
g) Technological shortcomings
h) Inability to give advice to farmers on the marketing of produces
i) Socio-political barriers
j) Lack of active village-based cooperatives and farmers' organizations
k) Lack of public commitment

Transformation of traditional societies to knowledge societies and beginning of e-Agriculture

In sociology, traditional society is a society characterized by an orientation to the past, not the future, with a predominant role for custom and habit.[9] A knowledge society generates, processes, shares and makes available to all members of the society knowledge that may be used to improve the human condition. A knowledge society differs from an information society in that the former serves to transform information into resources that allow society to take effective action while the latter only creates and disseminates the raw data (Castelfranchi, 2007). Farmers' decision on selection of crops depends on a number of factors as identified by Van den Ban (1998):

a) What technological options could be used profitably in his/her situation keeping in view the potential resource constraints in terms of land, capital, labour and knowledge?
b) How to manage the various technologies? (e.g.: how to make optimal use of new inputs in his farm?)
c) How and when to change his farming system? (e.g. diversifying from crop production to mixed farming or vegetable or animal production)
d) For which type of products is there a good demand in the market?
e) What are the quality specifications he should achieve to get good value for his produce and how to achieve?
f) How, when and where to buy inputs and sell products?
g) How to make decisions collectively on resource use and marketing?
h) How to find quickly the most relevant and reliable knowledge and information?
i) What are the feasible off-farm income generation options available for him and how far he could depend on them?
j) What are going to be the implications for his farming if the input subsidies are phased out and/or if the trade in agriculture is liberalised?

E-Readiness for E- Agriculture

E-readiness (electronic readiness) is a measure of the degree to which a country,

[9] en.wikipedia.org/wiki/Traditional _society,Accessed on August 8, 2013

nation or economy may be ready, willing or prepared to obtain benefits which arise from information and communication technologies (Dada, 2006).

According to Venkatesh (et al 2003), the basic concept behind the acceptance and use of information technologies is a process of three constructs (See Appendix-I, Figure-4). They identified the valid factors with regards to technology acceptance and combining these factors developed a model known as Unified Theory of Acceptance and Use of Technology (UTAUT). This model had a number of constructs in relation to each of the factors and also shows the interaction between variables, genders, age, experience and voluntariness of use (See Appendix-I, Figure-5). The following are the factors and their root constructs:

Performance Expectancy: Perceived Usefulness, Extrinsic Motivation, Job Fit, Relative Advantages and Outcome Expectations.

Effort Expectancy: Perceived ease of use and complexity

Social Influence: Subjective norm, social factors and image

Facilitating Conditions: Perceived behavioural control, facilitating conditions and compatibility.

For e-readiness three strong interventions are needed: infrastructural development for E-Application, farmers' preparedness for E-Agriculture and preparedness of line departments:

a) Infrastructural development for E-Application: Developing countries, where ICT infrastructure is available mainly in the urban areas, need to focus on providing rural areas with infrastructure and access in order to narrow the digital divide and infrastructure include-

1. Landline/Fixed telephone line for every 100 inhabitants.
2. Mobile connectivity for every 100 inhabitants.
3. Computer/laptop for every 100 inhabitants.
4. Internet subscription for every 100 inhabitants.
5. Highspeed Internet connectivity for every 100 inhabitants.
6. Cost of connectivity and usage charge of fixed telephone line, mobile, internet & high speed internet.
7. Percentage of public Internet access centres.
8. Radio, television sets for every 100 inhabitants.

b) Farmers' preparedness for E-Agriculture: To accrue the benefits of e-agriculture, preparedness among the farming community is imperative and realistic consideration and this readiness should take account of the following:

1. Supporting the farmers with informal education in different modes viz. training.
2. Enhancing the farmers' cosmopolitness.
3. Promoting education among the offsprings and relatives of farmers for

secondary support.
4. More interaction with extension people.
5. Presenting and promoting e-agriculture success stories among the farming community.
6. Use of more friendly softwares for easy handling of ICT tools.
7. Reducing the cost of ICT usage.
8. Creating ICT infrastructure in the villages.
9. Installing kiosks with local support.
10. Giving emphasis on local language and local people during content development.

c) Preparedness of line departments: The departments of agriculture have both top down and bottom up approaches to information flow both in India and Bangladesh. The line of command is top down. The Department of Agriculture has to be prepared for the installation of ICT infrastructure in the department and train its heterogeneous human resource for ICT convergence and application (See Appendix-I, Figure-6). The success of the above considerations requires triangulating the farmers, market and government as a process of ICT as e-agriculture is merely a tool (See Appendix-I,Figure-7).

Recent ICT and e-Agriculture Policy of the governments of India and Bangladesh

A. Policy of the Indian Government

Under the National e-Governance Plan–Agriculture (NeGP-A), more than 100 services were identified and prioritized into 22 services initially. Now there are 30 services following widespread consultation with various stakeholders. Moreover, the scope of NeGP-A was defined and processes, services and functions were mapped. These 30 services (See Appendix-II, Table-2) were then finally clustered into 12 services from the point of view of application, development and implementation. These include G2F (Government to Farmer), G2B (Government to Business) and G2G (Government to Government) services. The services offered are: [10]

- Information on pesticides, fertilizers and seeds
- Providing information on soil health
- Information on crops, farm machinery, training and good agricultural practices (GAPs)
- Information on weather forecasts
- Information on prices, arrivals, procurement points, and providing interaction platform
- Electronic certification for exports and imports
- Information on marketing infrastructure
- Monitoring implementation/evaluation of schemes and programs

[10] http://negp.odacmohali.in/Projects/Agriculture.aspx?id=3&page=Services,Accessed on August 26, 2013

- Information on fishery inputs
- Information on irrigation infrastructure
- Drought relief and management
- Livestock management

B. The Bangladesh Government's policy

The following are the outcomes of the Sub-sectoral study on ICT in Agriculture and Disaster Management by the Bangladesh Agricultural Research Council, Hussain (2010):

1. The National ICT Policy 2002 could not reach the perceived levels of success due to lack of appropriate plans to achieve the goals set in the policy as well as poor implementation of the underlying actions. Consequently, the Government took an initiative in 2008 to update the National ICT Policy 2002 and make it befitting with the current and foreseeable future needs of the country.

2. The information disseminated by e-Agriculture can be divided into several major areas, which can be termed as the services of e-Agriculture. These are:

i. Weather information
ii. Price information
iii. Production and cultivation techniques
iv. Plant nutrients and water usage
v. Education and health information
vi. Government and non-government facilities
vii. Demands and current stock information
viii. Diseases and insect information

3. Revitalizing the Agricultural Technology System in Bangladesh for the use of ICT, including Internet connectivity, as an aid to extension. Capacity building of the district/upazila/union level staff of all partners, including farmers, is the need of the time. Overall human resource development is also a concern in relation to the use of new sciences such as biotechnology, informatics and ICT in agricultural research.

4. In the draft Agriculture Policy (2009), importance was attached to communication media to make extension services more efficient and effective. In disseminating extension services, both traditional and advanced media and ICT will be utilized. Agricultural Information Service (AIS) will be strengthened both in terms of workforce and modern facilities to enable effective information dissemination and technology transfer.

5. The objectives of National ICT Policy 2008 (proposed) were:

(1) Social equity
(2) Productivity

(3) Integrity
(4) Education and research
(5) Employment
(6) Strengthening exports
(7) Healthcare
(8) Universal access
(9) Environment, climate and disaster management
(10) Support for ICTs

The proposed National ICT Policy 2008 was revised as the ICT Policy 2009 incorporating specific directions and guidelines reflecting most of the priorities of the government's "Digital Bangladesh" agenda. The policy has been approved in the cabinet. The 9th Parliament has already passed the Right to Information Act. The act requires legal imperatives that corroborates and promotes the overall context of the "Digital Bangladesh" vision.

Joint Plan Perspective and Developing the Framework

India and Bangladesh aspire to prosper with their exciting opportunities and by managing the challenges. Joint strength is always helpful in this time of economic meltdown and supporting each other's markets and farming communities, because the fate of the farmers are regularly squeezed between the vagaries of nature in one extreme and the volatile market in other. The propose framework for joint perspective plan should begin with bilateral interactions between India and Bangladesh, namely those between ministers and secretaries of both the countries. Involvement and convergence of the ministers and secretaries of the ministries of foreign affairs, agriculture, information technology and the departments of trade and commerce of the two countries may serve as the beginning of mutual confidence building. The educational institutions of both the countries including the state agricultural universities (SAUs), the Indian Council of Agricultural Research (ICAR), the agricultural universities of Bangladesh, the research institutes and the allied sectors should work together. Representatives from the trade and farmers' bodies can also play pivotal roles. The representatives from all these wings will have to form the joint team for preparing policy guideline. According to the policy guidelines, the institutions concerned should be involved to work with the farming community as part of the process for the application of e-Agriculture in the grassroots level (See Appendix-I, Figure-8).

Conclusion

Among the South Asian countries, India and Bangladesh share common objectives for agricultural development. Both have the necessary availability of fertile lands and more than 65% of the populations of both the countries depend on agriculture for livelihood. The adjoining states and regions of the two countries have common language and social structures. Moreover, both the countries have achieved tremendous improvement in information technology and the applications

of ICT have proven their positive roles in agricultural and rural development (See Appendix-II, Table-1). It can therefore be concluded that time has come for ICT to reach its pinnacle through joint benevolent application in agriculture and the allied sectors in the form of e-Agriculture.

Recommendations

1) More interaction at the foreign ministry level to pave way for bilateral talks on e-Agriculture.
2) Joint initiative for agriculture in the border areas and management of the allied sectors.
3) Exchanging technical know-how among the various institutes related to agriculture and the allied sectors.
4) Better exchange between students and scientists at field and institutional levels.
5) Going for joint studies to find out the problems and prospects of agriculture of both the countries.
6) Strengthen bilateral trade in agriculture and the allied sectors between the two neighbours.
7) Computerization of all the line departments.
8) Internet connectivity among and with the departments needs to develop.
9) Development of a core group with representation from both countries.
10) Improvement of a specialized corridor for trade and railway connectivity.
11) Building, promoting and maintaining confidence and faith among the citizens of the two countries.

References

Ahmed,C.Q.K.M. (2010). Agriculture in Bangladesh: Present position, Problems, Prospects and Policy, retrieved from www.bpatc.org.bd/handouts/Agriculture_Bangladesh.ppt, accessed on August 16, 2013.

Bachhay, N. B. (2012). Information Needs of the Rural Farmers: A Study from Maharashtra, India: A Survey, Library Philosophy and Practice (e-journal). Paper 866. retrieved from http://digital commons.unl.edu/libphilprac/866, accessed on August 19, 2013.

Castelfranchi, C. (2007). Six Critical Remarks on Science and the Construction of the Knowledge Society. Journal of Science Communication, 6(4), 1-3.

Chapman, R. and Slaymaker, T. (2002). ICTs and Rural Development: Review of the Literature, Current Interventions and Opportunities for Action. ODI Working Paper 192. London: Overseas Development Institute.

Chapman, R., Slaymaker, T., Young, J. (2002). Livelihoods Approaches to Information and Communication in Support of Rural Poverty Elimination and Food Security, retrieved from www.odi.org.uk/resources/docs/4788.pdf, accessed on August 19 2013.

Dada, D. (2006). E-readiness for Developing Countries: Moving the Focus from Environment to Users, The Electronic Journal of Information Systems in Developing Countries,27(6), pp.1-14. Retrieved from https://www.ejisdc.org/Ojs2/index.php/ejisdc/article/viewFile/219/184, accessed on August 28, 2013.

Diekmann et al. (2009) in Babu, S.C., Glendenning, C.J., K Asenso-Okyere, K. and Govindarajan, S.K. (2011), Farmers' information needs and search behaviors: Case study in Tamil Nadu, India, International Food Policy Research Institute (IFPRI), retrieved from www.ifpri.org/sites/default/files/publications/ifpridp01165.pdf, accessed on August 20, 2013.

Glendenning, C.J. and Ficarelli, P.P. (2012), The Relevance of Content in ICT Initiatives in Indian Agriculture, IFPRI Discussion Paper 01180.

Hussain, G. (2010), ICT in Agriculture and Disaster Management; Sectoral Study in connection with the preparation of Vision Document-2030 and beyond, Bangladesh Agricultural Research Council. Retrieved from http://www.barc.gov.bd, accessed on August 15, 2013.

Islam, A.T.M.S. (2009). Bangladesh Agriculture: In 21st Century, retrieved from www.amazon.in/Problems-Prospects-Cultivation-Jessore.../3845437502, accessed on August 3, 2013.

Jahiruddin, M. and Satter, M. A. (2010), Agricultural Research Priority : Vision- 2030 and beyond, Sub-sector: Land and Soil Resource Management, Bangladesh Agricultural Research Council, and Bangladesh Agricultural University, retrieved from http://www.barc.gov.bd/subsector.php. Accessed on August 13, 2013.

Kemp, D.A. (1976). Nature of knowledge: An introduction for librarians, Clive Bingley: London, pl0l.

Lele, U., et al. (2010). Transforming Agricultural Research for Development. Paper presented at the Global Conference on Agricultural Research for Development, Montpellier, France.

Meera, Shaik. N., Jhamtani, Anita, and Rao, D.U.M. (2004), Information and Communication Technology in Agricultural Development: A Comparative Analysis of Three Projects from India. Agricultural Research & Extension Network, Network Paper No.135. Retrieved from www.odi.org.uk/resources/docs/5186.pdf, Accessed on August 25, 2013.

Michiels, S.I. and Van Crowder, L. (2001). Discovering the 'Magic Box': Local Appropriation of Information and Communication Technologies (ICTs). Rome: Food and Agriculture Organisation of the United Nations, Communication for Development Group, Extension, Education and Communication Service.

National Extension Coverage Survey (2003), Agricultural Extension in Bangladesh: An Entitlement of All Farmers? Retrieved from www.lcgbangladesh.org/.../ The%20Results%20of%20a%20National%20. Accessed on August 22, 2013.

National Academy Of Agricultural Sciences (2005). Redefining Agricultural Education And Extension System in Changed Scenario, Policy Paper No. 31. Retrieved from www.naasindia.org/Policy%20Papers/Policy%2031.pdf. Accessed on August 28, 2013.

Saravanan, R., (2010), ICTs for Agricultural Extension: Global Experiments, Innovations and Experiences. New India Publishing Agency, New Delhi.

Sulaiman, V. R., and Van den Ban, A.W. (2000). Agricultural extension in India; The next step, Policy brief 9, New Delhi: National Centre for Agricultural Economics and Policy Research.

Uddin, M. (2008). Agricultural Extension Services in Bangladesh: A Review Study. Bulletin of Institute of Vocational and Technical Education No.5 October, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh 2202 Bangladesh. Retrieved from http://ir.nul.nagoya-u.ac.jp/jspui/bitstream/2237/12150/1/p119-130.pdf. Accessed on August 22, 2013.

Van den Ban, A. (1998). Supporting Farmers' Decision-Making Process by Agricultural Extension. Journal of Extension Systems 14:55–64.

Van Beek, P. G. (1997). Beyond technology transfer, European Journal of Agricultural Education and Extension, 4(3), 183-192.

Venkatesh, V., Morris, M., Davis, G. and Davis, F. (2003) User Acceptance of Information Technology: Toward a Unified View, MIS Quarterly, 27, 3, 425-478.

Wilson (2006) in Babu, S.C., Glendenning, C.J., K Asenso-Okyere, K. and Govindarajan, S.K. (2011), Farmers' information needs and search behaviors: Case study in Tamil Nadu, India, International Food Policy Research Institute (IFPRI), retrieved from www.ifpri.org/sites/default/files/publications/ifpridp01165.pdf, accessed on August 20, 2013.

APPENDIX-I

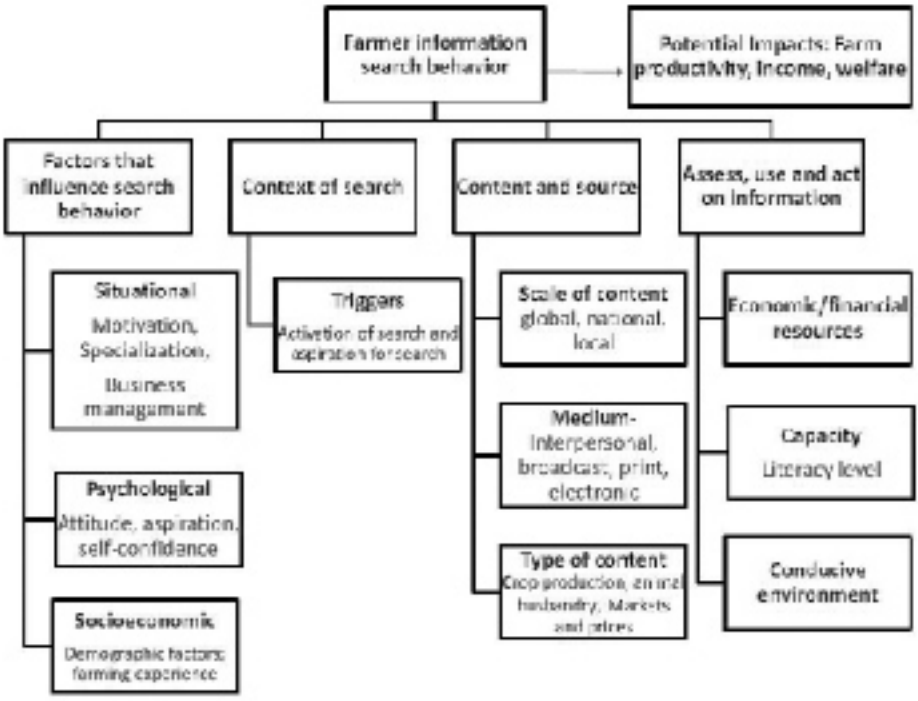

Figure-1: A Conceptual Framework of Farmers' Information Needs and Search Behavior [Based on Diekmann et al (2009) and Wilson (2006)].

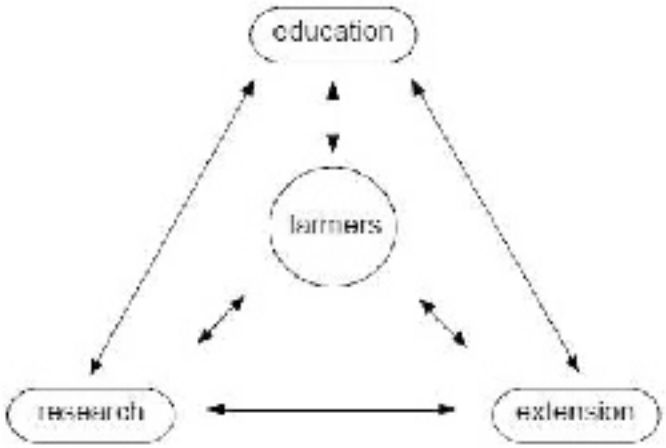

Figure-2: The Knowledge Triangle of an AKIS/RD, Chapman, Slaymaker and Young (2002)

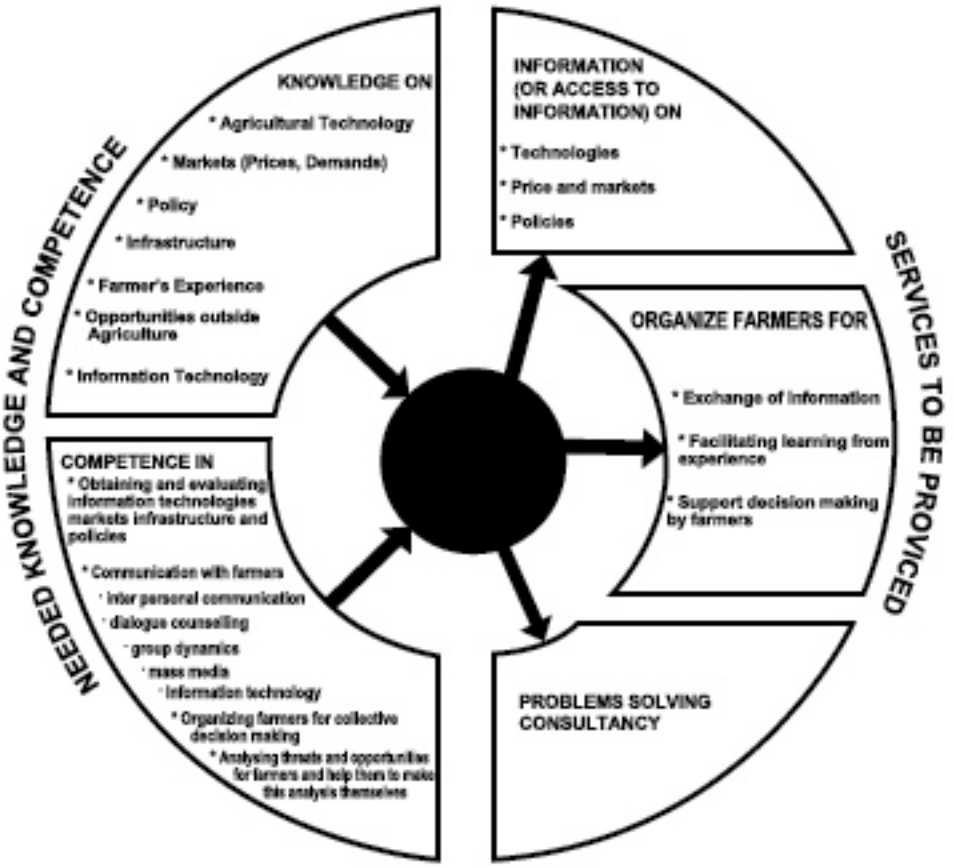

Figure-3: Future roles and competencies for extension
Sulaman and Van den Ban (2000)

