INNOVATIONS IN AGRICULTURAL EXTENSION

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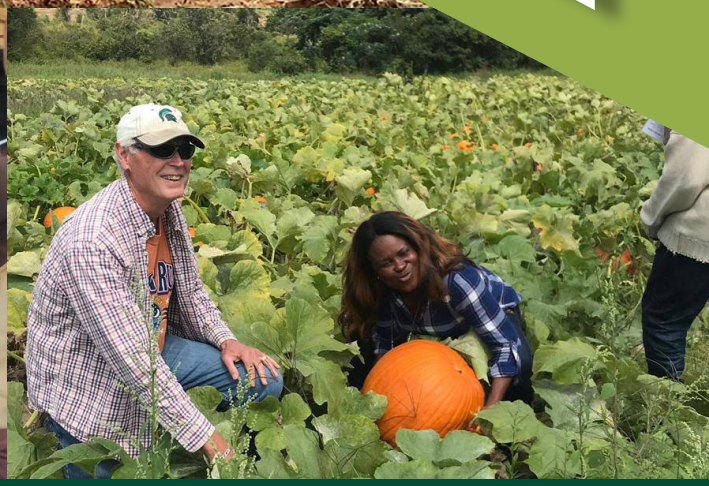

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Innovations in Agricultural Extension

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Michigan State University Extension
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Foreword

It gives me immense pleasure to write a foreword for the book *Innovations in Agricultural Extension*, jointly published by Michigan State University (MSU) Extension, East Lansing, Michigan, U.S.A., and the National Institute of Agricultural Extension Management (MANAGE), Hyderabad, India. The idea of this book emerged at the International Conference on Agricultural Extension: Innovation to Impact, jointly organized by MANAGE and MSU Extension in February 2019 at MANAGE, Hyderabad, India.

Agriculture throughout the world is transforming from production driven to market driven, which requires new and innovative ways to deliver agricultural extension and advisory services. The national governments and international organizations working in agriculture development have designed and implemented different types of agricultural extension models in various countries and regions globally. Extension specialists and leaders have developed their own models and practices and tried to bring new innovations in their ongoing programs or initiated new programs to deliver knowledge and technologies to local farmers and communities. Learning from these experiences may be useful for many professionals, managers, administrators, and policymakers the world over.

This book has brought together the diverse experiences, best practices, and innovations described in 20 chapters from various countries. The book chapters cover major themes such as an overview of the agriculture extension system; outreach and advisory services; approaches in broad-basing extension; community and government engagement; information and communication technologies, digital extension, and animation for extension training; entrepreneurship and agritourism; and professional development in extension. The case studies included in the book share experiences from the Central Asian countries of Kyrgyzstan, Tajikistan, and Uzbekistan; India; Mozambique; Nepal; Nigeria; and the United States of America. I hope the best practices, case studies, and experiences shared in the book will inspire extension specialists, advisors, consultants, and extension workers in developing as well as developed countries globally. I congratulate all the authors who contributed chapters in this book.

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CHAPTER 1

Overview & Importance of Agricultural Extension

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Introduction

With a growing population, shrinking land base, and emerging threats of climate change, agricultural transformation has become a high priority globally to enhance productivity and conserve natural resources. Global efforts are needed to address the pressing challenges of food insecurity, hunger, malnutrition, and poverty, as well as to protect livelihoods, enhance economic growth, and engage youth with due consideration to gender equity in the food and agricultural sector. Along with research and education, extension and outreach remain key pillars for global agricultural development and food systems. Several models of extension have been implemented globally to serve the farming communities (Kumar et al., 2019; Antholt, 1998; Torimiro & Igodan, 2019). These models increasingly include emphases on other aspects of life in agricultural communities such as health, mental health, and youth development, which benefit from both long-standing and trusted relationships and a community-based framework for service delivery (Dwyer et al., 2017).

The Various Models of Agricultural Extension

The term *agricultural extension* means different things to people around the world, and even within specific countries. In general, extension includes transferring information, knowledge, and technologies from research systems to farmers; advising farm families in their decision-making; educating farmers; and empowering farmers to be able to clarify and realize their goals. To a large extent, most extension programs are publicly funded, supported by local, state, and national governments. During the past several decades, numerous models of agricultural extension and community outreach services have been implemented. A list of some of these models follows:

- Farmer Business Schools
- Farmer Field Schools
- Farm Science Centers (KVKs) Model of Extension

- Information and communication technologies (ICT)-enabled E-extension
- Nongovernmental organizations (NGOs)-led Extension
- Private extension services and consultants
- Self-help groups
- Student Field Schools
- Training and Visit (T&V) Model of Extension
- U.S. Land-Grant Model of Extension

These models of agricultural extension and advisory services are described in detail in the subsequent chapters of this book. In addition, entrepreneurship, professional development, digital messaging, and other important components for implementing effective agricultural extension systems will be addressed.

U.S. Land-Grant University System & Cooperative Extension

The U.S. agricultural system is organized at federal, state, university, private, and commodity group levels. The United States Department of Agriculture (USDA) is a federal agency that funds research projects of national or regional relevance. The USDA also plays a regulatory role at the national level. All 50 states have state agencies similar to the federal USDA. These agencies fund research projects that have relevance to individual state's needs. They also are responsible for and enforce state regulations. In the state of Michigan, this agency is the Michigan Department of Agriculture and Rural Development. Each state has at least one land-grant university dedicated to agricultural development. In Michigan, Michigan State University (MSU) is the 1862 land-grant university (known as an 1862 Institution) charged with the mission to meet the agricultural needs of the state (www.msu.edu).

The U.S. land-grant university system, which operates the U.S. Cooperative Extension System, is heralded throughout the world as a model for disseminating evidence-based information and technologies to farmers and local communities in rural and urban areas. The U.S. Congress passed the Morrill Act in 1862. This act established the land-grant university system whereby lands were set aside for the development of institutes of higher education to promote agricultural education. The Morrill Act of 1890 increased the size of the land-grant network by providing *separate but equal* designation to Historically Black Colleges and Universities with programs in agricultural sciences to increase opportunities for Black students and those from economically disadvantaged backgrounds. In 1994, land-grant status was extended to Native American Tribal Colleges through the Improving America's Schools Act. Although both the 1890 and 1994 Institutions face significant challenges (for example, funding), new efforts are under way to foster collaboration among these institutions to the benefit of students, families, farmers, and communities.

The Hatch Act (1887) created the Agricultural Experiment Station and established a method of using federal monies to fund agricultural research at the university level. In 1914, the Smith-Lever Act was enacted, establishing the Cooperative Extension System. These three acts set the framework for the land-grant university systems, leading to MSU's present-day mission of research, teaching, and extension (https://bit.ly/3npV0Ea). The land-grant

university system links research and extension by combining agricultural research, the cooperative extension system, and campus and field staff to disseminate information to the agricultural community in rural and urban areas (CALS, 2020). In Michigan, MSU Extension collaborates with colleagues and leaders at Bay Mills Community College, Keewenaw Bay Ojibwa Community College, and Saginaw Chippewa Tribal College (all 1994 Institutions).

Twenty-first century extension in the U.S. is now funded by a variety of revenue streams to meet the growing and diverse needs of agricultural communities. In addition to federal Smith-Lever funding, for example, the private sector funds agricultural research projects related to their own interests. Examples would include insecticide, herbicide and fungicide trials; hybrid variety trials; as well as other projects. Commodity groups fund research projects that meet their specific needs. The funds for these projects are usually obtained by adding a levy or tariff, collected by the commodity group, to the amount of the specific commodity produced by individual farmers. County and state funding are also critical to the ongoing support of the Cooperative Extension System. Finally, in Michigan, competitive grants and contracts, collaborative partnerships, and service agreements are now the single largest source of revenue supporting traditional needs in agriculture as well as health, mental health, and youth development.

MSU is recognized as the premier land-grant public university in the U.S. It was founded in East Lansing, Michigan, in 1855. Today, 17 degree-granting colleges offer studies from fine arts to human medicine. The College of Agriculture and Natural Resources (CANR) (https://www.canr.msu.edu/) was the first college of the university meeting the role of the land-grant mission. The CANR is the lead college for 10 departments and 2 schools including Animal Science; Agriculture, Food and Resource Economics; Biosystems and Agricultural Engineering; Community Sustainability; Entomology; Fisheries and Wildlife; Food Science and Human Nutrition; Forestry; Horticulture; Plant, Soil and Microbial Sciences; the School of Packaging; and the School of Planning, Design and Construction. Faculty members of these departments and schools have split appointments where their time is divided between research, teaching, and extension. This arrangement allows for a means of disseminating information obtained from research to the agriculture community through the extension system. In addition, MSU Extension has more than 600 staff members working in all 83 counties across the state in the following program areas: Agriculture and Agribusiness; Children and Youth; Community, Food and the Environment; and Health and Nutrition.

MSU Extension

The mission of MSU Extension is “Helping people improve their lives through an educational process that applies knowledge to critical issues, needs and opportunities.” They do this by “help(ing) people improve their lives by bringing the vast knowledge resources of MSU directly to individuals, communities and businesses” (www.extension.msu.edu). MSU works closely with the clientele of many commodities and agricultural industries. They review the long-term goals of these groups and identify the research, along with the needed education and policy, to reach their goals. In many cases, these partners also provide resources to jointly fund positions critical to the agricultural economy. MSU Extension strives for transparency,

accountability, and sustainability in their activities and provides annual programmatic and fiscal accounting to the university, counties, the state government of Michigan, the USDA, and all partners. MSU Extension has a statewide presence. There are 83 counties in Michigan, and each county receives the benefit of Extension educators and staff.

Figure 1-1. MSU AgBioResearch university research centers.

MSU Extension works in collaboration with 13 university research centers and MSU AgBioResearch. AgBioResearch was first conceived as the Michigan Agricultural Experiment Station in 1888 as part of a national network of such centers focused on conducting research for farmers. It continues to ensure profitability and resilience in agriculture and natural resources. AgBioResearch, the 13 outlying research centers, and several on-campus research facilities (see Figure 1-1) collaborate to ensure that MSU Extension agricultural educators are abreast of research that provides growers, natural resource managers, and commodity groups with the critical information they need to remain viable and competitive in the global economy.

