CASE STUDY

Category: ICTs and Agricultural Adaptation to Climate Change

Climate Change, Innovation & ICTs Project

Centre for Development Informatics (CDI), University of Manchester, UK
With the support of the International Development Research Centre (IDRC)

e-Arik: Using ICTs to Facilitate "Climate-Smart Agriculture" among Tribal Farmers of North-East India

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Initiative Overview

The *Adi* tribal community inhabit the Siang river valley and foothills of the Eastern Himalayas of North-East India. Most farmers are smallholders, and practice *jhum* (slash-and-burn) cultivation. Together with difficult mountainous terrain, regular natural calamities, irregular monsoon rainfall, etc., this means agriculture is only for subsistence. 40 per cent of the population lives below the poverty line, and agricultural productivity has been among the lowest in India (MoRD-GoI, 2005). Within such an environment, climate change can readily tip the balance between security and insecurity. Meanwhile the slash-and-burn practices cause significant deforestation, and exacerbate the impact of climate events, for example by increasing the likelihood of landslides.

A 2007 information needs assessment found the overwhelming majority of *Adi* farmers lacked access to agricultural information with which to address these and other challenges such as pest and disease management. Four-fifths of the population possessed a radio, and nearly one-third of farmers had a TV and a fixed phone line. Very few possessed mobile phones, and none had computer and internet access; with only a very few of the more highly-educated community members even having ever used the internet (Saravanan 2007). More than half of the households (56 per cent) were not connected with electricity.

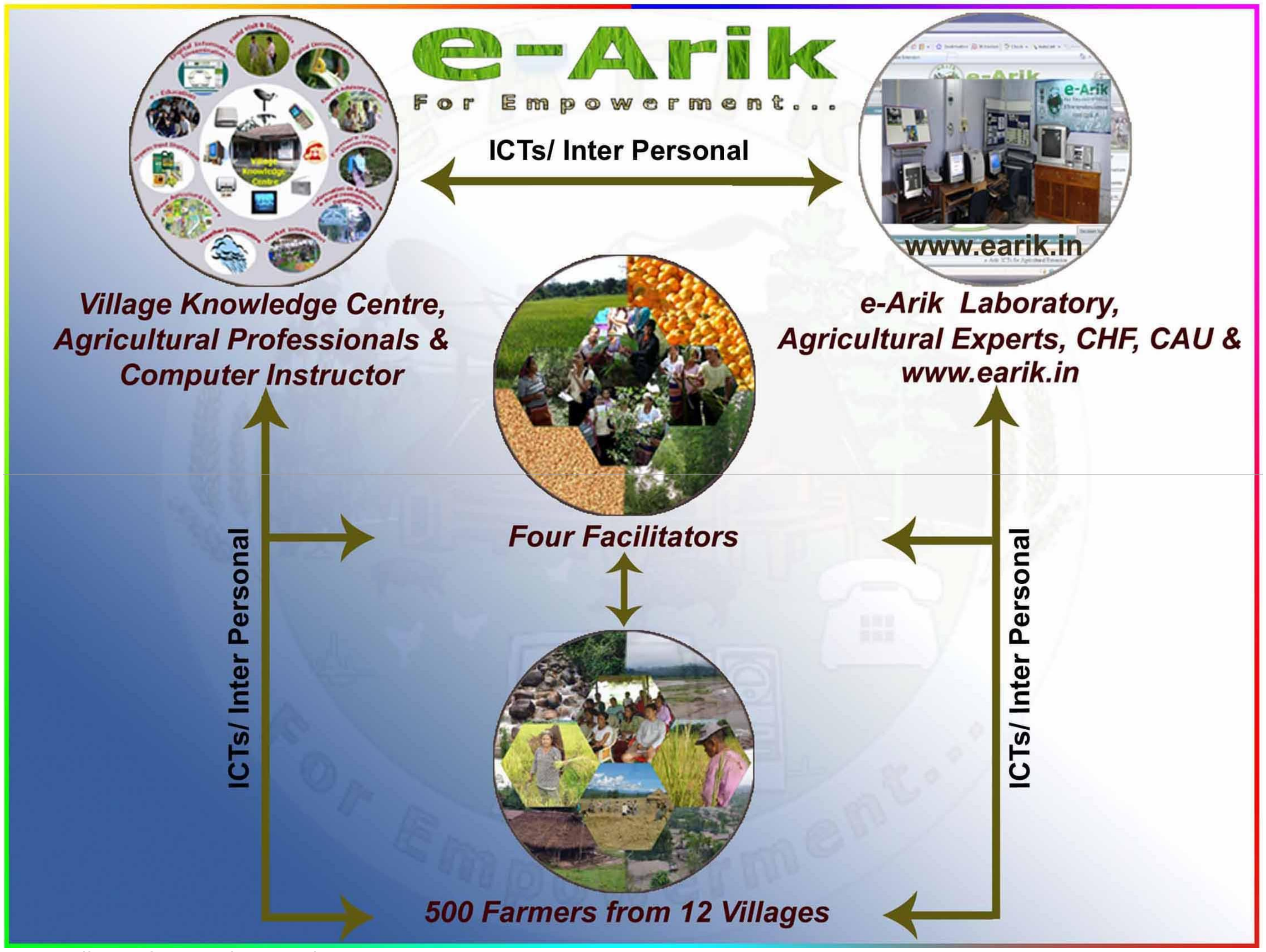
Considering this very difficult scenario, the *e-Arik* (e-agriculture) project was initiated in 2007, aiming to disseminate "climate-smart agriculture practices" and also to achieve food security. Climate-smart farm practices were seen as those that were sustainable, low input and reliant on organic technologies; and focus was on the two major crops of the project area: paddy rice (*Oriza sativa*) and Khasi mandarin oranges (*Citrus reticulata*).