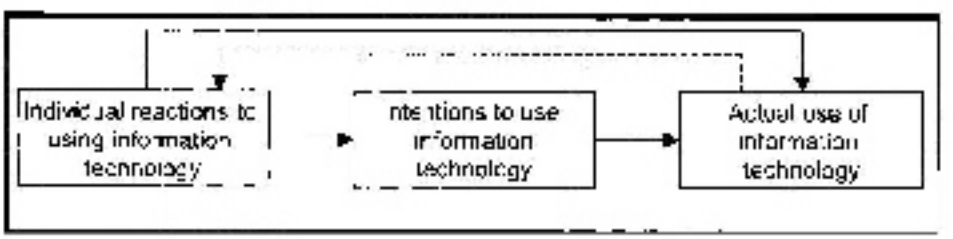

Figure: 4: Basic concept underlying user acceptance models,
Venkatesh et al. (2003)

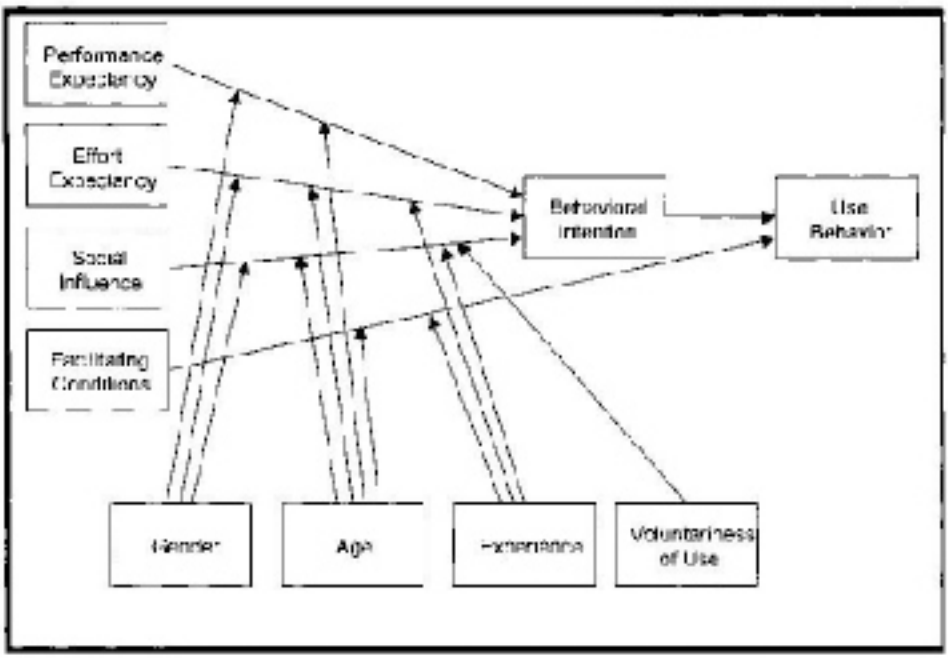

Figure-5: The Unified Theory of Acceptance and Use of Technology, Venkatesh et al. (2003)

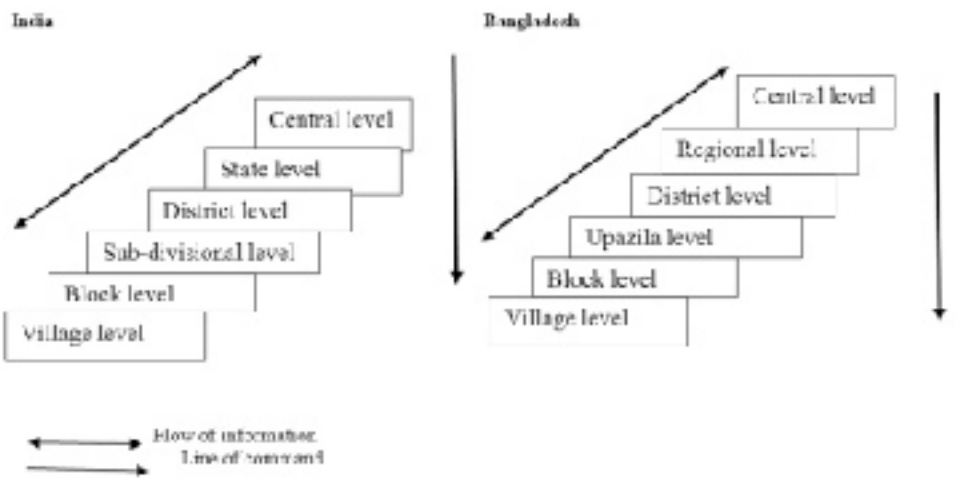

Figure-6: Line of command and flow of information in the Department of Agriculture

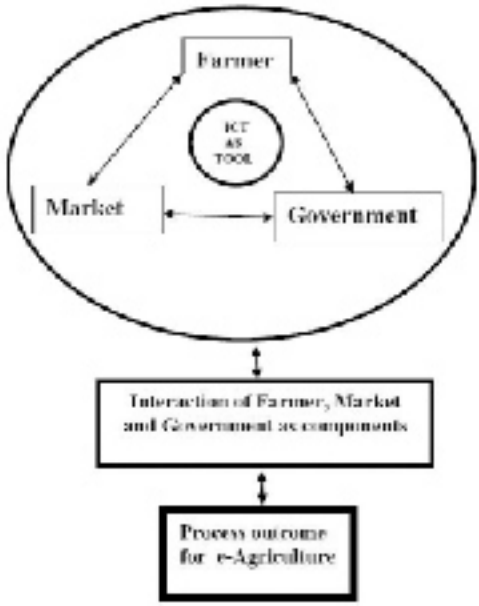

Figure-7: Triangulating the farmers, market and government as a process

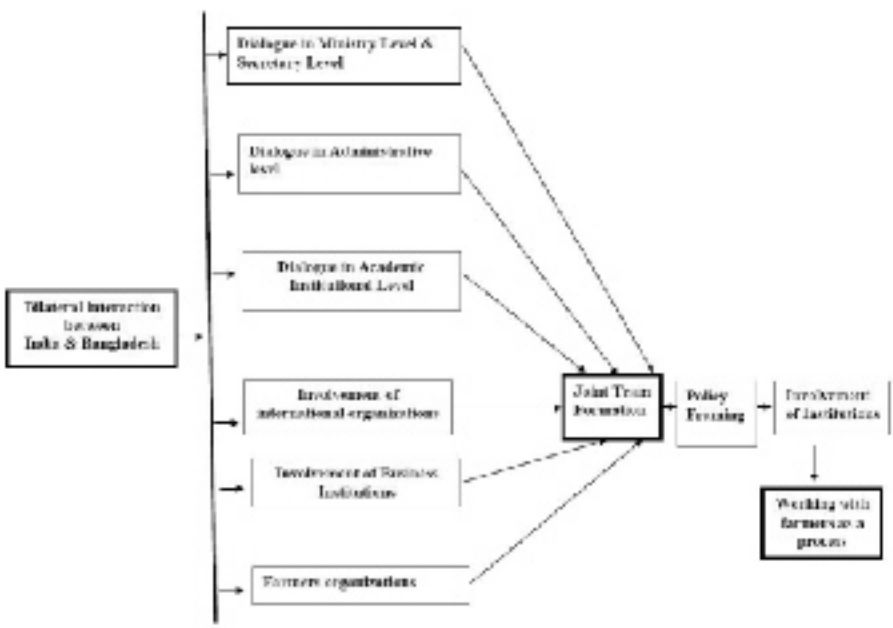

Figure-8: Joint Plan Perspective and Developing the Framework

APPENDIX-II

Table-1: ICTs' contributions in agriculture and rural development

Authors/Researchers	Findings/Observations
Meera et al.(2004)	• Efforts should be made to incorporate ICT in all endeavours related to agricultural development. • The organizations and departments concerned with agricultural development need to realise the potential of ICT for the speedy dissemination of information to farmers. • Government at national and state level in India has to reorient agricultural policies so that a fully-fledged strategy is formed to harness ICT's potential for assisting overall agricultural development.
Saravanan (2010)	It is expected that integration of ICTs in agricultural extension will provide needed impetus to agricultural sector and ICTs can complement the traditional extension system for "knowledge resource" delivery to millions of farmers.
Glendenning and Ficarelli (2012)	ICTs have the potential to reach many farmers with timely and accessible content. The content that the ICTs deliver has more relevance if it is localized and context specific, as this improves the value and actionability of the information, which can have important impacts on farm management. Content management and development through ICTs is important to examine because public extension services may be able to increase their efficiency and effectiveness by using these tools to support their work with farmers. For knowledge management in agriculture for rural livelihoods, it is necessary to put in place a centralized search engine, or harvester, to access the decentralized and dispersed digital agricultural information repositories and network of experts.
NAAS (2005)	Suggestive strategic intervention - formation of commodity specific extension kiosk or indigenous food, horticultural crops, livestock, poultry, rabbitry, bee keeping, mushroom, medicinal and aromatic plants, sericulture, tea and value addition enterprises.

Table-2: Thirty types of farmer-centric services

Service-1:	Providing information on quality pesticides
Service-2:	Providing information on quality fertilizers
Service-3:	Providing information on quality seeds
Service-4:	Providing information on soil health
Service-5:	Providing information on crop diseases
Service-6:	Providing information on weather forecast and agro-met advisories
Service-7:	Providing market information on prices and arrival of agricultural commodities
Service-8:	Providing market related information to make sure that farmers get better prices
Service-9:	Providing interaction platforms for producers, buyers and transport service providers
Service-10:	Providing information on minimum support price and government procurement points
Service-11:	Providing electronic certification of imports and exports
Service-12:	Providing information on marketing infrastructure and post-harvest facilities
Service-13:	Providing information on storage infrastructure
Service-14:	Monitoring the implementation of schemes/programmes
Service-15:	Providing information on training support to farm schools for adoption of good agricultural practices
Service-16:	Sharing good agricultural practices with farmers and trainers and providing extension support through online videos
Service-17:	Providing information on fisheries
Service-18:	Providing information on irrigation infrastructure
Service-19:	Providing information on crop development programmes and production technologies to increase productivity
Service-20:	Providing information on farm machinery and implements
Service-21:	Providing information on drought related aspects
Service-22:	Providing information on livestock development
Service-23:	Providing information on financial services available from PACs, RRBs and public sector banks
Service-24:	Providing information on financial security to persons engaged in agriculture and allied activities through insurance products and other support services (Agricultural Insurance Services)
Service-25:	Providing information on the use of plastics in agriculture, horticulture and floriculture.
Service-26:	Providing information on medicinal plants
Service-27:	Providing information on patent on traditional practices
Service-28:	Providing information on allied sectors like sericulture, floriculture, horticulture and bee-keeping
Service-29:	Providing information to farmers on food processing technologies
Service-30:	Providing quality information about ways to increase milk production

Article

Providing Sustainable Solutions to Farmers through Agricultural Helpline: The Case of Bangladesh[1]

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Abstract
In Bangladesh, agriculture plays a major role in terms of its GDP contribution and as a source of employment in rural areas. Unfortunately farmers in Bangladesh face many constraints, access to reliable and timely agricultural information being chief among them. The present paper explores how Katalyst, a multi-donor funded market development project, with a view to increase the competitiveness of farmers and small enterprises, addressed this constraint by collaborating with telecom operators and launching agricultural helpline. The paper will put special emphasis on the viability and sustainability of offering ICT based solutions to farmers through the lens of systemic change.

Key words
ICT, M4P, agriculture helpline, telecom, systemic change, Bangladesh, farmers

Introduction
Farmers in Bangladesh are faced with many challenges, access to reliable and timely agricultural information being chief among them. This information need persists throughout the various stages of the agricultural process, ranging from identifying the best quality seeds and improved production techniques to having information on disease prevention techniques and pesticide dosage. To fulfil their information needs, farmers depend on different sources of information such as Sub-Assistant Agricultural Officers (SAAOs), input dealers, peer farmers, etc. However, availability of these sources during times of need and the reliability of the

[1] The article is written on a personal title and views expressed are not necessary that of Katalyst

information provided remains a challenge.The telecommunications industry has been one of the fastest growing industries in the country and has witnessed remarkable growth in recent years. The active subscriber base of the major telecom operators increased from 70 million in 2010 to 98 million in 2013 (BTRC). However, with urban markets becoming saturated, the major telecom operators started looking towards rural markets to expand their customer base.

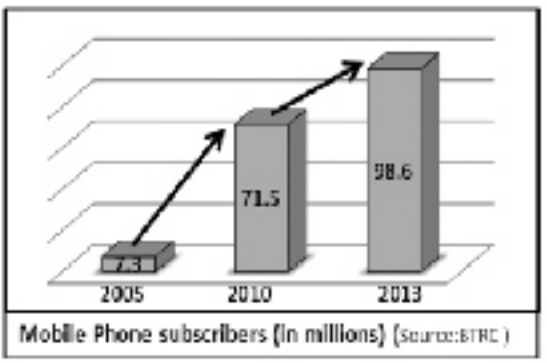

Figure 1: Cell-phone subscriber base

Katalyst, a multi-donor funded market development (M4P) project, with a view to increase the competitiveness of farmers and small enterprises, decided to capitalize on this opportunity to reach their target group. In 2008, Katalyst partnered with Banglalink to help them launch Jigyasha 7676, an agriculture helpline targeted to reach rural farmers. The idea was very simple: by dialing 7676, any Banglalink subscriber would be connected to an agriculture specialist who would be able to respond to the queries of the dialer. It was hoped that the farmers would be able to get access to accurate and reliable information whenever needed. Seeing the success of Banglalink, other telecom operators also decided to enter the market to provide similar services to their clientele, bringing about a systemic change in the market for agricultural information. This paper will attempt to look at the successes of the agriculture helpline and the systemic changes brought about by it. Special emphasis will be attached with the viability and sustainability of offering ICT-based solutions to farmers through the lens of systemic change.

Literature Review

Agriculture continues to be the engine that propels economic growth in most developing countries. In Bangladesh, agriculture contributes around 20% of the GDP and nearly 50% of the labor force is engaged in agriculture; although the contributions in both areas are declining (Bangladesh Bureau of Statistics, 2011). Kizilaslan (2006) argues that proper dissemination of information for agricultural and rural communities is a crucial tool in the fight against poverty and deprivation. While Kiplang'at (1999) suggests that dissemination of relevant information to the

farming communities can facilitate the effective adoption of agricultural inputs, decision-making on markets and adoption of scientific methods.

Government extension officers, while extensive in number, still face difficulty in serving the large number of farmers effectively (Poole, 1994). According to the National Extension Coverage Survey (2003), conducted as part of the Agricultural Services Innovation and Reform Project (ASIRP), the government extension officers from the Department of Agriculture Extension (DAE) and Livestock (DLS) have a total coverage (contact) of around 30%. On the other hand, the rapidly growing telecommunication network and mobile phone penetration meant that such information and communication technology (ICT) could now be used affordably for providing timely and relevant agricultural information to farmers.

ICT offers technologies and tools that, engaged effectively, can facilitate improved access to information which can assist farmers in protecting themselves from potential losses, while learning and applying new production techniques and technologies can help them make optimum use of limited resources, thereby increasing productivity and production (Katalyst, 2011). Thus it is not surprising that many have come to see ICT as a potentially powerful tool for achieving sustainable development (Paz, Russell, & Johnson, 2006). Research conducted by Lio and Liu (2006) found strong correlation between the use of ICT and farmers' productivity.

However it is all too possible to get caught up in the technology and forget the original intention of serving the farmer's information need. As Heeks (1999) argues, ICT can contribute positively to development if it is used appropriately. Unfortunately, there seems to be ample evidence of technofilia and "cyber-fetishism" in popular ICT discourse. Thus using ICT as a conduit for channeling relevant and timely information to farmers must go beyond simple access, and should focus on meaningful and effective access which translates in to action (Gurstein, 2003).

How did Katalyst intervene?

Katalyst, a multi-donor funded development project[2], tried to alleviate poverty in Bangladesh through economic advancement of rural farmers and SMEs. It tried to do so through a market development approach (also known as M4P approach or Making Markets Work for the Poor), whereby Katalyst worked with private sector partners in various agricultural or related industries to deliver services to rural farmers. These services ranged from making quality seeds available to farmers and homestead producers at an affordable rate in the form of seed minipacks, to providing integrated pest management technologies through bio-pesticides.

An M4P project tries to identify the constraints in existing market systems where the poor operates and then attempts to address those constraints in a systemic

[2] Phase 1 of the project was funded by DFID, SIDA and SDC while Phase 2 was funded by SDC, DFID, CIDA and the Embassy of Netherlands.

way. A market system can be viewed as consisting of different sets of functions, rules and players. The core is where the transaction or exchange between supply side and demand side takes place e.g. ICT vendor and farmers. Rules, including formal policy/guideline and informal norms/tradition, act to shape market outcomes and govern participation and behavior in markets. Finally supporting functions are essentially requisite for the sustenance of growth and better functioning of core exchange (M4P Synthesis Paper, 2008).

By working with the private sector and existing market players, an M4P project makes sure that it does not create any distortion in the market system. By aligning the incentives of private businesses with the intended beneficiaries, it creates a win-win situation whereby both parties stand to benefit through mutual interaction. This helps to ensure that the intended changes are sustainable in the long run, even after the project ceases to be in operation. Working with private businesses has the added benefit that the intended changes are scaled up organically when businesses increase their scale of operation or when other businesses enter the market seeing the success of the incumbents (Figure 2).

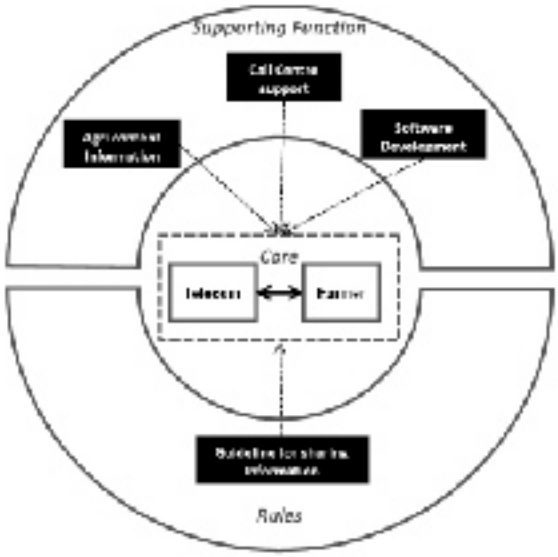

Figure 2: ICT Market System

In Phase 1 and 2, Katalyst worked in various agricultural value chains such as fish, maize, vegetables, potato, jute, etc. It also worked in a number of cross-cutting sectors such as seed, fertilizer and ICT, with ICT being one of its biggest sectors in terms of outreach.Katalyst began operation in the ICT sector by experimenting with telecenters. With the help of two local private organizations, Broadlink and DEN, Katalyst helped to set up three Rural Information Centres (RICs) in northern Bangladesh on a pilot basis. However, neither of these organizations had the capacity at the time to scale up their operations nationwide. In early 2006, Katalyst

entered into a partnership with Grameenphone, the largest mobile telecom operator in the country, to scale up the telecenter model and bring more farmers and SMEs within their reach. The service bundle included information ranging from cultivation techniques to disease prevention. Over time, more services, such as the Fertilizer Recommendation Software (FRS), were added to the bundle. By October 2008, Katalyst helped Grameenphoneto set up over 500 CICs across the country.

Following on from the success of the Grameenphone CICs, Katalyst started looking for new partners to collaborate with in the ICT sector and reach out to a greater number of farmers with possibly an alternative ICT-based platform for information service delivery. With urban markets reaching saturation point, most telecom operators at the time started looking towards rural markets in order to increase their subscription base. Banglalink, the second largest mobile telecom operator, was keen to bundle more value added services to their voice-based services to attract more customers. Two options were presented to Banglalink: the telecenter model of Grameenphone or a call center-based agricultural helpline. In order to differentiate themselves from their competitor, Banglalink opted for the call center-based agricultural helpline as a viable medium to target the farmers in rural areas.Banglalink wanted to uniquely position itself along the lines of more value added voice-based services in sharp contrast to the data/Internet services of its competitor. The idea of the call center-based agricultural helpline resonated well with Banglalink's existing expansion strategy.

The idea entailed a revenue-sharing agreement between agriculture content provider WIN Inc., established with assistance from Katalyst and Banglalink, whereby the content provider developed a tailored agricultural content management system (CMS) and trained WIT's call-center agents on how to use it. Similarly,Banglalink separately drafted a three-year contract with WIT, detailing the nature of a revenue-sharing agreement and the key performance indicators (ICT Case study, 2012[3]). Katalyst facilitated these linkages between the telecom operator, content provider and the call center. Katalyst also supported the WIN to put the necessary internal functions in place such as the CMS software, to enable WIN to offer new and tailored services to other players within the telecom industry (ICT Case study, 2012). The market system for ICT is shown in Figure 2.

Analyzing the impact of helpline

A detailed analysis of the caller data from the helpline services of Banglalink helped to discover some interesting findings (ICT Case Study, 2012). An important finding that emerged was that the ratio of relevant calls to total calls during the initial years of the helpline was very low, despite the high number of calls being made. Most of the queries were not relevant to the service being provided, i.e.

[3] The case study was titled 'Making ICT work for Bangladesh's farmers,' but throughout this paper it will be referred to as 'ICT Case Study'. For details please check the reference section.

agricultural information. However this began to change towards the end of 2011. The percentage of relevant calls to total calls rose from an average of 8% in 2010 to 88% in 2012. Even though the total number of calls went down over time, more people were now calling to get information on agriculture. This can perhaps be

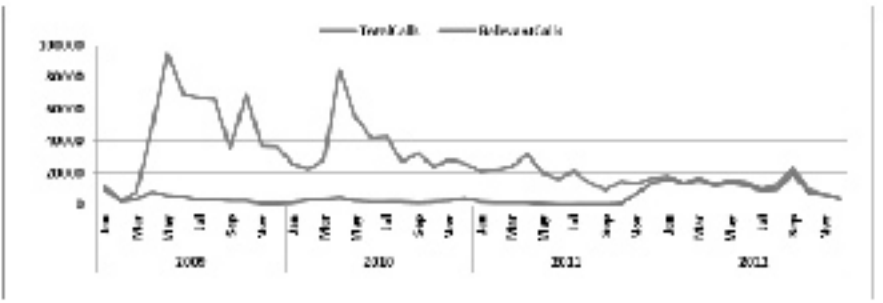

Figure 3: Relevant calls vs. total calls

attributed to the fact that Bangalink started running its own promotional campaign in the second half of 2011. Figure 3 depicts the convergence between relevant calls and total calls over time (ICT Case Study, 2012).

