INCLUSIVE INNOVATIONS

Agriculture ICT Extension Services

Improving smallholders' knowledge of agricultural practices and markets through innovative media platforms

HIGHLIGHTS

- Increasing penetration of budget-friendly smartphones facilitates real-time access to information.
- Up-to-date market information on prices of commodities, inputs and consumer trends can improve farmers' livelihoods substantially and improve their negotiating positions.
- Tailored content and relatable delivery is a key factor for uptake of new techniques, and in a more cost-efficient manner than standard extension services.

Peter Kapuscinski / World Bank

Summary

Millions of smallholder farmers are the foundation of agricultural and food supply chains in most developing countries. Yet, the agricultural practices of smallholder farmers are at times not economically viable and struggle to be sustainable. Small farms produce low yields, adversely affecting farmers' economic conditions. Lack of information about critical inputs and inadequate knowledge about modern and efficient agricultural practices contributes to low farm yields.

Information and communications technology (ICT) extension services involve the transfer of practical knowledge and exchange of market information through ICT platforms. These solutions are relevant to agricultural and rural transformation processes, especially for smallholders. While traditional media such as radio and television continue to play a major role in extension and development communication, growth in the use of internet and mobile technology for communication is perceived to be a game changer in the extension services space.

ICT extension service providers offer a range of information services to the smallholder farmers, from pre-harvest stage to post-harvest stage. They help the farmers understand and adopt agricultural best practices on crop selection, input management, land selection and preparation, finance, transportation, packaging processing, and marketing of the agricultural produce. The enterprises provide these services via radio and television shows, mobile applications, digital video disks (DVDs) and interactive voice response (IVR) technology. Enterprises that provide information services can help improve agricultural yields and guide farmers in procuring and using the right inputs and participating in commercial value chains

Development Challenge

There are over 475 million smallholder farmers globally.[1] Nearly 80 percent of the food supply in Asia and Sub-Saharan Africa is produced by these smallholder farmers.[2] Limited access to technology, lack of productivity enhancement inputs, low awareness about farming best practices, and weak links across the agricultural value chain are some of the major challenges that smallholder

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This series on Inclusive Innovations explores business models that improve the lives of those living in extreme poverty. Editors are Elaine Tinsley and Natalia Agapitova. Researched and developed by Intellecap.

farmers face. Further, severe climatic conditions lead to crop failure when farmers are not able to take preemptive steps due to lack of weather forecast information. Improper planting and harvesting practices result in loss of productivity and lower profit margins for farmers.

ICT can facilitate wide dissemination of relevant information at the right time in a cost-effective manner. The increasing penetration of mobile phones and internet, more specifically budget friendly smartphones can support a business model that expands information sources and farmers' ability to access the same. Such solutions have significant impact in the rural and remote regions of developing countries with large farmer populations. For instance, in India, the smartphone market is estimated to grow to over 200 million by end of 2016.[3]. ICT can be applied to address various aspects of agriculture including identification of farmers' pre-harvest needs, devising solutions to meet those needs, and collection of feedback from farmers regarding a specific service or solution.[4]

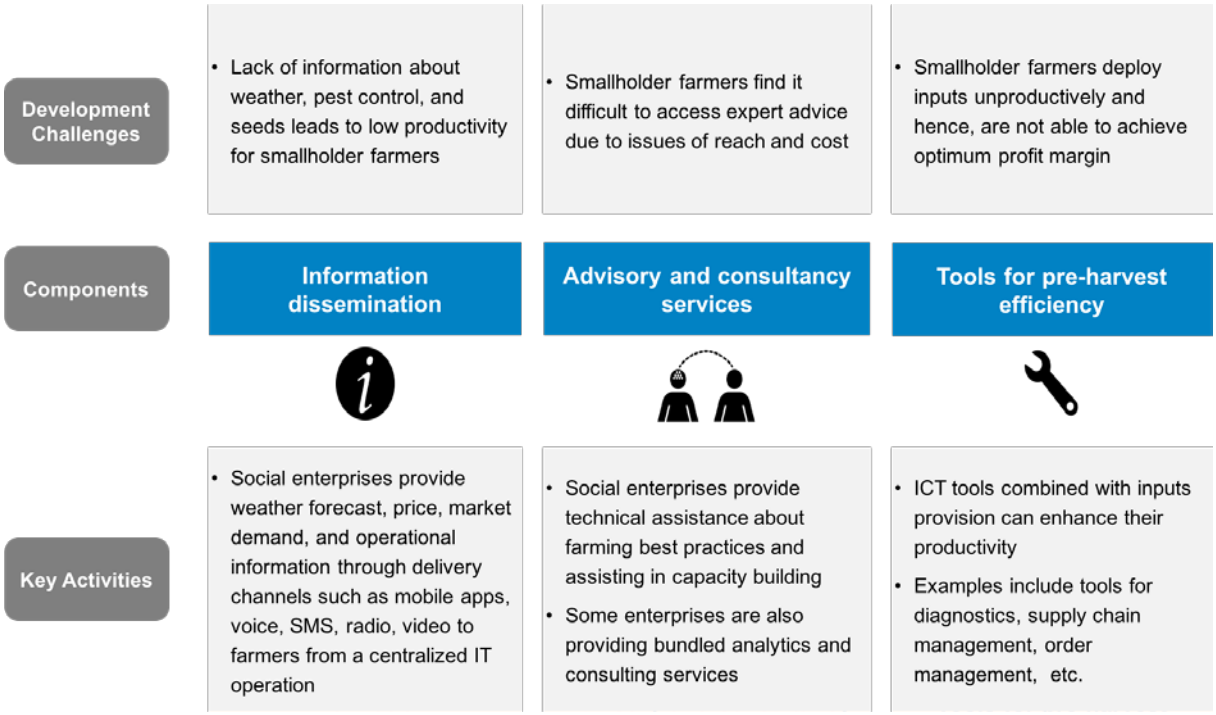
Popular information dissemination models using ICT include online platforms, mobile applications, training content through videos, personalized call centers, and radio and television programs. Some of these are interactive and help smallholder farmers solve problems in real time. The quality and type of ICT extension services vary based on telecommunication facilities and nature of demand from farmers. A critical factor for adoption of ICT extension services is the ease of use of information. Enterprises offering these services should address issues such as ICT illiteracy, and the need for relevant and localized content.

Business Model

Many social enterprises (SEs) have introduced ICT applications to enable farmers to access vital pre-harvest information. The diffusion of ICT devices (especially mobile phones) and infrastructure has eased constraints in supply-chain management and farmer aggregation. ICT extension enterprises enable farmers to access information related to agricultural inputs, weather forecast, market prices, and best practices in agriculture being followed by fellow smallholder farmers in general as well as other developing countries or regions. These services connect smallholder farmers at the global level, facilitate cross-learning, and help them increase their agricultural productivity.

Components of the Model

Figure 1. Components of the model



Most ICT-based SEs provide extension services through one or more of the following operational phases:

Disseminating pre-harvest related information

Many SEs provide information about regional weather conditions, weather forecasts, agri-related policies, and pest and disease control. Enterprises such as Reuters Market Light and Farmer's Friend enable farmers to search for agricultural information and use SMS to provide advice and relevant information such as regional weather forecasts, planting, storage and harvesting, and pest and disease control information for crops and livestock.