Application Description

The e-Arik project established a 'Village Knowledge Centre' with computer, internet link, printer, scanner, phone and TV at Yagrung village. Project facilitators (agricultural professionals, a computer instructor and farmer-facilitators) were appointed at the Centre to help farmers access ICT-based agricultural information. A project portal (www.earik.in) was also created, providing:

- information on crop cultivation and other agricultural practices;
- baseline information from relevant agriculture and rural developmental departments of government (including information on objectives, priority areas, and administrative and technical personnel details and contacts for the departments of Agriculture, Horticulture, Fisheries, Animal Husbandry and Veterinary, Dairy, and the District Rural Developmental Agency);
- specific information on government schemes such as farmer welfare programmes; and
- day-to-day market information and weather forecasts.

Farmers could obtain information direct (e.g. from the portal and other websites, or from offline CDs) but would more often work via the facilitator intermediaries to access ICT-based information or to engage in remote consultation with other agricultural experts (see Figure 1).



CHF: College of Horticulture and Forestry
CAU: Central Agricultural University
ICTs: e-Mail, Fixed Phone/ Mobile
Interpersonal: Farmer-facilitators, computer instructor, agricultural experts

Figure 1: e-Arik Overview

For example, the e-Arik project staff regularly undertook field visits to observe crop conditions and to diagnosis pests, diseases, nutrient deficiencies and physiological problems. They could then digitally document these issues using ICTs in the field (see Figure 2) and, via e-mail and webcam, communicate them to staff at the e-Arik Research Laboratory at the Central Agricultural University. Problems were analysed by the experts (who themselves sometimes also undertook field/advisory visits) and recommendations were passed on to the e-Arik Village Knowledge Centre by e-mail and then to the concerned farmers by phone or personal face-to-face communication by the farmer-facilitators. Dissemination of information and good practice was also addressed by innovative approaches such as farmer-to-farmer communication and local self-help groups.