Figure 3 shows that with the fall in the number of unrelated calls, calls for other types of information went up, both in relative and absolute terms. For instance, the number of calls for information related to vegetables increased from 4.2% in 2011 to 23.3% in 2012. The hike was even more pronounced for fruits where the number of calls went up from 2.6% in 2011 to 22.6% in 2012. Results also show that the sub-sectors for which the most number of queries were received were fruit, grain and vegetable.The following table shows the most common types of agricultural queries made by farmers in 2011 and 2012. Information on diseases and disease prevention made up the overwhelming majority, followed by information on

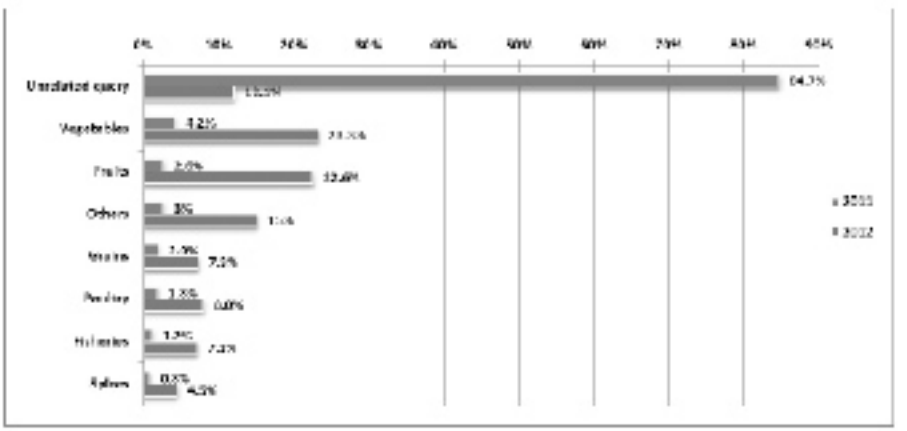

Figure 4: Types of query

cultivation techniques and fertilizer use.

In 2011, Katalyst commissioned a study to assess the impact of the agriculture helpline. The study was conducted by the Bangladesh Institute of ICT in Development (BIID) via phone interviews. A total of 350 phone interviews were conducted by randomly selecting phone numbers from the caller database. It was found that most of the respondents were male (97%) and most of their occupations were related to agriculture, fisheries or livestock. Around 32% were found to have fallen within the income bracket of Tk. 10,000-20,000 per month and around 30% within the income bracket of Tk. 5,000-10,000.40% of the respondents stated that they had called the helpline once or twice, while around 44% had called between 3-4 times. Most of the queries were made for disease related information (around

Table 1: Reasons for calling (Operator database)

Common reasonsfor calling	2011 (n=4219)	2012 (n=11711)
Disease prevention	70.3%	67.3%
Cultivation techniques	8.1%	9.7%
Fertilizer use	4.3%	7.0%
Seed	1.4%	1.7%
Others	15.9%	14.2%

63%), followed by information on cultivation techniques (around 16%). This was more or less consistent with the findings from the Banglalink database (Table 1).

When asked, 82% of the respondents said they had received proper solution through the helpline, while around 77% affirmed that they had benefitted from the application of the information received. Of those who said they had benefitted, nearly 47% said it was due to an increase in productivity, while around 13% reported that it had helped them to apply better agricultural techniques. 10% said they had experienced a decrease in their costs of production, while another 10% said the helpline had aided them in starting new business/farming ventures (BIID, 2012).

Progress towards systemic change

Making market systems work better for the poor is the fundamental focus of the Katalyst approach – reducing poverty in Bangladesh through facilitating improved market system where the poor operate rather than solely at the firm level (ICT Case study, 2012). The systemic constraint in the market system that Katalyst addressed was that farmers had limited access to timely and accurate agricultural information and services. To achieve this, the project intervened in the telecom sector since:(1) there is a vibrant and competitive industry; and (2) presence of

private sector actors with a strong interest in rural populace with the intention to increase their market share. Leveraging on the telecom operators as service providers provided a pathway for achieving pro-poor sustainable impact at scale by addressing the systemic constraint. The facilitative nature of the work with the private sector meant that sustainability and scale was built in to the design of the project activities. The concept of systemic change entails both scale and sustainability with the former viewed as breadth of impact, and the latter viewed as

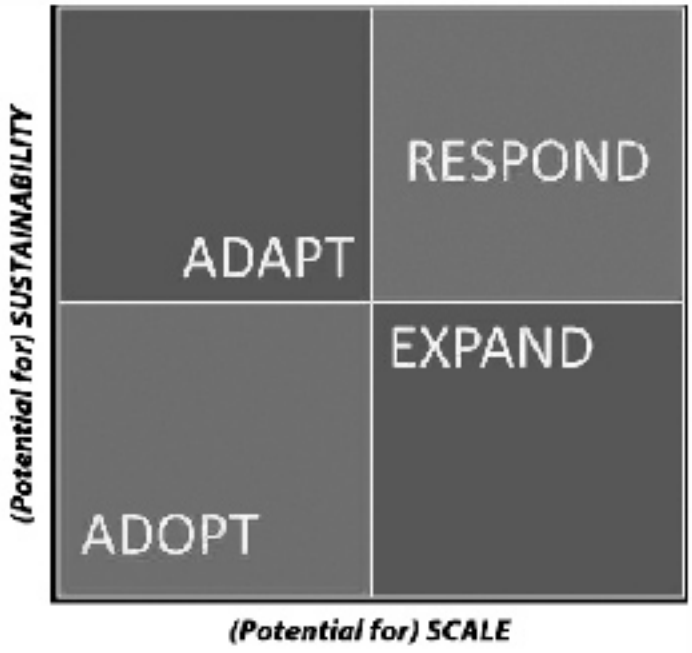

Figure 4: Systemic change framework [4]

depth of impact (Operationalising Systemic Change, 2011). We can think of systemic change as being composed of four different elements, related to the achievement of both sustainability and scale.

These four degrees of change are what the project targets and the extent to which they are achieved helps us judge whether a change is genuinely systemic. However,systemic change does not follow a linear path and change varies from market to market. So, the matrix is not about a fixed sequence starting from Adopt and ending with Respond. Nor is it the case that a change is only systemic if all degrees are achieved.

Adopt looks at initial innovation and piloting by a private sector. Adapt looks at independent and autonomous tailoring by the private sector; we want to see whether the market player really 'owns' and continues the innovation in some form

[4] Developed by Katalyst in collaboration with Springfield Centre UK

or the other without the help or reduced help from the project. This is an important dimension of sustainability. Expand looks at crowding in of other players, when the initial innovation becomes mainstream or a norm; finally respond looks into increasing depth and resilience of the market and response from interconnected market players. We will use this framework to capture the overall system level change that has been instigated by the introduction of helpline services and to gauge where the project is on the pathway to crowding in.

After the successful launch (adoption) and subsequent continuation of the Banglalink helpline (adaption), the project facilitated the signing of a Memorandum of Understanding between Agriculture Information Service (AIS), an independent government organization, and WIN Inc., a private content provider. AIS agreed to share with WIN any new information and research deemed ready for public consumption. This ensured that the content that was vetted by a reliable source, was offered in a sustainable manner by the content provider. Recently (2013), a guideline has been approved by the government which governs the flow and communication of agricultural research, information, and technology transfer between public and private agencies. This ensured that more content providers could crowd in to the market and have a ready mechanism and procedure whereby they can get information from government agencies, thus building resilience. By 2013, there were three agricultural content providers in the market (expansion), around 230 independent call centers and over 600 software developers (ICT Comprehensive Sector Strategy, 2012). Thus it is no surprise that Grameenphone has recently launched its own agricultural helpline (expansion) using similar arrangements and others are following in their footsteps.

Interestingly, private input companies, especially pesticide companies, have voluntarily started to develop their own helpline so as to assist farmers with adequate field level information (response). This is in line with the findings that farmers overwhelmingly demand information regarding disease prevention. With significant field presence in the form of sales agents, these pesticide companies are developing in-house call center capabilities with modest specialized staff and information from content providers, allowing their sales agents to respond to farmer queries timely and more efficiently, thus increasing customer loyalty. This provides an alternate market for content providers as there are roughly 20 large pesticide companies operational in Bangladesh with the potential to implement such models (Vegetable Comprehensive Sector Strategy, 2012). The following figure shows the pathway to systemic change using the aforesaid systemic change framework[5].

Conclusion

The paper showcased how a systemic constraint in the agricultural sector pertaining to limited access of timely and accurate agricultural information to

[5] Adapted from 'Developing Training Systems for Health Workers in Bangladesh' (2011), case study ofKatalyst.

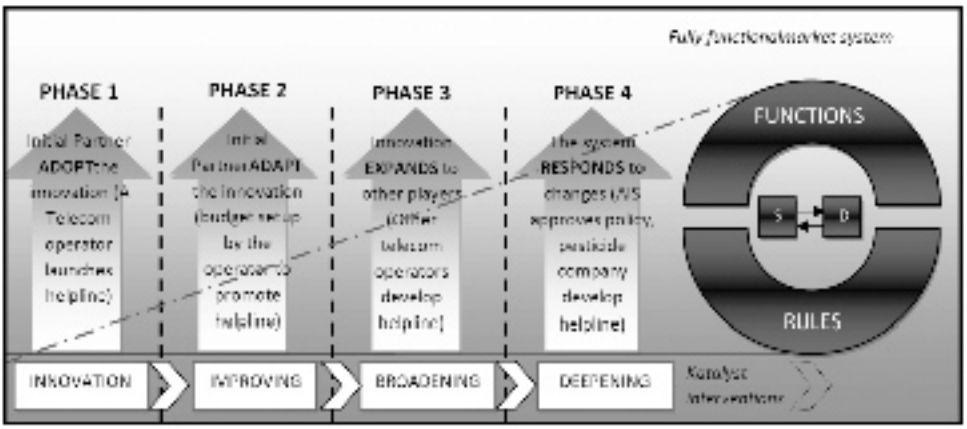

Figure 5: Facilitating systemic change

farmers was addressed by harnessing the growing mobile telephony and value added service market. The systemic change instigated by the project through the introduction of an agricultural helpline, and its subsequent expansion and deepening, has ensured that Bangladesh's growing ICT market is now capable of better addressing the needs of small farmers and businesses, which goes beyond telephone and SMS services. Furthermore, other service providers have started to crowd in, thus building resilience in the market system.Thus the overall Katalyst strategy has contributed to an increase in the number of ICT-enabled services, resulting in greater choice made available to farmers as sources of information allowing them to fulfil their need for accurate and timely information. These innovations show that an increased investment of the private sector in rural agriculture markets and initiatives for better inclusion of the poor can help to increase their customer base and ultimately make a difference to their bottom line.

Reference

Amariles, F., Paz, O. P., Russell, N., & Johnson, N. (2006). The Impacts of Community Telecenters in Rural Colombia. Journal of Community Informatics, 2(3).

Agricultural Services Innovation and Reform Project (ASIRP). (2003), Agricultural Extension in Bangladesh:An Entitlement of All Farmers?, The Results of a National Extension Coverage Survey.

Bangladesh Bureau of Statistics (2011), Statistical Pocket Book of Bangladesh2010, Dhaka.

BIID (2012), Impact assessment of GP CIC and Banglalink 7676 helpline, Katalyst.

Developing Training Systems for Health Workers in Bangladesh (2011), Katalyst Case Study 5, Katalyst.

Gurstein, M. (2003). Effective Use: A Community Informatics Strategy Beyond the Digital Divide, First Monday, http://www.firstmonday.dk/issues/issue8_12/gurstein/index.html

Heeks, R. (1999), "Information and Communication Technologies, Poverty and Development", Development Informatics Working Paper, University of Manchester.

ICT Comprehensive Sector Strategy (CSS) (2012), Katalyst.

Kizilaslan, N., (2006), "Agricultural information systems: a national case study", Library Review, Vol.55, No.8, pp 497-507.

Kiplang'at, J. (1999), "An analysis of the opportunities for information technology in improving access, transfer and the use of agricultural information in the rural areas in Kenya", Library Management, Vol. 20, No 2, pp 115-127.

Lio, M. and Liu, M. (2006), "ICT and agricultural productivity: evidence from cross-country data", Agricultural Economics, Vol. 34, pp. 221-228.

Making ICT work for Bangladesh's farmers (2012), Katalyst Case Study 6, Katalyst.

Operationalising Systemic Change (2011), Katalyst in collaboration with Springfield Centre UK.

Poole, Nigel, (1994), The NGO Sector as an Alternative Delivery System for Agricultural Public Services, Development in Practice, Vol. 4, No. 2 (Jun., 1994), pp. 100-111

Vegetable Comprehensive Sector Strategy (CSS) (2012), Katalyst.

Article

Grow Mobile: Mobile Opportunities for Water Management and Food Security in Bangladesh

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Abstract
Mobile technology is reshaping our future. Although it has large potentials, most innovations are simply not effective. Designing a winning solution is really quite a challenge. The Dutch agency for development cooperation's programme "Blue Gold" is designed to improve water management and food security of 150,000 households in Bangladesh's coastal districts. Financed by the Embassy of the Kingdom of The Netherlands, this study focuses on the question: Can the Blue Gold Programme be supported using mobile technology? With the rollout of 3G services in the offing, the supply of information technology to the outskirts of rural Bangladesh is within reach.

Key words
Mobile Technology, Water Management, Food Security, Web Application, Mobile Application

1. Introduction

In this study, we have taken an inventory of the existing mobile initiatives for development worldwide, interviewed 20 organisations that had been active in development cooperation and ICT in Bangladesh, studied the inefficiencies identified in the predecessor of Blue Gold, IPSWAM and interviewed the key experts and a number of beneficiaries in the program. On this basis, we identified a number of mobile opportunities for Blue Gold and propose concrete follow-up actions. Parallel to the study, we have developed experimental software: Via the application "Eye on Infrastructure," a user can report damage to infrastructure by sending an SMS. Via "Blue Gold Viewer," a user can have a look at some of the data that is available with other data sources, for the beneficiaries of Blue Gold. The website and applications can be accessed via http://www.hkvindonesia.co.id/blue_gold. We hope you enjoy reading this final report and testing the experimental applications.

2. Mobile technology in Bangladesh

Mobile technology is on the move in Bangladesh. Out of a population of 154 million people, there are 62 million unique subscribers with 112 million mobile connections. In September 2013, it is expected that 3G will be auctioned and rolled out taking about two to three years in total. Following this, the use of smartphones will spread out quickly. In this section, we describe the usage of mobile technology for water management and food security. After holding 20 interviews with organisations active in development cooperation in Bangladesh, we have found that there is a large number of initiatives and ideas with the interviewed organisations, but the maturity of their output is generally low. Most organisations have little idea about how to develop a successful application. However, a few organisations that we spoke to are professionally entering the mobile applications market. They are BRAC, BIID, Grameenphone and to a lesser extent Teletalk. They have significant capacity for web-development and are pushing hard for it. Have a look at Table 1 to see some of the most successful applications. Next, to understand the level of mobile penetration in rural areas, we visited a village near Patuakhali and held three group interviews. Although a poor sample, it gave us some idea about the potential of mobile technology. In the next two sections, we will discuss:

- The overview of mobile application initiatives
- The use of the mobile phones in a village near Patuakhali

Table 1: Selection of Mobile Applications in Bangladesh

Bangladesh initiatives	
E-Purjee[1]	SMS-based purchase order that sugar mills all over the country send to sugarcane growers during crushing season. 200,000 users.
SMS reporting for tubewells[2]	Application to monitor 30,000 rural tubewells.
Dial 10941[3]	IVR system for weather and disaster information; 100,000 callers in the last three months; 30,000 callers during specific cyclone threat.
Aponjon[4]	Health information for mothers, 117,000 subscribers.
DICOT	Health diagnostic tool; piloted in three locations; 1490 users in 10 months; now expanding to 20 locations; distribution through franchise of CICs (Community Information Centres).
E-Krishok[5]	Provide agricultural support and virtual marketplace, available online and at 350 franchise Internet points (Batighar); 175,000 registered users.

2.1 Overview of Mobile application initiatives

Nutrient Manager (IRRI): Farmers answer 15 to 20 questions about their practices for rice cultivation and then they receive a fertiliser recommendation customized for their field. This enables them to increase rice yield and profit by applying the right amount of fertiliser at the right time. The questionnaire can be answered via Internet or calling an automated service (answering with the dial pad). The Indonesian version can be checked on the website http://webapps.irri.org/nm. The Bangladesh version is currently under development.

Early Warning via txt messages (CEGIS): CEGIS had a project that used text message for early warning. For a specific location, they derived inundation maps for different water levels of the river. When the thresholds are exceeded, they send text messages to the local representative, who operated a flag system indicating the intensity of the hazard (blue, yellow, red). The pilot project was very successful. However, after the project funding stopped, the system stopped functioning.

Icress (BRAC): Three years ago, BRAC started with ICT for Development (ICT4D) and is developing a web-application called Icress. Icress is an application that receives information from RIMES and shows the information on a map. It has a communication component (calling, SMS, IM), a resources tracker component

[1] http://a2i.pmo.gov.bd/content/e-purjee-digital-purchase-orders-sugarcane-farmers
[2] http://www.telenor.com/corporate-responsibility/initiatives-worldwide/grameenphone-introduces-sms-solution-to-help-keep-bangladeshs-water-clean/
[3] http://www.ddm.gov.bd/ivr.php
[4] http://mobilemamaalliance.org/mama-bangladesh
[5] http://www.ekrishok.com

(monitoring the location of volunteers through their smartphones) and some other functions. The project is in pilot phase and the platform is not open (yet). At present, eight programmes of BRAC are using it for information sourcing and dissemination. What they are missing they say is trusted climate information.
Disaster monitoring (BRAC): BRAC monitors disasters by receiving information via text messages from locals, organised in closed user groups. BRAC shares this data with BMD and RIMES (for on-ground validation).
GIS tool for disaster management (ECHO): The humanitarian aid section is developing a GIS tool to better grasp the locations of shelters and resources; but they say it is at an initial stage.
Mobile questionnaire (Worldfish): Worldfish will start a pilot project soon by sending questions via text messages (more than 15,000 text messages to lists of farmers). People have to text back to another number and pay for the text message that they are sending. The language is Bangla written in English letters.
Agriculture Information Service (DAE): The Department of Agricultural Extension (DAE) has its own Agriculture Information Service (AIS). The AIS stays in touch with the local DAE representatives via telephone and Internet (Instant Messaging and skype) and they maintain an extensive website with agricultural information (text and video) and a farmers' blog. As part of their digital extension project, in the hall of its building, DAE placed a pillar with a touchscreen operating the website. Some of the upazilas have ICT services, using software and data packages developed by SDRI. Upazila officers can open these data package and show them to the farmers. Ninety-four Upazilas have laptops as part of a pilot project. DAE tries to educate farmers on using email, Internet etc. Officers have found that the farmers are very smart; some are very quick in understanding ICT. Many farmers have regular phones. Smartphones are not very common.
Mobile rain gauge monitoring (RIMES): RIMES has given rain gauges and telephones to eight volunteers of Save The Children and two volunteers from CARE. The volunteers send precipitation quantities every 6 hours, increasing the accuracy of forecasting for a small area.
Weather App (BMD): Nokia assisted Bangladesh Meteorological Department (BMD) in creating a Weather App. The App can be downloaded from Nokia's website, but is only available for Nokia phones.
Hackathon (World Bank): On December 2, 2012, a Hackathon event took place in Dhaka. The Hackathon is a worldwide event where programmers team up to solve problems with ICT. This year's theme was sanitation. 14 countries joined a total of 350 programmers who worked for 36 consecutive hours on a selection of problems. The problem statements came from the field, local governments, donors, NGOs, and incubator makers. Of the developed software, World Bank selected 46 prototypes from the Hackathon that are interesting for further development. It is not decided yet whether this should be World Bank funded.
Pilot projects Oxfam: OXFAM has a few small piloting projects. They are:

• *EWS via mobile phones:* This pilot project is being implemented in collaboration with ECHO.
• *GPS tracking of fisher boats:* Together with Hyratel they operate a GPS system that monitors the boats of the fishermen in a coastal area. The system registers when a boat capsizes and rescue teams can be deployed. Last year they started with 50 boats; coming year there will be 350 boats.
• *Gobhari project:* They are using mobile money transfer, agreement with bKash, via the BRAC bank. There are some risks to open data transfer, so they are researching alternatives.

Learning Lab (Save The Children): This has the plan to improve the information flow, should run via the Union Parishad Offices and speed up the information process. Now it takes very long for information from the field to reach the main offices. The plans include distributing smartphones for their employees in the field in the future, to get information back to headquarters quicker (pre- and post-disaster).

DICOT: Grameenphone (GP) launched the Teledermatology Pilot Initiative[8] in partnership with Telemedicine Working Group Bangladesh Ltd. Their device DICOT (Digital Imaging & Communication on Telemedicine) provides diagnostic tools and a video connection to a professional dermatologist located in Dhaka. They piloted it for 3 locations, providing services to 1490 people in the first ten months in 2012. They are expanding the programme to more locations (20 this year) and more services (mother and childcare).

