CASE STUDY
Category: ICTs and Agricultural Adaptation to Climate Change

Climate Change, Innovation & ICTs Project

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ICT-Enabled Knowledge Brokering for Farmers in Coastal Areas of Bangladesh

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Initiative Overview

Bangladesh is at the forefront of climate change, which translates into frequent flooding and soil salinity. For a country like Bangladesh, food security is a key concern with 69% of its population directly engaged in agriculture. Given the considerable contribution of agriculture to the livelihoods of the majority of its people, any significant change in climate has far-reaching impacts on the overall socio-economic system of the country.

With their livelihoods under constant threat, climate adaptation strategies are needed to help farmers cope with natural disasters and fluctuating livelihood conditions. In addition, rural farming communities are often marginalised in terms of timely access to agricultural and market information. An information and communication technology (ICT) enabled knowledge brokerage system known as the *Agricultural Knowledge Management System* (AKMS) was set up in 2006 in the coastal district of Khulna. AKMS brings together organisations, strategies and sources of knowledge required to improve agricultural processes and food security within a framework of climate change. The initiative supports farmers' critical decision-making processes throughout the year, ranging from assistance with crop calendar planning, climate-resilient crop selection, seed purchase, tillage methods, pest control, harvesting, market access and the securing of fair crop prices.

Application Description

The underpinning framework for the Agricultural Knowledge Management System is a multi-stakeholder knowledge flow structure that functions as both a knowledge brokerage and a supply chain management tool (see Figure 1); hence supporting flows of both information and agricultural resources with the aim of improving food security. Consisting of organisations, sources of knowledge, multi-directional communication, and behavioural approaches, AKMS incorporates climate change adaptation issues, and the system continues to be tweaked in response to rising sea levels, increased flooding and saline intrusion of coastal land.

Since lack of connectivity and literacy is still widespread in rural farming communities, information is provided to farmers via knowledge brokers: these are educated youths from participating rural farming communities who work for community-based organisations and are embedded in the community through family ties and are hence highly accepted within their communities. Knowledge brokers map the agricultural, economic and social information and communication needs of client communities (see Figure 2), locate the information if and when needed, provide the information in accessible terminology and the local language at prices that are realistic given farming communities' limited resources.