Figure 2: Facilitator Use of ICTs in the Field

Formal Drivers

Arunachal Pradesh State has rich biodiversity and unique ethnic groups, but also has a fragile and marginal geography characterised by predominantly hilly ecosystems, inaccessible terrain, and excessive sloping land (Saravanan 2006). The agriculture in the region is mainly at subsistence level, with food grain deficits being not uncommon. Add in a lack of irrigation facilities and a susceptibility to landslides, and it can be seen that this is an area that is highly climate-sensitive. The population depends heavily on the pattern of monsoon rains. Even slight deviations from normal weather patterns and normal climatic conditions have a disproportionately-damaging effect on those who live in Arunachal Pradesh. Yet such deviations appear to be increasing as a result of climate change.

Climate change should be recognised as just one factor among many that face these vulnerable rural communities, with the drivers behind the e-Arik project being the general state of agricultural insecurity, and the general lack of agricultural information.

Objectives/Purpose for ICT Usage

The e-Arik project aimed to provide better information about "climate-smart agriculture" in order to increase awareness of and capacity for climate-smart agricultural practices, ultimately leading to adoption of those practices. As defined by FAO (2010), climate-smart means agriculture that sustainably increases productivity, resilience (adaptation), reduces/removes greenhouse gases (mitigation), and enhances achievement of national food security and development goals. This can cover a whole variety of actual practices on the ground – those being adapted to each particular context. Examples might include bunds and ridges for water retention, water conservation techniques, vermi-composting, and changing from shifting to settled cultivation patterns.

Stakeholders

The project stakeholders are summarised in Table 1.

No.	Stakeholders	Role
1.	Project sponsors from the Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology, Government of India	Providing financial resource, overall review and monitoring of project
2.	Project Team (Central Agricultural University)	
a.	Principal & Co-principal investigators	Overall day-to-day guidance and direction
b.	Project fellow	ICT specialist: designing multimedia CDs and project publications, uploading market information to the e-Arik web portal
c.	Research fellows (agricultural professionals)	Field advisory by ICT/ personal face-to-face communication
d.	Computer instructor	Project intermediary at e-Arik Village Knowledge Centre
e.	Farmer-facilitators	Field visits, digital documentation, local communicators
3.	Experts (faculty & scientists from the University)	Expert advice via ICTs and field visits
4.	Subject matter specialists of *Krishi Vigyan Kendra* (Farm Science Centre)	Project partners
5.	Village Tribal Council members	Project Advisory Committee members
6.	500 registered farmers from 12 remote tribal villages	Project beneficiaries

Table 1: e-Arik Project Stakeholders

Impact: Cost and Benefits

The e-Arik project incurred costs of Rs.245,000 (US$4,963) for the purchase of ICT, Rs.300,000 (US$6,077) for the project team's local travel (mainly vehicle hire charges), Rs.400,000 (US$8,103) for personnel (all project team members listed under Item 2 in Table 1) and Rs.81,000 (US$1,640) for other costs (e.g. consumables and contingencies). From 2007 to 2011 (the project was initially approved for two years, but it was extended for a further two years), the total cost incurred by the e-Arik project was therefore Rs.1.26m (US$20,783).

The main – as intended – impact has been the adoption of climate-smart agricultural practices. 44 per cent and 92 per cent of farmers implemented the information they had received via e-Arik on climate-smart farm practices on rice and mandarin crops respectively (Drishti 2011). Two years after project initiation, 55 per cent of farmers had developed new khasi mandarin orchards in their *jhum* field, which means they are permanently moving from slash-and-burn to settled cultivation. 42 per cent and 29 per cent of e-Arik beneficiaries reported increased production of rice and khasi mandarin crops, respectively.