Information from research is disseminated by various methods. Social media tools such as email, cell phones, Twitter, and Facebook are useful for providing information in real time. Weekly newsletters pertaining to current issues are published online and widely distributed. MSU faculty members and Extension educators write articles and visit farm sites where problems exist. Researchers and educators from MSU Extension teams have demonstration plots on growers' fields, or at one or more of the university farms, and conduct field days where they interact with the agriculture community. Winter conferences are also a means of providing information to growers. At these conferences, researchers from Michigan and neighboring states present findings from their research efforts. MSU provides customer-focused educational programming. Online resources help to supplement all of this activity. The MSU Extension website has more than 30,000 pieces of evidence-based content on a wide range of topics that generate more than 1.25 million visitors each month from around the world.

MSU International Extension Programs

MSU has a vibrant extension and outreach system respected around the world. The international programs of the CANR at MSU are receiving requests from several developing countries to share the MSU Extension model, approaches, and experiences in an effort to strengthen their national agricultural extension systems. MSU Extension embraces the need to respond to the changing needs of the food and agricultural sectors striving to remain competitive nationally and globally.

Harnessing the vast global network of MSU, MSU Extension launched an international extension program in 2017 to share their rich experiences with the global community for mutual benefits. MSU Extension has developed an innovative partnership with the National Institute of Agricultural Extension Management (MANAGE) in India. Through this partnership, exchange programs involving extension specialists from MSU and India have been implemented to share experiences, and best practices, and learn from each other. In 2018, the MSU Extension leadership team was invited to Central Asia to develop joint programs to enhance extension systems in Uzbekistan and Kyrgyzstan. In summer 2019, with support from USDA-FAS (USDA Foreign Agricultural Service), MSU Extension hosted a delegation from Nigeria for a two-week training program in agricultural extension. Similar requests have been received from Zambia and Senegal as well as other countries in Africa, Asia, and Europe. In 2019, MSU Extension also engaged in a leadership-level exchange effort with Northern Ireland's CAFRE (College of Agriculture, Food, and Rural Enterprise) (https://www.cafre.ac.uk/) to explore collaboration opportunities. A formal Memorandum of Agreement was developed to allow for annual professional development exchange programs for staff. Focal areas will be defined by each respective organization to share best practices and experiences along with mentored shadowing opportunities. The COVID-19 pandemic has delayed the 2020 exchange although planning continues for future exchanges.

The demand for technical assistance, information, and training for strengthening agricultural extension systems is growing. However, technical and financial resources are limited. In this context, using a demand-driven approach based on the expertise and resources available at MSU and with collaborating partners, MSU Extension will launch and implement the following three agricultural extension programs over the next several years: an annual international short course, a Michigan global resource network, and a youth empowerment program.

An Annual International Short Course in Agricultural Extension

The MSU Extension team in collaboration with MSU CANR International Programs will design and offer a 10-day short course *Innovations in Agricultural Extension* to share models and best practices in the planning, design, implementation, management, and evaluation of agricultural extension programs serving local farmers and communities in rural and urban areas of Michigan.

This short course will be offered annually during the crop-growing season in summer months and will provide training to 12 to 15 extension specialists from developing countries all over the world. The course program will use conventional methods as well as advanced emerging technologies (such as farm mechanization, farm management tools, and ICT digital tools used for precision and smart agriculture) and will include visits to research stations, county Extension offices, local farms, companies, and markets operated by both public and private sectors. Participants will receive a certificate of participation upon completion of the short course. Based on special requests and availability of funding and trainers, a similar short course could also be offered in international settings in developing countries to train a large number of extension specialists in a cost-effective way. In response to the COVID-19 pandemic and ensuing travel restrictions, MSU Extension and the MSU CANR offered a one-week online course in August 2020 focusing on the U.S. land-grant model of extension and various extension programming models in place of the face-to-face model. Participants from China, Ghana, India, Ivory Coast, Nepal, Nigeria, Pakistan, the Philippines, and Uzbekistan took part in the blended instructional model, which provided participants with self-paced pre-work in a course management system followed by synchronous video-conference discussion sessions. This adaptation proved to be an effective model for navigating the challenges of working with participants in various time zones, as it allowed synchronous sessions to focus more on discussion and interactions.

Michigan Global Resource Network in Agricultural Extension

The MSU Extension team will develop a web portal to serve as an online repository of global agricultural extension information resources and a roster of experts. These resources, coming from both MSU and other national or international extension services, will be freely accessible by the international agricultural development community. MSU-E Global will serve as a one-stop shop for up-to-date information on agricultural extension resources and expertise. Possible resources may include:

- Training manuals, handbooks, and curricula
- Tools and technologies
- Evidence-based articles
- Extension bulletins
- Field guides and pocketbooks
- Country and program case studies
- Policy briefs
- Various models of extension

Youth Empowerment for Agriculture Development

Globally, the engagement of youth in food and agricultural sectors is gaining increased attention. The U.S. land-grant universities have successfully implemented the 4-H Youth Development Program for several decades. MSU International Studies and Programs has recently launched a Global Youth Advancement Initiative (GYAI) to build youth capacity (https://globalyouth.isp.msu.edu/). The GYAI serves as a coordinating platform at MSU for research and international development activities

related to the education, entrepreneurship, mentoring, and leadership training of youth. MSU Extension is also a member of the World Food Prize (WFP) Global Youth Institute, which engages and inspires youth on issues and challenges related to global food security. The WFP Michigan Youth Institute hosts an annual one-day event that provides an opportunity for Michigan high school students to present their research, recommendations and vision on how to address key global challenges (https://www.canr.msu.edu/wfpmiyi/).

Building on these platforms, MSU Extension will provide opportunities for youth from Michigan and from the global community for enhancing engagement of youth in the food and agricultural sectors. Pilot programs will be initiated for providing international exposure and opportunities for Michigan youth to visit and meet with youth in Asia and Africa with a goal of mutual learning opportunities toward youth empowerment and leadership development for global food and agricultural systems.

Mutual Benefits to Michigan, U.S. & Global Agriculture

We live in an interconnected global village. Food and agricultural systems and markets are becoming global. Internationally, MSU is recognized as a worldwide center of excellence for agricultural research, education, extension, and technology transfer. There are multiple benefits of internationalization of MSU Extension to Michigan, the U.S., and global agriculture. International experiences enhance intercultural development and global competencies through the exchange of information, knowledge, expertise, experiences, and technologies.

The international extension programs are helping to build global knowledge and partnerships, and sharpening and enhancing the resourcefulness of MSU Extension specialists though collaboration with other developed and developing countries. These programs are increasing understanding of emerging markets globally for Michigan and U.S. food and agricultural products and thereby enhancing global competitiveness. The outreach and extension programs are also opening new doors of opportunities for expanding international trade of Michigan and U.S. agricultural products, enhancing incomes and livelihoods of farmers and economic growth.

Additionally, these programs are bringing new knowledge, information, and innovative approaches to MSU classrooms, laboratories, and fields to enhance and diversify agricultural extension education opportunities for students, farmers, and local communities. Overall, internationalization of extension programs is helping to advance MSU's competitiveness as a global leader in agricultural research and education, as well as outreach and technology transfer.

Way Forward

Extension is a key pillar of agricultural development globally. While large investments have been made during the last few decades to strengthen agricultural research, extension, and advisory services, the extension and outreach systems in most developing countries remain weak and are often broken, under-funded, and disconnected from research and education

systems. Useful technologies, innovative farming, and marketing practices and information sources are available; however, they are not efficiently reaching to farmers and end users to create the desired impacts (Buehren et al., 2017). The extension systems in these countries need to be enhanced to better serve the target communities and stakeholders (Sharma, 2006; Alex et al., 2002).

The synergism between extension and research is well recognized, but in practice, often a lack of cooperation exists between them. Greater integration, cooperation, and effective communication are needed, and appropriate mechanisms to foster joint programs linking research and extension are critical. Additionally, extension programs should go beyond farm advisory support and encompass broader areas of community development in both rural and urban areas. Programs should include community nutrition, mental health, youth empowerment, leadership development, and agribusiness, among others. Extension programs need to be gender responsive and give due consideration to gender equity. The new tools of ICT are advancing rapidly, providing unique opportunities for agricultural extension programs that were not possible in the past. Leadership development and education of everyone engaged in strengthening extension systems is critical for success and sustainability of these programs. The extension advisory services and outreach programs should be continually monitored, evaluated, and adjusted as the agricultural sector evolves and the needs of the farmers, communities and other stakeholders change over time.

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CHAPTER 2

Global Experiences in Agricultural Extension, Community Outreach & Advisory Services

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Introduction

Extension, community outreach, and advisory services play a vital role in transferring new knowledge and technologies to farmers and end users. Globally, governments and international development agencies have invested large resources for developing agricultural extension systems. During the past six decades, the national governments and international development agencies have supported and implemented numerous extension models and programs (Birner et al., 2006). The nature of these programs has varied from country to country. These programs continue to evolve (Zivkovic et al., 2009). Many of these programs have been successful and created a great impact in enhancing the agricultural productivity and livelihoods of rural communities. The following sections describe various examples and models of extension that have been implemented in various regions of the world. They provide rich experiences on agricultural extension and advisory services from around the world.

Case Studies of Global Experiences in Agricultural Extension

Training & Visit Model of Extension in Developing Countries

The Training and Visit (T&V) system of extension was one of the early innovations in agricultural extension. This model was developed and

advocated by Daniel Benor in the early 1970s. The World Bank formally launched the T&V extension model in India and Turkey in 1974. Initially, this model was implemented on a pilot scale at Sehan in Turkey and at Chambal in Rajasthan and Madhya Pradesh states in India (Benor & Harrison, 1977; Benor & Baxter, 1984). The T&V model was later implemented in several countries of Asia and Africa.

Under the T&V model, systematic training programs were developed and implemented for village extension workers including regular visits to family farms in villages. This model was adopted in more than 70 developing countries as a national public extension program (Anderson et al., 2006). The T&V model promoted locally developed technologies to farmers at the village level with a goal of delivering the latest technologies developed by the national agricultural research systems to local farmers and end users.

The main feature of the T&V model of extension was a single line of command and a well-defined geographical boundary of operation for each extension program. The extension agents were trained to offer skills and share their knowledge for implementing best practices in crop management, evaluate production constraints, and provide advisory services to farmers. The trained extension workers visited local farmers every 15 days through a fixed schedule. The other features of the T&V system of extension encompassed regular training of extension staff, provision of feedback to research institutes on farmers' problems, and a continuous supervision, monitoring, and evaluation of extension activities. For the local farmers, the T&V model was found effective and led to agricultural growth and high rates of returns. The model was also helpful for staff training and increased extension services in additional geographical areas that further improved linkages between research and extension.