Some enterprises leverage information technology to share and replicate best farming practices from one region or country, with smallholder farmers of other regions or countries. For instance, Digital Green disseminates targeted agricultural information via digital media to small-scale and marginal farmers in India. The solution includes a digital video database that is produced for farmers by farmers. Participating villages are provided with a TV, DVD player and camcorder operated by local NGO staff and managed by farmers, along with DVDs or flashdrives that are shipped to the village. The enterprise organizes shows in different areas of the village for small groups of 10 to 20 farmers. Similarly, Mali Shambani is a weekly radio program featuring agricultural news and responding to the business and market access needs of rural farmers in Kenya. The hour-long program covers a wide range of topics, including market prices and trends, farming techniques, weather and seasonal issues, financing opportunities, inputs, land use, and quality standards.

Imparting advisory and consultancy services

Online dissemination and sharing of knowledge among experts, farmers, students and research scholars can encourage rapid adoption of efficient and modern farm practices. Some enterprises have developed virtual platforms to disseminate expert advice and technical knowledge, cutting across geographies and time zones to reach a potentially large audience. Other enterprises have leveraged the prevalence of mobile phones to share information, and have set up call centers and help lines that farmers can access for answers to specific queries. Yet other solutions involve the inventive use of videos and design thinking to develop content and material that are easy to understand and internalize. Kenya-based Farmers Helpline operated by KenCall is a call center service staffed by agricultural experts that provide information, advice and support to smallholder farmers over phone, providing voice and voice call-back facilities.

By applying design thinking to extension services, Kenya based Agro-Insight works closely with rural communities, using effective video and print materials. It designs and organizes tailor-made training courses for extension service providers as well as in the development of video and fact sheets for farmers. The company also offers courses in surveillance of plant pests and diseases.

Akshamaala, an agri-extension services company in India, uses its technology platform to enable knowledge sharing and farmer education on key products. To facilitate post-sales service for agri-inputs, Akshamaala provides input companies with a contact center, knowledge management system and farmer relationship management software. It also offers a fully-integrated mobility solution that has a knowledge bank for farmers who can educate themselves on input dosage, usage and risk management.

ICT enabled enterprises can also utilize their virtual platforms to provide farmers access to networks of experts. eKutir, an ICT firm in India has developed the Farmer Portfolio Management Tool (FPMT)—a system created to record individual farmer activities, advise them on how to efficiently manage their assets, and connect them to experts.

Providing tools for pre-harvest efficiency

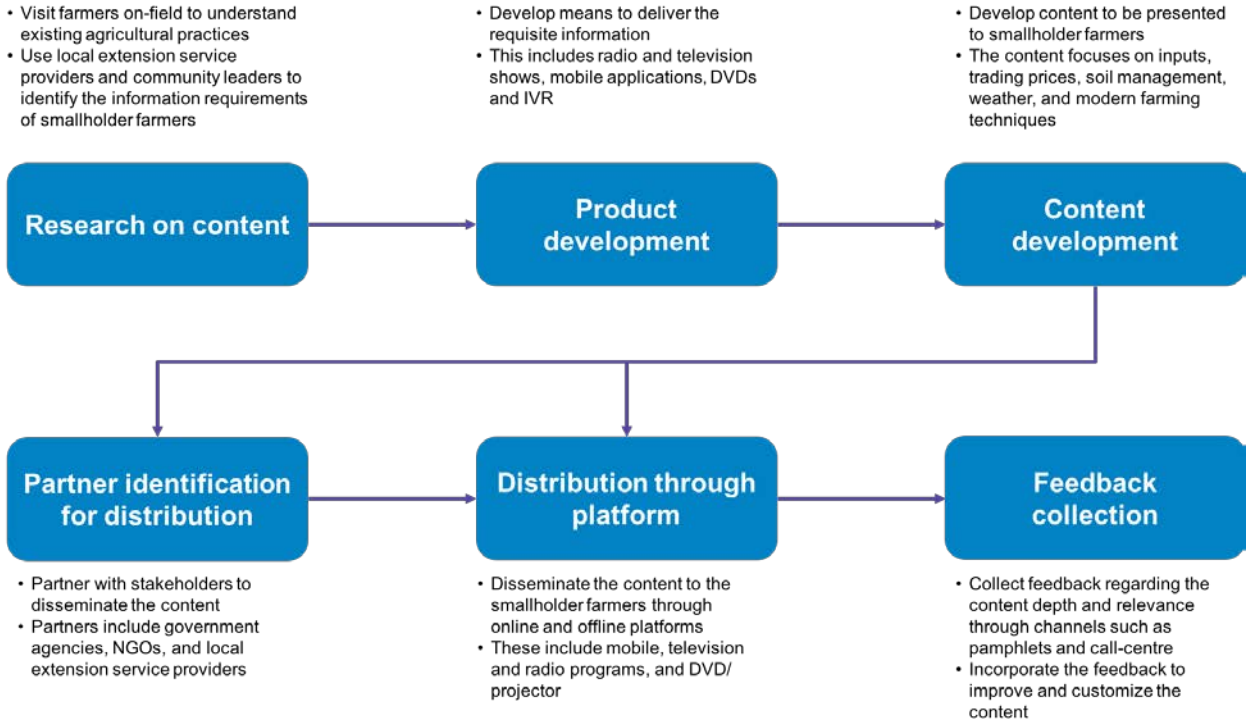
SEs have adopted ICT to support farmers in achieving efficiency through information systems. Indiagriline is a web-based portal that enables farmers to forecast demand, access records of their previous transactions with the company, register their sugarcane area, submit payment information,

and monitor demand, among other services. ICT enables remote agriculture extension where farmers can use email and digital cameras to reach experts and seek crop diagnostics support. SEs such as Cojengo provide a smartphone based diagnostic tool for animal health to improve disease diagnosis, surveillance and treatment of cattle in sub-Saharan Africa.

Virtual City, a private Kenyan technology startup, has developed AgriManagr software which is used by collection centers to manage the process of buying agricultural produce from farmers. AgriManagr has several benefits for both, the procurer and the farmer. It eliminates the manual transcription that inevitably results in record-keeping errors or fraud. It speeds procurement and ensures clarity and accuracy of information, which increases the buyers' ability to respond rapidly to bottlenecks or opportunities.

eKutir has developed several innovative productivity enhancement solutions to improve the livelihoods of smallholder farmers. For example, it has developed a tool called 'mrittikka' which provides soil nutrient analysis and recommendations. Another tool called 'ankur' assists farmers with better seed selection to achieve increased productivity and farm yield. On the basis of the agro-climatic analysis and the type and condition of farmland, the tool recommends the best seed type/variety for the crop, localized for each region.

Figure 2. Process of the model



Cost Factors

ICT extension service providers incur high capital expenditure for solution and platform development, and content creation (including research and development costs). Some enterprises such as Digital Green are able to cover these costs through their partners— either the government or private sector companies. Some of the operational costs include cost of acquisition of customers, cost of remuneration of staff members and cost of content enhancement. These costs constitute a smaller component of the total cost, and are also lower compared to that incurred by non-ICT extension service providers. A number of ICT extension enterprises partner with local stakeholders to further lower these costs.

For some enterprises such as eKutir, product development, sales and marketing, and data informatics are the top three cost components. Likewise, Access Agriculture spends the most in website maintenance, and partner training followed by remuneration of field staff. The enterprise currently incurs large capital expenditure as it plans to build its umbrella of services, and expand its operations. A few enterprises such as Mediae, that presents a TV program called "Shamba Shape-up." incur expenditure in the research and understanding of the issues to be presented in the program. The enterprise terms this as the "Knowledge, Attitude, and Practice (KAP) study" that incurs nearly USD 40,000 per episode. The filming production costs per episode of Shamba Shape-up are around USD 25,000. The enterprise' prime focus has been Kenya, where it has developed 6 series consisting of a total of 115 episodes. It has also developed one series each in Uganda and Tanzania consisting of 13 episodes in each series.