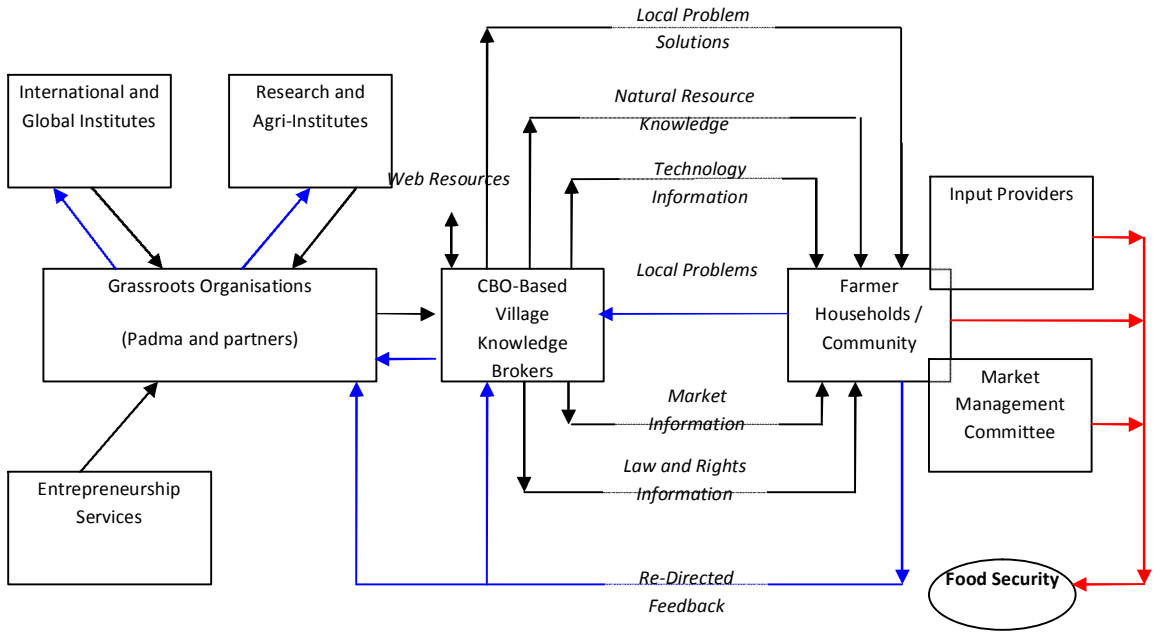

Figure 1: Agricultural Actors and Information/Resource Flows of the AKMS

Note: black arrows represent 'downward' flows of information and knowledge; blue arrows represent 'upward' flows: both of problems and questions that require solutions, but also of feedback on the appropriateness of the downward information flows; red arrows indicate broker-facilitated flows of information and resources within the agricultural supply chain.

Figure 2: Mapping Farmer Information Needs

Equipped with laptops, the knowledge brokers browse online information in Bengali. Due to their understanding of local circumstances, they are then able to convert this information into locally-relevant knowledge and share this knowledge with the farmers; initially face-to-face and on-site and then (once their brokerage relationship is established) via mobile phone. Topics covered would include which crops are best suited to changing climate conditions; developing and adopting climate-resilient seed and crop varieties; climate-friendly methods of production, irrigation and land preservation; and up-to-date market information. Topics without a ready source of online information

– such as product diversification, credit application opportunities, supply chain and labour issues – can also be discussed with the knowledge brokers, who have been trained to source the appropriate knowledge or knowledge provider as required.

If the knowledge brokers are themselves unable to identify relevant information online, then – via the nodal partner, the Padma Research and Development Organisation, which maintains the system and is located in Khulna town – they are able to contact other national and even international agricultural and climate change organisations to seek advice for the farmers; that contact typically being undertaken by email or mobile phone. But AKMS should not be seen as just a one-way flow of information. Based on principles of interactivity and feedback loops for continuous information improvement, the system not only feeds knowledge down from international, national, regional and local sources, it also (shown as blue arrows in Figure 1) feeds information back up the chain.

Formal Drivers

Climate change is expected to have a substantial impact on food production and jeopardise food security in many regions. Bangladesh in particular is recognised as one of the most susceptible to the negative impacts of climate change. Rising sea levels threaten inundation and saline intrusion in the coastal regions of the country. These risks are further accentuated by greater cyclone intensity.

Access to information on climate change adaptation and sustainable agricultural production is vital for marginalised farming communities as better information systems can greatly assist decision-making at all levels. Research suggests strategies involving sustainable agricultural practices that integrate climate change have a number of impacts: they reduce vulnerability and improve food security, human well-being, environmental management and community resilience (Hania & Quirehi 2010; Parry et al 2007).

Figure 3: Map Indicating AKMS-Active Areas

The Jhenidah, Dacopa and Botiaghata sub-districts in the southwest coastal region of Bangladesh (identified by red dots on Figure 3 map), where AKMS has been rolled out, regularly experience natural disasters which cause excess flooding, crop damage and soil salinity issues, resulting in steady soil degradation. This, in turn, creates substantial obstacles to maintaining regular and healthy cropping cycles and directly impacts food security. Traditional technologies used in agriculture are no longer in synch with actual food demand. Moreover, the introduction of hybrid seeds and high chemical inputs for high yielding crops, further contribute to a decrease in land fertility and increased marginalisation of rural farming communities.

Bangladeshi farmers that live in flood-prone areas such as the Khulna sub-districts of Jhenidah, Dacopa and Botiaghata frequently lack basic infrastructure. Over 60% of rural farmers are illiterate and many communities do not have access to information and technology to solve pressing agri-production issues related to soil degradation and climate change. At the same time, rural farmers have valuable tacit knowledge based on longstanding oral traditions that needs to be acknowledged and built upon, so it may purposively be combined with external knowledge on climate change adaptation to create more sustainable farming practices.

Objectives/Purpose for ICT Usage

The ICT initiative started in 2006 in the Jhenidah sub-district of Khulna to bridge the gap between marginalised farming communities and agricultural information (including climate-relevant information). Originally, five pilot villages were selected, targeting approximately 1,500 farming households. The objective of ICT usage, as embodied in the AKMS, is to bring together and create linkages between a wide range of knowledge sources generated by farmers, agri-business experts, climate change adaptation researchers, and stakeholders along the value chain.