Tubewell Monitoring: HYSAWA installed and maintains 30,000 tubewells in Bangladesh. To facilitate the process of reporting and fixing broken tubewells, GP introduced an SMS reporting system. A designated person checks the tubewells regularly and sends out an SMS when it is broken or needs maintenance. The SMS is sent to HYSAWA head office and the local mechanic. Result is a large improvement in administrative efficiency and response time to fix the water source.

Mobile School: GP has just started a pilot project with a mobile school. They felt inspired by the fact that although 90% of children can go to school, still 70% completes primary school without knowing how to read or write. Their mobile school has a teacher in Dhaka, teaching children in the rural areas through a Skype-like connection. The NGO providing the teacher and assistants is JAAGO. GP provides hardware and software. Next year they are looking to expand this service.

Disaster Information Dissemination: This project is still in its start-up phase. JICA through ADB funds a new disaster management dissemination system. GP works in this together with BUET (Bangladesh University of Engineering Technology), University of Japan and the Government of Bangladesh. GP sends to Japan the details of the number of people within the reach of the BTSs. Japan

[8] www.telenor.com/corporate-responsibility/initiatives-worldwide/grameenphone-pilots-tele-dermatology-project-in-bangladesh

sends back an information package that GP forwards to the mobile phones in range.

Bima Life Insurance: This is offered for free to the pre-paid subscribers of mobile operator Robi. Each registered subscriber earns insurance coverage each calendar month depending on his/her airtime usage. The more airtime used, the more insurance coverage earned.

Dial 10941: State-run operator Teletalk facilitates an IVR system where people can dial 10941 for weather and disaster information. The information comes from the Disaster Management Bureau (DMB), providing regularly updated voice messages to Teletalk. The system has general messages for daily weather forecast, cyclone warning and flood warning and customized information for fishermen and for people living in coastal areas. The service reaches all around Bangladesh. In the last three months, they have had 100,000 callers, 30,000 of them in the past few days due to a specific cyclone hazard.

Maternity alert: It is a mobile service hosted by Citycell. Customers can register to receive information about pregnancy. Depending on how far along the women are, they receive specific advice about medicine, etc.

E-Krishok: BIID together with GP developed e-Krishok. E-Krishok is an application that offers farmers information and advisory services. Information comes from various sources such as DAE, IRRI and others. Their strategic partner is ACI (producer of farmer goods) who also deliver content, which is allowed as long as it is unbiased, says the regulatory body. The website does not generate income and is sustained by BIID themselves.

Batighar: BIID supports small Internet shops they call Batighar (meaning lighthouse). Via the Batighar, people have access to various services such as trading crops. Farmers gather at the Batighar to make a joint offer of their product. An agent at the shop offers the crops for a certain price via internet. Interested buyers can make a counterbid, after which the deal is closed or cancelled. Farmers receive their money via m-mobile. In future they can also get cash via regular banking from a rural ATM (recent investment of Tk400,000,000 by the Eastern Bank Limited). The Batighar have 175,000 registered users.

Dial 16250: This month BIID and GP will start a new SMS service. The farmer registers and pays Tk15. Then the farmer is called by a call centre (30 agricultural experts in three shifts) to collect the data of the farmer. Based on that data, the farmer gets 6 SMS with very specific information in the coming two months. Information may include when to provide immunization for their livestock, etc. With this service GP aims at 3 million registration in the coming few months.

FRS (Fertiliser Recommendation Software): The software was developed by USAID for the project Katalyst. Among others, they connected to the Soil Resources Institute, who at that time had a paper database of soil samples for the

whole of Bangladesh. With the FRS, the database as well as the process of collection had been automatized. The database is still being updated as of today, but the software is not.

2.2 Use of the mobile phones in a village in Patuakhali

About half of the interviewees had a telephone with them. They explained how most households have a phone and the men carry the phones with them. The coverage of mobile phones among the farmers is about 95%. The telephones were mostly featured phones that could take photos and videos. None of those present owned a smartphone.

The interviewees charge the telephones with solar power (15 families). Those that do not have solar power can charge their phones for Tk5 at a shop with solar power near their houses. Some explained that they spend about Tk50 on charging mobiles per week.

Group I explained how they were using the mobile phone to call the Grameen mobile health point 789 to transfer money. Some said they used the telephone to receive weather information and half of them indicated at using the telephone to get update on market prices.

Group I and II had never heard of the Health hotline and only used the telephone for social interaction. They use the telephone sometimes for exchanging text messages; but that too not regularly, they like voice better. None of the interviewees had ever used the mobile phone to get information about disasters (cyclones, floods). They receive disaster warnings through Red Crescent volunteers, door-to-door.

Group III uses the telephone for social interaction and sometimes obtain market prices. Mainly they use radio and television to receive information. They did not hear about 789 and never obtain disaster related information via the mobile phone. None of those present had ever visited the UP office to use Internet.

They have limited access to electricity (15 families have solar panels) and no access to Internet. Children cannot learn how to use computers or Internet. They have no televisions at home. But sometimes they watch TV in shops. They watch some television in the Patuakhali town. The nearest Internet connection is at the UP centre, 5km away. Some of the interviewees had visited the UP centre and used Internet. Some seasonal workers had applied for a job in Malaysia online via the UP office, after having heard about it in an advertisement on TV. Two persons said they had used Internet to exchange experiences on agricultural practices. Some people said they had visited the DAE website.

The people interviewed do not seem to use even the current possibilities of Internet or the mobile phones to their full potentials. They described agricultural and health information as their largest needs, while most of them have not ever looked up any agricultural information on Internet or known about the GP health line.

Besides these, there are other mobile applications in Bangladesh.

Figure 1: A young mother in Bangladesh using a cell phone provided as part of Mama! (Aponjon).

3. Information inefficiencies in water management and food security

Mobile ICT can basically do two things: remove inefficiencies in the exchange of data and establish data exchange that otherwise would not occur (but has added value for at least two parties). To identify the inefficiencies, we have collected problem statements and information needs from the interviewed organisations, collected their additional suggestions for Blue Gold, studied the IPSWAM reports and talked to the experts of the Blue Gold team (we have had discussions with Anis Pervez, Dirk Smits, Hein Bijlmakers, Karel T'Jonk and Abul Kashem). In the next sections you will find the results:

- Problem statements and information needs from interviewed organisations
- Suggestions for Blue Gold by interviewed organisations
- Information inefficiencies identified in the IPSWAM reports and by Blue Gold experts

3.1 Problem statements and information needs

The 20 organisations proved to have many similar problems and suggestions. Among the problems, they mentioned that the need for customised data, the difficulties to share and use data effectively and the behavioural difficulties when organising projects in water management and food security. In overview can be seen as follows:

Problems identified in data sharing:

- Institutional or system inefficiencies in data sharing - it takes a long time to receive data and there is little capacity for data integration and dissemination.
- Little coordination and data exchange between departments. Information from agricultural department is not used in the design of water infrastructure, or information about water infrastructure is not used for designing road

infrastructure. This results in inefficient measures such as roads that have no culverts with floods due to drainage constraints as results.

- There is a lot of overlap in development projects, for instance in baseline studies. A hopeful development is the joint cooperation of the NGO's under ECB (www.ecbproject.org) for joint needs assessment of ongoing relief and recovery needs in Bangladesh. More of these efforts are needed.

Problems identified in the involvement of beneficiaries:

- IPSWAM had trouble to get the right people involved. The meetings always attracted those farmers, who thought that they could make money directly from the project rather than improving their businesses altogether.
- It is very difficult to reach the women for getting them involved in water management, as they normally do not attend meetings. However, they make important decisions in the household and share strong interests in ensuring food security for the children.

Information needs:

- Requests for more information on short and long term expectancies for rainfall, fog and drought
- Requests for more information on agricultural inputs, such as fertiliser
- Requests for more accurate information on cyclones, as current forecasts are often wrong
- Request for customised information on cyclones, as many people do not understand the SODI (categorisation of cyclones) and what it means for their activity of the day
- Request for more information on salinity levels and what it means for peoples' crops
- Request for support to people - what they can do about cyclones and strong storms

3.2 Suggestions for Blue Gold by interviewed organisations

Between the suggestions we found improved dissemination of information and knowledge (e.g. customised cyclone warnings), effective management of information (sharing data for water management) and using mobile technology for training purposes. The overview is as follows:

Agriculture:

- Use Mobile applications for dissemination of IRRI data and knowledge, building on experiences with the Nutrient Manager.
- Improve the insight of farmers on the market prices of their crops. Many do not know who to sell it to and often have only one market or agent to work with. Farmers are already connecting via their mobile phones, but they do not reach beyond their immediate surroundings with them. There were suggestions about displaying prices of agricultural products in the various markets.

Indeed crop prices are shared via the mobile phone. But this is not institutionalised and usually the farmers are calling the same contact persons, without having an overview of the prices around them. Fishermen are most vulnerable in this sense, as they have to sell immediately. Often they are held hostage by the unscrupulous middlemen. Suggestions for Blue Gold included a wider approach for this, displaying prices for local, regional and even Dhaka prices in the same overview.

- EKN underlined the impact of sharing crop prices with an example from the northern part of Bangladesh. Farmers can now choose between several markets because they call them to ask for their prices whereas before they only had one option and no information about the other markets.
- Although the short-term forecasting is reasonable, DAE has little information on medium and long range forecasting (precipitation, drought, cold and fog), which is a real problem. They need this to make better decisions on what crops to grow, when to sow seeds and when to harvest.
- Any information on weather, agriculture (prices, practices, etc.) and health would be welcomed.

Education and horizontal learning:

- Use mobile applications to facilitate horizontal learning (blogs, videos, online tutorials). Because farmers have no Internet, they miss out on education opportunities.
- At one point, Socioconsult Ltd. tried to make videos for training up the farmers. But there was no facility to show them in the villages. Potentially, a WMG could play central role in educating the farmers and making people, especially the young, acquainted with IT.
- Use of Mobile Services for horizontal learning: Although limited, but this already exists in the form of SMS. Mirva Milanen explains about the "Farm Management System" that is used in their (horizontal) learning program focusing on educating people about how to manage a farm.
- Use ICT to exchange experiences, technologies and training (horizontal learning): this could well be supported by the WMAs (some of the WMAs have electricity) in Blue Gold.
- Mobile applications can be used to share information between WMGs, for instance, upstream to downstream water levels or water levels in polders (Mamunur Rashid, UNDP)
- Mamunur does not like the idea of using mobile or web applications for training because he thinks they are too difficult and costly. Perhaps if Bangladesh is connected to 3G, there is more potential. Training is spoon feeding and it works better if it is market driven. Would it be interesting for a service provider to reach communities with this?
- A list or training show what could be done with mobile phones would be welcomed.

Access to Information (E-Documents):

- In the rural areas, information is usually stored in hard copies. IT could be used to manage community data.
- DAE has a lot of data among others from IWM feasibility studies, which is all in reports. This requires a lot of tedious paper work.
  Using mobile applications to make better use of community maps and geographic information showing the local situation. For instance, inundation maps can be used by farmers to demonstrate risks and past events of their land being under water. If the functionality allows, they can draw into the map and be interactive. The map can also be used for decision makers (water planners who do not travel locally) so that they do not rent out good land to bad people and water management of canals cannot be destroyed. In general, ICT could help the government in its operational planning and services rendering.

Crowdsourcing and mapping:

- The proposed map with the status of infrastructure could be very useful.
- Small disasters are badly documented. The twitter tool could help greatly to get the overview of a situation.
- Using mobile applications for infrastructure monitoring may be a good idea. What if WMGs make a small (geo) referenced photo of the embankment and ask for advice from the BWDB? Also unusual behaviour of the water levels and state of the embankments can be monitored.

Other suggestions:

- Blue Gold should organise information dissemination and monitoring more mobile phone based. Current obstacles are (1) the slow speed of Internet. Everybody is waiting for 3G to be rolled out in Bangladesh; and (2) farmers may not understand the message, so it should be translated to practical information for the user; and (3) who will maintain such a system?
- Keep things simple. Choose something that will work and do it in a very slow pace. Do not try and do everything at the same time. Also, make sure to connect to systems and networks that are in place already. Do not introduce too much new in too little time. If mobile services are going to be part of Blue Gold, make sure to customise it for the project. Farmers will have simple phones. Take into account that things break down.
- Suggestion for Blue Gold is to involve cultural experts. Most international projects fail because of the lack of cultural sensitivity. Blue Gold needs someone preferably from academic society ethnography, who understands the 24-day routine of farmers and fishermen, by participatory observation. In UNDP, they make much use of this. Mamunur tells a story about a guest: "The first day you give him your very best. The second day a little less and the third day you act normal. The ethnographer stays until it is normal and then starts the research."

- Customise the service to local needs and to make a deal with big telephone chargers. Some of them are already running this sort of pilot schemes.

Connectivity (IT points, locations, devices, packages):

- A cheap tablet with customised information would be a step forward and create interest among the farmers. For instance, a tablet worth Tk8,000 could be affordable for two farmers together.
- Poor people are interested in mobile phones, mostly because of transistor functions. They do not have smartphones. Charging mobile phones is usually done through a village shop or solar power. Solar panels are getting more and more common.
- Suggestions came up for providing the 250 Blue Gold WMAs with Internet IT points[7]. They will be equipped with an office and storage space anyway and Internet would be an interesting next step.
- Smartphones will be within reach of farmers within a year. Farmers are smart and wish to get smartphones specifically to get market prices.
- Mind though, that Bangladeshi people are talkers and do not like to text too much.
- Only some selected upazilas have these ICT centres. Blue Gold can use the infrastructure for information dissemination and help the farmers. For those upazilas that actually have Internet and laptop, Blue Gold could even downscale to register farmers group and provide them with ICT connections.
- Arman suggested that we can talk to the telecom service providers to know what they have already been doing. Arman knows about Robi, Banglalink and Grameenphone have special services for farmers and in the field of health. They sometimes advertise with it. Perhaps Blue Gold can use bulk text packages from them to reach the communities.
- There has been suggestion that Grameenphone or some other mobile phone company could help in setting up a mobile service for EWS.
- Note that most people (not all) in Bangladesh have mobile phones. But Smartphones are still not common. Also, the experience is that most of the rural people cannot read or write. The mobile is used for talking but not texting. So it is very important to look at literacy rate and who is the customer.
- The Union Information Centre is the right place for knowledge exchange. It is used (and run) by local NGO's, including BRAC. Farmers sometimes come to see market prices, agriculture, health, and get access to government services. There are government officials available among them people of the DAE. Still, Oxfam believes it is difficult to attract more farmers to the Information Centres.

[7] Added by EKN: In Blue Gold, there is a provision for 250 office cum storage buildings for the 250 best performing WMG's out of the potential 800 WMGs. Request to check these numbers with the Blue Gold team during mission #2.

Policy or regulations ICT development can connect to or should be in line with:

- Any ICT development must be in line with the 6th five-year plan of the government (6th five year plan 2011-2015. Accelerating growth and reducing poverty. General Economics Division, Planning Commission, Government of the People's Republic of Bangladesh).
- The recent "Access to Information Act" (Access to Information A2I, Right to Information R2I) will improve transparency and public availability of government information (World Bank).

3.3 Information inefficiencies identified

As mentioned, we made inventory of the inefficiencies addressed in the IPSWAM reports and by experts of the Blue Gold team. We categorised the inefficiencies into the following:

- System inefficiencies: Inefficiencies in existing systems; for instance too much paperwork in dealing with the results of questionnaires.
- Behaviour inefficiencies: Inefficient behaviour due to lack of knowledge; for instance, exaggerated use of fertiliser in agriculture.
- Market inefficiencies: Inefficiencies in the demand and supply of a product because of information constraints. Hereunder the main results:

Table 2: Information related inefficiencies

System inefficiencies	Behaviour inefficiencies	Market inefficiencies
Water, disaster information does not reach target or does not reach target in appropriate way	Wrong use of infrastructure, damage (e.g. fishermen operations, inlet of saline water)	Supply demand resources do not meet (labourers at time of harvest, fingerlings fish-culture)
Maintaining logistics of infrastructure laborious, delays	Women have little knowledge of water system, opportunity lost for O&M	No credit facility for credible borrowers, entrepreneurship
Excessive paperwork, little automation in project execution of development projects	New infrastructure not effective (e.g. road construction without culverts, blocked drainage)	
Excessive paperwork in public administration, not transparent	Difficult training process, little horizontal learning	

3.3.1 System inefficiencies

System inefficiencies: These are inefficiencies in the working of existing systems, for instance a lot of paperwork in dealing with the results of questionnaires, or messages sent out but not reaching their destination. From the IPSWAM reports and interviews, we list the following:

- The process of weather and disaster dissemination shows system inefficiencies in the way that information is sent out, but only received by people after multiple channels and in a way that beneficiaries do not comprehend. An example is the cyclone warning that runs through different

layers before it reaches the citizens. And when it does, the villagers often do not understand the code of the message: "Cyclone level 3 expected. Does that mean I can go out fishing or not?" Another example is weather information, where citizens now only receive national weather forecast, while better information is available using global sources such as TRMM of NASA.

- Mr Bijlmakers summarised briefly the process of collection and dissemination of land use data. The process starts with a sub-assistant officer manually gathering the land use information per farmer and writing them down on paper. This information is forwarded in various layers to the head office in Dhaka. The whole process takes two years before the report is published with land-use information.
- Mr Smits summarised briefly the process of collection and dissemination of failing/non-functioning infrastructure in the field. The process includes water board officers collecting the information from the field and, in various layers, reporting them to Dhaka. Then BWDB officers have to confirm it and make the arrangements for maintenance repairs. The whole process takes a lot of time and is prone to errors.
- From other meetings, people identified there may also be system inefficiencies in the project management. Field visits typically result in much paperwork. Midterm reviews involve much paper work delaying adaptive measures.
- Shahid Uddin Akbar of BIID identified another type of inefficiency. He says for many different researches and projects, farmers are asked the same questions over and over again. This is expensive and time consuming for all parties.

3.3.2 Behaviour inefficiencies

Behaviour inefficiencies are inefficiencies in people's behaviour due to lack of knowledge, for instance excessive use of fertiliser for agriculture. We came across the following behaviour inefficiencies:

Drainage congestion

The reports describes how there are three reasons for drainage congestion, the most common problem in Ragunathpur polder. Two of them are behavioural inefficiencies: Sluices that are out of order or not operated properly and canals that are obstructed by embankments and roads.

- One of the reports [IPSWAM, Water Management Review in Raghunathpur, 2012] describes how Khals here have been closed by the construction of an embankment, causing water logging in the surrounding area. It says the control of some sluices lies in the hands of fishermen/fish businessmen and they operate the sluices in ways that best serve their purposes and do not take drainage requirements into consideration.
- The same report describes how culverts have not been constructed in a

number of new roads, blocking the flow of irrigation as well as drainage. It says: "No fresh water remains in the dry season because either the sluices are out of order or are not operated properly" or "the flushing inlets are almost in non-functional conditions. As they have been wrongly used for both flushing and drainage, most of the protective aprons have been damaged".

Basic water management

Basic water management is not always done as effectively as possible. The reports mention several non-optimal water management decisions, such as allowing salt water to enter the polder, wrong use of khals causing damage, etc.:

- [IPSWAM, Water Management Review in Raghunathpur, 2012] mentions that people sometimes allow water to enter into the polder by opening sluice gates without considering whether it is saline or sweet. It said that happened because people have no choice. The crops need water. Cultivation, which is an interest of the majority of the population, is further impaired by the fact that some people fish at the sluice gates without giving any consideration to the water requirements of the crops.
- The same report mentions the participation of women: "Women's capacity to provide useful input into water resources management is hampered by their lack of exposure and proper knowledge of the technical aspects of the polder system management. Women are never involved in the original planning of the polder. To make informed choices and decisions the women should have access to basic knowledge and understanding of the technologies involved."

Agriculture

Agricultural techniques are obviously very important for the farmers. The agricultural expert of the team (Hein Bijlmakers) explains for instance how farmers usually apply too much fertiliser and pesticides. That is why IPSWAM and now Blue Gold also work with farmer field schools, where farmers are taught about optimising agricultural output at less costs. That, now, brings us to training.

Training

The behaviour inefficiencies are addressed in communication strategies and training sessions. In farmer field school, farmers are being taught how they can apply less fertiliser and improve productivity at less cost. They are also being trained about breeding and feeding techniques for livestock. These field schools work very well according to Mr Bijlmakers. After the project, the farmers sometimes stay in touch with the trainer with the help of mobile phones. In other sectors, Mr Abul Kashem says the effectiveness of training is not always very large. Common problems are:

- People do not show up for training.
- Group do not have sufficient trust on the trainer, for instance when it concerns a training up a neighbour (what does he know that I do not?).
- Trainers educated in "train the trainers" look for other opportunities.

Other training strategies, such as radio shows, videos, posters, books all seem to have low impact. For instance, a video is watched during a formal training session, but would not be something people will look at somewhere else. What seem to be working are interactive techniques. Mr Kashem mentions three:

- *Horizontal learning*: They have organised sessions where they connect farmers who are sitting under a tree discussing agricultural problems. It is very effective.
- *Interaction through drama:* For enjoyment, people will always make time and even, they will pay for it. There is one group that tours the south with drama about water management, starting discussions on how to manage the important infrastructure. According to Mr Kashem, this usually triggers constructive discussion.
- *Individual advice:* Conclusively, there is always time for individual advice. When a farmer can explain his problems, he will certainly listen to the answer. But individual training is expensive.

3.3.3 Market inefficiencies

Market inefficiencies are inefficiencies in the demand and supply of a product, due to information constraints. Based on IPSWAM reports and interviews, we came across the following market inefficiencies:

- No labourer available at the time of harvest hampers harvest.
- No availability of fingerlings during right time hampering fish culture.
- No access to credit for credible borrowers hampering entrepreneurship.