ICT Extension Service Providers: Cost break-up[5]

As is evident from the table, the capital expenditure incurred by the enterprises lessens with the increase in the customer base. Operating cost increases initially, however it will also decreases when the enterprises achieve economies of scale.

Table 1. Components of the model

Company	Current or target customer base	Cost per user or transaction (USD)	
		Capital expenditure	Operating expenditure
b2bpricenow	26,000	31	2
DrumNet	5,000	57	45
e-Dairy	300	333	20
KACE	1,000,000	0.40	0.50
Reuters Market Light	250,000	8	4

Revenue Streams

ICT extension service providers earn revenues in two ways: the first, through sale of content that includes provision of advisory services, and management information system (MIS) solutions; and second, by charging segment fees per episode of broadcast content. The advisory services are provided to smallholder farmers either free of cost or at very nominal rates. The enterprises sell content to government and private extension service providers. Digital Green, for instance, earns revenues from sale of videos and technology to government and private extension service agencies that work directly with farmers. The pricing depends on several factors including the partner category, duration of engagement, type and volume of support required by the partner (for instance the number of extension agents that need to be trained), and their density in a given market or region. Another such enterprise, eKutir, licenses the technology at a pre-decided fee to micro-entrepreneurs that provide training to smallholder farmers. Customized 'software as a service' is sold to the customers; and the customers pay for the data.

Some enterprises charge segment fees per episode. For instance, big corporates including Syngenta Foundation pay nearly USD 5,000 for a five-minute slot per episode for TV shows such as Shamba Shape-up. The corporates use this slot to describe and advertise their products and solutions for smallholder farmers. Other corporates such as Google, Oracle and Cisco sponsor shows by ICT extension providers such Digital Green. Likewise, donors and foundations also support these enterprises, given the high impact nature of their services. For instance, one of the major revenue streams for Access Agriculture is funding from the government of Switzerland, and for Digital Green is funding from The Bill and Melinda Gates Foundation and USAID.

Other innovative modes of revenue generation include sale of video content through video shacks or distributors that sell Bollywood and Hollywood movies. Access Agriculture sells the agricultural training videos in DVD format and 3GP format for mobile phone viewing for a small fee of 50 cents per video. Access Agriculture also sells smart projectors to customers who are off-grid, off-mobile and off-internet. Consultation services and advertising through social media platforms are emerging as sources of income for ICT extension service enterprises.

Financial Viability

Most ICT extension service providers aim to achieve financial sustainability within 2-3 years of their operation. Some of the enterprises design their financial model to achieve break-even from the outset. They achieve this either through strategic partnerships that help the enterprises in increasing the outreach and distribution of their products and services or by developing unique solutions that provide them "first-mover advantage". Other forms of partnership include those for financial support. Donor agencies and governments provide grants and debt funding to enterprises that ensure business sustainability for a few years until they start making profits.

The pricing strategy of ICT extension service providers such as Digital Green depends on a variety of factors such as type of partner, duration of engagement with the partner, type of support required, and number of extension agents to be trained. The enterprise does not have any real competitors, as it partners and works with local extension service providers in different geographies. It provides end to end ICT extension services including production, analysis and distribution of information, which is a distinguishing feature of the enterprise and ensure better financial viability to the enterprise.

An integrated information system reduces the cost, minimizes duplication of data, ensures consistency, and can address a wide variety of information needs. DrumNet, a network of support centers in Kenya provides hands-on assistance through the delivery of financial, marketing and other information products and services to the smallholder farmers.[6]

Partnerships

The ICT extension service providers establish partnerships with various stakeholders including government bodies, development organizations, NGOs and input manufacturers for a number of activities. For instance, Digital Green partners with government extension workers who disseminate Digital Green videos and training material to farmers in remote rural areas. Access Agriculture partners with farmer groups, universities, agriculture colleges, and other extension service providers in the video production and distribution process— the enterprise provides filming equipment to its partners and trains them to produce videos based on different agri-themes. Some enterprises such as Mediae partner with corporates such as seed companies, fertilizer companies and chicken providers to showcase their products and support associated education content on their TV show. These partners share information about their pilot programs and demo plots on the show to disseminate best practices to farmers.

Implementation: Delivering Value to the Poor

ICT extension services have gained traction in developing countries in the past few years because of the increasing penetration of mobile and other telecommunication channels and decreasing digital divide in these countries. ICT extension enterprises are changing the manner in which smallholder farmers communicate with stakeholders and access requisite information to improve their agricultural productivity.

Awareness

Nearly 60 percent of farmers lack adequate access to information on advanced agricultural technologies and best practices resulting in huge adoption gap.[7] Some ICT extension service providers such as eKutir find it easier to establish a

market for their offerings as its customers are already aware about the challenge and the need for such services. The enterprise caters to a mature customer base including multinational companies such as Starbucks, Mars and Danone; development banks; financial service providers; and other financial institutions.

Enterprises such as Farm Radio International work with established programs and partners such as African Farm Radio Research Initiative of the Bill & Melinda Gates Foundation, and Orange-Fleshed Sweet Potato radio drama of USAID[8] to quickly gain access to a wide audience. Their programs are supported by advertising through mobile phone and other media.

A few associations, for instance, the Federation of Agricultural Professional Producers of Sissili Province (FEPPASI), a 96 member federation of farmers' organization, leverage ICT to train smallholder women farmers and help them professionalize their farming businesses. FEPPASI used videos, photos, and digital presentations to train farmers in their respective districts. [9]

Acceptance

Enterprises adopt several measures to reach and connect with their target customers and beneficiaries. Many of them now use streaming media to make non-text, i.e., video and audio information, more widely available to illiterate audiences. The integration of ICT in agriculture extension, especially through the use of videos and other visuals depicting stories similar to those of the regional farmers, increases the possibilities of a direct connect with the smallholder farmers. Enterprises also leverage interactive applications over one-way communication tools.[10] These interactive media, including radio messages, feedback pamphlets, and call-center services help the enterprises understand the local context and provide requisite consulting services. Internationally acclaimed ICT extension service providers such as Digital Green emphasize a lot on the content and delivery quality to provide global services at local levels. Digital Green and Shamba Shape Up present stories and instance of some of the role models that help the smallholder farmers grasp the message. A few other enterprises have to invest considerably in adapting their ICT based products and services to the local context. For instance, Access Agriculture customizes its content into local languages. It also ensures relevance with respect to the crops and geographical conditions.

Accessibility

ICT extension service enterprises reach farmers through radio, television, mobile, internet, and videos. Most of the enterprises either have an online mode to reach the farmers or take the support of local community leaders to conduct shows or screen their videos. However, the effectiveness of a video is highly dependent on the quality of the facilitator, so proper identification and training of facilitators is key. Community based tele-centers offer a way of providing affordable access to ICT services in rural areas. These centers could assist agricultural extension officers to disseminate required farming information.