From this starting point, a knowledge 'ecosystem' has been designed to provide farmers with the agricultural knowledge they require to improve the management of their land, biodiversity and livestock, and also to cope with climate change. Set up as a knowledge brokerage system to provide marginalised rural communities access to information and sustainable farming practices, the system is managed like any other key business input. It addresses questions such as 'who needs information', 'who can supply the information', 'what format and delivery mechanisms allow the knowledge provider and consumer to communicate and share information', and 'what institutional and market structures provide the appropriate incentives for information sharing to take place'.

Specifically, the purpose of the ICT-enabled AKMS system is to:

- Facilitate multi-directional ICT-enabled information and knowledge flows – the built-in feedback loops allow for continuous information improvement;
- Adopt a common language – information is translated into the local language and brokered in a non-scientific manner;
- Facilitate information and knowledge exchange – the interactive process relies on strong linkages with various agricultural actors that enables grassroots level access to national and global expertise on agriculture and climate change adaptation. Vice versa, these research experts gain practical implementation data and insight into grassroots needs;
- Create a regional knowledge base – on climate resistant seeds, crops, best practices on climate change, irrigation, land preservation, etc.;
- Build a learning community – learning is based on the continuous information updates and knowledge flows between stakeholders;
- Facilitate value chain opportunities – securing timely and sufficient input supplies such as credit, fertiliser, seeds, and fuel; securing crop prices with market committees on behalf of farming communities, and bringing diversification opportunities to the attention of stakeholders;
- Build mutual trust and respect – ensuring both traditional and contemporary knowledge and practices are respected and integrated.

Stakeholders

The AKMS system project was developed by senior management of the Padma Research and Development Organisation: a regional non-profit youth organisation working with marginalised farming communities. Development costs have been supported by various international grants and fellowships, including the Global Social Benefit Incubator Initiative at Santa Clara University in the US and the Youth Social Enterprise Initiative for emerging young social entrepreneurs in developing countries.

Acting as the intermediary, Padma sources and coordinates agricultural and climate change adaptation information from input providers, market management committees, various ministries, local authorities, national and international research institutions and repurposes the same into online and offline information in easy to understand Bengali. Padma also trains the knowledge brokers in ICT and system navigational skills, knowledge sourcing, and community engagement (see Figure 4). The three-pronged training process takes two months and is conducted at the Information Service Centre (ISC) based at Padma's offices in Khulna. Youths from rural communities start by volunteering at the ISC for two weeks, followed by one month intensive training based on the Microsoft 'Unlimited Potential' curriculum. The last two weeks focus on the use and management of information within the AKMS.

Figure 4: Knowledge Broker Training

The knowledge brokers generally avoid issuing prescriptive recommendations; rather, they play an advisory and facilitating role, providing information, communication, and knowledge that allows armers and farming cooperatives to make better management decisions that will improve their long-term livelihoods.

Impact: Cost and Benefits

While the approximately US$25,000 in AKMS development costs were borne by international grants and fellowships, the current and future sustainability of the system predominantly depend on small subscription fees from participating farming communities and market brokerage fees where applicable. For example, when knowledge brokers facilitate logistics between farming communities and market opportunities, such as securing fair crop prices with market management committees, a brokerage fee is charged. Fees are based on 20% of value addition. For example, prior to being part of AKMS, a farmer might have sold a particular crop for US$10. By obtaining appropriate knowledge via AKMS, that same crop now fetches US$15. Given the US$5 value addition, the AKMS fee for this crop would be US$1.

By applying a participatory and inclusive approach to knowledge brokering, rural Bangladeshi farming communities are linked to international best practice, to one another and to stakeholders along the value chain. Apart from being integral to fostering diversification opportunities and new multi-sectoral partnerships in the region, the system also fosters greater awareness among marginalised farming communities of the need to adapt to climate change and local appropriation of climate adaptation processes.