4. Mobile opportunities for Blue Gold

Before going to the solutions themselves, we would first like to address the techniques. Reason for this is the most frequent question asked during the project: "How can Blue Gold benefit from web-applications, when people in the field do not even have Internet?" A very legitimate question of course. The answer is that you can use the benefits of Internet, without directly connecting to it. Many people with no access to Internet are actually Internet users. For instance telephone information services often use Internet. An example from Bangladesh is dialling 10941 through which farmers use IVR to connect to a webserver providing them with information on the weather. In this case, dumb phones (phones with no Internet or features) are using Internet simply by connecting to it in a different way. In the next two paragraphs, we explain two techniques. In the remainder of this chapter we explain how you can use these and other techniques to overcome data exchange inefficiencies for Blue Gold.

4.1 Between dumb phone and Internet

The challenge for the Blue Gold is the low availability of Internet in the area. However, "dumb phones" (as opposed to smart phones, dumb phones are mobile devices that only support voice and text) are widespread. There are several ways to exchange information with dumb phones. We explain two of them:

- IVR (Interactive Voice Response)
- SMS reporting system

IVR (Interactive Voice Response) system

Interactive Voice Response (IVR) with customized information to beneficiaries. An IVR is a system where users can call a number, select their choice from a menu and listen to a prerecorded message. This way, any piece of audio information can be conveyed. It can be designed as a free service or a paid service. Teletalk already provides such a service for weather information, with good pilot results (100,000 requests in three months). The operation and maintenance of this system includes sustaining the software and for the information source, generate new messages (either recorded or generated). Not much is needed to setup a decent IVR system. Minimum requirements are:

- *The IVR service of a telephone company:* the number that people can dial; the menu options and the voice recordings; all need to be installed at the telephone company's system.
- *Spoken content in a database:* The content can be weather forecast or market information, found on the web or extracted from a flood early warning system (FEWS) or another source. The content has to be translated into spoken messages. This requires a person recording all the different messages regularly or a computerizesed response system. The content will be collected and stored in a collection system and a database.
- *Menu options:* The caller chooses options from a menu making choices on what information is requested. This menu has to be defined.
- *A functioning mobile phone:* A user dials a number and chooses options, and listens to the response on a mobile phone. Besides the device itself, you will need a mobile network, telephone credit and electricity to charge it.

Interactive map with SMS communication

The web can also communicate with SMS. For instance, an interactive map with SMS communication can be established when an SMS server is configured to receive SMS and upload the information to the map on the web. This technique is widely used for creating community reporting systems (community observations are plotted on a map that is shown via a website). Such a system would have the following requirements:

- A server to host the system
- A collection and storage system: the content has to be collected and stored. This requires a collection system and a database.
- A functioning mobile phone: the user text a message to a number. This requires credit and the possibility to charge it, besides the phone itself.

  Just for demonstration purposes, we developed this exchange for polder 45 in the south of Bangladesh, as described in section 2. Please visit www.hkvindonesia.co.id/blue_gold where you can send an SMS to the number +62 812 95404864 appearing on the map a few seconds later. The technique is quite simple.

Other options from Internet to dumb phones even down to signboards

In the interviews that we have done, we were explained how people from Bangladesh, especially those in rural areas, prefer voice over SMS, even if they can read. For this reason, IVR is preferred over SMS systems where possible. Besides IVR and SMS, there are many other ways to transfer messages even to conventional signboards, as is piloted by Practical Action with their rolodex (see Figure 2). In this system, a designated operator receives an SMS with a code that guides him to scroll to the different parts of a rolodex to the right position. In this way, information is translated to a simple signboard. It is very smart indeed. It reminds us that basically, content can be shared anywhere in any way, depending on what device you are using (dumb phone, featured phone, smartphone, tablet,

Figure 2: The "Rolodex" of Practical Action

PC) and what networks are available (mobile network, Internet, bluetooth). In the next section, we have several suggestions for applications on the basis of the identified inefficiencies, data, ICT solutions and media.

4.1 Mobile opportunities for Blue Gold

In this section we discuss potential applications on the basis of the identified inefficiencies, available data and available techniques.

4.1.1 IVR system with customized information to beneficiaries

An IVR system with customized information for beneficiaries. The potential messages contain real-time information (on weather, crop prices, advertisements for fertiliser, etc.) or even include expert podcasts of agricultural or water management experts. The podcast could contain an entertaining element, as suggested by Mr. Abul Kashem, training expert in Blue Gold team. Mr Abul explained about a program he knows, where people actually pay to watch a drama, while the drama discusses agricultural practices. It has proven to be very effective. In any case, the key criterion for success is whether the information is perceived interesting enough to listen to. Note that it is very much possible to send information to selected regions only. With the help of the mobile operator, the messages can be conveyed via selected BTCs (Base Transceiver Stations).

Another option is that more numbers are opened for different regions and further divided via a main menu.

Relation to inefficiencies: System inefficiencies are where information is sent out, but not received appropriately at the other end. This inefficiency has been mentioned in many of the interviews held and reports studied.

Potential steps forward:

- Make detailed inventory per component of Blue Gold what information they deem important and they would like to offer to the beneficiaries. Also, make detailed inventory of all the other information that may add value to the lives of Blue Gold beneficiaries. This study already identified a considerable number of them but there are more and everyday the amount of useful data is increasing, also thanks to donor funded projects such as RIMES, Flood Early Warning System, Sat4Crops and numerous others.
- Put your favourites to the test: the response of such information sources is never really predictable. That is why the best approach is usually to "fail early and fail often." For the test Blue Gold may consider connecting to the number 10941 of Teletalk (see Appendix A, meeting minutes with Teletalk) or alternatively initiate a new special number for Blue Gold. This can be done via GrameenPhone (for GrameenPhone subscribers) or via the BTRC (for all subscribers). The service can be free or a paid service.

4.1.2 Community reporting system

Map with information by the beneficiaries. This includes community observations on infrastructure, agricultural practices, health information, disaster damage etc. The information is generated by SMS from the beneficiaries, either or not after sending out a specific request to beneficiaries to do so. Variations are where other media are used to produce the interactive map, such as IVR, phone calls, via social media or other.

Relation to inefficiencies:

- Interactive community maps are widely used around the world, for instance in USA (a citizen-reporting tool allows people to report municipal issues with their mobile phones, more than 57,000 incidents reported in ten month pilot), India (application captured 200,000 photos for crime and accident reporting in one year), Kenya (where volunteers smartly mapped the infrastructure of a large slum) and even in Bangladesh (where Grameenphone supports the monitoring of 30,000 tubewells for rapid repairs). Such a system will address the system inefficiencies, especially the inefficiencies in "the process of collection and dissemination of failing infrastructure on the field."

We discussed this idea during interviews with Alamgir Chowdhury (SocioConsult Ltd.), Mamunur Rashid (UNDP) and Dirk Smits (Blue Gold).

Potential steps forward:

Make an overview of what data adds value to anyone inside or outside the Blue Gold programme and promote the data that have a location component. There are several interesting data that can be exchanged between the dumb phone and the internet. Then select the most interesting and put it to the test. A low threshold start is to use such a system for the Blue Gold program internally first, to see how it is working and what the benefits are. Ideas are:

- Create infrastructure map that is connected to BWDB staff, through which they can monitor the status of infrastructure in the Blue Gold regions.
- One of the reports of IPSWAM mentions that "since people saw that there was no government/non-government agency to solve their problems, the people of the project area tried to solve their problems by their own initiatives". The report mentions their initiatives include operational management of the sluice gates and all kinds of maintenance works, such as filling breaches, making bamboo bridges, buying materials, collecting subscriptions, closing the mouth of inlet with the earth in the rainy season and to open the mouth in the dry season etc. An interactive map could very well support exactly these initiatives.
- Connection to a school may be interesting, where students are asked to make the first community map. A tested assignment is to ask students to map what they think is important and go from there, as done by the Kibera application, Kenya [Hagen, 2011]. This will introduce IT to students, while creating a community map. Another option is to select designated persons to create and maintain the map, for instance in exchange for airtime, while Blue Gold offers BWDB to show exactly what the status of the system is.
- Another interesting application is the collection of meteorological and geological data as for instance is being practiced in Turkey (small meteorological stations at farms add on to national aggregated information on weather in Turkey, enabling accurate pest monitoring). We have discussed this idea with people from the RIMES for meteorological stations. They believe that local measurements are useful for improving cyclone forecasts in long term. According to RIMES, the relation between temperature and amount of rainfall varies from place to place. Accurate data on rainfall makes it possible to better estimate the "threshold temperature". There is a project going on where volunteers report measured rainfall using mobile devices. RIMES would like to extend this project in the Blue Gold areas. Note that an important criterion for success of farmer advise, is whether they trust the source. Shahid Uddin of BIID explain how important it

was that GrameenPhone, a trusted brand for many people, was involved. Alternatively, the actual source of information (the DAE, a trusted expert, etc.) should be visible as source of information.

4.1.3 SMS system for inventories and questionnaires

Mobile questionnaires via SMS: The use of mobile questionnaires has been discussed in several interviews and is successfully used by many applications; among them are the Nutrient Manager (fertiliser advise after entry of 15 questions on land-use, crop, etc.) and Jana (crowdsourcing app that gathers small pieces of information of consumers by questionnaires in exchange for airtime). This system is much like the technique in the previous section, but more applied on information exchange without principal spatial feature, such as inventories and questionnaires. Alternatively, if illiteracy is too much of a problem, IVR can be used for questionnaires, where respondents can choose multiple choice answers that they select via their dial pad.

Relation to inefficiencies:

System inefficiencies where information is exchanged laboriously. Examples have been mentioned in several interviews, such as:

- For many different researches and projects, farmers are asked the same questions over and over again. This is expensive and time consuming for all parties. (Shahid Uddin Akbar, BIID)
- Laborious process of gathering land-use data, taking total two years before the official numbers can be published (Hein Bijlmakers, Blue Gold team)
- Also field visits typically result in much paperwork (Alamgir Chowdury, Socioconsult) and midterm reviews involve much paper work delaying adaptive measures.

Potential steps forward:

- Same as section 4.1.2 for information exchange without location component. One example is the soil tests that are handed out at the farmer field schools. Farmers can use this to test their soil and make a decision about the fertiliser and pesticide they need to use. An idea would be that these farmers send the result via SMS to a central number, where an agricultural expert (automatised or not) responds with a suggestion. This enables the project to create a large database with soil data as well as keep in touch with the farmers after the farmer field school.
- If there is enough interest from within the project, most effective would be to create a general application that all components can use for internal reporting and questionnaires. It can be piloted by the project team and eventually shared with other organisations. To use the applications, it will be configured so that a user will only have to hand in the questions and the application can do the rest. Of course there will need to be an incentive for the beneficiaries to do so, for instance free airtime.

4.1.4 Training via mobile applications

Training materials should be those that can be displayed or listened to on a mobile device. The project English in Action[8] already has experience in this, as do many other development projects around the world from reminders (mothers needing to take medication, water users that need to change filters) to classes (Khan University offering a free library of 4300 ten-minute videos on biology, chemistry, physics, finance, history and others, with hundreds of millions views worldwide) to gaming (pilot projects have been run where tablets were handed out offering interactive modules for science and English, with amazing results [Schmidt pg. 22, 2013]). What seem to be working well in Bangladesh (Mr. Abul Kashem) are three types of learning: horizontal learning, learning by entertainment and individual advice (see section 3.3.2). All three types of training can be supported by web ICT:

- Learning by entertainment, by offering games and videos (drama) through mobile devices. More and more people have featured phones even with an extra large screen, perfect for watching videos and gaming.
- Individual advice, by supporting SMS exchange between a trainer and the beneficiaries. This can be on the basis of sending regular questionnaires or advises, for instance as extended support to farmers after they have done the farmer field school. The farmers may choose to reply or not.
- Horizontal learning, by offering blogs and communication features via mobile apps (less obvious, because of current internet constraints).

Relation to inefficiencies:

The web ICT would be supporting training, for which no further explanation is needed. Training directly relates to behavioural inefficiencies. We mentioned three of this type in section 3.3.2: drainage congestion, basic of water management and agricultural practice.

Potential steps forward:

The design of a training program basically depends on three things: (1) Consumer behaviour of the beneficiaries; (2) available networks and devices; and (3) amount of resources to produce material. We suggest that all three are carefully evaluated, after which a training application can be suggested. Most promising and easiest way to get started is to deliver individual advice, as extended support to farmers after they done with the field schooling. In this way, trainers can keep in touch with the farmers.

4.1.5 Other developments to be watching

During this study, we came across a large number of other interesting developments. Hereunder we would like to mention a few of them that, sometime in the future, will certainly affect the beneficiaries in the Blue Gold regions.

[8] http://www.englishinaction.com

Web-applications for the marketplace

The BIID has already started it on a small scale, supporting trade from their Batighar. Mr Khaled of the Dutch embassy also referred to it, explaining about a commodity exchange market via Internet, not yet approved by the regulatory body. In India, they are using mobile marketplaces on a large scale among others, via 6,500 Internet kiosks called E-Choupal. For such trade to work properly in Bangladesh as well, the following are needed:

- Farmers need to be organised, so that they can offer larger quantities.
- An internet point, for instance, the Batighar of BIID, and the ICT (inclusive payment model) to support trade;
- The regulatory body needs to approve it.

We know that Blue Gold is working hard on the first, while the second and third will at one point be overcome. The benefits are obvious: less transport needed (to and from the marketplace); products can stay on the field longer (especially important for perishable products); and for instance in fish trade, less overfishing, as was the result of an application in Congo (Schmidt, 2013). Beyond the trade itself, many services are now or soon will be offered through the mobile, such as mobile banking (bKash), market information systems, mobile accounting; eventually even mobile administration via m-government.

Web applications for public health

Eric Schmidt puts it in The New Digital Age (page 25): "Of course, you will be able to scan body parts the way you do bar codes". It is easy to believe that this will indeed come true, especially hopeful for remote areas with little healthcare. GP has already implemented the first generation: DICOT (Digital Imaging & Communication on Telemedicine) – a computer with diagnostic devices attached plus a video connection to a professional doctor located in Dhaka. The service reached 1490 people from 3 locations in the first ten months of operation. And there are many more applications that somehow support health by providing reminders for medication, pregnancy, babycare, sickness monitoring, etc.

We suggest that Blue Gold keeps monitoring the quick developments in these two sectors, web-applications for the marketplace and public health. They have a lot to offer.

4.2 Options for information exchange

4.2.1 Information availability

What data is available at global, regional or local levels that add value to the beneficiaries? The interviews showed that there was a lot of information out there that could add value to the beneficiaries. All such data can be made available for the Blue Gold people via mobile technology (for instance, through a tool such as "Blue Gold Viewer", see section 2.2). The available data and knowledge mentioned by the interviewees are mentioned bellow:

- IRRI is developing a GIS map of the coastal areas, on which they can show salinity scenarios. This is done in partnership with BWDB, LEGD, SRDI and IWM. This data should be public good when it is finished. IRRI also measures river water salinity. The Soil Resources Development Institute (SRDI) and the Institute of Water Modelling (IWM) have long term data sets.
- IRRI has much knowledge on ways to increase people's food production, for instance, by combining fish farming and rice farming and how to use different rice crops during different times in the year (dry winter, high salt levels; wet summer, flooding and submersion of fields).
- BRAC has its own climatologist for EWS and has set up eight meteorological WMO standard stations. They have signed an MoU with the Ministry of Defence for data sharing (MET and remote sensing). Based on their own stations and data from BMD and RIMES, BRAC creates a 10-day forecast. BRAC monitors disasters by receiving information via text messages from locals, organised in closed user groups. Government law states that BRAC cannot disseminate information about disasters. So, they disseminate this information to their local BRAC representatives via SMS and MMS, calling and internet streaming.
- WorldFish has been working with IRRI and IMI on the CPWF (challenge program water and food) introducing a multiple cropping system (several harvests of different crops in different seasons) and introducing highly nutritious fish (mola). They work to close the value chain for the farmers: good hatcheries (more oxidised), good seed, quality feed, and use of large fingerlings lead to less mortality and the right density for successful and increased crop production. They train farmers on how to do this and it is likely that the data of the CPWF project will become publicly available.
- WorldFish and IRRI produce GIS salinity maps for surface water, groundwater and soil. IWM then models the salinity levels on the basis of this data. WorldFish disseminates the information via research forums, media and trainings in the field.
- DAE has a huge amount of agricultural knowledge, from feasibility studies in reports to very practical suggestions on pesticides. Besides knowledge, for DAE it must be mentioned that their field services wing has an extensive network of representatives. A total of 30,000 representatives of DAE are working at upazila and village levels. With this, they are probably the most represented government agency in the field. The local representatives help the farmers with training, education and information. Besides providing information to the farmers, the DAE also gathers much information from the field through the field services wing.
- RIMES/ BWDB/ BMD/ CEGIS have the following information available:
  - Agromet service: humidity, temperature and evapotranspiration
  - Long time-series of 55 rain gauges, 74 water level gauges (per telephone

to central point, upload to website)
- Two hydrologic models: 1 deterministic and 1 probabilistic model (based on 10d ECMWF meteorological model), 15 pilot sites in Bangladesh. One model runs for about 30 minutes.
- Water level forecast for 3 days in 38 locations in Bangladesh
- Flood inundation model, based on topography map from 1960. CEGIS is planning to make new topography maps.
- Slowly getting more data cooperation with India for upstream hydro and meteo data. At the moment they receive water level data from 9 stations in India. CEGIS, UNESCO-IHE and IWM cooperate to calibrate the upstream precipitation data with radar.
- RIMES is working on a higher resolution (9x9km) cyclone forecast, will start piloting next cyclone season. At the moment the cyclone forecast is 3 days and large resolution, for whole of Bangladesh.

In the next paragraph, a more detailed insight into the available weather and water information available with interviewees and with global and regional sources is presented:

Weather and water information

Meteorological data can be distinguished into operational data, warnings, climate and monitoring data and climate scenarios. The monitoring data can be further distinguished into remote sensing data and in situ measurements. The in situ measurement will in general be more accurate than remote sensing data. However, they will only represent a locally significant value. In situ measurements are typically scarce in Bangladesh.

- *Operational meteorological forecast data:* These models provide estimates on precipitation, evaporation, wind, temperature etc. The forecasts are typically valid for a period of 5-10 days ahead. These data is crucial as input to models that generate forecasts of river and sea level rise, as well as drought and crop development. Available data sources are:
  - Bangladesh Meteorological Department
  - GFS (Global Forecast System)
  - ACCESST (Bureau of Meteorology)
  - ECMWF (subscription required)
  - ARL (Air Resources Laboratory); website enables the generation of meteograms based on the GFS model.
  - Sea level forecasts (Admiralty EasyTide or University of South Carolina)
- *Warning systems:* Based on the results of operational meteorological forecast, data warnings for specific hazards can be issued, for instance, cyclones, river flooding or excessive rainfall. Available data sources are:
  - Bangladesh Meteorological Department
  - Flood Forecasting & Warning Centre
  - Severe Weather Information Centre (http://severe.worldweather.org/tc/in/)

Global drought forecasting (http://gis.csiss.gmu.edu/GADMFS)

- Climate and Monitoring data: These data sources provide information on past weather or river discharge. This data is crucial in the development and evaluation of models. Available data sources are: Bangladesh Meteorological Department, El Tiempo[9], TRMM (Tropical Rain Measuring Mission), Global Runoff Data Centre and NOAA.
- Climate scenarios: Climate scenarios are projections of expected changes like sea level rise or changes in precipitation due to global warning. The scenarios can be used in studies on the effects of the climate change on the local environment and how to anticipate to the changes. Available data sources are:
  - Future Water (http://www.futurewater.nl/uk/projects/water-availability-analysis- for-the-upper-indus-ganges-and-brahmaputra-river-basins/)
  - Basin Focal Projects of the Challenge Program for Water and Food (http://cpwfbfp.pbworks.com/w/page/5927019/Water,%20poverty%20and%20livelihoods%20in%20the%20Indo-Ganges%20Basin)
  - Indian Institute of Technology Kanpur (http://www.iitk.ac.in/nfca/link_res_ proj.htm#Project_2)

4.2.2 Information that can be collected

Besides an opportunity to use information technology, the communities in the Blue Gold polders also have something to offer: data. We have examples of this in many applications, such as Jana (users provide consumer behaviour information), e-Krishok in Bangladesh (users provide agricultural information), NWS in Turkey (users provide information of local weather stations), Kibera in Kenya (users provide information on infrastructure in the community) and BanjirOnline in Jakarta (users provide information on local inundations and floods through Twitter). On the basis of the IPSWAM reports, the meetings with the experts and our expert view, we listed the following data that the communities of Blue Gold can offer:

- Information on agriculture practice, such as land-use, use of pesticides, use of fertiliser, plagues like diseases, insects, how much of a certain crop a farmer is about to harvest, for how much did the farmer sell of his products, etc.
- Information on water management and water infrastructure, such as which Khals are clogged, what embankments are damaged, which structures do not function properly anymore and also operational decisions such as 'opening structure x at this moment', so much water flowing in that direction, water level in Khal is so high etc.
- Information on disasters: Which parts are flooded, what measures are taken, how many people are affected, what kind of resources are needed, including

[9] http://www.tutiempo.net/en/Climate/Bangladesh/BD.html)

messages and photos.

- Information on water use, such as people showing how much water they have been using or expressing that they are in need of water due to water shortage. Any information that people can measure, such as precipitation, wind, humidity, soil composition etc. People would have to be provided with additional devices for this.
- Demographic information, such as information about births, deaths, illnesses, etc.
- Information on supply, demand and market prices of goods and services that people want to trade (fingerlings, maize, labour, etc.)
- Information on consumer behaviour that could be interesting for marketing purposes.
- Any other information that could be interesting for the project, such as training impact, people reached, supplies available, etc.