Like many other agricultural extension models, the T&V model also had several weaknesses. The national governments faced multiple challenges to implementing the T&V model of extension. The T&V model was a top-down model. Several implementing agencies and officials found it rigid and financially unsustainable. The cost included for training a large number of trainers and other personnel and their overall management was high. There was a lack of organizational structure, so a penetration at the village level was low. There was also a lack of coordination in regular farm visits by educators and extension agents and a lack of systematic supervision and support to extension staff. The communication between research departments, extension agents, and farmers was weak. Transportation facilities were lacking to visit farmers and demonstration sites, which severely impacted extension agent mobility. Also, few women extension agents existed, and technical expertise was lacking (Dejene, 1987). There was also a lack of political commitment to support the overall extension programs in many countries (Rivera & Alex, 2004). Learning from these challenges and impact studies of the T&V model, the intention, discussions, and debates were shifted to developing new models of agricultural extension, such as Farmer Field Schools.

Farmer Field School Model of Extension

The Farmer Field School (FFS) model of agricultural extension emerged in Asia in 1980 and was implemented by several institutions and organizations in over 90 countries with around 10 to 20 million farmers benefiting

globally (Braun & Duveskog, 2008, as cited in Phillips et al, 2014). The FFS model was an intensive, season-long program that focused on experiential learning where farmers met frequently and developed experiments, learned, and shared their skills and knowledge with other farmers in a village. The FFS was called a school without borders. It was a driving force in community engagement, rural participation, knowledge sharing, skill acquisition, and adoption of technologies in rural farming communities. The FFS model successfully facilitated Integrated Pest Management (IPM) practices in Asia and in Africa.

Using a people-centric approach, the FFS approach focused on learning via participation, using community-based learning systems with local people supported by technologies and methods developed by outside organizations and institutions. FFS activities were completely nonformal education (learning by doing), a school without walls, where adult male and female participants had an opportunity to learn new science-based agricultural practices and technologies through communication in local languages. The FFS addressed several topics since its inception, such as IPM, agricultural cultural practices, sustainable production system to value chain development, and nutrition. More recently, the FFS has helped address emerging agricultural problems such as fall armyworm and several other issues in agricultural systems (Food and Agriculture Organization, n.d.).

Through FFS in Indonesia, millions of smallholder farmers were trained in rice production (Pretty & Bharucha, 2015). This program was later expanded to vegetable production. Bangladesh conducted large FFS projects and trained hundreds of thousands of farmers on integrated fish culture and integrated rice IPM in FFS curricula through the INTER FISH project. Learning from Bangladesh's experience, this model expanded to Colombia, Brazil, and six Caribbean countries on rice and aquaculture. FFS contributed tremendously to farmers' knowledge and skill development that resulted in increased productivity (Van Den Berg, 2004). In Nepal, the FFS approach was applied to community forest management (Miagostovich, 2004), gender issues in Indonesia (Fakih, 2002), HIV/AIDS in Cambodia (Yech, 2003), women's self-help groups in India (Tripathi & Wajih, 2003), and many other areas of farmer and community empowerment.

In Africa, FFSs were launched in many countries with a focus on crop production and practices in pesticide management as there were comparatively low levels of production and pesticide use. In addition to the IPM, FFSs helped create awareness in additional areas such as nutrition and health, and combating HIV/AIDS and malaria in rural communities. In West Africa, the FFS approach to education regarding vector-borne diseases was undertaken by the Wageningen University and Research Centers, Food and Agriculture Organization (FAO), and other institutions (Van Den Berg, 2004). In Kenya, the International Livestock Research Institute adapted the FFS approach in 2001 for animal health and production (Braun et al., 2006) with the help of several pilot programs established in nine countries including Kenya, Tanzania, Uganda, and Nigeria that resulted in increased livestock production.

Additionally, FFSs provided training and capacity-building support to the farmers. Through FFSs, FAO in partnership with International Crops Research Institute for the Semi-Arid Tropics and the national research system, actively promoted environmentally friendly practices such as minimum tillage, conservation agriculture, water harvesting, and irrigation

systems (Hughes & Venema, 2005; FAO, 2008). The FFSs became the foundation of the food security program in Nigeria, Kenya, and Sierra Leone. In central and eastern Europe, through FFSs, the IPM approach was introduced in 2003 by FAO to tackle the western corn rootworm problem in maize. In Peru and Bolivia, FAO established a national program on FFS to effectively scale up IPM strategies. FFS long-term contributions were successful in many countries to strengthen the farmers, management of farm enterprises, and ecosystems (Jiggins et al., 2005).

Numerous studies conducted by various international organizations, universities, nongovernmental organizations (NGOs) and other public and private institutions highlight multiple benefits that FFSs have created. These include the following:

- Increase in crop production, productivity, and income generation
- Significant decrease in the use of chemical pesticides
- Enhanced market and value chain linkages for farmer groups and elimination of intermediary for marketing
- Favorable local policies and strengthening relationships among communities and local government authorities
- Enhanced farmers capacities and empowerment as well as leadership skills, program management skills, and problem-solving skills of farmers

Krishi Vigyan Kendra Model of Agricultural Extension

In 1974, the Krishi Vigyan Kendra (KVK) (farm science center) model of extension was first established in the Pondicherry region of Tamil Nadu, India, under the auspices of the Tamil Nadu Agriculture University. With the success of the pilot KVK, this model was replicated in every district of India. Currently, 675 KVKs cover every district. These KVKs operate under various platforms. Of these, 456 are under agriculture universities, 63 under the Indian Council of Agricultural Research (ICAR) institutions, 102 under NGOs, 36 under state governments, three under public sector universities, and 15 under other educational institutions (Ramsunder, 2019). The KVKs are financed by the Government of India.

KVKs have become an integral part of the National Agricultural Research System (NARS) in India. KVKs have played an active role in assessment of location-specific technologies for agriculture and allied enterprises, through technology assessment, refinement, and on-farm demonstrations. KVKs act as knowledge and resource centers of agricultural technology helping initiatives of public, private, and voluntary sectors for improving the agricultural economy of the districts. They link the NARS with the extension system and with farmers. KVKs have specific mandates and have important features as outlined following (Ramsunder, 2019):

- To assess the location-specific agricultural technologies
- To establish demonstrations of farms and fields to display the potential of technologies, information, and inputs
- To enhance capacities of the farmers and extension personnel to update and improve their skills and knowledge in modern agriculture technologies as well as capacity building of various stakeholders
- To work as a knowledge resource center of agriculture technologies

- To provide farm advisories services using information and communication technology (ICT)-based tools and other means on various subjects of interest to farmers
- To show participatory approaches in planning, implementing, executing, and evaluating

In addition, KVKs are also responsible for production of quality seeds, planting materials, and livestock. They also make these resources available to farmers and link them with current and ongoing government programs. KVKs have developed need-based training and frontline technology demonstration programs for farmers to empower them with knowledge and skills in crop management practices, which includes use of quality seeds, efficient irrigation practices, fertilizers and pesticides use, quality production, and assessment of markets for their produce. KVKs serve woman farmers, self-help groups, district extension workers, and other volunteers in their mandated regions. In India, KVKs also facilitate linkages among various programs implemented by the government departments and ministries at the district level including the Agriculture Technology Management Agency, Rastriya Krishi Vikas Yojana, and National Horticulture Mission of the Department of Agriculture as well as the Ministry of Rural Development`s national programs such as the Mahatma Gandhi National Rural Employment Guarantee Act.

KVKs have created a tremendous impact on farming communities. They have been active in demonstrating and communicating the benefits of new technologies through various training programs. Training conducted by KVKs on improved technologies has been adopted and implemented immediately by nearly 40% of the farmers. Nearly 80% of the farmers changed their agricultural practices patterns, diversified their crops, and implemented new cropping patterns as recommended by KVKs (National Institute of Labour Economics Research and Development, 2015). Through experts' advisory services of KVKs, farmers have used good quality seeds; changed their seed planting patterns, and applied appropriate pesticides, chemical and biofertilizers; adopted organic agriculture approaches; and implemented irrigation techniques such as drip irrigation and sprinklers. Through KVKs' intervention, nearly 50% of the farmers have mechanized their farm operations either by purchasing or renting machines on a seasonal basis (Ramsunder, 2019).

However, despite the KVKs' excellent work in many districts of India, few studies have reported great variations in their effectiveness on serving local farming communities. Several of the KVKs face insufficient infrastructure and field staff as well as constraints in reaching out to their mandated locations. Due to the remote location of many KVKs, some struggle to recruit and retain talented staff with advanced skills and knowledge in emerging technologies.

NGO-Operated Extension Programs

NGOs, often referred to as civil society organizations, play a vital role in agriculture and rural development globally. The NGOs have diverse origins (Padron, 1987). They are social charities or service organizations, and many of them emerge through social movements and specific group activities. NGOs vary in size and professional capacities. They work locally, nationally, regionally, and internationally. NGOs have played a legitimate and niche role

in agriculture development, focusing on local farmers and communities at grassroots levels. In the absence of public and governmental extension services, the activities and services offered by NGOs have filled the gaps. In several countries, the public extension system does not effectively reach poor farmers (Ashby et al., 1995; Howell, 1985; Rivera, 1996). To such poor farmers and communities, NGOs have provided effective support at the grassroots level.

Several NGOs refer to themselves as self-help groups and are proactive in providing support when there is a demand for extension and other services. Often, many of these NGOs working in agricultural extension have limited funding, facilities, and human resources (de Treville, 1991). Many local and regional NGOs working at the grassroots level are effective in communication, have built trust with communities, and provide extension advisory services to farmers. They are flexible and responsive, and they maintain their on-the-ground presence at the field level, whereas public or private sector extension service providers who are not as close to the community may not be as responsive or effective at communication.

NGOs' rapport with farmers help them disseminate knowledge and technologies to farmers easily (Chaguma & Gumbo, 1993). For example, in Bangladesh, an NGO developed an innovative technology for Soya Production (Buckland & Graham, 1990). In the Philippines, a technology on sloping agriculture land was developed by NGOs (Watson & Laquihon, 1985). In India, an NGO called PRADAN has been providing agricultural extension and technology transfer services (Aguirre & Namdar-Irani; 1992; Sotomayor, 1991). The major strengths of NGOs are in their group formation and responsiveness for the disadvantaged groups.