Bangladesh based ICT extension service provider, mPower SEs, has developed an integrated ICT approach that includes mobile and web applications to cater some of the agricultural challenges in the country. It addresses the issue of limited access to agri-extension service providers[11] by means of its community based, infomediary-driven approach, in which the community selects an 'ICT leader' in each farmer group. These ICT leaders are trained by the mPower and are provided with a mobile application named 'Farmer Query System'. When farmers in the community face a particular agriculture challenge, the ICT Leaders send the details of this problem through the app to a call center where expert agriculturists respond to the query through a phone call, becoming a virtual extension agent.[12] Another Bangladesh based enterprise, D-Net, implements the Microsoft Unlimited Potential Project in the form of *Pallytathya Kendra,* a community-based technology center. It enables rural communities to access different ICT tools including computers and internet. It also helps smallholder farmers use mobile phones to retrieve information from telecentres and other sources.[13]

Some enterprises have incorporated innovative mechanisms to increase their reach. For instance, Shamba Shape-up shows are hosted by famous Kenyan actors who attract large audiences. The program also leverages its partner corporates' demonstration plots and extension workers to reach farmers. Access Agriculture has a unique distribution strategy where it leverages the inclination of Kenyan farmers towards soccer watching, and in religious belief. It partners with soccer screening establishments, and religious places such as churches and mosques to show the 'Access Agriculture' videos. Likewise, in Malawi, the enterprise sells the content loaded on DVDs and micro SD cards through video shacks that rent/sell DVDs of Bollywood and Hollywood movies. It also provides access in multiple formats - farmers can access the free content through its website, mobile phones and television.

Affordability

ICT based extension service providers balance their infrastructure and human resource costs with their revenue model to ensure affordable services to various stakeholders including smallholder farmers. ICT extension service enterprises make their products and services affordable and often free for farmers by cross-subsidizing or charging large corporate partners and other paying customer groups. They also leverage donor and grant money to bridge the gap between costs and revenues. Some enterprises receive funding from development finance institutions (DFIs) including United States Agency for International Development (USAID), Department for International Development (DFID), and the Rockefeller Foundation (RF). For instance, USAID funded mPower to implement its Ag Extension Project in Bangladesh. Likewise, DFID, RF and USAID funded Mediae, the enterprise that broadcasts Shamba Shape Up program.

DFIs partner with the enterprises on a cost-sharing basis, and support critical activities such as filming of content, as in case of Mediae. It maintains its financial sustainability through donor funding and corporate advertisements during the airing of Shamba Shape-up program. This allows the enterprise to waive viewership fees from farmers. Digital Green also partners with governments and private sector players on a cost sharing basis. As a partner, the private sector company covers all costs including the project cost and the operational cost, while the governments cover only the operational cost.

Results and Cost-Effectiveness

The combination of traditional and modern media, such as radio and mobile phones has increased the outreach of extension services to smallholder farmers.

Scale and Reach

ICT extension service providers have been able to reach a large number of smallholder farmers quickly. The viewership number of Shamba Shape Up has reached over 10 million. In a given week in Kenya, nearly 18 percent to the total TV-watching audience, which is equal to over 5 million viewers, watch the program. The program is watched by another 5 million viewers in Tanzania, 1 million in Uganda, and 0.5 million in Rwanda.[14] Likewise, Digital Green has expanded its network in India and other countries in the last few years. The enterprise, along with around 58 partners has provided training to over 1.15 million farmers across India and other developing countries in the last 6 years. e-Krishok has addressed information inadequacy in Bangladesh and has directly impacted 375,000 farmers, while creating an indirect impact on another 650,000 farmers within 8 years of its operation.[15]

Some enterprises plan to expand their customer base and geographic reach; some others plan to improve their partners' strengths, and a few others plan to increase their product portfolio. Digital Green targets to reach the next one million, from the current 1.15 million, in the coming 2-3 years. The enterprise plans to leverage its network of farmers to provide them other services besides ICT

extension. In India, Digital Green is in the process of extending its partnership with other NRLM states like Jharkhand through smaller pilot projects. It is also leveraging the Mahila Kisan Sashaktikaran Pariyojana (MKSP), an initiative under NRLM to empower women in agriculture, partnering with NGOs to work in three states of India—Maharashtra, Andhra Pradesh and Karnataka. The initiative, e-Krishok targets to reach 1 million farmers by 2017.[16]

A number of ICT extension service providers are planning to expand to other geographies in the next 2-3 years. For instance, Shamba Shape Up plans to expand to Malawi, Zambia, Ethiopia, and Nigeria. eKutir targets to increase the number of partners to 20, thereby reaching 10,000 million farmers by 2020. A few other enterprises plan to leverage their subsidiary products and services to generate other sources of revenue. Access Agriculture, for instance, plans to utilize its website AGTUBE.org, which acts as a social media platform for agricultural enterprises to raise funds through corporate sponsorships and advertisements by various corporates including telecom companies and Fast Moving Consumer Goods (FMCG) companies. The enterprise plans to enhance its financial sustainability by selling smart projectors, and by providing training and translation services.

Table 2. Examples of companies and their reach

Company	Country of operation	Years of operation	Number of farmers reached
Digital Green	Afghanistan, India, Ghana, Ethiopia, Niger, Malaysia and Mozambique	10	Over 1.15 million farmers
eKutir	Bangladesh, Cambodia, India, Nepal, Republic of Macedonia, Haiti, Peru	3	Nearly 61,000 farmers
e-Krishok	Bangladesh, Pakistan	8	Over 1 million farmers
Shamba Shape Up	Kenya, Tanzania, Uganda	6	Approximately 9 million viewers

Generally, the reach of ICT service providers is quite high. This is because of the nature of the service and the mode of delivery. Though, the above numbers reveal commendable reach and access to the smallholders, there are no third party evaluations or studies that validate the real impact in terms of adoption of best practices.

Improving Outcomes

Strategic application of ICT has led to better information dissemination, and access to best practices in agriculture at reduced costs. It has also resulted in mobilization of farmer groups towards increased agricultural production, poverty alleviation and economic development. According to a number of sector studies, ICT intervention has dramatically improved the amount and quality of extension services in agriculture, which is the largest economic sector in most of the developing countries. For instance, an SMS based intervention that sends agricultural advice to smallholder farmers in Kenya increased yields by 11.5 percent relative to a control group who did not receive any such messages.17 Basic voice calls have helped smallholder farmers expand their buyer network. According to a study conducted in Benin, mobile phone usage facilitates transactions and provides producers access to relevant, timely information, allowing them to sell at a higher price improve their income. In the study, a randomized control trial of 1,000 farmers using Esoko's market information service in Ghana showed an increase of 7 percent-11 percent in farmer's income for yams.[18]

One immediate benefit of ICT extension solutions to smallholder farmers is a decrease in transportation costs to obtain market information. Farmers can make a voice call to estimate the demand for a product and the price being offered on a particular day. They can then make an informed decision comparing the travel effort and the possibility of making profit that day. According to a study conducted in Niger an average trip for an agricultural laborer to a market located 65km away can take 2-4 hours round trip, as compared to a two-minute call. This results in cost savings of USD 0.50 per trip (considering daily wage of USD 1). [19]

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ICT extension service providers are also expanding their umbrella of services to continue providing incremental benefits to the farmers. eKutir has served nearly 61,000 farmers across India, Bangladesh and Cambodia. Digital Green has reached over 1 million individuals across 13,592 villages through 4,426 videos, which showcase and demonstrate best practices. Nearly 574,222 of the viewers adopted one or more of the best practices promoted through these videos. According to the post-broadcast research, 87 percent of the Shamba Shape Up audience learns something new, and 46 percent adopts a new practice as a result of watching the show.20 Shamba Shape Up generated a direct positive impact on nearly 428,566 households by increasing the farmer income by nearly USD 24 million.21 VetAfrica app, produced by IT enterprise Cojengo, helped in dealing with 80 percent of cattle diseases commonly found in rural Ethiopia. There was a 70 percent level of agreement in diagnosis between the app and vets examining the animals.22 Besides creating a number of direct impacts such as increased awareness and income of smallholder farmers; ICT extension services also result in several indirect impacts such as creation of jobs for agricultural experts, targeted marketing for agricultural companies, data collection, analysis and feedback generation for further improvement of services.