The question is to whom this information is interesting/useful? We listed the following organisations to whom this information could add value:

- The Blue Gold programme: Planning and monitoring of the programme
- The Department of Agricultural Extension: Agricultural information and practices
- The Bangladesh Water Development Board: Status of Water Infrastructure
- The Bangladesh Meteorological Department: Local weather monitoring stations
- Non-Governmental Organisations: Grass root research
- Marketing departments: Consumer behaviour of people in Blue Gold area
- Department of Disaster Management: Impact/needs assessment
- Organisations and people in the food value chain: Markets and agriculture information, transaction information of individual merchants, to be used to customise (micro-)credit
- Other parties and programmes that use grass root level data to support programming decisions; for instance other donor projects, micro-credit organisations and others

4.3 Revenue models

How to realise some revenue from web-applications is not an easy trick. Thousands of great initiatives have been tried and failed to reach cost recovery; among them is the very popular Reuters Market Light application that, despite its success, cannot cover its costs (see text box). However, there are also many examples that in fact are profitable or at least covering costs, such as E-Purjee, Kishani, Jana and many others. In this section, we do not present the 'winning business model;' we merely describe how others did it. In the next chapter called "Recommendations," we will refer to the models that can be interesting for Blue Gold.

Reuters Market Light

"An international news giant launched Reuters Market Light (RML) in 2007 to provide market prices and weather and crop advisory services to farmers in India. Invented by a Reuters employee, this service offers highly customisable market information to farmers through text messages delivered to mobile phones. To subscribe, farmers call a toll-free number to activate the service in the local language and specify the crops and markets in which they have an interest. Farmers receive four to five SMS alerts with relevant information each day. Initial studies show that farmers who receive the service typically earn 5–10% more income. The company employs over 300 office staff in eight states to process localised agricultural information, serving around 250,000 customers. RML competes with traditional information services (radio, market intermediaries, and newspapers) and other services that use mobile phones. IFFCO Kisan Sanchar Limited (IKSL) offers similar market information for rural farmers but uses voice messages so illiterate farmers can use the service. (Mobile Money, 2012)

Revenues from charging the user

- Internet shops in general are charging per hour of internet connection. For instance, in the CICs (community internet centres) that GP supports, the entrepreneurs are asking up to Tk30 per hour for an internet connection.
- For the health application of GP DICOT, where a patient can be examined through various devices and a video connection with a doctor, the patient pays per consult. The revenues are split between the doctor, the entrepreneur (exploiting the DICOT) and the operator.
- The IVR weather messages application of Teletalk is paid by charging a marked-up tariff.
- BBC Janala that provides English classes via the mobile phone, is paid for by marked-up tariff.
- Trade applications for instance in India charge a provision per transaction.
- BIID offers agricultural advise through a paid service (Tk15 for six text messages).
- Mobile operator Robi offers registered subscribers life insurance build-up, depending on used airtime. The more airtime used, the more insurance coverage earned.

Note that the above applications may be partially subsidised.

Revenues from charging the organising company or organisation

- The application for tubewell monitoring is paid for by the owner of the tubewells.
- E-purjee, the Bangladesh sugarcane application, is paid for by the organizer, that is Bangladesh Sugar and Food Industries Corporation.
- All m-government applications, including community reporting systems, are fully funded by the government. Where government has less capacity, for

instance, in Kenya, this role can be assumed by NGOs, as has happened in the case of the application for Kibera (community infrastructure mapped).

- The mobile school of GP is paid for by the NGOs managing the programme and the CSR programme of GP.
- JICA and GP are working on disaster information dissemination. In this, GP collects and forwards data on the locations of potential affected persons, while JICA pays for the warning dissemination
- Some applications that advise on the use of certain products, are sponsored by the suppliers themselves. For instance fertiliser advice is sponsored by fertiliser producers, health advice is sponsored by suppliers of pharmacies, etc.

Revenues from selling the data

- Jana is a crowdsourcing app that gathers small pieces of information of consumers by questionnaires in exchange for airtime. They have automated algorithms to evaluate the quality of the data and compensate respondents. The data is sold to marketing departments of companies and organisations that want to understand consumer behavior.
- In Turkey, the national weather service improved their forecast, by asking farmers to collect information on temperature, humidity, precipitation and soil fertility. In return, the weather service offered more detailed weather forecast through a mobile application.
- Actually selling the data can be actively pursued as well. In Uganda, a worker can earn up to $20/month by disseminating and collecting information via the mobile phone and another $20-$30 from charging farmers' phones from their solar charger.

Of course there are many more, but this provides some idea, a cross-section of revenue models in and outside of Bangladesh. Note that none of the applications go for cost recovery from advertisement, as the quantity of traffic of such specialist apps is usually much too low.

The access to internet can be organised as a business model as well. GP and BIID follow the same strategy to distribute the means for this. They support entrepreneurs that exploit the hardware. GP does this for its health programme (they call the shops Community Information Centres) and BIID does this to support their e-Krishok (they call the shops Batighar).

2 Demonstration of Mobile ICT

For demonstration purposes, we have built a simple website and two web-applications: "Eye on Infrastructure" and the "Blue Gold Viewer".

2.1 Website

The website contains three parts:

- An overview of organisations that carry relevant information for food security and water management in Bangladesh. We distinguish real time from non-real time information. The information can be obtained either under a Memorandum of Understanding (would be advisable for data from for instance BMD and BWDB) or information that can be obtained publicly (for instance NASA, TRMM).
- Applications that can be used by Blue Gold beneficiaries, includes links to all services that are currently offered that may be interesting for the Blue Gold beneficiaries. Among them are telephone numbers to IVR systems with agricultural information, weather and market information.
- Applications developed for Blue Gold. At this moment they are alpha versions of Eye on Infrastructure and the Blue Gold Viewer. In the next section, these applications are discussed in more detail.

4.4 Eye on infrastructure

We have developed this application to demonstrate just how simple it is to create an interactive map, and what it looks like. We developed it in about two days and demonstrated it during our meeting at EKN, on 20 June 2013. A user can report

Figure 3: The web interface

damage to infrastructure by SMS, which is then shown in a geographical display. A user sends a coded message to a central number (for the time being it is +62 812 95404864). The code that we used was two digits for polder identification, one digit for infrastructure identification and one digit for status of the infrastructure. A few seconds after the message is sent, it will appear in the web-application.

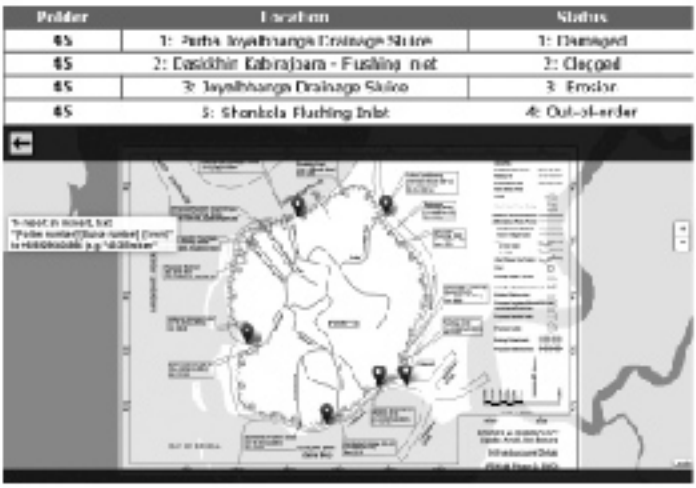

Figure 4: Demonstration version of "Eye on Infrastructure"

Implementation of "Eye on Infrastructure"

We are now using an Indonesian telephone number on of our servers in Jakarta, Indonesia. If Blue Gold considers adopting the application, it will need some work, including:

- Migrate the SMS gateway to a location in Bangladesh that can be online 24 hours a day, 7 days a week. Once the SMS gateway is migrated, a Bangladesh mobile number can be used. For instance it is possible to have a 5-digit telephone number that can be accessed from subscriber to different mobile phone operators. The cost of registering such a number is about US$1500.
- Include more polders and more detail to the physical infrastructure. Add additional codes to give more detailed information about the infrastructure.
- Extend the potential messages that can be received by the server to receiving multiple-choice response to IVR, photos of infrastructure, input from smartphones etc.
- Create a mobile application that can upload the information via the internet. This way it is easier to transfer a larger amount of data, containing more information. In addition, the user's position can be determined and send together with the information.
- Ideally, users pre-register so that a database holds information such as telephone number, name, gender, occupation, residence etc. and the observations that they have made so far. This also allows for the receiving organisation to provide feedback to the sender of the text messages.
- An option is to let the database interact with information from FEWS and the world wide web. The analysis module interpreters the message by combining the message with the information in the database.

The draft functional design for mature application is displayed in the next figure:

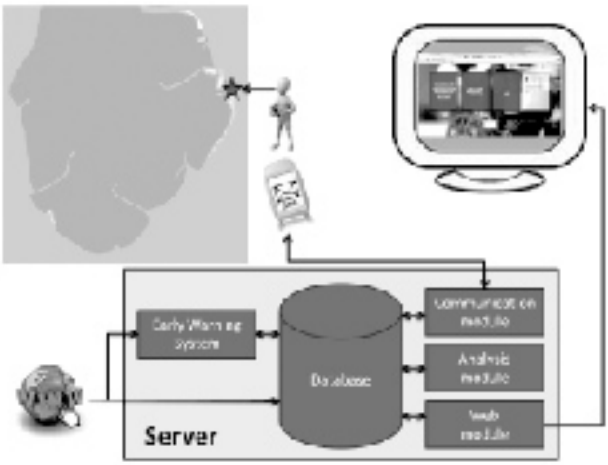

Figure 5: Draft functional design display

2.2 The Blue Gold Viewer

As suggested in section 4.2, there is a lot of information available. The Blue Gold Viewer shows data that is available from data sources on the Blue Gold project area, like a real-time GIS for all real-time geospatial data. It can be used as standalone for project staff to know what is happening in the project areas. But when combined with an IVR system, any type of information in the "Blue Gold Viewer" can be conveyed to the beneficiaries.

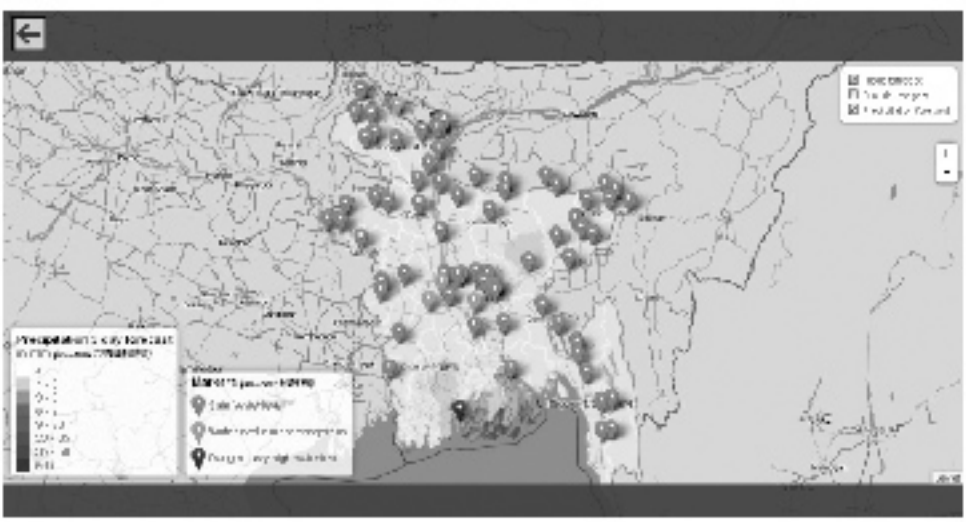

Figure 6: The Blue Gold Viewer

From the menu on the right upper corner, the user selects what information he or she would like to see on the screen. The following data is available now:

- Precipitation forecast of TRMM/ GFS
- Flood forecast of BWDB
- Clouds imagery of NASA

Precipitation forecast of TRMM/ GFS

The application shows the precipitation forecast for each province of Bangladesh. When the user hovers over an area, more detailed information is displayed in the upper left corner of the screen. This extra information contains the amount of precipitation as well as the time for when it is forecasted.

The precipitation forecast is based on Global Forecast System (GFS) of the US National Weather Service. GFS is a global numerical weather prediction system. The model is run four times a day, and produces forecasts for up to 16 days in advance, but with decreasing spatial and temporal resolution over time. The spatial resolution of the GFS data is around 60 km. The past rainfall is deduced from the TRMM satellite data set. NASA's Tropical Rain Measuring Mission (TRMM) provides estimates of the past rainfall amounts. The data are available on different timescales. NASA regularly reprocesses past measurements using the most recent algorithms to obtain better assessments. The TRMM data can be valuable as input for large scale runoff model, water balance studies, and in areas where in situ measurements are scarce. The spatial resolution of the TRMM data is about 30 km. The estimate combines time series of past and future rainfalls. The gridded rainfall is aggregated in administrative regions.

Flood forecast of BWDB

Besides precipitation forecast, this application also shows water level information from the BWBD and cloud imagery of the NASA. Just as the TRMM data, this data is available as a layer on top of the map. The water level information is shown as 72 stations throughout Bangladesh, represented by a marker. This marker can have one of the three colours:

- Green, meaning the water level is normal
- Yellow, meaning the water level is less than 0.50 mPWD, that is below danger level
- Red, meaning the water level at that station is at a dangerously high level.

When a user clicks on one of the stations a popup window appears with a graph showing the water levels of the past few days and, if available, the forecasted levels for the next few days. The user can interact with this graph by hovering over it with his mouse pointer. The graph then shows the exact value together with its measure date. This graph is directly taken from the FFWC website. On the bottom of each graph, a link to its source is given.

Clouds imagery of NASA

The cloud imagery is shown as an image over the map. NASA offers satellite imagery of the whole world and twice a day. They place the latest pictures on a public website. These images contain some detailed information about the clouds above Bangladesh. In the Blue gold viewer, the user can turn on this imagery to see the clouds above Bangladesh.

FEWS standalone

To generate the TRMM data, we configured a standalone FEWS. It performs the following tasks:

- Downloads the most recent GFS forecast
- Imports the GFS data into FEWS
- Downloads the updates of the TRMM data
- Imports the new TRMM data into FEWS
- Calculates averages of the past precipitation per administrative districts in Bangladesh
- Calculates the averages of the forecasted precipitation per administrative districts in Bangladesh
- Merges the past precipitation series with the forecasted series
- Exports the series

The system goes through this routine every hour. The data visible in the Blue Gold Viewer is also visible in the FEWS interface; but in a slightly different format (see Figure 5). Note that FEWS is not a web application and the interface is only accessible when logged on to the server or using a FEWS client application.

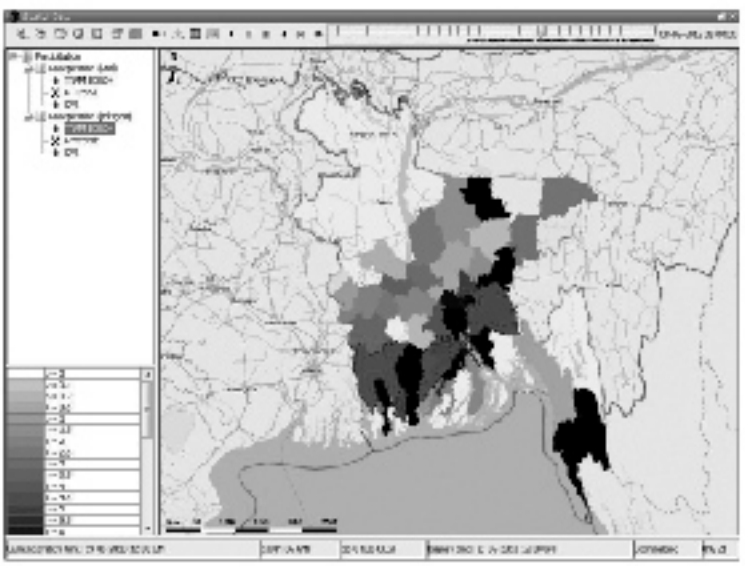

Figure 7: Example of the Precipitation display from FEWS.

The existing FEWS system imports only two data sources (TRMM and GFS), but it can be used to import many other data sources, described in section 4.2.

Implementation of "Blue Gold Viewer"

The Delft-FEWS system processing the data is currently implemented on a test server of HKV in the Netherlands. If Blue Gold considers adopting, it will need some work, such as:

- Implementation on a server better accessible from Bangladesh and closer to the server hosting the mobile application and Blue Gold Viewer.
- Implement a network implementation of Delft-FEWS.
- Implement tools to monitor the system status implement support. The system status should be checked regularly and actions should be taken in case the status is not OK.
- Optionally add more data sources and models.

2.3 Hosting and maintenance of the demonstration ICT

At this moment, the demonstration ICT consists of hosting and maintenance of the Blue Gold website, the FEWS Server and the SMS Gateway. The website is hosted by HKV in Jakarta, Indonesia. The FEWS Server is locally hosted on a test server at HKV in The Netherlands (there is only up-to-date FEWS data available if that server is on) and the SMS Gateway is hosted on a laptop at HKV in Indonesia (always on). Of course, beyond the demonstration, all servers should be migrated to more robust solutions.

Main recommendations

Hereunder are our main recommendations to the Blue Gold program and in fact, any other development project in water and food security:

- Make inventory of your program problems/opportunities and identify those that contain an information component. As an example, you can use the inefficiencies, suggestions and solutions in Table 2 and Table 3 and mirror them with the ambitions and developments set in your program. When your target is clear, it is advisable to map the existing landscape of applications that may be utilised or adapted to fit your purpose. This is a cost-effective way to move forward, without duplicating efforts. As motivational issues are a large influence to any solution, a thorough social research on consumer behaviour related to your mobile ideas is recommended.
- After selecting your best options, develop it and get it out there! "Fail early and fail often" is a widely accepted, general advice for any ICT development. And it is not for nothing. The response to Mobile Applications can only be fully understood by experiencing it.

Specific recommendations for Blue Gold

We selected four types of mobile opportunities for Blue Gold. Together, these four solutions address the most important inefficiencies discussed in chapter 3. They are:

1. Interactive Voice Response (IVR) with customised information to beneficiaries. An IVR is a system where users can call a number, select their choice from a menu and listen to a pre-recorded message. This way, any piece of audio information can be conveyed. It can be designed either as a free service or a paid service. Teletalk already provides such a service for weather information, with good pilot results (100,000 requests in three months). Through an IVR system, Blue Gold could disseminate any kind of information, e.g. on agricultural inputs, crop prices, customised explanation of cyclones (after warning by the responsible authorities), drought forecasts, irrigation needs, etc. In addition, any type of advice that Blue Gold would like to provide to the people, can be recorded and listened to via audio messages. Whether they are podcasts with an entertaining element or specific advices that discuss current events, for instance advice for fertiliser inputs during planting season. The beneficiaries could even drop questions via IVR, for specialists to reply to in a Q&A audio message. There are many possibilities. An interesting extra with IVR is that its data traffic will reveal popular requests, showing what data really matter to end-users. This may guide specific further research and development, where other programmes can assist such as RIMES, Flood Early Warning System, Sat4Crops, etc.
2. Community reporting system. Through SMS, people can upload any type of information to a community map. This is a proven concept where citizens can report accidents, damage to infrastructure, crime and any other type of observations. With this, the Blue Gold beneficiaries can become data suppliers. It can be used to monitor water infrastructure (which Khals are clogged, what embankments are damaged, which structures do not function properly, what is the current operation of a structure, water level information, etc); weather (they can take measurements of additional weather stations for an organisation such as BMD, a proven concept in Tanzania); agriculture (e.g. on land-use, use of pesticides, use of fertiliser, plagues, diseases, yields, soil samples, etc. interesting information for DAE and companies in agricultural inputs); disasters (text and photos of impact assessments, resources needed, measures taken, etc.); water use (household and farmer usage and needs); market information (prices, goods and services that people want to trade); etc. Taking measurements may involve additional devices (weather stations, soil test) and may include an incentive to upload data, e.g. via free airtime.
3. SMS system for inventories and questionnaires. SMS systems can support any kind of communication to and from beneficiaries, as is being practiced in many parts of the world. A simple SMS server can send out automated batch of questions and receiving reply, possibly supported by a deal with telephone companies who arrange airtime in exchange. Such a facility can be used for the project itself (taking inventories, doing project questionnaires, advising farmers on crops inputs) while its results can even be used for commercial purposes (following the example of Jana, gathering small pieces of information from consumers through questionnaires in exchange for airtime).

4. Training via mobile applications. This includes offering audio, video and games through mobile devices and supporting blogs and group communication. More and more people have featured phones even with an extra large screen, perfect for watching videos and gaming. On the other hand, group communication can well be supported even on dumb phones. Training via mobile applications is not new. The project English in Action already has experience in this, as do many other development projects around the world from reminders (mothers needing to take medication, water users that need to change filters) to classes (Khan University offering a free library of 4300 ten-minute videos on biology, chemistry, physics, finance, history and others, with hundreds of millions views worldwide) to gaming (pilots have been done where tablets were handed out offering interactive modules for science and English, with amazing results) and horizontal learning (through blogs and communication features of mobile apps). It might be of great assistance to the Blue Gold beneficiaries.