While many NGOs have been effective in providing extension and advisory services, the majority of stakeholders working in agricultural extension believe that NGOs and government organizations should work together for delivering extension and outreach services (de Janvry et al., 1989; Jordan, 1989; Korten, 1987). However, many of these NGOs want to keep their own autonomy and identity and focus on their priorities. Numerous NGOs have limitations in size, nature of funding, and mandates. The majority of NGO programs are supported through short-term external funding, and the donors have specific goals to create a short-term impact on specific communities or geographic areas, which often affects long-term sustainability and impact.

Private Extension Services & Crop Consultants

Agriculture is developing rapidly and increasingly becoming a commercial activity in many parts of the developing world. The demands for processed food and value-added products are rapidly growing. As the agricultural sector evolves, the demand for new skills, market information, and new technologies are increasing and changing day by day. In recent decades, the agri-food industry has been transforming, linking small-scale farmers to high-value markets through global supply chains (Reardon et al., 2009). Private extension services are growing and have been adopted by millions of farmers globally. In many countries, private sector extension and advisory services are provided by subject specialists, company agents, dealers, and

retailers of private seeds, fertilizer, pesticides, and chemical companies. They offer their private extension services along with selling and marketing their company's products.

Often, the private extension and advisory services are fee-based services. The fees are either paid individually or through a group of farmers or through a farmer association. The private extension specialists, companies, consultancies, and products suppliers offer these services. The strengths of the private sector extension services include delivering their services through the use of modern ICTs and promoting new and emerging agricultural technologies and products that have shown potential benefits for increased yields and quality production. These private extension service providers support farmers through connections to scientists and scientific institutions as well as annual farmer field days that demonstrate irrigation and crop management practices. Also, private extension service providers visit individual farms and offer their advisory services. In recent years, private sector extension services in agriculture and allied sectors have increased tremendously. A few examples follow:

- The New Zealand`s Ministry of Agriculture and Fisheries agricultural advisory services established the user pay commercial criteria (Hercus, 1991). It now runs a commercial consultancy business model owned by a private company called Wrightson LTD (Ritchie, 1995).
- The Netherlands has privatized one-half of its public agricultural extension system, where earlier it was a public extension system and used to run through government financial support (Le Gouis, 1991). Dutch farmers access extension services through the membership and farmers association.
- In Mexico, a fee-based private extension system has been developed for large-scale farmers (Wilson 1991).
- In Chile, the government pays for private extension services thorough vouchers (Cary, 1993).
- In the United States, the emergence and use of private extension services and private consultants has increased in recent years.

With the expectation of higher crop yield and use of advanced machineries, technologies, and scientifically proven methods and practices, farmers are in great need of information, skills, and advisory services that the private sector can offer effectively. However, several challenges are observed with private extension advisory services. Since demands for private sector agents have increased, they are not able to reach every farmer or each farm. Their advisory charges have increased multifold, so sometimes small-scale farmers are not able to afford their expensive services and are left out. It has been observed that, with private extension services, there is a pressure to buy their companies' products regardless of quality and high prices.

e-Extension: ICT-Based Extension

With rapid advances in ICTs, emerging technology has become an essential tool in agriculture extension systems and has received enormous attention globally. Access to timely and relevant information is critical to remain competitive in market-driven agriculture. ICTs are playing a key role in agricultural extension development and advisory services. Through ICTs' platforms, connections between farmers to farmers, farmers to extension specialist and scientists, and farmers to input suppliers and markets have increased.

With advances in ICT tools, timely, live, reliable, and accurate information is affordable and at the fingertips of producers. ICTs include electronic and social media, mobile phones, email, video and audio signals, and other information technologies (Celebic & Rendulic, 2011). With ICTs' tools, women and youth engagement has increased in the agricultural extension system. Currently, several public and private organizations are promoting ICTs to reap benefits in agricultural extension. In the future, ICTs will be used widely on a large scale. Several new tools and technologies are currently on the market and many more are in the development pipeline. Keeping this in mind, several national governments have developed polices, regulations, and guidelines on the effective use of ICTs.

Currently, numerous ICTs are helping extension specialists, agricultural scientists, and farmers in predicting crop yield and weather conditions, forecasting pests and diseases, and collecting and analyzing crop data, along with supplying automatic advisory services on irrigation applications and crops management practices (Hafkin & Odame, 2007). Through ICT tools, farmers can enhance their agricultural production and productivity, and increase access to local, regional, and international markets and commodity prices. ICTs are greatly contributing to the communication and capacity-building activities of extension workers and farmers as well as entrepreneurs in rural and underprivileged regions.

Several examples of the use of ICTs in agricultural extension follow:

- In India, agricultural extensions services such as e-Choupal and KHETI (Knowledge Help Extension Technology Initiative) were developed with the aim to facilitate speedy communication among stakeholders such as farmers, communication specialists, agricultural scientists, and local communities.
- In Afghanistan, "eAfghan Ag" provides credible relevant information to those helping farmers in Afghanistan.
- In Rwanda, YEAN (Youth Engagement in Agriculture Network) project is encouraging communities and supporting young farmers through social media platforms.
- In Sri Lanka, agricultural extension officers are using ICTs and social media platforms for offering trainings and other skill development programs (Gowda, 2018; Jayathilake et al., 2017).

The use of ICTs in agricultural extension and community advisory services is increasing worldwide, but with several challenges. ICTs are not utilized fully, and scale-up programs remain challenging due to internet connectivity issues in remote areas. ICTs can help illiterate and resource-poor farmers with land records assessment, pest and diseases management, farm management, and market information; however, these services are inaccessible to these resource-poor communities in many parts of the world (Meera et al., 2004). ICT-based tools are not easy to navigate, handle and manage; therefore, many older people are not comfortable using them due to lack of digital literacy.

Land-Grant University Model of Agriculture Extension: An Example of Michigan State University Extension

Michigan State University was founded in 1855 as the Agricultural College of the State of Michigan. In 1914, the U.S. Congress established the Cooperative Extension System through the Smith-Lever Act, making MSU Extension the longest-established university extension service in the U.S. The mission of MSU Extension follows:

Michigan State University Extension helps people improve their lives by bringing the vast knowledge resources of MSU directly to individuals, communities and businesses.

Although MSU Extension originally focused on agricultural extension, it has now expanded into many content areas, including health and nutrition, youth development, entrepreneurship and finance, community, civics, and government. MSU Extension brings translational science into communities, creating evidence-based programming to communities via its 600 plus faculty and staff members throughout the state of Michigan.

MSU Extension is a part of the MSU College of Agriculture and Natural Resources and is organized both topically and by geographic region. There are 14 geographic districts (see Figure 2-1) and four institutes, which are organized by content areas. Each district has a district director, and each institute has a director and associate director. The employees most frequently work within one institute, but also may work across multiple or all institutes. Thus, in one district, there are employees who report to different institutes, with different content-area expertise. The four institutes are:

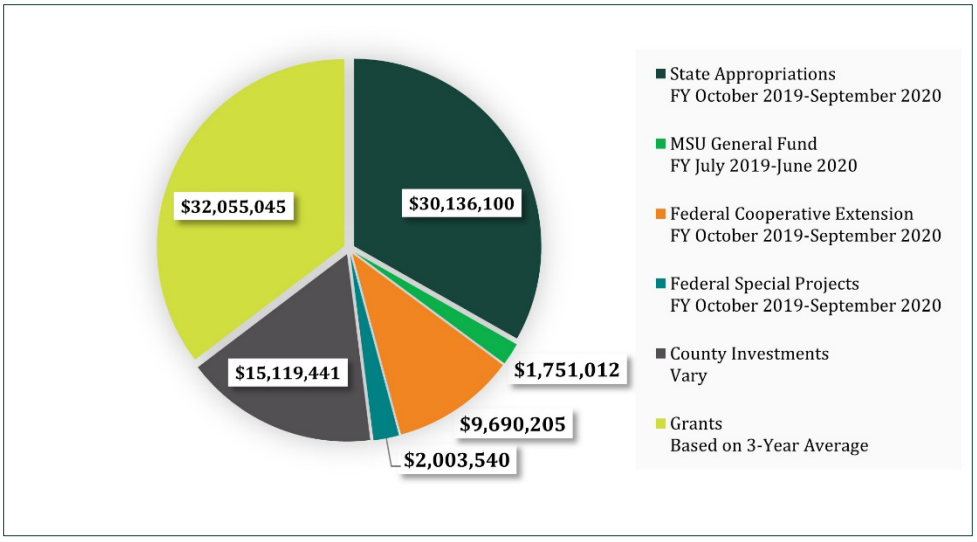
- Agriculture and Agribusiness Institute
- Children and Youth Institute
- Community, Food and Environment Institute
- Health and Nutrition Institute

Every county but one (of 83) in the state has at least one MSU Extension county office, ranging in size from a few employees to dozens. MSU Extension educators, who were in the past referred to as MSU Extension agents, specialize in a specific content area. Educators usually serve multiple counties across the state or may even cover the entire state.

MSU Extension staff and programs are supported through a variety of sources, including federal, state, local, and grant sources. In recent years, grant funding has increased to become the largest sector of funding (see Figure 2-2).

Figure 2-1. Michigan State University Extension districts.

Figure 2-2. Michigan State University Extension total revenue for fiscal year 2020.



Self-Help Groups: Community-Based Organizations/Farmers Helping Farmers

A Self-Help Group (SHG) is a small group of people that come together to help each other at local levels for mutual benefits. SHGs are usually made up of 10 to 15 people or more. The first SHG was formed in 1975 based on an idea conceptualized by the Grameen Bank in Bangladesh. Later, the SHG model flourished in India, and in 1987, the SHG model was adopted by the National Bank for Agriculture and Rural Development in India.

The SHGs are found in various categories, such as farmers' groups, savings groups, or women's groups, which all have specific goals and objectives. The majority of SHGs are found in rural areas where farming is a major activity. Several of these SHGs come together, collect their saved money, and deposit it in a nearby bank to support the development and implementation of their group. Their linkages to the local bank help to empower them financially and socially (Selvaraju & Vasanthi, 1999).

Many state governments in India and several civil society organizations and NGOs reach out to the SHGs to implement local programs in various areas. The SHGs' platforms help strengthen agricultural extension programs in disseminating information, sharing good agricultural practices, enhancing crop production, and supporting access to market (Munshi, 2004). Through SHGs, private organizations reach out to farmers to market their agricultural products, machineries, inputs, and technologies at discounted prices. At the local level, SHGs benefit from various government-supported programs for agriculture.