Among the 500 e-Arik beneficiaries, an average income increase per farmer per season was reported of Rs.1,689 (US$37.50) and Rs.5,251 (US$117) for rice and mandarin respectively. An estimate can also be made that each farmer is saving – on average – Rs.2,400 (US$53) per year in fuel costs due to journeys to the agricultural extension office that would previously have had to be made, but which can now be foregone. Overall, it is estimated that the e-Arik approach is 3.6 times cheaper than a conventional agricultural extension system; that farmers can get access to information and services 16 times more quickly, and that is requires one-third of the time to then deliver the information and services (Saravanan 2008a).

Not all the ideas introduced by e-Arik have been a success. For example, a low methane-emitting and water-conserving technology – the System of Rice Intensification (SRI) – was introduced. Among forty trained farmers only two had adopted SRI by 2010. It may take a few more years to convince more farmers to adopt this, because it requires an entirely different farm practice compared to their usual cultivation method followed over the generations.

Evaluation: Failure or Success

The project was successful in demonstrating application of ICTs in promoting climate-smart agriculture practices; new approaches to farming that require few external inputs and which are organic. Such projects must necessarily be driven by the needs and interests of the farmer beneficiaries. For them, climate is an important issue, and they recognise signs of climate change. However, their overriding priority – and the main aspect that will contribute to their resilience in the face of climate change – is increased incomes. This has therefore been the main initial focus for the project; a focus – given the growth in average incomes and the journey/fuel cost savings – in which it can claim success. ICTs are only one part of the socio-technical package that has consisted of greater intervention from agricultural facilitators and experts. But that package would – if given ongoing funding – be sustainable, and able to address more climate change-specific issues as and when they arise in future.

As noted, the project was initially funded for two years, and then for a further two years, up to 2011. At the time of writing, a second-phase scale-up of the project is planned with further government funding, greater emphasis on use of mobile phones, and the intention to replicate the same model in India's seven other north-east States.

Enablers /Critical Success Factors

The following were identified as critical factors that have enabled the e-Arik project to be successful:

- **Utilising trusted local intermediaries**: A key challenge for projects seeking to support agricultural adaptation is the gap between external agricultural experts and the local farmers. These are gaps of knowledge, culture and – in this case – language with farmers speaking the *Adi* tribal dialect. The key to bridging that gap was the selection of educated young farmers to act as intermediaries under various terminologies including "farmer-facilitators", "local knowledge managers" and "para-extension professionals". The young people were able to record field conditions using digital cameras and camera-enabled phones (see Figure 3); were able to make use of ICTs in the Village Knowledge Centre to send and receive information; were able to communicate with the agricultural experts; and could act as trusted and credible channels by which information could be communicated to the other farmers, hence forming a farmer-to-farmer communication model.

Figure 3: Using Mobile Phones to Collect Field Data

- **Appropriate use of different – including non-digital – ICTs**: The e-Arik project had at its disposal a wide variety of different ICTs, and made use of them in different ways. Thus mobile technologies were used to record from the field. Radio and TV were used as a channel for general awareness-raising about climate and agricultural issues but not for specific guidance. Video was used – sometimes shown via laptop actually in the field – in order to communicate specific details of adopting new agricultural technologies. Physical publications were used – forming a village library – for use when power outages prevented ICTs from being used. Finally, physical display of organic farm inputs at the Village Knowledge Centre was used as a means to stimulate interest and awareness (with 90 per cent of visitors recorded as having enquired about availability of the inputs shown).

- **Multi-channel message reinforcement including face-to-face**: As can be seen from the previous item, e-Arik did not rely on a single channel in order to communicate. Where conventional agricultural extension may use just human communication, and some e-agriculture projects use just ICTs, e-Arik used both people and multiple ICTs. Thus awareness-raising occurred through farmer-facilitators and radio and TV. And demonstrations of new agricultural technologies were undertaken by visiting agricultural experts and through video. This multi-channel approach increased the scope and depth of communication, and – through reinforcement – helped ensure that messages were received and were turned into actions.