Recommendations

In this study we have seen how mobile technology is playing an increasing role in the lives of people in developing countries worldwide and in Bangladesh. There is a wealth of both good ideas and bad pilots that we are learning from as a society. And, there are a small number of really good initiatives that are changing the lives of people from all socio-economic backgrounds, including those in Bangladesh. For the Blue Gold program, there are many opportunities to address the system, behaviour and market inefficiencies identified. But beware, this is no cake stall. Mobile applications should be carefully selected and customised before launching. Our main recommendations to the Blue Gold program and in fact, any other development project in water and food security:

- Make inventory of the program problems/opportunities and identify those that contain an information component. The inefficiencies, suggestions and solutions of Table 2 and Table 3 can be used as an example. Mirror them with the ambitions and developments set in your program. When the target is clear, map the existing landscape of applications that may be utilized or adapted to fit the program purpose. This can prove a cost-effective way to move forward, without duplicating efforts. As motivational issues are a large influence to any solution, a thorough social research on consumer behaviour related to new mobile ideas is recommended.
- After selecting the best options, develop a beta version and get it out there! "Fail early and fail often" is a widely accepted, general advice for any innovative ICT development. And it is not for nothing. The response to mobile applications can only be fully understood by experiencing it.
- Remember to make it fun! "The most compelling part about the whole mobile revolution is its positive psychology. Mobile apps are fun. Its pervasive-billions participate in it. It is empowering-extending individual's capacity and influence and its ethical-mobile levels the playing field" [Michael Saylor, founder of MicroStrategy]

Specifically for Blue Gold, we recommend to:

- Verify the inefficiencies identified in this report and make any required corrections.
- Take note of the available ICT solutions and evaluate whether there is scope for information technology in particular program components.
- Choose one or more inefficiency-solution combinations that generate energy and are easy to implement.
- Design and develop a prototype application that is useful and fun! To support this, we advise to conduct a social or ethnographic research on the use of the mobile phones and internet in the daily lives of the beneficiaries. Publish the prototype for a small audience to understand the response.
- When the prototype shows good results, it is time to take the idea seriously and design a mature application. This includes investigating what revenues the application could generate (charging the users, charging the organising company or organisations, or selling data collected) and what resources that will be needed for the application (funds and/ or data from other organisations). This process may be done together with a mobile operator, to mirror and to discuss how the application can be supported at different locations.
- When all ingredients are there, the application can be developed in release version, after which a testing period starts and after that, full implementation with the targeted users. This may include a marketing campaign.

Final remark

In information revolution, as some people call it, your development program can either lead, or follow. Both may be good strategies, but they are totally different. When taking the latter strategy, you are using the best technologies after they have proven their successes in other projects. The most important thing here is to keep up-to-date with developments, so that whenever others have developed interesting applications, you can test and adopt it yourself. In contrast, the first strategy is much more work and requires investments and acceptance of failures. But, the first strategy will also deliver the first and best customised results. A third, perhaps interesting option for Blue Gold, is to do both: selecting one or more top inefficiencies that you believe can be tackled using web ICT. Invest and accept possible failure hopefully to reach a real breakthrough. For all other inefficiencies, just monitor the latest developments and adopt whenever you are ready.

5 Recommendations

In this study we have seen how mobile technology is playing an increasingly crucial role in the lives of people in developing countries worldwide including Bangladesh. There is a wealth of good ideas and bad pilots that we are learning from as a society. And there is a small number of really good initiatives that are changing the lives of people in all income groups, including those in Bangladesh. For the Blue Gold program, there are many opportunities to address the inefficiencies identified.

But beware, this is no cake stall. Mobile applications should be carefully selected and customised before launching. Many before us have failed!

Appendix A: Facts and Figures

From connectivity to applications for development

Between 2000 and 2012 the number of mobile phones grew from 1 to 6 billion. Connectivity grew from 61% in 2003 to 90% in 2010. Worldbank changes focus from 'connectivity' to 'applications'. 75% of their projects have an ICT component. Calls mobile network "biggest machine in the world". Mobile transformation increasingly happening in developing countries who are more "mobile" than developed countries. Sense that "mobile applications not only empower individual users, they enrich their lifestyles and livelihoods and boost the economy as a whole".

Many good practices around the world

Farmers and traders significantly increase their income following mobile usage (example Indian potato sector 19%, Niger grain sector 29%, Uganda banana sector 36%). 29 countries in sub-saharan Africa use m-health applications; 68 worldwide. 74 countries use m-money applications. Governments are increasingly using m-Government applications. More examples of applications worldwide appear in the next table

Selection of applications Worldwide

Weather, Agriculture, Disaster Management

- Turkey: National aggregated information on weather proved inaccurate. 5 small meteorological farms and 14 small reference farms were established to collect information on temperature, humidity, precipitation and soil fertility, enabling accurate pest monitoring (investment costs $40,000, savings $1 million/year)
- In Sri Lanka, it was found that more than half of the country's lactating cows were not pregnant half the time. This was due to a lack of timely access to artificial insemination and breeding service. The E-dairy program enables farmers to request veterinarian services and extension services (animal health, artificial insemination, milk prices, construction of dairy stalls) which is sent to all registered suppliers who can more easily connect to the farmers.
- "Seeiing is believing" project in West Africa involves local extension service providers who interpret information from high resolution imagery taken from satellites. The images are used to gauge the relative fertility of the soil and measure the size and shapes of the fields. Many farmers do not know the size of the fields, but this way SIBWA team can work with farmers and determine the optimal amounts of fertiliser, pesticide and seeds to cover their land.
- In any type of disaster, twitter information usually comes out first. SMS services are increasingly being used for disaster warnings. Networks for flood monitoring and warning via mobile services are now found in urban areas in

Asia such as in Bangkok, Singapore and Jakarta and even in rural areas. In Jakarta, www.banjironline.co.id monitors floods by counting and interpreting the tweets.

Crowdsourcing and community participation

- In Tanzania, smartphones used for geo-tagging climate information and in a community, people share videos of farmers offering advice on techniques
- In USA, a citizen reporting tool allows people to geo-tag nonemergency municipal issues, such as potholes or graffiti, with their mobile phones. With more than 57,000 incidents reported and a 45 percent fixed rate between January and October 2010 across multiple cities, this application shows promise for efficient and streamlined citizen-government interactions.
- In India, the state of Kerala's mGovernment program has deployed over 20 applications and facilitated more than 3 million interactions between the government and citizens and captured 200,000 photos for crime and accident reporting usage since its launch in December 2010.
- www.kibera.org in Kenya facilitates community mapping of infrastructure and services. Experiments in mobile-enabled mapping by urban slum dwellers suggest that innovative mGovernment could actually transform governments' design process for urban development programs by directly involving beneficiaries.
- Jana is a crowdsourcing app that gathers small pieces of information of consumers by questionnaires in exchange for airtime. They have automated algorithms to evaluate the quality of the data and compensate respondents. The data is valuable for marketing departments of companies and organisations that want to understand their citizens' behalvior, motivations and interests. Partnerships between information suppliers and demanders of public and private.
- Uganda: A worker earns $20/month from disseminating and collecting information via the Mobile phone and another $20-$30 from charging farmers' phones from their solar charger.
- Cooperatives can be ideal networks to manage mobile information services. In Chili, cooperatives use text messages to help small-scale famers increase productivity.
- In Congo, mobile tools allow citizens to participate in budgeting, by voting how to spend local budgets.

Other applications

- Mothers receive medical reports on their pregnancy by phone, doctors can determine whether special healthcare is needed. WaWaRed provides various messages for pregnant women.
- Uganda: Track school attendance so that school administrators can see patterns in attendance, for instance by village, by day of the week, and by

season. Tracking attendance for pupils indirectly also tracks absenteeism among teachers.

- In India, barbers who do not have a bank account can use mobiles to send money to their relatives in villages. In Kenya mobile payments equate to one-fifth of GDP.
- www.checkmyschool.org allows citizens to view budget allocations, teacher and textbook information and test results for 10,000 schools in Philippines.

Selection of applications in Bangladesh

Weather, Agriculture, Disaster Management

Sugarcane farmers receive SMS telling when they should bring their products to sugar mills and an SMS when their payment is ready. E-Purjee reaches 200,000 farmers and all 15 state-owned sugarcane mills. Sugar production rose 62% and farmers are benefitting from the transparent system.

Other applications

- Bangladesh's Health Line provides citizens with medical advice through a telephone hotline, cutting travel time and waiting at health centers.
- BBC Janala (meaning window), launched in November 2009, is a unique multi-platform (including mobile, internet and TV) project that harnesses multimedia technology to provide affordable education to potentially millions of people in the Bangla-speaking community. By dialing 3000 users can access hundreds of English language audio lessons and quizzes.
- Students can apply for university entrance examination, reducing travel time. Fees are deducted from applicants' mobile account.
- Cellbazaar: CellBazaar leverages the widespread power of SMS to bring the market to your phone. By sending simple text messages to 3838, you can post items for sale, look for items to buy, and obtain current market prices of products or services. Alternatively, WAP provides an even faster experience as you browse a simple graphic menu to access the entire marketplace.
- Digits to all developed Amadeyr tablet ($100 dollar). The project found that villagers who had never used PCs or internet, were able to use the tablets within a few days

Appendix B: Interview List

- Malik Fida A Khan (CEGIS)
- Manoranjan Mondal (IRRI)
- Alamgir Chowdury (SocioConsult) and his colleagues
- Babar Kabir, Saiful Islam Raju (BRAC)
- Abdul Awal (ECHO)
- Kaiser Rejve, Mohua Slotema (Oxfam)
- Dr. Craig Meisner and his colleagues (Worldfish)
- Tonmoy Sarker, Jabed Hossain (RIMES/ BWDB/ BMD)
- Tahmina Begum, Matiar Rahman (DAE)

- Mirva Moilanen, Mostafa Zaki Haider (Worldbank)
- Khaled Khaleduzzaman, Catharien Terwisscha (EKN)
- Community members of Patuakhali
- Andrew Jenkins (BRAC, former TL IPSWAM)
- Mamunur Rashid (UNDP)
- Harun (Save The Children)
- Carel de Groot, Arman Akbary Khan (EKN)
- Jahidur Rahman, Shakil Ahmed (Teletalk)
- Ziaur Rahman (Citycell)
- Hafizur Rahman Khan (Grameenphone)
- Shahid Uddin Akbar (BIID)

Appendix C: Interview Results

Hereunder a summary of the interview results in six tables:

- Mobile applications initiatives
- Other mobile applications in Bangladesh
- Available data and knowledge
- Suggestions for Blue Gold
- Problem statements and information needs
- Use of the mobile phone in a village in Patuakhali

Mobile applications initiatives

Hereunder an overview of the initiatives that the organisations themselves have been developing. Almost all of them are in pilot or start-up phase.

Nutrient Manager (IRRI)

Farmers answer 15 to 20 questions about their practices for rice cultivation and then they receive a fertiliser recommendation customised for their field. This enables them to increase rice yield and profit by applying the right amount of fertiliser at the right time. The questionnaire can be answered via internet or calling an automated service (answering with telephone keypad). The Indonesian version can be checked through http://webapps.irri.org/nm. The Bangladesh version is currently in development.

Early Warning via txt messages (CEGIS)

CEGIS had a project that used text message for early warning. For a specific location, they had derived inundation maps for different water levels in the river. When thresholds are exceeded, they send text messages to the local representative that operated a flag indicating the hazard (blue, yellow, red). The pilot was very successful. However, after the project funding stopped, the system stopped functioning.

Icress (BRAC)

BRAC started 3 years ago with ICT for Development (ICT4D) and are developing a web-application called Icress. Icress is an application that receives information

from RIMES and shows the information on a map. It has a communication component (calling, SMS, IM), a resources tracker component (monitoring the location of volunteers through their smartphones) and some other functions. The project is in pilot phase and the platform is not open (yet). At present eight programmes of BRAC are using it for information sourcing and dissemination. What they are missing they say is trusted climate information they say.

Disaster monitoring (BRAC)
BRAC monitors disasters by receiving information via text messages from locals, organised in closed user groups. BRAC shares this data with BMD and RIMES (for on-ground validation).

GIS tool for disaster management (ECHO)
The humanitarian aid section is developing a GIS tool to better grasp of the locations of shelters and resources, but it is in an initial stage they say.

Mobile questionnaire (Worldfish)
Worldfish will start a pilot next week sending questions via text (> 15.000 text messages to list of farmers). People have to text back to another number and pay for the text message that they are sending. The language is English script Bangla.

Agriculture Information Service (DAE)
The Department of Agricultural extension has their own Agriculture Information Service (AIS). The AIS stays in touch with the local DAE representatives via telephone and internet (IM and skype) and they maintain an extensive website with agricultural information (text and video) and a farmers' blog. As part of their digital extension project, in the hall of the building DAE placed a pillar with a touchscreen operating the website. Some of the Upazilas have ICT services, using software and data packages developed by SDRI. Upazila officers can open these data package and show them to the farmers. 94 Upazilas have laptops as part of a pilot. DAE tries to educate farmers how to use email, internet etc. and they find that farmers are very smart, some very quick in understanding ICT. Many farmers have regular (dumb) phones. Smartphones are not around.

Mobile raingauge monitoring (RIMES)
RIMES has given rain gauges and telephones to 8 volunteers of Save The Children and 2 volunteers from CARE. The volunteers send precipitation quantities every 6hrs, increasing the accuracy of forecasting for a small area.

Weather App (BMD)
Nokia assisted BMD in creating a Weather App. The App can be downloaded from their website, but is only available for Nokia phones.

Hackathon (Worldbank)

The 2nd of December a Hackathon event took place in Dhaka. The Hackathon is a worldwide event where programmers team up to solve problems with ICT solutions. This years' theme was sanitation. 14 countries joined with a total of 350 programmers worked for 36 consecutive hours on a selection of problems. The problem statements came from the field, local government, donors, NGOs, incubator makers. Of the developed software, Worldbank selected 46 prototypes from the Hackathon that are interesting for further development. It is not decided yet whether this should be Worldbank funded.

Pilot projects Oxfam

OXFAM has a few small piloting projects. They are:

- EWS via mobile phones: A pilot they are doing with ECHO.
- GPS tracking of fisher boats: Together with Hyratel they operate a GPS system that monitors the boats of the fishermen in a coastal area. The system registers when a boat capsizes and rescue teams can be deployed. Last year they started with 50 boats, coming year 350 boats.
- Gobhari project: They are using mobile money transfer, agreement with Picash, via the BRAC bank. There are some risks to open data transfer, so they are researching alternatives.

Learning Lab (SaveTheChildren)

Have the plan to improve the information flow, should run via the Union Parishad Offices and speed up the information process. Now it takes very long from information from the field to reach the main offices. The plans include distribution of smartphones for their employees in the field in the future, to get information back to headquarters quicker (pre- and post-disaster).

DICOT

GrameenPhone (GP) launched the Teledermatology Pilot Initiative[10] in partnership with Telemedicine Working Group Bangladesh Ltd. Their device DICOT (Digital Imaging & Communication on Telemedicine) provides diagnostic tools and a video connection to a professional dermatologist located in Dhaka. They piloted it for 3 locations, providing services to 1490 people in the first ten months in 2012. They are expanding the programme to more locations (20 locations this year) and more services (mother and childcare).

Tubewell Monitoring

HYSAWA installed and maintains 30,000 tubewells in Bangladesh. To facilitate the process of reporting and fixing broken tubewells, GP introduced an SMS reporting system. A designated person checks the tubewells regularly and sends out an

[10] www.telenor.com/corporate-responsibility/initiatives-worldwide/grameenphone-pilots-tele-dermatology-project-in-bangladesh

SMS when it is broken or needs maintenance. The SMS is sent to HYSAWA head office and the local mechanic. Result is a large improvement in administration efficiency and response time to fix the water source.

Mobile School

GrameenPhone just started a pilot with a mobile school. They felt inspired by the fact that although 90% of children can go to school, still 70% completes grammar school without knowing how to read or write. Their mobile school has a teacher in Dhaka, teaching children in the rural areas through a skype-like connection. The NGO providing the teacher and assistants is JAAJO. GP provides hardware and software. Next year they are looking to expand this service.

Disaster Information Dissemination

Still in start-up phase, JICA through ADB funds a new disaster management dissemination system. GP works in this together with BUET (Bangladesh University of Engineering Technology)l University of Japan and the government of Bangladesh. GP sends to Japan the details of amounts of people within reach of the BTS-es. Japan sends back an information package that GP onwards to the mobile phones in range.

Bima Life Insurance

Offered for free to Robi pre-paid subscribers. Each registered subscriber earns insurance cover each calendar month depending on his/her airtime usage. The more airtime used, the more insurance cover earned.

Dial 10941

Teletalk facilitates an IVR system where people can dial 10941 for weather and disaster information. The information comes from the disaster management bureau, providing regularly updated voice messages to Teletalk. The system has general messages for daily weather forecast, cyclone warning and flood warning and customized information for fishermen and for people living in coastal areas. The services reaches all of Bangladesh. In the last three months they have had 100.000 callers, 30.000 of them in the past few days due to a specific cyclone hazard.

Maternity alert

A mobile service hosted by Citycell. Customers can register to receive information about their pregnancy. Depending how far along women are, they receive specific advice about medicine etc.

E-Krishok

BIID together with GrameenPhone developed e-Krishok. E-Krishok is an application that offers farmers information and advisory services. Information comes from various sources such as DAE, IRRI and others. Their strategic partner is ACI (producer of farmer goods) who also deliver content, which is allowed as long as it is unbiased, says the regulatory body. The website does not generate

income and is sustained by BIID themselves.

Batighar

BIID supports small internet shops they call Batighar (meaning: lighthouse). Via the Batighar, people have access to various services such as trading crops. Farmers gather at the Batighar to make a joint offer of their product. An agent at the shop, offers the crops for a certain price via internet. Interested buyers can make a counterbid, after which the deal is closed or cancelled. Farmers receive their money via m-mobile. In future they can also get cash via regular banking from a rural ATM (recent investment of Tk. 400.000.000 by the Eastern Bank). The Batighar have 175.000 registered users.

Dial 16250

This month BIID and GrameenPhone will start a new SMS service. The farmer registers and pays Tk. 15. Then the farmer is called by a call centre (30 agricultural experts in three shifts) to collect the data of the farmer. Based on that data, the farmer gets 6 SMS with very specific information in the coming two months. Information may include when to provide immunization for their live-stock etc. With this service GP aims at 3 million registration in the coming few months.

FRS Fertiliser Recommendation Software

Developed by USAID in the project Katalyst. Among others, they connected to the Soil Resources Institute who at that time had a paper database of soil samples for the whole of Bangladesh. With the FRS the database as well as the process of collection had been automized. The database is still being updated today, but the software is not.

Other mobile applications in Bangladesh

Below list is what the interviewees know about other web-developments that they themselves have not been involved in.

M-health

Health assistants visit villages with their laptops to connect distant doctors and give advice (mobile doctor). According to Worldbank not widespread because of its high expenses.

M-health

People can call 789 and are answered by a room with Doctors giving advice. Phone costs are marked up to pay the doctors who are on duty.

M-Health

A USA program provides new born mothers IVR (instant voice response) in 5 different dialects of Bangla. The service is called Mama (Aponjum). Customers

register one time and then receive regular calls. It does not yet have a business model (free service). They are running a two-year pilot now with 25.000 members.

M-Money
M-Money being used by BKKSH and BRAC. ECHO mentions humanitarian aid is also using M-Money.

E-Purjee
Connects 200.000 farmers to 15 state-owned sugarcane mills. With the improved logistics, sugar production rose 62% and farmers are benefitting from the transparent system. Initially the project gave out tokens when to bring in their crop (10.000 farmers for one sugar mill) but this caused unrest because everybody wants to be the first to free up their land for another crop. E-purjee now works with a randomizer (lots).

M-Agriculture
An app called Krishi Somossa Somadan has information on crops. It can be downloaded from www.eatlapps.com (records shows that it has been downloaded 37 times).

People having heard of (but not knowing exactly how and what):

- Helen Keller (an NGO) uses a device (speculation whether it was a PDA, tablet or telephone) to exchange information
- Abdul Awal knows about relief money being sent by M-Money to beneficiaries. He refers to his partner NGOs for more information on this and other mobile applications.
- AAS (community research) is collecting measurements from farmers via txt messages (Meisner, Worldfish)
- Worldbank mentions an App (Foshil) that crowdsources and shares prices of grocery shops (dashboard of prices).
- DMP is providing flood pictures via mobile phones (a CEGIS experiment). This was brought up by Mamunur Rashid, but CEGIS had not said anything about this.
- Humanitarian organisation Grameen has a mobile services scheme (Oxfam)
- There is an anti-corruption mobile application TIB (Oxfam)

Other initiatives:
Alamgir Chowdury (SocioConsult): In India some districts have IT points at the Union Parishad office, with information about when to plant, harvest, measures to take etc. For example when a cyclone was on the way, they sent out the advise to immediately harvest. At the UP there is a local representative that can onward the message via txt or otherwise. You have to register with a e-water ID (BSN) to

receive information. The initiative is run by Dr. Saminatan. The system is not available everywhere (yet).

Jabed Hossain (RIMES/ BMD): Practical Action developed a Rolodex that visualizes information on a board The board can be operated by 'scrolling' the wheel manually, after reading a code sent by SMS or telephone. The project is funded through asian development bank (ADB) and BMD (contact Shamin Hossain Guljah)

Zaki Haider (Consultant to Worldbank): Although communication between India and Bangladesh is difficult, twinning towns on the border of Bangladesh with India are now using social media to connect.

Mamunur Rashid (UNDP): Government is thinking how they can bring flood warning under CSR programs of private companies to provide this service.

Dirk Smits[11] explained about the project English in Action. They provide teachers with mobile telephones with English classes on their SD-cards. The project SMS the teachers about upcoming lessons with directions to the SD-card where they can find materials. The telephone comes with speakers so that it can be used in the classrooms. Eventually 65.000 teacher will be reached this way. The sets are £35 per piece. After distributing 4500, they lost around 45 of them (reported stolen).

Harun Rashid (SaveTheChildren): CDAC (Community Disaster with affected communities) is global, but now they submitted a proposal with ECHO to start a pilot in Bangladesh. The goal is to investigate how to be better in disseminating and collecting information from the community. This is a joint effort by NGOs, IT organisation and media (BBC).