Recently, many SHGs have developed their own production, processing, and marketing networks. With their growing capacities to repay loan payments, several banks are now offering credit plans for SHGs and connecting them with regional business and entrepreneurs to expand their agricultural-related businesses. SHG members have great potential to learn new skills, adopt knowledge and technologies, and deliver agricultural extension services to women farmers. Learning from India's and other south Asian

countries' experiences in SHGs, several other countries in Asia and Africa are adopting the SHG model of agricultural extension.

Farmer Business School Model of Extension

The Farmer Business School (FBS) is a new model of agricultural extension services developed by the FAO. This model evolved from the experiences of experiential learning of the FFSs model of extension. The FBS model helps farmers to develop their capacities and knowledge in farm businesses, decision-making skills, and entrepreneurship skills (FAO, 2011). This model is designed for marginal and smallholder farmers who aim to manage their farms professionally and profitably.

The FBS model of agriculture extension can be started by public and private enterprises, farmer group and farmer producer companies, advisory services, cooperative and farmer associations, NGOs, and educational institutes. These institutions need to have capacity to effectively run the FBS as it is a long-term learning and mentoring program for individual farmers to develop their capacity in business development and entrepreneurship. Often, FBS training programs provide training materials, manuals, to-do lists, and future tasks to the participants in local languages.

FBS takes place at individual farms, community places, village schools, village training centers, and in meeting rooms of village leaders. These learning and training programs are managed professionally with excellent management plans created by district level trainers who facilitate training programs in FBSs at the village level. FBS is a unique platform where farmers learn practical experience and can plan their crop production, management practices, and marketing strategies. The key approach of the FBS is to develop business plans and create an attitude among farmers that they can develop a vision and goals along with the best marketing plan for their produce. With the increased interest, FBS is emerging in several countries in Asia and Africa. Countries such as Indonesia, India, the Philippines, Nigeria, Ghana, Zimbabwe, Togo, Côte d'Ivoire, Benin, Tanzania, Burkina Faso, Malawi, Cameroon, Zambia, and Mozambique are exploring opportunities in developing businesses and entrepreneurship skills among farmers in a variety of cash crops.

The FBS model of agricultural extension is at the preliminary stages in many countries and needs support from successful farmers, communities, local government officials, and public and private institutions. FBSs highlight several challenges. Among these include (a) a lack of skilled trainers who can communicate business development and strategies with farmers in local languages, (b) practical implementation of skills gained through training, (c) financial support, and (d) lack of courage and positive attitude among the FBS members.

Summary/Lessons Learned & Way Forward

Over the past six decades, several models of agricultural extension have been developed and implemented to support farmers and rural communities around the world. Every model has its strengths and weaknesses, and the success of these programs have varied from country to country and from region to region depending on sociocultural aspects and institutional support structures. No single model fits everywhere. Globally, the nature of farming is changing. Agriculture is transforming from a production-driven to a market-driven enterprise. Agriculture is becoming more technology and information intensive. This transformation is demanding new sets of extension and advisory services requiring new and innovative approaches to serve farmers and stakeholders along the value chains.

The recent advances in information and communication technologies are providing new and innovative tools for rapidly delivering timely and relevant information to farmers and stakeholders. These exciting new developments are offering tremendous opportunities for transforming extension and advisory services. Additionally, there is a growing interest in urban agriculture and urban food systems. Innovative approaches and programs will be needed to meet the growing demand of extension and advisory services for urban agriculture and urban food systems. Extension and advisory services will always remain a key pillar of agriculture in rural and urban development programs worldwide.

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Resources

- e-afghan app: https://afghanag.ucdavis.edu/
- e-Choupal: https://www.itcportal.com/businesses/agri-business/e-choupal.aspx
- Farmer Business School: https://bit.ly/2HCFHZv
- Michigan State University Extension: www.extension.msu.edu/
- YEAN (Youth Engagement in Agriculture Network) project: https://bit.ly/2HMvxVT

CHAPTER 3

Zabo (Zabü) Farming of Kikruma Village, Nagaland, India

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Introduction

The Naga farmers have since time immemorial worked closely with nature by understanding the rich resources to innovatively develop farming systems to their advantage. Tested indigenous knowledge of farming is orally passed down through generations and is still in practice along with the modern agriculture farming technologies. One such farming system that has already been accepted and acknowledged by all stakeholders to be one of the best practices and sustainable farming approaches is the cultivation method developed by the Kikruma village of Phek district, Nagaland, India.

The Zabo (Zabü) farming method is similar to IFS (Integrated Farming System). The only difference is in the involvement of the entire farming families of the village and the sharing of the rainwater harvesting during the cropping season and management of land and off-farm activities.

There is ample scope for this indigenous farming system to be adopted with technology intervention in hill agriculture where farmers face water scarcity and soil erosion.

Nagaland

Nagaland is one of the smallest states in India. Located in northeastern India, it occupies an area of 16,579 sq km, having a population of 1,978,502. Agriculture is the main occupation and the state has the potential to cultivate approximately 721,924 lakh hectare, that is, 4.35% of the total geographical area. The topography of Nagaland is largely undulating hilly terrain, situated between 25'06 °N and 27'04 °N latitude and 93'20 °E and 95'15 °E longitude. The state harbors rich and diverse natural resources that can be attributed to its unique geographical location. It is bordered by three states: on the west and north by Assam, on the north by Arunachal Pradesh, and on the south by Manipur. It shares a wide international border with

Myanmar on the east (Directorate of Economics & Statistics, Nagaland: Kohima, 2019).

Climate

The state experiences a typical monsoon marked with contrasting subtropical to temperate seasons across altitudes that range from 194 m to 3840 m above sea level. The average rainfall is 2,500 mm with heavy rains from May to August, and occasionally from September to October, with a dry spell occurring from November to April.

Agriculture

More than 70% of its population depends on agriculture and allied activities for its income and livelihood. The total farming households of 250,360 traditionally practice three types of farming that are mostly rice-based systems. They are classified as:

- Jhum farming or shifting cultivation, often termed as the "slash and burn" method;
- Terrace Rice Cultivation (TRC) practiced in the hilly regions following the monsoon season as their crop calendar; and
- Wet Rice Cultivation practiced in the foothills, lowlands, valleys, and catchment areas where perennial water and irrigation facilities can be sourced.

(Department of Agriculture, Government of Nagaland, 2019)

TRC is practiced more commonly in the districts of Phek and Kohima along the hill slopes cutting them into flat beds through land shaping with provisions for irrigation water to flow. The department has documented 109 indigenous rice varieties of TRC alone cultivated by the rice farmers of the Chakhesang tribe over generations (Department of Agriculture, Government of Nagaland, 1997).

Best Practices: Zabo/Zabü Farming

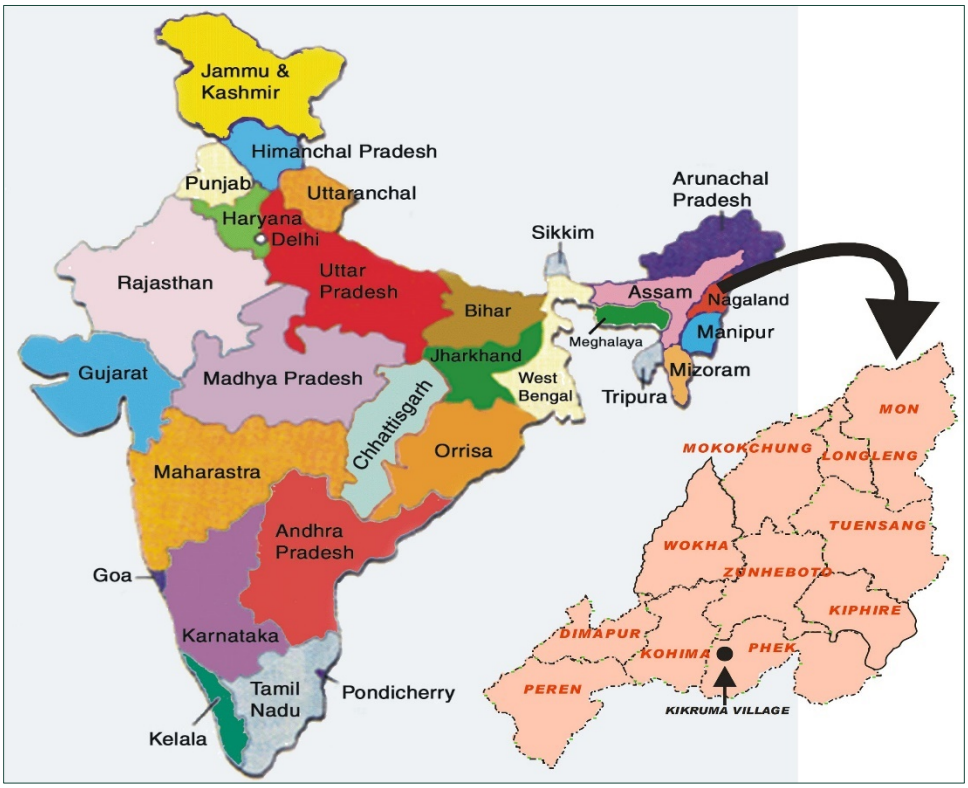
The Naga farmers have, since time immemorial, worked closely with nature and have used the terrain as their natural farming systems. These time-tested indigenously developed farming methods are still in practice today in the remote and sloping farm areas. One such farming system that has already been widely accepted, duplicated, and acknowledged by all stakeholders to be a sustainable method of farming is the Zabo/Zabü of Kikruma village.

Profile & Location of Kikruma Village

The Kikruma village in Nagaland lies in geo-coordinate latitude 25.58 and longitude 94.21. It is situated at an altitude of 1,643 meters above sea level. The village is 68 km away from its district headquarter Phek and approximately 52 km east from the state capital Kohima. The village has 1,664 households that make a population of 7,298 with a literacy rate of

78.31%. It is located on a hilltop where perennial water sources are scant. The villagers belong to the Chakhesang tribe, considered to be one of the hardest working communities having traditional knowledge and experience in hill farming (see Figure 3-1).

Figure 3-1. India map with Kikruma village.



The farming community of Kikruma village has developed its own unique, indigenous system of water harvesting that nurtures the soil and enhances agriculture production specifically to irrigate the rice fields. This simple and effective method is known as the *Zabo/Zabü farming system of Kikruma*. It combines agriculture and forestry land use with built-in water-harvesting-recycling systems and conservation measures. In the process, soil erosion is checked, and the water sources and soil fertility are managed sustainably involving the entire village community.