- **Multi-stakeholder partnership**: Although there are costs to setting up a project with multiple partners, there are also significant benefits. Partnership with community members as Advisory Committee members and as intermediaries was central to the acceptance of the project. Partnership with a broad range of other agricultural advisory service providers – mainly the various government departments and the Farm Science Centre – ensured support for the project, and gave access to all necessary expertise. Thus, for example, expertise on indigenous pest and disease management was only available via subject matter specialists at the Farm Science Centre; and their expertise was readily channelled to the Village Knowledge Centre and, from there, via the farmer-facilitators to the farmers.

Constraints/Challenges

Challenges faced by the project included:

- **Technological and human challenges of working in remote, rural areas**: Climate change especially affects rural, upland areas, but intervening with ICTs in such locations has specific challenges. Technologically, there were frequent power and communication cuts, thus making it impossible to provide continuous ICT-based information services, and requiring an escalating series of back-up options from offline CDs through hard copy to human facilitators. Even the human side had its difficulties with landslides and flooding during the rainy season making travel difficult or impracticable; and with the dominance of the local language making it impossible for outsiders – such as visiting agricultural professionals – to communicate direct with farmers.

- **The need to create climate-appropriate information from scratch**: While traditional agricultural information – whether from local or external scientific sources – is fairly readily available, this was not always the case with climate-smart agricultural information; i.e. information on practices of particular relevance to climate change adaptation, or on practices that were low-carbon-footprint and sustainable. Therefore, that information had to be created through a combination of external research and local, iterative piloting.

- **Digital scepticism**: While some of the core project team were familiar with ICTs, this was not the case with many of the more senior officials from both the implementing organisation, and also from governmental agricultural and rural development departments. As a result, they were unaware of the role of ICTs in both agricultural development generally and climate-smart agricultural practice specifically. Reactions ranged from naivety and incomprehension through to scepticism and a lack of willingness to co-operate.

- **Demand for total development assistance**: The project was offering assistance in a specific and delimited area: climate-smart agriculture. But the farmers – seeing this as the main government-supported assistance project interacting with them – saw no such boundary lines. They wanted the project to help with other problems, such as fencing to protect from animal intrusion, and marketing to improve product sales. This caused problems at the start, in convincing the farmers about the value of the project, and causing ongoing tensions between narrower project priorities and wider farmer problems.

- **Project scepticism**: The farmers' conflation of the project with typical government rural development programmes was also problematic because this raised negative connotations. The farmers associated such programmes with the siphoning-off of project funds by officials for their own personal use. It was difficult to help some farmers understand how e-Arik was different and, as such, they were reluctant to engage with the project; at least initially.

- **Problems of financial sustainability**: In the beginning, the e-Arik project was only funded for two years, and sustaining project activities after this period looked to be very difficult. Farmers were surveyed to find their willingness to pay for the type of service provided. In large part due to the scepticisms and/or demand for total assistance noted above, 34 per cent were not willing to pay at all, and 52 per cent were only willing to pay Rs.50 (US$1) per crop season – not by any means enough to sustain the project financially (Saravanan 2008b). This also related to the farmers' perception that agricultural advisory services are part of the welfare activities of the state, and thus should be provided free of charge. As a result – and in recognition of the value of the project – it was given the additional funding already described.

Recommendations/Lessons Learned

- **Climate change adaptation projects can legitimately target income generation**: Wealth is recognised as a key component of climate change adaptive capacity; perhaps the single most important component (Brown et al. 2007). It is therefore appropriate for e-agricultural adaptation projects to focus on raising rural incomes. This will help build adaptive capacity.

- **Make use of local knowledge for climate change adaptation**: It could be observed within this project that many of the tribal farmers were already undertaking climate-smart practices such as those to counteract pests and diseases. Thus local innovations that were relevant to climate change were already in existence; what was needed was to digitally document those practices and then disseminate them to other farmers via the power of ICTs.

