CASE STUDY
Category: ICTs and Agricultural Adaptation to Climate Change

Climate Change, Innovation & ICTs Project

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An ICT-Based Community Plant Clinic for Climate-Resilient Agricultural Practices in Bangladesh

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Initiative Overview

The south-west coastal region of Bangladesh is particularly climate-vulnerable; impacted both by immediate climate events and by longer-term climate change. Crops and horticultural production are being hampered due to changing seasons, erratic rainfall, rising temperature, unpredictable fog, and coastal flooding and increasing salinity due to rising sea levels and cyclone/storm surges in the area. Moreover, new pests and insects are destroying crops. As a result, local farmers are demanding information about pest control, new saline-tolerant varieties, improved agricultural management practices, early warning of weather events, etc.

Local NGO, Shushilan, responded to these climate challenges by developing two ICT-based plant clinics in the sub-district of Kaligonj (part of Satkhira district). So-called "plant doctors" – that is, local agricultural extension workers employed by Shushilan – use ICTs in order to assist farmers; providing the farmers with the information they require. ICTs can also be used by the plant doctors to share experiences between farmers, and to pass on early warnings on floods and cyclones that are generated by the Bangladesh Meteorology Department, mainly via mobile phone. In addition, Shushilan has set up an Agriculture Research Centre, soil-testing laboratory, demonstrator farms, and seed storage facilities in order to provide holistic support to the c.4,000 farmers who fall within the project's purview.

Application Description

As detailed below, Shushilan has been using a variety of different ICTs in its plant clinic project:

Mobile phones**:** Mobiles are widely available in rural Bangladesh; for example via Grameen Phone and Banglalink. If farmers face any plant-related problems, they can call and either speak to one of the plant doctors direct, or leave their query with the plant clinic. Examples of calls would include fairly specific questions about attack by unknown pests, about seed quality, about pesticide or fertiliser dosage, or about how much to irrigate. Typically, the plant doctors are able to give immediate responses via phone. However, sometimes, they must in turn contact agricultural experts to get their advice which they can then pass on to the farmers. Occasionally, they put farmers in touch with other farmers whom they know have faced and dealt with similar issues via the clinic service.

Computers and Internet: The plant doctors themselves make use of laptops for field visits. They keep records of the calls they receive and also the field visits they undertake using standard MS Office software. In this they record farmer details and location, date, and problems and solutions. They also utilise software from the *Pallitathya* project as a Q&A database on which they store similar details. They can interrogate this subsequently to see if later problems have already been recorded against possible solutions. This could, in time, form a database of agricultural and adaptive practices for wider dissemination and use. As noted above, if the plant doctors cannot themselves address a problem they will contact agricultural scientists – either by phone or email – for example from the Bangladesh Rice Research Institute (BRRI) and Bangladesh Agricultural Research Institute (BARI). More complex queries will involve emailing notes and photographs (see next). On this basis the scientists will seek to provide solutions – typically around issues of pest/disease management, treatment of salinity, and shifts to low-input agriculture. Sometimes, during plant doctor field visits, the farmers are put into direct contact with scientists via phone or webcam, to enable the latter to directly understand – and see – the field issue being faced (see Figure 1). Finally, plant doctors make use of a geographic information system (Arcview) and Google Earth to identify exact farmer locations, and to map this against known climate and climate change vulnerabilities.

Figure 1: Farmer Talking with Remote Agricultural Scientist via Mobile Phone

***Digital cameras and microscope*:** When they visit farmers, the plant doctors take along a digital camera. They use this to take photographs – of pests, of diseased plants, of weeds, of water levels, of soil condition, etc. They also use the cameras to make video recordings of these problems and of the farmers talking about the problems. The project also has a digital microscope through which photos or video of pests and microorganisms can be recorded. Once edited, these photographs and videos can be sent via the Internet to the remote agricultural scientists (see Figure 2). The scientists use these to provide information and advice to the farmers, and also as the basis for their own research work. The videos can also be used (see next) for farmer multimedia presentations.

Figure 2: Plant Doctor Interacting with Remote Agricultural Scientist via internet, Using Microscope Images

Multimedia**:** As well as being solution providers, the plant doctors have a more general educational role. For this purpose they have made use of video presentations, particularly video made within the local farming communities. This is particularly seen as a tool for agricultural technology transfer; for example around management of new pests and diseases, introducing saline-tolerant crops, applying fertiliser appropriately, crop diversification or intensification, and increasing crop productivity.

Formal Drivers

The agro-ecology of the south-west coastal region of Bangladesh is very fragile, and has suffered adverse impacts due to climate change. Within the last ten years, many farmers in Satkhira district have migrated away due to loss of agricultural land and crops because of increased salinity. Land erosion and rising salinity – measured by Shushilan's clinic as having risen up to 15 to 25 parts-per-thousand (ppt) in the dry season, and up to 5 to 12 ppt in the wet season – are a direct result of climate change and resulting sea level rise. Plants that were healthy in the early stages of planting are seen to turn yellow in the vegetative and reproductive stages due to saline intrusion and also due to erratic temperature and rainfall, both of which can in part be related to climate change. In 2007, the rice crop failed significantly due to erratic weather – a long duration of fog and cold, plus attack from new pests and weeds. This area is therefore on the front line of climate change – for farmers in Satkhira, climate change is not a future possibility, it is a current lived reality that is damaging their livelihoods.