The history of the unique farming system can be traced back to the village forefathers who faced acute water scarcity, leading them to develop an elaborate water and land efficient management system (Nagaland Environmental Protection and Economic Development & International Institute of Rural Reconstruction, 1999).

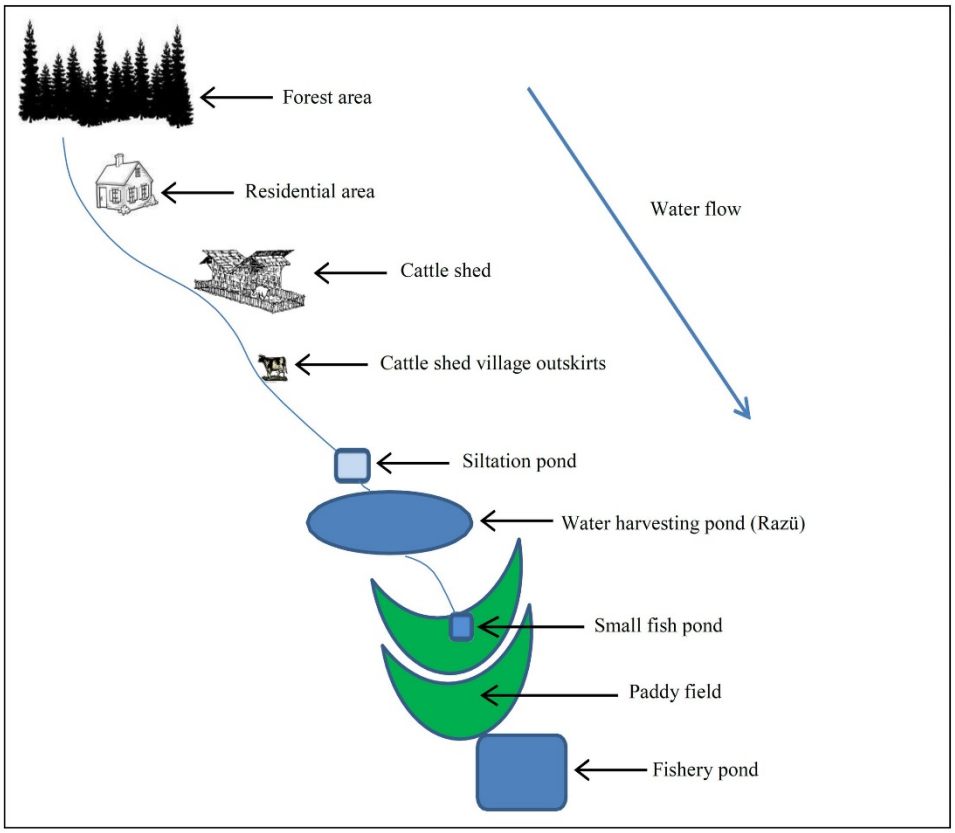
What Is Zabo/Zabü Farming?

The word *Zabo* can be traced back to a local dialect word *Zabü*, which is translated as "impounding runoff water and utilization." It is an approach to farming that integrates forestry, agriculture, fishery, and animal husbandry activities by using harvested rainwater.

The three-tier system consists of the top of the hill having protected village forestland (forest area); the mid-hilly section where the village resides (residential area) and maintains the water-harvesting ponds called *Rüza*

(*Razü* in local dialect) and cattle yard and dairy farms (cattle shed and cattle shed village); and the third lower section where rice cultivation or paddy fields, and fishery ponds of the farmers are located (see Figure 3-2).

Figure 3-2. Schematic diagram of Zabo/Zabü farming system.



The Practices & Technique

Upper Section, Tier, or Top Forest Area

The village communities conserved forest area is located at the hilltop of the village. Strict rules are enforced regarding foraging and collecting of wild foods (leaves, berries, fruits, seeds, roots, and barks), and harvesting of the forest timber. Such activities are normally taken up during the dry seasons of winter(see Figure 3-3).

Figure 3-3. Village conserved forest area at the top and paddy field at the lower section.

Mid-Section: Water-Harvesting Ponds or Rüza

The community or farmers themselves hand dig the ponds to harvest the rainwater during the monsoon season. For this work, the bottom surface of the ponds are thoroughly puddled (mixed) and the sides of the ponds are rammed and compressed using a strong coarse sacking jute bag(gunny bag) tied to a wooden or bamboo pole, then hand plastered. This exercise of using mud to plaster and compress minimizes the loss of water through seepage. Sometimes more than one pond is constructed so that the surplus water flows down to the pond or ponds below. If the farming family is unable to find a suitable location for construction of the water storage tanks or water ponds, the runoff from the catchment area is directly led to the paddy fields to store and use for irrigation purposes. To control water seepage, generous amounts of the husk of the rice left after milling is also used and incorporated into the mud bunds (earthen dams) by smoothing them out or plastering them with mud. A pond measuring 3 m by 2 m by 2 m can irrigate terraces that yield 600 kg of rice (see Figure 3-4).

Figure 3-4. Using a pole tied to a gunny bag, a farmer rams and compresses the side wall of a pond.

Water-Harvesting Structures & Channel Preparation

Once the monsoon rain starts, the rainwater flowing from the forest hilltops or even from residential areas and small puddles acts as a catchment area. Through gravitational flow and manmade channels, the rainwater is diverted to the harvesting ponds (see Figure 3-5). The water channels are maintained at suitable locations and small bamboo check dams are erected at intervals to control soil erosion (see Figure 3-6). In addition, silt retention tanks or small ponds are constructed at several points before the runoff water is allowed to accumulate in the harvesting structures. The accumulated rainwater is stored in the silt retention tanks for two or three days before being transferred to the main water-harvesting ponds. Water is then released from the pond for irrigation by opening or cutting an outlet at the base of the water pond by use of bamboo pipes to allow water to flow from one field to the next. To reduce water filter, the water channels are also compacted by hammering or beating down its base (see Figures 3-7 and 3-8).

Figure 3-5. Rainwater from hilltop channeling down to the harvesting pond.

Figure 3-6. Water channel with bamboo check dam made to control soil erosion.

Figure 3-7. Water from siltation pond flowing to the main harvesting pond.

Figure 3-8. Water flowing from harvesting pond to the main paddy or rice field.

Supporting Activities: Sharing Water & Repairing Ponds & Channels

The sharing of water from the catchment area to the harvesting pond is mutually undertaken to ensure that every farmer gets an equal share of irrigation water from the catchment areas during a crop season. In situations where a farmer receives less water, the problem is settled through a rotation basis. Further, diversions from the catchment areas are created with demarcated water channels, usually 6.66 to 20 m long, for each farmer. Sharing of the harvested water between families is exercised through mutual discussions, ensuring that every farmers' plot in the village benefits. The remaining excess water is then drained out to fishery ponds (see Figures 3-9 and 3-10).

The water benefit sharing process is a serious affair since the cultivation of agricultural crops and rearing of animals depends on these exercises. Therefore, all of the families who own the rice terraces, irrespective of the farm size, participate in the clearing, cleaning, and repairing of the siltation tanks, ponds, and channels. During such exercises, the strong bonding that exists within the Kikruma village community is displayed.

Figure 3-9. Water sharing from one crop field to the next.

Figure 3-10. Excess water drained to the fishery pond, the lowest tier or section.

Animal Nutrition & Management

The water-harvesting ponds and tanks not only serve as a water reservoir for irrigation but they are also a source of drinking water for cattle and other animals of the village. Cattle, pigs, poultry, and birds are also let loose in the forest, and the cattle under enclosures are provided nutrients from these water-harvesting ponds. Animal husbandry activities are usually located near and above the water-harvesting pond. The water collected in the catchment area is allowed to pass through the cattle yard, carrying with it manure and urine, which is nutrient rich, before holding in the tank or pond or directly passed on. In situ manuring is also practiced using *azolla*, a green manuring crop, and paddy stubbles (see Figures 3-11 and 3-12).

Figure 3-11. Animal manure flow from cattle shed.

Figure 3-12. Manure from cattle shed flowing to the water-harvesting pond.

Water Utilization in the Paddy or Rice Fields

The harvested water from the catchment along with animal dung and urine is left in the water-harvesting pond for about a month. Some farmers rear fishes for additional income. The water is then released to the main field through an outlet maintained about 6 inches in height directly to the main field or through bamboo poles as needed (see Figure 3-13). Fish fingerlings are introduced in June and July right after the transplanting of rice seedlings. The fish is harvested in September and October after the water is drained from the terraces. Some farmers introduce snails as another source of income.

Figure 3-13. Paddy straw or stubbles and pulse crop left in situ.

Use of Water in the Main Crop Field

Paddy fields are terraces, which are generally of 0.2 to 0.8 hectares in size, located at the lower elevations of the village. The bunds are cut at a 45 degree angle by using a specific indigenous spade that is outwardly curved. At the time of puddling, the bunds are thoroughly rammed or pressed and mud plastered manually with wooden sticks to create a hard pan to reduce percolation and filtration of water. Two supplementary irrigations are provided from the water-harvesting ponds to the main field, to maintain a 10 cm height (see Figures 3-14 and 3-15). The paddy-cum-fish culture is practiced by most of the farmers.

Figure 3-14. Bunds cut at an angle slope with indigenous spade or hoe.

Figure 3-15. Bunds or earthen dams prepared by ramping or pressing down and plastering.

Harvesting

When the paddy crop attains ripening stage, the tillers are bunched and tied together by draining out the water (see Figure 3-16). This activity generally takes place during October and November and is followed by harvesting, which extends to December. Right after the harvesting, the threshing operation is carried out in the main field right away to reduce the pest and rodent infestations (see Figure 3-17). Hays, along with the paddy stubbles, are left in the field plots to rot. When water is drained out from the terraces, the fish gets collected in the nearby smaller ponds for the next season. Harvests from paddy and fish range from 3 to 4 tons per hectare and 50 to 60 kg per hectare respectively.

Figure 3-16. Paddy bunched and tied for harvesting.

Figure 3-17. Threshing of paddy in the farm.

Post-Harvest Operations

Once the paddy is harvested, the terraces are again prepared for cultivation of winter crops. During this time, the bunds are rammed again and mud plastered. Some farmers opt to maintain standing water and rear fish for the next season or practice *azolla* culture. During this operation, the paddy straw and stubbles are incorporated into the bunds to clear ways for fish (see Figures 3-18 and 3-19) (Agricultural Technology Management Agency, Phek, 2017).