- **Prioritise appropriate ICTs**: For these remote rural areas, the web and internet are, as yet, rather "foreign" technologies that the farmers themselves are largely unfamiliar with. ICT design for e-agricultural adaptation projects should therefore focus on those ICTs that are already in use. This would include radio and TV for general awareness-raising, and mobile phones for more individualised assistance. Farmers also seemed quite comfortable with participatory video as a technique.

- **To convince farmers, show and tell**: ICT-based information alone – i.e. just telling farmers – was typically not enough to get them to change their practices; even if that information was delivered via local farmer-facilitators. What was also needed was a demonstration within farmers' fields. For example, the use of bio-fertiliser-based seed treatments required some innovative local farmers to adopt the practice, and for other farmers to then see it working. Similarly, text-based information about new practices was much less effective than digital videos showing a demonstration by other local farmers.

- **Provide not just agricultural practice information but a complete resource package across the agricultural supply chain**: Climate-smart agricultural projects will not be effective if they only focus on providing information about agricultural practice. Provision needs to be more holistic in two ways (see Figure 4). First, the project must find a way to deliver all the resources necessary to turn information into agricultural action. This means the provision of money, labour, technology, motivation, and support. Even if not directly delivered by the project, these resources must be available or the information will remain unused. Second, the project must work across the supply chain: not just focused on agricultural processes but on backward linkages to inputs (farm machinery, fertiliser, seeds) and on forward linkages to outputs (post-harvest technologies, and agricultural markets).

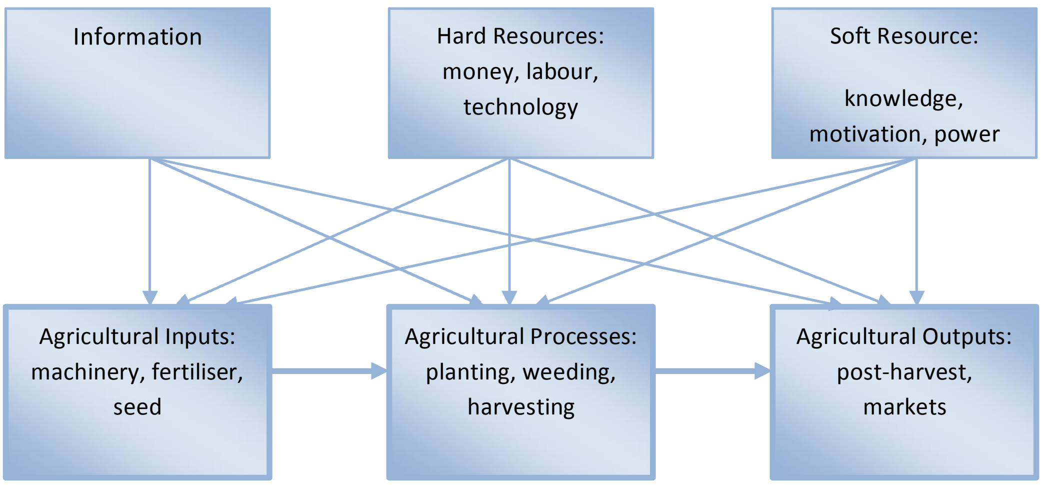


Figure 4: Holistic Provision on e-Agricultural Adaptation Projects

Data Sources & Further Information

This case study is based on published information (available at www.earik.in) and also the personal observations of the author, who was Principal Investigator of the project. Some of the videos produced for the project can be found at: http://www.youtube.com/user/eArik2007

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Acknowledgement: the e-Arik project was implemented by the Central Agricultural University with research grant support from the Technology Information Facilitation Programme, Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology, Government of India. Grant No.: DSIR/TIF086/2007; dated March 2007.

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The **Climate Change, Innovation and ICTs** project is an initiative led by the Centre for Development Informatics (CDI) of the University of Manchester, UK, with funding support from Canada's International Development Research Centre (IDRC).
Further information about the project and related resources can be found at: http://www.niccd.org

2011