It is for this reason that Shushilan launched its plant clinic project. It had already piloted climate-resilient agricultural practices, such as the use of saline-tolerant rice varieties. However, a fuller agricultural information and support approach was required if these and other new technologies were to be rolled out across the district. Key gaps included lack of awareness and practical information about climate-resilient practices, general lack of modern agricultural practices and technologies, and a lack of effective linkages between scientists, extension workers, and farmers.

Climate change and associated weather pattern changes and extreme events have also driven changes to traditional cropping patterns and agricultural practices. Again, the farmers lacked information about how to react. For example, when monsoon rains have been delayed, farmers are unclear what they should do, and their lack of an agricultural support system that could provide answers was a further impetus to Shushilan's project.

Objectives/Purpose for ICT Usage

The overall aim of the project was:

- To identify causes, and provide solutions to common agricultural problems including those related to climate and climate change such as new pests/diseases and rising salinity levels.
- To increase the usage of innovative agricultural technologies; specifically those such as saline-tolerant rice varieties that could address the rising salinity level which climate change was causing.
- To improve agricultural productivity generally through more appropriate use of fertiliser, pesticide/herbicide, and modern agricultural practices including crop intensification and diversification.
- To develop a strong network of linkages between agricultural scientists, extension workers (plant doctors) and farmers.

The role of ICTs was to support achievement of all four objectives, enabling the capture, processing, storage and dissemination of information that would support climate-resilient agriculture.

Stakeholders

As already outlined, there are three main levels of stakeholder. At the field level are the coastal area farmers. They are the main beneficiaries, who are seeking to maintain or increase their agricultural production in the face of climate change and other challenges. Centrally, there are research scientists in the rice and agricultural research institutes, and also officials of the Department of Agricultural Extension. Sitting between these two groups are Shushilan; in particular the two plant doctors who provide farmers with as much support as they can in terms of education, diagnosis and prescription, but who also connect with the scientists when need be (see Figure 3).

Figure 3: Plant Doctor with Farmer Diagnosing Vegetable Crop Problems

Impact: Cost and Benefits

The primary investment to establish the two plant health clinics was around US$6,000 to pay for two computers, two webcams, two digital cameras, two mobile phones, one digital microscope (shared by the two clinics) and two motorcycles. In addition, there is a recurrent cost for the two plant doctors' salaries, house rental, transportation, and fuel and utility bills (including internet connectivity charges). This amounts to around US$1,500 per month.

It was the initial intention that the farmers would be charged for the services being provided e.g. around US$0.10 for service provided via a mobile or the Internet. However, given the low level of community awareness about ICTs and the need to demonstrate the value of the plant clinic service, it was decided to offer it for free in the first instance.

The farmers do seem to perceive a value from the service, with group discussions showing that farmers rated positively both the suggestions they have been receiving via the ICT system (such as suggestions about tests to conduct on their crops; about planting saline-tolerant crops; about cultivating different crops such as maize or sunflower), and the prescriptions they have received (i.e. specific guidance on fertilisers or pesticides: which to choose and how much, when and where to apply them). It is therefore anticipated that in future, farmers will be willing to make a small payment for the plant clinic services.

The plant doctors themselves were also able to report project benefits. For example, one of them was asked to identify a new and unknown disease in part of an eggplant crop. He uploaded digital images and sent them to the Global Plant Clinic (GPC). The disease was diagnosed as *Tulshipora* (the local name), which was correlated with the warmer temperatures that area had been experiencing. Unfortunately the GPC's advice was that there was no effective treatment, and that the infected plants would have to be destroyed.

Evaluation: Failure or Success

Three years after inauguration of the clinic, a formal evaluation of the project was carried out. This was based on qualitative analysis through focus group discussions (resource constraints prevented a detailed quantitative cost/benefit analysis). As noted above, farmers reported positively on the value of suggestions and prescriptions received from the plant clinic. Farmers were also keen to receive the type of fast, good-quality information and advice which the plant clinic could deliver; particularly relating to pests/disease, new crop varieties, fertiliser/pesticide dosage, and early warning information. They expressed a willingness to pay something for this information, and certainly demand for the plant clinic's services has been continuously growing. The project overall was able to demonstrate good results from planting of saline-tolerant rice variety BR-47 (developed by BRRI) in two village areas where wet season saline levels rose up to 10 ppt (see Figure 4).

Although Shushilan itself was unable to conduct quantitative research, the local office of the Department of Agricultural Extension was. Its 2010 report for Kaligonj sub-district showed, for example, that the prescriptive information about treatment of pests and diseases has helped, with an estimate that the loss of production due to these causes had been reduced by at least 20% between 2007 and 2010, though the plant clinic is only a partial contributor to this outcome. Over the same period, crop productivity has also increased with the yield gap (the gap between the actual and the potential output level of crops per hectare) being reduced in 80% of cases. There has also been greater diversification of the crops planted (e.g. use of saline-tolerant rice and planting of maize and sunflowers), and a growth in crop intensification (the average number of crops planted per year) from 1.00 to 1.28.