The Kikruma village agricultural crop system follows a specific calendar. Table 3-1 outlines each month's activities.

Figure 3-18. Bunds rammed after harvesting to check seepage, and water way cleared for fish.

Figure 3-19. Terrace fields left with rice stubbles for next crop season.

Table 3-1. Monthly agricultural crop calendar of Kikruma village, as narrated by Kikruma farmers and village council in 2017.

Month	Activity
March	Preparation of nursery bed outside the main paddy field
April	Preparation of catchment areas and sowing paddy in nurseries and harvesting of early winter crops
May	▪ Harvesting of winter crops sown during the month of January ▪ Clearing and removal of debris in the irrigation channels/drainage ▪ Enriching the main field by incorporation of green manuring plants and forest leaves ▪ Cleaning and preparation of bunds by scraping (cleaning and smoothening) and compacting the soil. ▪ Preparation of water-harvesting ponds ▪ Re-aligning the water channels
June	▪ Lifting the paddy sapling and transplanting in the main field ▪ Addition of fish fingerlings ▪ Plastering of the bunds with mud
July	▪ Addition of decomposed organic leaves and bio compost ▪ Intercultural operation—irrigation
August	▪ Weeding ▪ Cleaning and re-plastering the bunds
September	Intercultural operation
October	▪ Bunching (tying up) of half-ripe paddy stalks to prevent lodging ▪ Harvesting of paddy by last week
November	Harvesting and threshing (separating paddy from stalk) near the main field.
December	▪ Cutting the paddy straw into smaller lengths for compost making ▪ In situ manuring of cut straw ▪ Preparation of the rice fields by ploughing/hand digging/hoeing for cultivation of winter crop.
January	▪ Sowing of winter crop seeds ▪ Addition of manure and compost of poultry, cattle, and rice husk
February	Intercultural operation-weeding and irrigation.

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CHAPTER 4

Agricultural Extension Services in Nepal

PAST, PRESENT & FUTURE

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Introduction

Speeding up agricultural production and productivity, employing demand-driven and participatory extension services, mobilizing competent extension professionals that Nepal should strive on, moving forward to address food insecurity and ensuring our country's progress and prosperity: How could this happen? Publications analyzing past efforts, deciphering the current status, and foreseeing future paths and needs of agricultural extension services have been a necessity.

Situated in the Hindukush Himalayan plateau, Nepal is a tiny Asian country with a unique weather pattern ranging from tropical in the south to temperate and arid in the north, with an altitude from as low as 60 meters above sea level (masl) to the tallest peak in the world. Endowed with several valleys and freshwater river systems, Nepal's agricultural potential is high. Contributing about one-third to the national gross domestic product (Asian Development Bank, 2019), agriculture is an important means for Nepal's development. Over 66% of Nepal's population takes part in agriculture and a similar proportion of people depend on it for their livelihoods. Nonetheless, in 2018, Nepal produced 10.3 million tons of cereals but imported 1.2 million tons of cereals in the same period, which indicates that domestic food production is not sufficient to feed its population (Food and Agriculture Organization of the United Nations, 2019). About 15% of the country's population, particularly in western and northern Nepal, are food insecure. Approximately 36% of Nepali children under 5 are stunted, while 27% are underweight and 10% suffer from wasting due to acute malnutrition (World Food Programme, 2019). Population growth has outpaced the agricultural growth for many years now. The state of food shortages and malnutrition will prevail if proper actions are not taken. This is contrary to the fact that until the 1990s, Nepal was a net exporter of cereals (Baral, 2000; Pyakuryal et al., 2010) and the government plans have bestowed a high priority to the agriculture sector for many decades now.

Several factors have affected Nepal's agricultural growth. The country went through a decade-long civil war (1996–2006), which took more than 10,000 lives, ruined many infrastructures, and disrupted public services and development projects. Thousands of people internally migrated from war-torn villages to cities, abandoning their farmlands. Agricultural land has been abandoned or underutilized in recent decades at an unprecedented rate. Many of those who are left behind at rural villages have access neither to farmland nor to extension services. After a peace deal in 2006, the security situation has improved but Nepal still faces several aftereffects of the conflict and development is yet to gain momentum. Additionally, Nepal frequently faces natural disasters such as flash floods, droughts, and earthquakes. These have also affected farming systems. A poor governance system and monitoring; weak linkages between research, farmer, extension, and education agencies; and poor extension services are some of the other major bottlenecks hindering adoption of new agricultural technologies.

History of the Agriculture Extension System in Nepal

The introduction of agriculture extension services (AES) in Nepal dated back to the mid-1800s when Jung Bahadur Rana imported a Jersey bull, two Jersey cows, and clover grass seeds from the United Kingdom, and initiated a cattle-breeding program. Table 4-1 lists the milestones in AES and related projects and programs in Nepal.

Table 4-1. Milestones in agricultural extension services in Nepal.

Date	Milestone
1952	Rural Development Program called Tribhuvan Gram Bikas started
1953	4-H (Charpate) Club, Rural Youth Club initiated
1956–1961	First Five-Year Development Plan (1956–61) implemented
1957	School of Agriculture under Department of Agriculture (DOA) at Kathmandu
1959	Extension offices opened in 25 districts
1962–1965	Second Development Plan implemented
1963	Extension offices opened in 50 districts
1965–1970	Third Five-Year Development Plan implemented
1966	DOA was restructured and formed five separate departments, under Ministry of Agriculture (MOA)
1968	School of Agriculture upgraded to College of Agriculture
1970–1975	Fourth Five-Year Development Plan implemented
1972	Institute of Agriculture and Animal Science (IAAS) established
1972–1973	Five departments earlier formed were amalgamated into DOA, and DOA made responsible for agricultural research, extension, and training
1975–1980	Fifth Five-Year Development Plan implemented

Date	Milestone
1977	Tuki extension approach started
1980–1985	Sixth Five-Year Development Plan implemented
1981–1982	DOA transformed into DOA and Department of Livestock Services (DLS)
1985–1990	Seventh Five-Year Development Plan implemented Nepal Agricultural Research Council (NARC) established
1989	Council for Technical Education and Vocational Training established
1991	Training Institute for Technical Instruction established
1992	All agriculture-related departments, including DLS amalgamated in to a single DOA
1992–1997	Eighth Five-Year Development Plan implemented
1994–1995	Women Farmers Development Division at the Ministry of Agriculture Development (MOAD) established
1995–2015	Agricultural Perspective Plan implemented
1997–2002	Ninth Five-Year Development Plan implemented
1997	Artificial insemination centers in 45 districts started
1999	Directorate of Extension under IAAS established
2000	Himalayan college of Agricultural Science and Technologies (HICAST), a private agricultural college established
2002–2007	Tenth Five-Year Development Plan implemented
2010	Establishment of Agricultural and Forestry University, Rampur, Chitwan
2007–2010	Three-Year Interim Plan (Eleventh Plan) implemented
2010–2012	Twelfth Development Plan implemented
2011–2030	Nepal Agricultural Research Council (NARC) Vision timeline
2013–2015	Thirteenth Development Plan implemented
2013	Agriculture Development Strategy started
2016–2018	Fourteenth Five-Year Development Plan
2019–2024	Fifteenth Five-Year Development Plan
2019	Three tiers of Agricultural Extension Services at local, provincial, and federal levels started

Source. Pyakuryal & Suvedi, 2000.

The milestones presented in Table 4-1 can be broadly divided into two phases: before 1950 and after 1950. Before 1950 is the period of infrastructural development such as the establishment of veterinary hospitals, central research farms, and technical schools. During this period, extension services was centralized and top-down, farmers' awareness and ambitions were low, and farming was dominantly for subsistence. From 1950 to 1980, zonal and district offices were opened. Several physical

infrastructures were also built in this period. After 1980, human resource development in extension services kicked up.

In almost all development plans implemented by Nepal, agriculture was accorded with a priority, at least on paper, even though until recent years the budget allocated for this sector was not adequate enough to pursue the envisaged programs. Nepal has designed many agriculture-related policies, strategies, and programs in past decades. However, it lacks the effective implementation, proper monitoring, and evaluation of what, whether, and how the policies and programs have been implemented. Literature suggests that an implementation mechanism, which is directly correlated to employees' competency, is weak in Nepal (Ghimire, 2017). Moreover, as can be seen in Table 4-1, the agricultural extension system in Nepal has largely been dominated by government-sponsored services and with less representation and contribution from the private and nonprofit sector. Nonetheless, Nepal has tried many extension approaches in the past but with little success.

Figure 4-1. Murrah, a popular buffalo breed in Nepal.

Extension Approaches

Nepal has tried many different extension approaches but with mixed outcomes. They have included Training and Visit, the Integrated Rural Development Project approach, the Tuki System, the Farming System Research and Extension approach, the Block Production Program approach, the Farmer Group approach, the Pocket Package Program approach, the Projectization approach, Farmer Field School approach, Public Private Partnership , Systems Thinking approach, and Nongovernmental Organization approach. As is true in the trend in the world extension system, when extension services first started, the approaches were more top-down, technician or expert led. As the extension services has progressed to recent decades and years, efforts are on to make them participatory, accommodative, democratic, and beneficiary led.

Training and Visit (T & V): Posited by Daniel Benor in the 1970s (Howell, 1988) and promoted by the World Bank, the government first introduced this approach in the Bara and Parsa districts through the Narayani Zone Irrigation Project in 1975. The T & V approach was employed in 19 of the 20 districts of Terai, leaving out Dang. This approach is based on the principle of training technicians and mobilizing them to train farmers. T & V envisages continued visits of extension agents to farmers and envisions close links

between research and extension. Extension agents help in technology transfer. Success is manifested by increases in the production of particular crops or commodities. Some of the shortfalls of this approach include a lack of regular training sessions as well as training that lacked real content. In addition, officers appointed as subject matter specialists did not have adequate qualifications to run T & V, and extension and research linkage was weak. Village agents did not regularly visit farmers and conversely, farmers were reluctant to attend the meetings and visits. T & V is centralized, top-down, rigid, and financially unsustainable because it is costly to hire large numbers of personnel and provide continuous training and management (Davis & Sulaiman, 2016).