In India and several countries of Sub-Saharan Africa, the contribution of agriculture to the GDP is lesser than 30 percent, however it employs a majority of the population. Therefore any impact on the sector has a huge impact on the larger population.23 Participatory Radio Campaigns (PRCs) have been piloted and evaluated in five countries in Sub-Saharan Africa viz Ghana, Malawi, Mali, Tanzania and Uganda. Nearly 80 percent of farmers listened to almost half of the PRC program; 40 percent direct listeners and 20 percent passive listeners adopted improved agricultural practices.[24]

Cost-Effectiveness

ICT helps the extension service providers reach rural and remote locations that are otherwise not feasible to cover by non-ICT based extension service providers. The ratio of extension service providers to smallholder farmers is worrisome. In Kenya, over 5 million smallholder farmers depend on around 5,500 extension service providers. Likewise, the extension service provider to smallholder farmer ratio is 1:2000 in Bangladesh. Moreover, the cost of building an extensive network of extension workers is far more expensive than investing once is technology. This is because the one-time investment in technology offsets against the increasing numbers of smallholder farmers who will start using ICT based extension services. . With the rapid expansion and penetration of smartphone market in the developing countries[25], such solutions will be a win-win for the service providers and customers.

The context, choice and compatibility of tools and the communication platforms play a crucial role in ensuring the cost effectiveness of any ICT extension product or service. For instance, Some ICT extension enterprises such as Mediae partner with corporates including agricultural input companies to describe their products along with associated education content for farmers as part of the TV show episodes. Mediae recovers its cost by taking fees from these partners to be featured in the TV shows thereby reducing the operational costs for the company.

Digital Green partners with government extension workers and NGOs to facilitate last mile reach. This improves the efficiency of existing government and NGO extension systems by a factor of 10 per dollar spent; it also helps the enterprise keep operational cost to the minimum.[26,27] While working with governments, the cost for training and technology development support provided by Digital Green is usually covered by donors including Bill & Melinda Gates Foundation, Google, Oracle, USAID, and the government covers the capital cost and operational cost. When Digital Green works with private sector agribusiness, such as JK Paper, Marcatus QED (MQED), the companies usually cover all of the costs, including that of technology development, training, capital expenditure and operational expenditure.

Figure 3. Partnerships for the model

Moreover, the process of video screening in the enterprise model leverages low-cost, peer-to-peer video-based knowledge exchange. Local agriculture agents and peer mediators are trained to use pocket-sized cameras to produce videos starring community members about locally relevant agricultural practices and issues. Trained local farmers facilitate regular screenings of these videos with a battery-operated, mobile projector among small groups of farmers.

Likewise, the financial model of Access Agriculture works is not very cost intensive as it works with local extension service provides that are already engaged into creation of video content. Access Agriculture helps such enterprises enhance the quality of the videos. Cojengo partners with non-governmental organizations (NGOs) to ensure the charitable donations and funding is sustained and used in the most efficient way resulting in real return on investment.[28]

A number of enterprises such as Farm Radio International leverage the reach of traditional communication media such as radio. This is because smallholder farmers in rural and remote locations have limited access to communication technologies; and radio reaches nearly 70 percent of the rural households.[29]

Scaling Up

Challenges

ICT extension services face a number of challenges that restrict the expansion of the business model. These challenges are broadly categorized as technology challenges, human resource challenges, and content development challenges. Though technology is an enabler in providing extension services, the challenge is to develop m innovative technology that can be used by smallholder farmers. Adequate internet and mobile bandwidth and connectivity is a limiting factor, especially in developing countries. Further, data is expensive in most remote rural areas and hence cost becomes a major barrier for internet or mobile usage by the smallholder farmers even where bandwidth is available. Therefore, alternate technologies such as training videos, radio and television programs are required to overcome this rural digital divide, and to ensure reach of ICT

extension services to the smallholder farmers either free of cost or at nominal feeA number of enterprises use these technologies to address the bandwidth and data cost issues, and even then reach remote rural locations.

The information requirements of smallholder farmers vary depending on their current knowledge, experience and existing sources of information. The highly localized nature of agriculture means that scientific information must be tailored specifically to suit local conditions, and should be timely available.

Lack of relevant content limits the application of proposed solutions; lack of context limits uptake by farmers. It is essential to develop the solutions in local language that are up-to-date and are provided in a timely manner. A few enterprises such as Digital Green are already developing content on a crowd-sourcing basis— by the farmer, of the farmer, for the farmer. However, many ICT extension enterprises struggle with consistency and quality in content creation and dissemination.[30]

The interviewed ICT extension service providers acknowledge other challenges such as access to finance. Generally, financial insecurity is a major challenge for agricultural extension service providers who have had to depend on grant funding. In Africa, there has been a renewed interest in funding agriculture in line with the commitment to the Malabo Declaration of using at least 10 percent of national budget for agriculture. A number of countries have met the commitment. However, currently state funding contributes only half of total requirement. The quality of funding of agriculture also varies within countries. Often, input subsidies get prioritized over strengthening of extension services for improved uses of subsidized inputs.[31]

According to the National Agricultural Sector Extension Policy (NASEP) of Kenya, the government is the main player providing extension services. However the funding is directed mostly towards staff remuneration, rather than operations and maintenance of extension services. A few programs and projects fund extension services as a core activity.32 Likewise, in Latin America and Caribbean (LAC), despite enormous investment in public extension programs, the impact is rarely visible. Further research is required to help policymakers and development practitioners understand the criticality of integration of ICT extension services in agriculture in LAC.[33]

Role of Government and Policy

Governments can facilitate the expansion of ICT based extension services by introducing relevant policies and legislations. They can also create awareness among the farmers regarding the use of ICT extension services, through their existing on-ground agri-support presence. Governments should invest in developing the ICT capacity of their existing extension programs and services and integrate ICT in national extension system such as those adopted by some countries such as Jamaica, where The Rural Agricultural Development Authority (RADA) of Jamaica has been proactive in using ICTs in its extension programs. The ICT program is financed through its core budget and grant funding. RADA extension agents have been trained in the use of ICTs for enhancing service delivery. Social media, Skype and SMS are various communication channels used to maintain close contact between farmers and extension agents.

In India, the central and state governments have supported various initiatives to address challenges in the agriculture sector. The national policy framework for agricultural extension emphasizes the importance of increased use of ICT in communication, marketing and provision of agricultural extension services to stakeholders in the agriculture value chain. The agriculture mission mode projects (MMP) are included in the national e-governance plan (NeGP) to provide information to the farmers on seeds, fertilizers, pesticides, government schemes, soil recommendation, crop management, weather and marketing of agricultural produce. Department of Agriculture and Cooperation (DoA&C) has initiated several projects such as ASHA in Assam, KISSAN and e-Krishi in Kerala and Krishi Maratha Vahini in Karnataka. The department has also launched two portals AGMARKNET & DACNET to lead the implementation of MMP in Agriculture.[34]

According to some of the ICT extension service providers, although government is supportive in general; there are not many supporting extension policies and regulations that could help escalate the ICT extension business model. Governments at the central level have some programs; however the system collapses at state or county levels. As a result, this is a private sector driven business model that rides on the back of government and donor backed agendas. In India, the umbrella program 'National Rural Livelihood Mission' provides flexibility to invest in innovative approaches in agriculture including investment in cameras and videos. There is no government subsidies offered for promotion of ICT extension service business model.