Available data and knowledge

Most of the interviewed organisations have either data or knowledge to share. The larger part explicitly mentioned that it can be used in the Blue Gold programme. Hereunder the overview:

- IRRI is developing a GIS map of the coastal area, on which they can show salinity scenarios. This is done in partnership with BWDB, LEGD, SRDI and IWM. This data should be public good when it is finished. IRRI also measures River Water Salinity. The Soil Resources Development Institute (SRDI) and the Institute of Water Modelling (IWM) have long term data sets.
- IRRI has much knowledge on ways to increase peoples' food production for instance by combining fish farming and rice farming and how to use different rice crops during different times in the year (dry winter, high salt levels; wet summer, flooding and submersion of fields).

[11] Dirk Smits (MottMcDonald Euroconsult) was not interviewed, but we met him in the Dutch Club in Dhaka where he explained about their activities in the project 'Learning in Action'.

- BRAC has their own climatologist for EWS and has set up 8 meteorological WMO standard stations. They have an MoU with the Ministry of Defence for data sharing (MET & remote sensing). Based on their own stations and data from BMD and RIMES, BRAC creates a 10 day forecast. BRAC monitors disasters by receiving information via text messages from locals, organised in closed user groups. Government law states that BRAC cannot disseminate information about disasters. So they disseminate this information to their local BRAC representative, via SMS, MMS, calling and internet streaming.
- WorldFish has been working with IRRI and IMI on the CPWF (challenge program water and food) introducing a multiple cropping system (several harvests of different crops in different seasons) and introducing highly nutritious fish (mola). They work to close the value chain for the farmers: good hatcheries (more oxidised), good seed, quality feed, use of large fingerlings leads to less mortality and the right density for successful and increased crop production. They train farmers how to do this and it is likely that the data of the CPWF project will become publicly available.
- WorldFish and IRRI produce GIS salinity maps for surface water, groundwater and soil. IWM then models the salinity levels on the basis of this data. WorldFish disseminates the information via research forums, media and trainings in the field.
- DAE has a huge amount of agricultural knowledge, from feasibility studies in reports to very practical suggestions on pesticides says DAE. Besides knowledge, for DAE it must be mentioned that their field services wing has an extensive network of representatives. A total of 30.000 representatives of DAE working at Upazila and village level. With this they are probably the most represented government agency in the field. The local representatives help the farmers with training, education and information. Besides providing information to the farmers, the DAE also gathers much information from the field through the field services wing.
- RIMES/ BWDB/ BMD/ CEGIS has the following information available:
  - Agromet service: Humidity, temperature and evapotranspiration
  - Long time-series of 55 rain gauges, 74 water level gauges (per telephone to central point, upload to website)
  - Two hydrologic models: 1 deterministic and 1 probabilistic model (based on 10d ECMWF meteorological model), 15 pilot sites in Bangladesh. One model run is about 30 minutes.
  - Water level forecast for 3 days for 38 locations in Bangladesh
  - Flood inundation model, based on topography map from 1960. CEGIS is planning to make new topography maps.
  - Slowly getting more data cooperation with India for upstream hydro and meteo data. At the moment they receive water level data from 9 stations in India. CEGIS, UNESCO-IHE and IWM cooperate to calibrate the

upstream precipitation data with radar.
- RIMES is working on a higher resolution (9x9km) cyclone forecast, will start piloting next cyclone season. At the moment the cyclone forecast is 3 days and large resolution, for whole of Bangladesh.

Suggestions for Blue Gold

Most of the interviewed organisations had heard of Blue Gold. Some had strong opinions on the programme as such and many had ideas for mobile applications that would be useful for Blue Gold. Hereunder the overview:

Agriculture

- Use Mobile applications for dissemination of IRRI data and knowledge, building on experiences with the Nutrient Manager (Manoranjan Mondal, IRRI)
- Improve the insight of farmers on the market prices of their crops. Many do not know whom to sell it too and often have only one market or agent that they work with. Actually farmers are connecting already via their mobile phones, but they do not reach beyond their immediate surroundings with it. Suggestion to show prices on different markets (Alamgir Chowdury, SocioConsult)
- Indeed crops prices are shared via the mobile phone. But this is not institutionalized and usually the farmers are calling the same contact persons, without having an overview of the prices around them. Fishermen are most vulnerable in this sense, as they have to sell immediately. Often they are captured by middlemen. Suggestion for Blue Gold to approach this more widely, showing prices of local, regional and even Dhaka prices in the same overview. (Mamunur Rashid, UNDP)
- EKN underlined the impact of sharing crop prices with an example of northern Bangladesh. Farmers can now choose between several markets because they call them to ask for their prices whereas before they only had one option and no information about the other markets. (de Groot, Akbary Khan, EKN)
- Although the short-term forecasting is reasonable, DAE has little information on medium- and long-range forecasting (precipitation, drought, cold and fog), which is a real problem. They need this to make better decisions on what crops to grow, when to seed and when to harvest. (Tahmina Begum, Department of Agricultural Extension)
- Any information on weather, agriculture (prices, practices etc.) and health would be welcomed (community in Patuakhali)

Education and horizontal learning

- Use mobile applications to facilitate horizontal learning (blogs, videos, online tutorials). Because farmers have no internet, they miss out on education opportunities (Manoranjan Mondal, IRRI).
- At one point Socioconsult tried to make videos for farmers to be trained. But

there were no facilities to show them in the villages. Potentially a WMG could be central place to educate the farmers and make (young) people acquainted with IT (Alamgir Chowdury, SocioConsult)

- Use Mobile Services for horizontal learning. This already exists via SMS, though limited. Mirva Moilanen explains about the "Farm Management System" that is used in their (horizontal) learning program focussing on educating people how to manage a farm. (Mirva Moilanen, Worldbank)
- Use ICT to exchange experiences, technologies and training (horizontal learning). This could well be supported by the WMAs (some of the WMAs have electricity) in Blue Gold. (Andrew Jenkins)
- Mobile applications can be used to share information between WMGs, for instance upstream to downstream water levels or water levels in polders (Mamunur Rashid, UNDP)
- Mamunur does not like the idea of using mobile or web-applications for training, it is too difficult and costly. Perhaps if Bangladesh is connected to 3G there is more potential. Training is spoon feeding and it works better if it is market driven. Would it be interesting for a service provider to reach communities with this? (Mamunur Rashid, UNDP)
  A list or training what you can do with a mobile would be welcomed (community in Patuakhali)

Access to Information (E-Documents)

- Storage of information at village level is usually hardcopy. IT could be used to manage community data. (Alamgir Chowdury, SocioConsult)
- DAE has much data among others from IWM feasibility studies, which is all in reports. This causes much paper work (Tahmina Begum)
- Use mobile applications to make better use of community maps and geographic information showing the local situation. For instance inundation maps can be used by farmers to demonstrate risks and past events of their land being under water. If the functionality allows, they can draw into the map and be interactive. The map can also be used for decision makers (water planners that don't travel locally) so that they do not rent out good land to bad people and water management of canals can be destroyed. In general, ICT could help the government in their operational planning and government services. (Alamgir Chowdury, SocioConsult)

Crowdsourcing and mapping

- The proposed map with status of infrastructure could be very useful (Alamgir Chowdury, SocioConsult)
- Small disasters are badly documented. The twitter tool could help greatly to get the overview of a situation (Abdul Awal, ECHO)
- Using mobile applications for infrastructure monitoring may be a good idea.

What if WMGs make a small (geo-)referenced photo of the embankment and ask for advice from the BWDB? Also unusual behavior of the water levels and state of the embankments can be monitored. (Mamunur Rashid, UNDP)

Other suggestions

- Blue Gold should organise information dissemination and monitoring more mobile based. Current obstacles are 1) The speed of the internet. Everybody is waiting for 3G to be rolled out in Bangladesh 2) Farmers may not understand the message, so it should be translated to practical information for the user 3) Who will maintain such system? (Babar Kabir, BRAC)
- Keep things simple. Choose something that will work and do it in a very slow pace. Don't try and do everything at the same time. Also, make sure to connect to systems and networks that are in place already. Don't introduce too much new in too few time. If mobile services are going to be part of Bluegold, make sure to customize it for the project. Farmers will have simple phones. Take into account that things break down. (Andrew Jenkins)
- Suggestion for Blue Gold is to involve cultural experts. Most international project fail because of the lack of cultural sensitivity. Blue Gold needs someone preferably from academic society etnography, who understands the 24 day routine of farmers and fishermen, by participatory observation. In UNDP they make much use of this. Mamunur tells a tale about a guest coming to visit you: The first day you give him your very best. The second day a little lees and the third day you act normal. The etnographer stays until it is normal and then starts the research. (Mamunur Rashid, UNDP)
- Customise the service to local needs and to make a deal with big telephone chargers. Some of them are already doing this sort of pilot schemes (Oxfam)

Connectivity (IT-points, locations, devices, packages)

- A cheap tablet with customised information would be a step forward and create interest with the farmers. For instance a tablet of Tk. 8.000 would be affordable for a couple of farmers together. (Manoranjan Mondal, IRRI)
- Poor people are interested in mobile phones, mostly because of transistor function. They do not have smartphones. Charging mobile phones is usually done via a village shop or via solar power. Solar panels are getting more and more common.
- Suggestion to provide the 250 Blue Gold WMA's with an internet IT point[12]. They will be equipped with an office and storage space anyway and internet would be an interesting next step. (Alamgir Chowdury, SocioConsult).
- Smartphones will be within reach of farmers within a year. Farmers are smart and have a wish to get smartphones specifically to get market values. (Craig Meisner, Worldfish). Mind though that Bangladeshi people are talkers and do

[12] Added by EKN: In Blue Gold, there is a provision for 250 office cum storage buildings for the 250 best performing WMG's out of the potential 800 WMG's. Request to check these numbers with the Blue Gold team during mission #2

don't like to txt much (says Mamunur Rashid, UNDP).

- Only some selected Upazilas have these ICT centres. Blue Gold can use the infrastructure for information dissemination and help the farmers (Tahmina Begum of DAE believes that 25 Upazilas in 3 districts are in Bluegold area). For those Upazilas that actually have internet and a laptop, Blue Gold could even downscale to registered farmers group and provide them with ICT connections. (Tahmina Begum, DAE)
- Suggestion of Arman to talk to telecom providers to see what they are already doing. Arman knows about Robi, Banglalink and Grameenphone that have special services for farmers and in the field of health. They sometimes advertise with it. Perhaps Blue Gold can use bulk txt. packages from them to reach the communities. (Akbary Khan, EKN)
- Suggestion that Grameenphone or some other mobile phone company could help in setting up a mobile service for EWS. (SaveTheChildren)
  Note that most people (not all) in Bangladesh have mobile phones. But Smartphones are hardly around. Also, the experience is that most of the rural people cannot read or write. The mobile is used for talking but not texting. So it is very important to look at literacy rate and who is the customer. (Oxfam)
- The Union Information Centre is the right place for knowledge exchange. It is used (and run) by local NGO's, including BRAC. Farmers sometimes come to see market prices, agriculture, health, and get access to government services.
- There are government officials available among them people of the DAE. Still, Oxfam believes it is difficult to attract more farmers to the Information Centres (Oxfam)

Policy or regulations ICT development can connect to/ should be in line with:

- Any ICT development must be in line with the 6th five-year plan of the government (6th five year plan 2011-2015. Accelerating growth and reduction poverty. General Economics Division, Planning Commission, Government of the People's Republic of Bangladesh) (Mamunur Rashid, UNDP)
- The recent "access to information act" (Access to Information A2I, Right to Information R2I) will improve transparency and public availability of government information (Worldbank). A2I was also mentioned by Andrew Jenkins who considers this an important step as well as Mamunur Rashid (UNDP). However Mamunur added that the project goes very slow because of the limitations in staff and priority of the government.

Problem statements and information needs

Most of the interviewees had their own problem statements on various development challenges in Bangladesh. These problem statements did not only relate to ICT development.

On weather, cyclones and farming:

- People want more information on rainfall, longer hot or colder periods. They don't care much about cyclones as their crop will be lost anyway. That stands aside of the fact that people do not trust forecast for cyclones, because they're often wrong. But the forecast of amounts of rainfall, can make difference in what kind of measures farmers should take. The current weather information is not accurate, maximum 48 hours forecast and not so detailed as this is a national forecast. Salinity levels would be interesting but people still need to be educated about what that means for their crops, such as what crops are tolerant for salt, to what level and what crops can be submerged and how much, how long and in what period (young/mature crop). The DAE should be responsible for this type of information. What farmers already know about salinity is that when it rained a lot last year, salinity levels will rise later in the coming year. (Alamgir Chowdury, SocioConsult)
- In Bangladesh, people do not listen to cyclone warnings. Even if they receive the warning, they do not understand its contents. For instance, it is not clear what a "cyclone nr. 3" means, so people continue their business as usual. Besides customisation, people need training to understand the information and take appropriate action. Mind that in remote areas illiteracy is high. A problem with cyclone dissemination is that if the cyclone does not hit, the government looks bad and they are very (too) careful with that. (Tonmoy Sarker, RIMES)
- Natural hazards are a large threat to food security in the coastal regions. One bad cyclone can wash away all the crop needed to sustain a farmer and his family and destroy his home. Most farmers do not have enough savings to buy everything from scratch again. Although not much can be done against strong cyclones, Mr. Mondal feels that farmers can take measures against weaker cyclones/ strong storms, such as netting and small dikes (Manoranjan Mondal, IRRI)
- For farmers the optimal methods sometimes get very complicated. They understand a flood, they understand a drought. But if they first have a flood followed by a drought and immediately a flood again, they become puzzled. They need advice on what kind of variety should be used. Fertiliser is not used much, except when crops fail. Mamunur says the land is already very fertile. (Mamunur Rashid, UNDP)
- A problem is that the current cyclone shelter is too small, so even if everybody is warned they will never fit into the shelter. Secondly, they do not understand the codes of the warning. The Red Cross volunteer tried to explain the system, but failed to convince. (Community in Patuakhali)
- Most important information that people need according to OXFAM is employments opportunities. People migrate to cities to look for a job in between harvests. They sometime find temporary employment opportunities

but sometimes they come back without having had any income. (Oxfam)

- One of the main problems with disaster warning is the confusion about cyclone warning signals (SODI). They have changed the warning system in the last couple of years but not made clear how the system works or what system they are following. The GoB should disseminate which system they follow. This warning system is not customized to local needs. Another problem is that there have been a few false alarms and people do not trust the warnings anymore. Furthermore, people are so poor they cannot afford to stop fishing or farming for a day. Often a weather depression system is especially good for fishing so the fisherman want to go out and might not act on the warning even if it is received (SaveTheChildren)
- The people need information about seasonal weather forecast, short term weather forecast (precipitation, drought, fog (that can destroy some crops)).
- The women are especially interested in the quality of the warning, they are more interested than the men to save their children and survive whereas men focus more on the importance of livelihood. (SaveTheChildren)

On cooperation and data sharing:

- A large obstacle for free information is that people/organisations do not want to share their data. Also, bureaucracy in the government is a problem. It is difficult to get the planners and the donors to talk together. The next problem is that farmers don't have access to internet. They do have mobile phones which they use for calling and texting. Because they have no internet, they miss out on education opportunities (Manoranjan Mondal, IRRI)
- The problem in forecastings are institutional hurdles (long time to receive data) and information integration (for instance FFWC only has little capacity do work with the flood forecasting (4 people) with no IT capacity). Data sharing from FFWC, BMD and RIMES is no problem. (Tonmoy Sarker and Jabed Hossain, RIMES).
- DAE always provides information to BWDB but after that, they don't hear anything anymore until they worked out their full and final plan for measures. Measures from BWDB are not always effective, for instance sometimes they make sluice gates with a bridge, but they don't connect it to the road. BWDB has no connection with the village people, but DAE does. (Tahmina Begum, DAE)
- SaveTheChildren used to do assessments as an individual organisation. There was no collaboration or shared understanding. Now several humanitarian organisations and NGO's have started to work together under ECB (www.ecbproject.org) to conduct a joint needs assessment of ongoing relief and recovery needs in Bangladesh. In addition they work to improve staff capacity in Bangladesh. GoB and UN are donors. (SaveTheChildren)

On workshops and trainings

- One big problem that IPSWAM faced was that they couldn't get the right people involved. The meetings always attracted the farmers that had the idea they could make money from the project itself, rather than from improving their businesses together. Also, the incentives of the farmers for highland are different that of lowlands, while they are supposed to cooperate in one water management group. His suggestion for Blue Gold is to divide the groups along the lines of their interests. (Manoranjan Mondal, IRRI)
- For the purpose of horizontal learning, IRRI organizes a field day once a year when the crop is ready to be harvested so that farmers can come together and exchange information and learn from each other. One challenge is to reach the women, as they normally do not attend these meetings, but make important decisions in the household. They have a strong interest in securing food safety for their children. (Manoranjan Mondal, IRRI)

Use of the mobile phone in a village in Patuakhali

A separate section for the use of the mobile phone in a village in Patuakhali that we visited.

Information needs:

- For the men: The most important information is agricultural information. Some of them ask DAE for advise on the amounts and types of pesticides. Usually they are informed about it by the salesperson in the market. They don't use fertiliser. Weather information is very important, but they never receive any local predictions and the national predictions are not accurate enough.
- For the women: The most important information is health. Health information they now receive only after visiting a doctor in Patuakhali city. Second at a distance is weather and disaster warning information. They would welcome any disaster information by txt, as long as it is clear what they can do with the information.

Use of the mobile phone and other means of communication

- About half of the interviewees had a telephone with them. They explained how most households have a phone and the man carries it with him. The coverage of mobile phones among the farmers is about 95%. The telephones were mostly featured phones that could take photos and videos. None of those present owned a smartphone.
- The interviewees charge the telephones with solar power (15 families). Those that do not have solar power can charge their mobiles for 5 tk. At a shop (with solar power). Some explained that they spend about Tk. 50 on it per week.
- Group I explained how they are using the mobile phone to calling the Grameen mobile health point 789, to transfer money, some said to receive weather

information and half of them indicated to use the telephone to obtain market prices.

- Group II and II had never heard of the Health line and only used the telephone for social interaction. They use the telephone sometimes for text messages but not regularly, they like voice better. None of the interviewees had ever used the mobile phone to get information about disasters (cyclones, floods). They receive disaster warnings through Red Crescent volunteers, door to door.
- Group III uses the telephone for social interaction and sometimes obtain market prices with it. Mainly they use radio and television to receive information. They did not hear about 789 and never obtain disaster related information via the mobile phone. None of those present had ever visited the UP office to use internet.
- They have limited access to electricity (15 families have a solar panel) and no access to internet. Children cannot learn how to deal with computers or internet. They have no televisions but sometimes watch in a toko. They see some television in Patuakhali City. The nearest internet connection is in the UP centre, 5 km. away. Some of the interviewees had visited the UP centre and used internet. Some seasonal workers had applied for a job in Malaysia online via the UP office, after having heard about it via an advertisement on TV. Two persons said they used internet to exchange experiences on agricultural practice. Some people said they had visited the DAE website.
- The people interviewed do not seem to use even the current possibilities of internet or the mobile phone to its full potential. They described agricultural and health information as their largest need, while the majority did not ever look-up any agricultural information on internet or knew about the healthline of Grameen.

INTRODUCTION

Internet and mobile phone penetration has opened-up new horizons for ICT based services to benefit communities at the bottom of the pyramid. Primarily driven by donors, development agencies, local and international NGOs, civil society, mass media, these services have extended even to the rural areas. Telecenter networks, for example, have reached previously inaccessible places using nonprofit and for profit models.

Although a large amount of work has been done in using ICT for Development, there has been no conscious effort to explicitly capture these initiatives. Hence, there is a pressing need to document success stories, lesson learnt and shortcomings. There is a call to write case studies on projects, programs and policies in this regard. As knowledge has become central to development, it is timely to publish a journal that specializes on ICT for Development issues. Academicians, practitioners and researchers can use the journal as a reference point for their work. It will contribute a great deal to strengthen knowledge management. Simultaneously, it will also enable them to share their experiences, works and knowledge.

OBJECTIVES

The ultimate objective of the working paper series is to articulate, capture and document success stories, best practices, lessons learnt and shortcomings of ICT4D projects or researches in developing countries.

TOPICS:

Academics/researchers/practitioners are invited to submit their work that addresses issues related to adoption, diffusion, and implementation and monitoring/impact assessment of ICT for development projects in developing countries. In fact, ICT4D being a crosscutting issue the working paper series will feature writing from almost any sectors or area namely E-Agriculture, E-Livelihood, E-Governance, E-Health, E-Education, E-Commerce, E-SME, E-Environment, Climate Change, etc in relation to ICT. The WPS encourages papers that are problem-finding, problem solving, forward-looking, sharing relevant experiences and investigating controversial and important issues.

AUDIENCE

The target audience of this working paper series are those who wish to learn how to encourage adoption of ICT, applications and impact assessment, and also researchers who are interested in the diffusion of ICT for developmental projects in developing countries. Therefore, the target audience includes ICT service providers, policymakers, and academics/researchers, students of social science, information systems, and information technology and development studies.

SUBMISSION REVIEW PROCEDURE

Researchers and practitioners will be asked to submit an abstract of the paper. Those whose abstracts have been approved will be invited to submit complete papers. Papers must be written in English. The full paper must be between 4,000 to 9,000 words including all diagrams and references, and in MSWord or PDF format. All submissions must have names, affiliations and full contact details (including email addresses) of all authors. Authors should utilize the APA Stylebook.

All submitted papers will be reviewed on a double-blind review basis by two unanimous reviewers. The reviewers will be selected by the editorial. The reviewers will provide constructive feedback to authors upon acceptance and rejection of the article. Articles submitted for publication are evaluated according to the following criteria:

- o Significance of the topic
- o Adequacy of the literature review
- o Quality of research design
- o Legitimacy of conclusions
- o Contribution to literature
- o Appropriateness to the Working Paper Series
- o Development of concepts/hypotheses
- o Adequacy of data analysis
- o Significance for practice
- o Clarity of presentation

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