Figure 4: Fully-Grown Saline-Tolerant Rice in Kaligonj Sub-District

Enablers/Critical Success Factors

The **plant doctors** themselves are vital to the success of the project. They are hired from within the local district, so they are familiar with the local context, and farmers are familiar with them. Both were unemployed prior to the project, but had completed an agricultural college diploma course, so they were familiar with ICTs and with overall agricultural science, issues and practices.

Availability of ICT infrastructure has been a key enabler of this project. Just a short time previously, mobile and internet coverage within Kaligonj sub-district were insufficient to have allowed a project like the plant clinic to have worked. Only once these were available did this project become feasible.

The digital microscope has been a valuable additional piece of specialised technology. While not quite bringing the facilities of an agricultural lab to the field, it has enabled this project to be the agricultural equivalent of telemedicine, delivering scientific results from within the community to distant agricultural experts and enabling them to diagnose problems and recommend solutions.

Constraints/Challenges

Competency deficits were a particular problem for the project, across the range of competencies – knowledge, skills, and attitudes. Farmers had low levels of awareness and even lower levels of skills in relation to ICTs; nor were they familiar with English, the working language of the majority of the software used. As a result, they were not positively disposed towards the idea of using ICTs for agricultural advice (leading, as seen above, to an initial unwillingness to pay); and when they did get involved, they had to rely entirely on the plant doctors in order to use the ICTs.

Other resource deficits that affected the project included power supply problems, meaning that ICTs could not be used continuously; and the limited number of plant doctors and related ICTs, as a result of which farmers could not always be availed of a quick service – this particularly being a problem when farmers faced immediate climate-related hazards. As noted previously, resource deficits also limited the extent of project monitoring and evaluation that Shushilan was able to undertake. This, in turn, has limited the ability to explore opportunities for wider replication of the project design.

Recommendations/Lessons Learned

The key lessons from the project are:

Agricultural climate change projects require designs that offer **on-site delivery of information and advice to farmers**. At least in the types of areas covered by this project, farmers have a lack of familiarity with ICTs such as computers and email and/or a lack of contacts or confidence through which to use mobile phones and other portable technologies. This will undoubtedly change over time as ICTs diffuse further into poor, rural areas. However, for the foreseeable future, adaptational projects focused on climate-resilient agriculture that use ICTs are going to need to be addressed largely via human intermediaries. This will increase the cost and/or reduce the scope and sustainability of such projects, but is necessary for agricultural practices and technologies to change.

A **more-than-mobiles approach is required**. The rapid diffusion of mobile phones within agricultural communities, and the growing familiarity of farmers with using mobiles has given hope for the idea of "m-agricultural adaptation" projects based around this technology. While – as noted in this project – mobiles can have an important role to play, their power is not yet sufficient. The digital camera, digital microscope, internet connections, laptops and GIS/databases were all a necessary part of capturing and transmitting the richness of data required to solve agricultural problems and/or to give guidance on new technologies such as saline-tolerant rice. Projects therefore need a full "ICT ecosystem" rather than relying on just a single digital technology.

Climate change and climate change adaptation information and advice must be available, accessible and usable. Farmers had a good sense of the problems that extreme climate events, variability and change were causing to their agricultural livelihoods. They were also provided – via the plant doctors and ICTs – with a means to get information and advice on this. However, many other elements need to be in place if the full information chain – from data through information and decisions to actions and results – is to be operationalised. Bangladesh has a good supply of traditional agricultural information, but it needs to develop more sources of information about climate change and particularly about how to adapt agriculture to climate change. Those working in the field – such as agricultural scientists and Shushilan's plant doctors – then need to be aware of these sources of information; at present they often are not. Then farmers must have a demand for, and receptivity to, this information. Again, at present they often do not, regarding climate change symptoms as natural *forces majeures* that they can do little or nothing to deal with. Finally, even if all these steps can be overcome, the farmers need to have ready access to the resources needed to take action – new seed types, materials for alternative irrigation arrangements, etc. Shushilan's relatively holistic approach did help meet the need for this final element.

Identify hybrids who bridge the digital and the agricultural, the external and the local. The plant doctors highlight a critical role that e-agricultural adaptation projects must fulfil: that of the intermediary or hybrid who combines and bridges between different worlds. In this case, the plant doctors perform this in a double way. They combine understanding of ICTs and of agricultural practices, including the impact of climate change on those practices. And they act as a bridge between the external, scientific knowledge of those working in the agricultural institutes, and the local knowledge of the farmers working in the fields.

Data Sources & Further Information

Data and information for this case study was collected from the Department of Agriculture Extension office at sub-district level, the Shushilan Agriculture Information Centre, the *Pallitathya Kendro* (village information centre), daily newspapers, discussions with plant doctors, and community consultation in different periods during implementation of the project.

The authors themselves all work for Shushilan and have been involved in the plant clinic project in various roles:

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Further information about the project and related resources can be found at: http://www.niccd.org

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