Conclusion

The ICT extension services business model addresses the development challenge of information inadequacy on best practices in agriculture, weather updates and prevailing market prices that support the income potential of smallholder farmers in a number of developing countries. This said, the business model is very impactful if it is provided along with on-ground support. In the absence of market linkages for the produce grown, any information, however great and useful, will not raise farmers' incomes. In spite of this, most ICT models don't focus efforts on markets or partnering with enterprises doing this.

The impact numbers outlined in the table in 'scale and reach' section provide validation for its impact potential. However, impact attribution with respect to adoption of the practices suggested by deploying ICT is not evident as it is difficult to measure. The model is heavily dependent on grants and partnerships for its operations and sustenance. The two major revenue streams include corporate sponsorships and advertising, and the model's profitability hinges on the presence of sponsors. Enterprises that provide agricultural consultancy and other extension services can leverage ICT to make the best combination of technology, sector expertise and on-ground presence.

Table 3. SEs: ICT Extension Services

Company	Country	Solution Description
Access Agriculture	Bangladesh, Ghana, Kenya, Malawi, Mali, Tanzania, and Uganda	Access Agriculture enhances the capacity building capabilities of several local extension services providers, by helping them produce relevant content. The content is translated in local languages, and is adapted to the respective regional requirements.
Cojengo	Multiple countries in Africa	Cojengo is a smartphone based diagnostic tool used in animal heath to improve disease diagnosis, surveillance and treatment of cattle in sub-Saharan Africa.
Digital Green	Afghanistan, India, Ghana, Ethiopia, Niger, Malaysia and Mozambique.	Digital Green uses a digital platform to mobilize rural communities and provide agricultural extension services to smallholder farmers. It works closely with public, private and civil society organizations for outreach and engagement in several countries.
e-Krishok	Bangladesh, Pakistan	e-Krishok is an initiative of Agricultural Information and Advisory (Extension) and Market Linkage Services that provides extension and market linkage services to the smallholder farmers. Every farmer who buys an input package is entitled to receive an information service package, value for which depends on the value of products.
eKutir Rural Management Services	Bangladesh, Cambodia, India, Nepal, Republic of Macedonia, Haiti (american republic), Peru	e-Kutir uses an entrepreneurship model combined with ICT to deliver solutions to BoP communities
Esoko	Kenya, Ghana	Esoko is a technology platform that integrates smallholder farmers into the formal value chain by leveraging mobile phone technology. The platform enables agribusinesses, governments, mobile operators and NGOs to provide critical information to small-holder farmers on market prices, agronomic and training tips. It also surveys the farmers for their needs and desires.
Farm Radio International	Tanzania, Burkina Faso, Ethiopia, Ghana, Mali, Uganda	Farm Radio supports small-scale farming and rural communities by leveraging on radio broadcasters. The organization does provides broadcaster resources, broadcaster training, and impact programming. The organization develops radio scripts, information packages, a weekly electronic news service, and a special on-line community called Barza, and shares these tools with thousands of African broadcasters. Broadcasters, in turn, use these resources to research, produce and present relevant and engaging programs for their audience.
KenCall - mKilimo	Kenya	M-Kilimo, launched by KenCall in Kenya, bridges farmers and agriculture experts by providing individualized answers through a call center approach.
Mobile Mandi	India	Mobile Mandi provides live updates on day-to-day commodity rates to different mandis of India. It is multilingual, and helps to track commodity rates across 500 mandis on the move. The content is updated at runtime to provide latest rates to users.
NAFIS	Kenya	NAFIS is a comprehensive information service, intended to serve the needs of smallholder farmers in Kenya including the rural areas where internet access is limited. It enables farmers' access to agricultural extension information via the internet or mobile phone. Information is updated through the web by field extension officers and disseminated through a detailed website or through mobile phones.
Shamba Shape Up	Kenya, Tanzania, Uganda	Mediae (Shamba Shape Up's parent company) supports education and development. Shamba Shape Up is Kenya's first make-over television program guiding small scale farmers on topics such as improved pest management, irrigation, cattle rearing, poultry keeping, financial education, crop management techniques.

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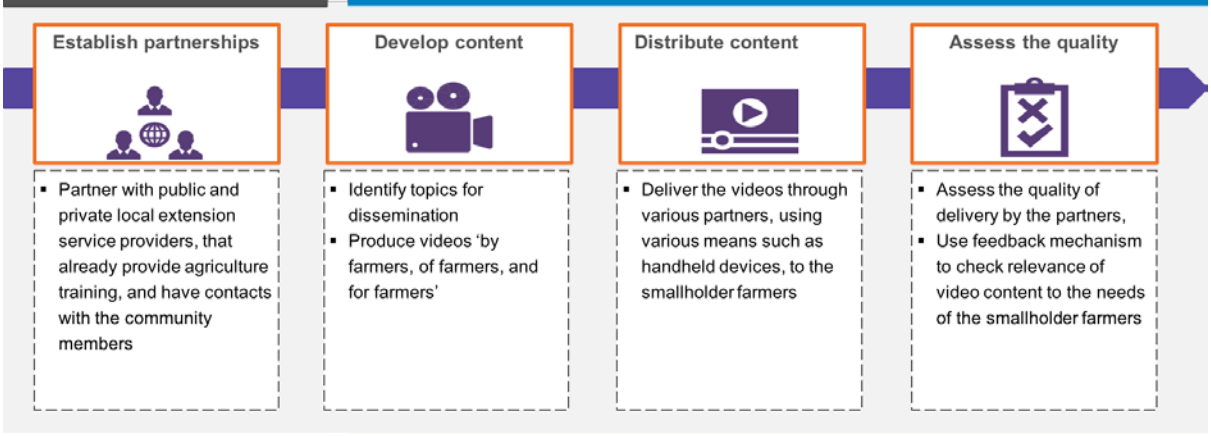
CASE STUDY: DIGITAL GREEN

digitalGREEN

Founding year: 2006
HQ: San Francisco, CA
Countries of operation : India, Ethiopia, Malawi, Ghana, Senegal, Niger, Papua New Guinea, and Nepal
Orientation: Not-for-profit
Employees: 100
Turnover: USD 4 million

Lack of information about critical inputs and inadequate knowledge about modern and efficient agriculture practices is a major factor contributing to low farm yields. While traditional media such as radio and television have continued to play a major role in extension and development communication, growth in the internet and increased access to and use of mobile technology are perceived to be the game changers in the ICT extension space.

Digital Green is a not-for-profit international development organization that leverages digital means for community engagement to improve lives of rural agriculture based communities across South Asia and Sub-Saharan Africa. The enterprise partners with local public, private and civil society organizations to share knowledge on improved agricultural practices, livelihoods, health, and nutrition, using locally produced videos and human mediated dissemination. The enterprise' approach is 10 times more cost-effective; and the uptake of new practices is 7 times higher in comparison to traditional extension services.



Operating Model

Digital Green builds and deploys information and communication technology to increase the effectiveness of extension services for the benefit of smallholder farmers. The enterprise provides training and technical support to its partners and develops technology-based solutions to empower rural farmer communities. Digital Green is supported by The Bill and Melinda Gates Foundation, USAID, Google, Oracle, and Cisco.