Marginalised farming communities benefit directly in terms of becoming informed farmers with the system providing opportunities for learning, adoption of new technologies, knowledge exchange, access to timely planting and climate friendly cropping information, which in turn creates crop and food security, market and marketing knowledge, informed negotiation and fair market prices, as well as opportunities for diversification and additional income generation The AKMS has made a particular difference to communities in the south west coastal area which has a mangrove ecology with the soil fertility and siltation processes dependent on upstream and downstream flows and the health of local rivers. Faced with a damaged natural water management system, one such rural farming community was tapping saline water from their fields in an attempt to augment its income by setting up shrimp farming, resulting in the soil losing both its fertility and opportunity to regenerate necessary micro organisms. With guidance from the AKMS, the community became aware of the situation, stopped tapping the soil water in the cropping fields and learnt sustainable cropping practices, including how to access natural water flows. This has resulted in the soil recovering its fertility and an improvement in agricultural livelihoods within the community.

Another case involves Gongram Pur Sabuj Mohila Somity, a 21-household women's farming cooperative located in the Botiaghata sub-district of Khulna. The salinity in the soil in this district is so severe that the cooperative's cropping season has been reduced to about four months per year, which does not provide food security for farming households year around. Until the AKMS intervention, the community employed ad hoc and inorganic farming practices and were unaware that they were further contributing to an imbalance in soil nutrients. Supported by climate adaptation information from the AKMS and from Locos, a German-funded local non-governmental social development organisation, the women have been motivated to adopt organic farming practices, use organic fertilisers and pesticides, and develop saline tolerant crops, which is extending the cooperative's cropping season. With the aid of Locos and the AKMS system, some 49 crop varieties of local indigenous seeds of paddy (rice) have been developed in the region, which are being distributed by Locos to participating farming households.

Evaluation: Failure or Success

The AKMS can be considered to be largely successful. The knowledge management system has been populated with a wide variety of agricultural information, including information relevant to climate impacts on the mangrove ecology in the region e.g. on eco-balanced organic and hydroponic farming, saline tolerant cropping varieties, fish cultivation for flooded open water bodies, vulnerability trend analysis tools and climate change adaptation strategies.

Linkages have been made with national and international information and knowledge institutions, such as Khulna University, Santa Clara University, the Foundation For Youth Social Entrepreneurship, South Asian Network for Development of Environmental Economic, and the UK's Department For International Development, among others.

A total of 176 youths have been trained to date, 73 of whom are presently working as knowledge brokers. The AKMS has assisted 3,780 farmers in five villages to increase their income and food security. Farming communities such as Gongram Pur Sabuj Mohila Somity are getting fair returns from their crops, are serving as a best practice example for other communities and are contributing to setting the standard for organic and sustainable farming practices.

Today 94% of AKMS revenue is generated through its products and services to farmers with the remaining 6% being derived from donations and grants. While no external expressions of interest have been received to expand the system, between 2008-2009 the project achieved a 20% profit margin, which is expected to rise to 35% by the end of 2011.

Enablers/Critical Success Factors

One of the critical success factors of this initiative is the **inclusive approach to collecting and disseminating climate adaptation information**, including the building on indigenous knowledge as the point of departure. The interactive multi-stakeholder system fills gaps in climate adaptation content and repurposes the content in a language and terminology that is acceptable to its target users. This approach provides even the most marginalised communities access to climate change adaptation knowledge and broader agricultural knowledge, builds capacity and contributes towards more sustainable livelihoods.

The other critical success factor is the **training of youths from participating farming communities**. Because they originate from – and have family within – the farming communities, the youths are accepted more easily by the farmers. They also have *a priori* knowledge of the socio-economic community make-up and micro climate conditions. This speeds up the knowledge mapping process and the creation of a trusted relationship between the community and the knowledge broker. Communities are more open to sharing their insights, on which youth are able to map their climate change adaptation needs.

Constraints/Challenges

Among the main challenges for this initiative is the **lack of infrastructure**, both physical and ICT infrastructure to ensure timely delivery of information to communities that are isolated, flooded and otherwise hard to reach. This is compounded by the **high level of farmer illiteracy and lack of technology skills**. For many regions, particularly in rural areas, direct use of ICT by farmers – with the exception of mobile telephony – may take decades. To that end, the system is increasingly utilising mobile technology to provide participating communities with the information they need. Once a face-to-face brokering relationship has been established, follow up is often via mobile phone.

A related challenge is the **management of wider stakeholder relationships**. There are challenges like discussing acceptable agreements and timely coordination between the farmers, market management committee, and input providers. Effective performance of knowledge brokers is essential to overcome these challenges as they are catalysts for the participatory approach.