Digital Green screens videos on topics such as agricultural practices, livestock, agriculture inputs, and government programs in agriculture sector, is organized for farmer groups. The process leverages low-cost, peer-to-peer video-based knowledge exchange. Local agriculture agents and peer mediators are trained to use pocket-sized cameras to produce videos starring community members about locally relevant agricultural practices and issues.

Digital Green has partnered with 58 different organizations, of which 40 partners are located in India. The enterprise has provided training to nearly 1.15 million farmers through its partners.

Trained local farmers facilitate regular screenings of these videos with a battery-operated, mobile projector among small groups of farmers in an interactive forum and encourage them to adopt the best practices featured in the videos. Extension agents collect and analyze feedback and usage data at the community level using an information system that operates in locations with poor Internet connectivity. Digital Green's approach focuses on peer learning and involves producing videos that are by farmers, of farmers, for farmers. The enterprise taps into the ability of viewers to connect with other farmers shown in the videos to disseminate important farming practice improvements.

The enterprise also partners with the government and private sector organizations that are involved in rural development and engage in on-ground extension activities, to train smallholder farmers. These agencies also usually already employ frontline village-level workers, like agricultural extension agents and village resource persons, who facilitate the screening of videos among community groups that they are already working with closely.

In 2012, Digital Green partnered with the Government of India under the National Rural Livelihoods Mission to improve the efficiency of agriculture and livelihoods interventions by promoting relevant best practices in agriculture and livelihoods, non-farm practices, financial inclusion, and institution building. Government extension workers were provided videos and other training material by Digital Green. In 2014, Digital Green entered into a national level memorandum of understanding (MOU) with the National Rural Livelihoods Promotion Society (NRLPS) to expand the Digital Green approach to other state rural livelihoods missions and partners. Digital Green also has formal Memoranda of Understanding with NRLM's state-level implementation agencies— Society for Elimination of Rural Poverty (SERP) in Andhra Pradesh and Bihar Rural Livelihoods Promotion Society (BRLPS) in Bihar. Of the total outlay for this project, the Government of India and state governments cover almost 70 percent of the cost, while the Bill & Melinda Gates Foundation covers 30 percent of the cost.

Digital Green has defined standard operating procedures and has a variety of technology tools that are open-source and can be customized. For instance, its data collection and monitoring system, Connect Online Connect Offline (COCO), is open source and freely available; partners can view and adapt the software code and use the software platform for its own use. Its training procedures and video content are posted on its website.

Financial Sustainability

Digital Green leverages its partners' strengths and existing infrastructure, such as local extension networks and relationships. This eliminates the possibility of parallel and unsustainable systems, and keeps the costs low for Digital Green and its partner organizations. The enterprise adopts different business models with different types of organizations. For instance, with NGOs, the enterprise follows a donor-supported model, where donors cover the capital as well as operational expenses. When working with governments, the cost of training and technology development support provided by Digital Green is usually covered by donors such as Bill & Melinda Gates Foundation, Google, Oracle, and USAID, while the government covers the capital cost and operational cost. The World Bank provides financing to some of these government programs, such as the National Rural Livelihood Mission (NRLM), which is led by the Ministry of Rural Development, Government of India (MORD, GOI). When Digital Green works with private sector agribusiness, such as JK Paper and Marcatus QED (MQED), the companies usually cover all of the costs, including that of technology development, training, capital expenditure and operational expenditure.

Digital Green incurs costs primarily for technology, human resources for technical assistance and training support, research and quality assessment. Its revenue streams include fees for providing technical assistance, and videos/ technology to the partners. Pricing of the services provided by Digital Green is a function of several factors such as the partner involved, duration of engagement with the partner, type of support required, and number of extension agents to be trained. Digital Green does not have any real competitors, as the local extension service providers in different geographies work as partners of the enterprise. Digital Green provides end to end ICT extension services including production, analysis and distribution of information. This is a distinguishing feature of the enterprise.

The enterprise has received external funding from donors such as Gates Foundation and USAID, and from corporates such as Google, CISCO and Oracle. Digital Green has won several awards; some of them include Ashoka fellow, and those from eNGO, Google, and Massachusetts Institute of Technology.

Impact

Digital Green has been shown to be at least ten times as effective, per dollar spent, as compared to traditional approaches to agriculture extension (Eikin Gandhi, Ashoka India Fellow).

The Digital Green videos empower three groups of farmers: community members involved in producing videos, members involved in screening videos, and members who watch the videos. The representatives for the first two groups may begin with limited skills and abilities. With experience, they benefit in terms of increased confidence and ability to create and share content with fellow members. The third group benefits by learning about new agriculture practices and strategies that could improve their agriculture output.

Challenges and Lessons

The foremost challenge that the enterprise faces is to maintain the quality of programs, mainly due of its scale. Although the enterprise provides requisite technical training to the partners, it does not have direct control on the quality of video screening, depth of content, and several other critical factors affecting video content quality. Digital Green addresses this issue by conducting a quality assessment at its end once it receives the videos from the partners, to ensure that the videos disseminated as Digital Green videos are of standard quality. The expansion is also a critical issue as it is a function of the number of extension services providers present in any region. In the absence of existing extension service providers in a particular area, the enterprise leverages its network from the nearest location to cater to the ICT extension service requirements in that area. Digital Green also leverages government programs and extension services to cater to this challenge and achieve the desired scale and reach.

Road Ahead

Digital Green has expanded its network in India and other countries in the last few years. It took 6 years to reaching the first million farmers. The enterprise targets to reach the next one million in the coming 2-3 years. The enterprise plans to leverage its network of farmers to provide them other services besides ICT extension.

In India, Digital Green is in the process of extending its partnership with other NRLM states like Jharkhand through smaller pilot projects. It is also leveraging the Mahila Kisan Sashaktikaran Pariyojana (MKSP), an initiative under NRLM to empower women in agriculture, partnering with NGOs to work in three states of India—Maharashtra, Andhra Pradesh and Karnataka.

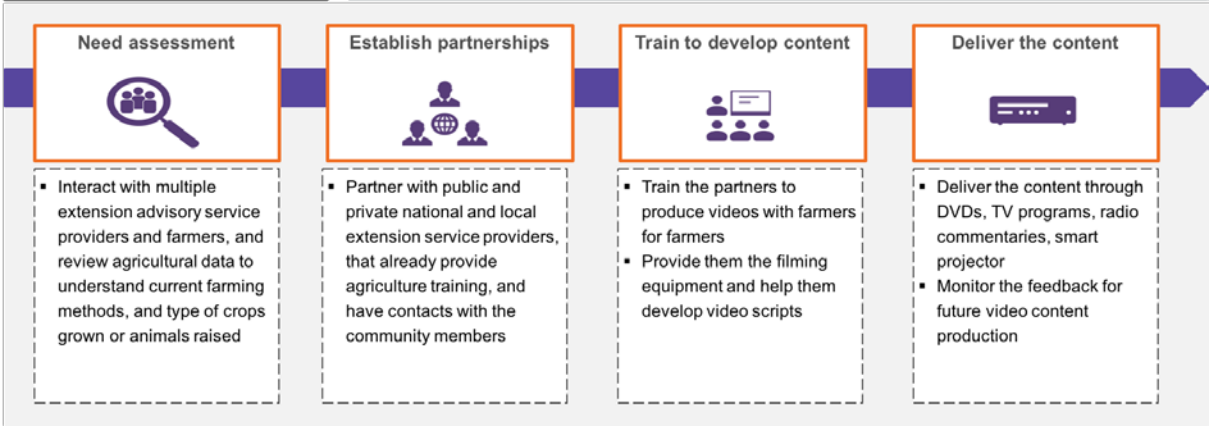
CASE STUDY: ACCESS AGRICULTURE

AccessAgriculture
www.accessagriculture.org

Founding year: 2012
HQ: Kenya
Countries of operation : Bangladesh, Benin, Ghana, India, Kenya, Malawi, Mali. Tanzania, Uganda; and videos used in over 100 countries
Orientation: INGO
Employees: 13
Turnover: USD 2 million

Videos are becoming increasingly popular among farmers. They are based on the concept that a farmer always looks over their fence to their neighbor's field to check what s/he can learn. In Africa where many households lack electricity or cannot afford the equipment to watch videos, many farmers are missing out on this great medium. There are now projectors with rechargeable batteries which can be used to screen farmer-to-farmer videos. With increasing mobile phone density, some farmers even watch the videos on their mobile phones.

Access Agriculture is an international NGO that works across all developing countries to enable the exchange of and access to quality audio-visual training materials to secure sustainable livelihoods of rural agriculturists. Access Agriculture facilitates and builds capacity for the production and translation of quality farmer-to-farmer training videos into local languages. It provides quality training material for rural advisory services and agricultural education systems to improve access of youth, women, and smallholder farmers to relevant knowledge.



Operating Model

Access Agriculture enables smallholder farmers in India, Bangladesh and seven African countries access to videos on best practices in agriculture. Its videos, disseminated through media including DVD, radio, television, mobile phones and solar-powered smart projectors - are scripted and filmed in a manner that is easily understandable to farmers and replicable in different geographical contexts. Primarily scripted in English and French, the content can be translated into other languages based on the demand of local communities. Based on the medium of dissemination, the videos are provided either free of cost or by charging a nominal fee to farmers.

The videos contain information on several pre-harvest and post-harvest best practices ranging from categories like cereals, vegetables, integrated pest management, farm mechanization and livestock and are exhibited by filming experiences of smallholder farmers. Farmers participate in the video shoot to share their success story that can be attributed to training and capacity building. They also believe that the exposure via videos can bring them other financial and business benefits. The local extension service providers participate because videos align well with their work of making agricultural information accessible to farmers, and validate some of their recommendations. In addition to spreading their message, these videos also ease their task of encouraging behavior change. Online and offline distribution of such videos helps farmers learn, understand and adopt the practices suggested in the content. The enterprise encourages all extension service providers operating in developing countries to translate the videos available on the website into local languages for easy access to farmers that otherwise do not have access to such content. The enterprise assesses the videos and selects some of them for dissemination on its website.

In addition to its repository of videos, Access Agriculture offers a fee-based translation service to extension service providers and other such agencies interested in using quality videos in their own

farmer training programs. The videos are available online as well in DVD format and 3GP format for mobile phone viewing. The enterprise also allows downloads of audio tracks (of the videos) by radio stations, who can feature it any time. Further, the enterprise has a network of partners who disseminate the videos in locations with no access to electricity. Trained agriculture experts use a motorized tricycle with an attached generator and sound system to project the farmer training videos to almost 200-300 villagers at once. The enterprise also sells 'smart projectors' providing access to the enterprise's video library to farmers who are not connected to electricity.

Access Agriculture operates mainly through partners that include private sector enterprises, universities, agriculture colleges, and other extension service providers. Usually, the partners engage with field staff in different regions to produce videos on any specific crop or agricultural practice. The enterprise trains these partners to produce videos, and provides them the filming equipment. The partners spread awareness among smallholder farmers regarding the significance of ICT extension services and their role in increasing agricultural productivity. They inform the farmers about Access Agriculture; and encourage them to register on the platform and avail of the extension services. The partners also help improve or customize the video content by incorporating feedback that they receive from farmers.

In the initial stages, television stations charged Access Agriculture to showcase videos. However, as a result of the growing popularity of the enterprise and its videos, the broadcasting stations have now entered into agreements with Access Agriculture to broadcast the videos without charge. The enterprise monitors viewership rates and farmer feedback for future video content production.

The enterprise is currently operational in 9 countries. As part of the first phase supported by the Government of Switzerland's grant, Access Agriculture started its operations in Benin, Kenya, Malawi, Mali, and Uganda; further leveraging on the grant, it expanded to Bangladesh, Ghana, India and Tanzania. Generally, while expanding to new geographies, Access Agriculture partners with established agricultural development organizations that are aware of local farming contexts and have an extensive network of farmers that they can reach. For instance, the enterprise has partnered with the Kenya National Farmers Federation (KENAFF), an umbrella organization of farmer groups, representing the interests of about 2.1 million farm families in Kenya. The Federation is a partner to Access Agriculture in producing and distributing agricultural videos for smallholder farmers.

KENAFF has invested in a TV station that will broadcast the videos hosted on the Access Agriculture website. The shows will share the link to the website so that farmers can browse for topics of relevance to them.

Access Agriculture has also worked with government extension service providers in Bangladesh, Benin, India and Malawi. The enterprise also had discussions with the governments of Kenya and Uganda on inclusion of ICT in agriculture.

Financial Sustainability

Some of the major costs incurred by Access Agriculture include those for website maintenance, partner training, and remuneration to the field staff and partners. The enterprise earns revenues from multiple sources including funds from the Government of Switzerland, sale of video translations, and commission from the sale of smart projectors (powered through a portable solar panel). The smart projector is targeted to customers who are off-grid, off-mobile and off-internet. It also earns revenue by providing consulting services and capacity building workshops. As an international NGO, the organization raises grant capital to run its operations. It has funds in pipeline by the Government of Switzerland at least until 2018.

As Access Agriculture works with local people, the model is not very cost intensive. This is because, in many cases, the partners are already engaged in the creation of video content. Access Agriculture helps such enterprises enhance the quality of the videos. It also encourages them to make videos in local languages; and in a format that can be easily applied by the farmers.

Impact

Access Agriculture has impacted over one million farmers by making quality videos available to thousands of extension service providers across developing countries. The enterprise videos that contain information about agricultural best practices are available free of cost on the company's website. Access Agriculture remains cost effective by partnering with local extension services providers that have established relationship and reach to smallholder farmers. Local partnerships also enhance its distribution capabilities.

Challenges and Lessons

As the enterprise operates mainly through partners, some of the major challenges are also connected with them. Access Agriculture partners with a variety of organizations that are all differently oriented, with different skills and capacities, and therefore faces a challenge in aligning them to its mission and objectives. In order to address this issue, it adjusts its operational activities and procedures, as per the speed and approach of the partners.

Another critical concern is the implementation of its process. It is quite demanding to make an agricultural training video as it requires a lot of time and invkolvement of many stakeholders, such as farmers, agricultural experts, local extension service providers, videographers, interviewers, and editors. The challenge is to integrate the knowledge of local farmers and experts in the video to be delivered in the shortest time. The enterprise partners with local extension services providers to address this challenge.

Videos from the Access Agriculture library are in the public domain, so anyone can use the videos for free. As thousands of organisations and individuals in the agricultural extension and education system use and further share the videos, it is impossible for Access Agriculture to accurately monitor video distribution and use.

Road Ahead

Access Agriculture has launched a new website, AGTUBE.org, which acts as a social media platform for agriculture stakeholders. It plans to use the platform as a social enterprise to raise funds through corporate sponsorships and advertisements on this website by telecommunication and Fast Moving Consumer Goods (FMCG) companies. The enterprise plans to enhance its financial sustainability by selling smart projectors, and by providing training and translation services.