Another challenge is **obtaining relevant climate adaptation information** needed for sustainable farming practices. For a relatively obscure regional knowledge management system it is not easy to link to reputable agricultural research institutions. Moreover, such research as they provide is often

highly academic, too complex to guide the knowledge brokers, and difficult to translate into easy to use adoption practices by the farming communities. The problem is fundamentally one of a lack of coordination between climate adaptation theory on the one hand and the climate adaptation practice on the other. Farmers need less academic feedback and more practical tools from agricultural research institutions. Moreover, micro climates and farming communities are not homogeneous in nature and therefore one size solutions do not fit all. Climate change solutions and strategies that can be embraced by farming communities will vary according to their geographical location, infrastructure, available resources, socio-economic make-up, culture and local context. The managers of the AKMS are instrumental intermediaries in terms of conveying grassroots needs to climate adaptation theorists and repurposing and contextualising climate adaptation information for the local market.

To date the AKMS has been funded by grants, fellowships and brokerage fees. The **maintenance and future sustainability** of the system itself is, however, not secure and creates a challenge in terms of the continued need to keep content and knowledge brokers up to date. There are also some challenges pertaining to the coordination of timely information for farming communities, which is subject to obtaining timely content from input providers, market management committees, and other stakeholders along the value chain.

Recommendations/Lessons Learned

- **Integrate climate change into broader agricultural information systems**. Farmers in the coastal regions of Bangladesh (as in many other coastal regions of the world) are already having to live with the consequences of climate change. However, they do not require a specific climate change information system because climate change is only one of the issues they face. Instead, AKMS has been effective because it is a general agricultural information service. It is therefore able to address the whole range of problems that farmers face, rather than just restricting itself to climate change; a restriction that would likely have led to great frustrations for the farmers.

- **Provide information and other resources**. Were AKMS only a provider of information and knowledge, it would be useful but very limited. But it has been designed to also support the provision of agricultural inputs, and the sales of agricultural outputs. It therefore offers not just advice – for example about adaptation to climate change – but also the mechanisms by which that advice can then be turned into practice.

- **Community-based intermediaries are vital to climate change adaptation**. You cannot connect the average developing country farmer directly into global, expert information on agricultural adaptation to climate change; for the reasons described above under 'Challenges'. Thus for all rural communities facing the threat of climate change, the knowledge broker model or some variant thereof will be essential – especially the fact of training someone who is already a community member. The knowledge broker can be seen to perform so many vital intermediating roles: translating external information into locally-relevant messages; integrating global and local knowledge; bridging the power gap between farmers and supply chain institutions; bridging the digital gap between farmers and the global ICT infrastructure; and so on.

- **Climate change awareness should precede information, resources and action**. Farmers are well aware that they have problems, but the causes of those problems and their relation to climate and climate change are often not well-known. Sensitising rural communities to these issues and getting the farmers to understand their climate adaptation needs, is a first step, then to be followed by access to contextually relevant climate adaptation information and resources, leading to action.

- **Climate change adaptation information must be locally-relevant and action-oriented**. At present, rural adaptation projects face a two-step barrier. First, there is very little information about adaptation to climate change. Second, what information there is often is of the wrong type for rural communities: too generic, too academic, and too reflective or suggestive. Thus many

projects will have to start by enabling the creation of appropriate information before they can begin to help farming communities take action.

- Overall, **design guidelines for an effective climate adaptation knowledge system** are that it should:
    - Build on traditional knowledge;
    - Consider local context;
    - Strengthen value chain communication;
    - Contain simple to understand and easy to manage/update climate adaptation content;
    - Use embedded knowledge brokers;
    - Adopt a participatory approach; and
    - Have low knowledge transaction costs.

Data Sources & Further Information

Dr Patrice Braun from the University of Ballarat, Australia, p.braun@ballarat.edu.au was Endeavour Research Fellow during 2010, studying the use of ICTs by rural farming communities in Bangladesh

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References

Hania, M.A. & Quirehi, M.E. (2010). Global water crisis and future food security in an era of climate change, *Food Policy*, Vol.35(5), 365-377.

Parry, M.L, Canziani, O.F., Palutikof, J.P., van der Linden, P.J. & Hanson, C.E. (2007) (Eds). *Climate Change 2007: Impacts, Adaptation and Vulnerability.* Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, UK.

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

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