Integrated Rural Development Project (IRDP): The IRDP approach is based on the integration and coordinated management of resources for rural development. Agricultural development programs are planned and implemented along with local development, forest development, soil conservation, women's development, and irrigation development programs. There were eight IRDPs in operation in Nepal in the 1970s that include the Integrated Hill Development Project, the Rasuwa Nuwakot IRDP, and the Rapti IRDP, among others, covering 23 districts in total (Pradhan, 1985). IRDPs boost agricultural production and productivity through improved supply of inputs, better extension services support provided by additional temporary technical manpower, infrastructural development, and additional funding for agriculture services (Food and Agriculture Organization of the United Nations [FAO], 2010). IRDPs were greatly appreciated as they brought many different sectors together; however, lack of seriousness among sectors to implement project activities and own the outcomes remained the biggest challenge (Pradhan, 1985). The Ministry of Local Development (MLD) was the central coordinating agency and the project coordinators were appointed from there. Individual components were implemented by the respective ministries through their district level line agencies. According to FAO (2010), grassroots-level extension infrastructures such as agriculture service center buildings, market yards, trails, rural roads, and small irrigation projects built during IRDPs proved useful.

The Tuki System: Started in 1977 in the Sindhupalchok and Dolakha districts and financed by Asian Development Bank, the Tuki System focused on assigning extension functions to locally rooted volunteer farmers. Those farmers were also working as agriculture input dealers, so that the technological message could go along with inputs required. This was in contrast to other extension approaches that depend on professionally trained, external extension workers who often came from other ethnic groups and were frequently transferred from other areas.

Farming System Research and Extension (FSRE): FSRE is an action-oriented approach embracing rapid design, evaluation, and implementation of relevant and realistic solutions to farm problems. Involving farmers, extension workers, and researchers, the FSER approach to technological improvement has evolved as an efficient means to develop farming systems that are uniquely suited to specific biophysical and socioeconomic conditions (Francis & Hildebrand,1989). Since researchers and extension practitioners work closely with farm families and in the local settings, they understand the surrounding environments and the ways farmers are influenced by the farming practices and systems and vice versa. Farmers participate in the development and testing of alternative practices and

technologies. This participation boosts the efficiency and effectiveness of the technology development and adoption process. Farmer-centered and cost-effective, the FSER approach leads to a sustainable farming system. In Nepal, FSER was first employed in the Lumle Agriculture Research Centre and the Pakhribas Agriculture Research Centre.

Block Production Program: This approach is based on the principle that intensive use of resources consolidated together in an area called a *block* could increase the farm productivity. About 1,000 hectares of land within a specified location constituted a block, which were then divided into subblocks of a minimum of 100 hectares in Terai and 20–25 hectares in hills. Initially it was implemented in the Parsa and Chitwan districts and later expanded in 20 Terai districts and eight hill districts that covered 510 hectares under the Integrated Cereal Project (1982–83). The focus of the Block Production Program was intensive farming.

Farmer Group Approach: The principle of the group approach is to put farmers of similar interests together and carry out the agricultural development and associated activities on a group basis. The group approach has been effective to bring innovation to the groups and expand to other farmers in their command area. The group approach promotes resource sharing and better utilizes the limited manpower and other resources. In Nepal, the group approach has been successful in many sectors, including livestock, horticulture, crops, small irrigation, and forestry. It is now being tried in women's development, marketing, and the health sector as well.

Figure 4-2. Women farmers seated in the front row at a farming group meeting. (Photo courtesy Ramjee Ghimire)

Pocket Package Program: The Pocket Package Program approach refers to the production focusing on a particular area (or pocket). The pockets for commodities are selected based on feasibility and projects are developed through a bottom-up process. This approach is effective to introduce new demand-driven technologies. It has also been instrumental in commercializing agricultural commodities such as crops, dairy, and off-season vegetables as it helps with increasing the scale of production.

Projectization Approach: Commodity-based production programs have been implemented on the basis of project design within the framework of time duration, budget expenditure, and expected output. The package of activities that are required to achieve the outputs are identified and included in the project plan. The Projectization Approach has been adopted in all the

75 districts with a priority on the pocket areas of production. While it has helped with giving continuity to the activities associated with or required for a project to accomplish its goals and objectives, ignorance of extension staff and senior officers about the approach has affected the outcomes.

Farmer Field School (FFS): FFS is based on the principles of *adult learning*, *learning by observing*, and *learning by doing*. FFS promotes peer learning. Rogers (2003) posits that individuals with similar sociocultural, educational, economic, and geographic backgrounds find themselves comfortable communicating with each other, and such communication is more effective than other casual communication. By observing fellow farmers' work, an observer farmer can learn new strategies and gain confidence to try those strategies on the farm. FFS has been effective in reaching out to less educated and smallholder farmers and helping them to have access to the knowledge and skills required for crop management, for example, integrated pest management. Importantly, FFS is a democratic and participatory approach (Sharma & Bhandari, 2005).

Public Private Partnership: Public Private Partnership has been ongoing in Nepal for the past several years, but not much was visible until the Third Livestock Development Project started providing support to the livestock sector in developing milk processing centers, meat shops, veterinary drug stores, veterinary paraprofessionals, and artificial insemination programs, among others. In this approach, the government provides seeds (cash, in-kind, training, and more) to needy private parties (private milk processing plants, meat shops, private veterinary paraprofessionals, and others). Private parties also invest their share in the program, in cash or in-kind and provide services to needy farmers or groups. It has the potential to lead to synergistic effects or outcomes in the agricultural sector.

Systems Thinking: Asian Development Bank-Funded Third Livestock Development Project introduced the Systems Thinking approach in livestock extension services in its project districts. The Systems Thinking approach posits that a system (for example, buffalo production farm) consists of many subsystems (for example, human activity, natural resource management, business, and others) and to effectively run a system, its subsystems have to be vibrant and in harmony. Experiential learning and soft skills among human activity systems are integral to the Systems Thinking approach. When subsystems work well it leads to synergetic results. Participatory program planning, implementation, and monitoring with involvement of beneficiary farmers and valuing beneficiary's knowledge and skills are salient features of Systems Thinking.

Nongovernmental Organization (NGO): There are about 5,000 NGOs (nonprofits) working on different aspects of agricultural development in various parts of Nepal. NGOs are found to be more effective in social mobilization, but they work in a limited area and many of them lack technical expertise. Since NGOs are project or donor sponsored, they exist and work for a certain period of time and leave once the projects phase out; therefore, the sustainability of NGO-led programs is always in question. Besides NGOs, many international nongovernment organizations (INGOs) offer many different agricultural development programs. The Food and Agriculture Organization, the Asian Development Bank, the United States Agency for International Development, and the United Nations Development Fund are some of the INGOs operating in Nepal for the past several decades. Support for these agencies to improve agricultural productivity and reduce

food insecurity and hunger has been crucial. These agencies are supposed to follow the Government of Nepal's plan and policies while they choose the program that they would like to pursue, but lack of coordination between government agencies and these INGOs is not uncommon in Nepal.

The Concept of Agriculture Extension

Agricultural extension provides research-based educational and informational programs typically for rural populations. Historically, agricultural extension assisted farm people through educational procedures aimed at improving farming methods and techniques, increasing production efficiency and income, and improving standards of living. However, increasingly extension serves both the rural and urban populations with a wide range of programs aimed at helping to improve beneficiaries' quality of life. "The role of extension is to help people to help themselves through educational means to improve their level of living" (Maunder, 1972, p. 5). The following definition of extension is even more practical and applied:

> Agricultural extension is a system that facilitates access of farmers or their organizations to new knowledge, information and technologies and promotes interaction with research, education, agri-business, and other relevant institutions to assist them in developing their own technical, organizational and management skills and practices. (Christoplos, 2010, p. 3)

Agriculture extension is the process of providing the information about new or improved technologies to farmers to enable them to improve their farming. Extension is a dynamic process of getting useful information to people (the communication dimension) and then in assisting those people in acquiring the necessary knowledge, skills, and attitudes to effectively utilize this information or technology (the educational dimension); and it is critical in the agriculture development process, both in terms of technology transfer and human resources development (Sharma & Bhandari, 2005). Sharma and Bhandari (2005) further provided the synthesis of extension as transferring knowledge from researchers to farmers, advising farmers in their decision-making, educating farmers to make appropriate decisions in the future, enabling farmers to clarify their goals and possibilities and to realize them, and stimulating desirable agricultural development. These definitions underscore that extension's roles are to enable farmers to help themselves, to better examine their current farming systems, to better foresee the future of their farming, and to better plan and act to get more profit from their farming. It means extension facilitates to meet the farmers' demand (demand-driven) and with their own participation (participatory) and with public, private, and nonprofit agencies partnering and collaborating to help farmers (pluralistic). Extension services may not always include public goods and services free of cost. As in many developed places such as in Europe, wherever feasible, extension services should be privatized, and farmers have to pay fees to get such services (privatization).

Provisions for Agriculture Development in Nepal's New Constitution

Article 25(4) in the new constitution of Nepal issued on 2015 has envisioned land reforms, management, and regulation in accordance with law for the purposes of enhancement of product and productivity of lands, modernization, and commercialization of agriculture, environment protection, and planned housing and urban development. Per the new constitution, many of the roles for development and services are devolved to local government.

Restructuring of Agriculture Institutions: The creation of local level political entities in Nepal marks a major restructuring of local bodies. As per the new arrangement, Nepal has 481 rural municipalities, 246 municipalities, 13 submetropolitan cities, and six metropolitan cities. These local entities are divided into 6,680 wards. One of the objectives of local level restructuring is to provide qualitative services to local people and that covers agricultural services as well.

The "Roles of Federal, Provincial, and Local Levels" section presents the roles of the three levels of government as they relate to agriculture. As can be seen in the list, provincial government units are responsible for agricultural research while local level units are responsible for developing and implementing crop and livestock extension services, among others. Under current scenarios, both of these governments require additional training and technical support to execute the assigned roles.

Roles of Federal, Provincial & Local Levels on Agricultural Development

According to the Global Sustainable Research and Development Center (2018), the federal, provincial, and local roles in agricultural development include:

Federal Level

- Policies development and its implementation
- International trade, exchange, port, and quarantine
- International agreements, negotiation between various international organizations, its implementation, and monitoring
- Assist, facilitate, and monitor interstate trade-related policies and laws
- Develop physical infrastructure relating to international trade, regulate, and coordinate it
- Implementation and monitoring of policies, laws, and standards of food quality and quarantine
- Implementation of pesticides and micronutrient usage and management-related acts and regulations
- Collection and dissemination of information-related internationally banned pesticides

Provincial Level

- Formulation of state-level policies, plans, and regulations, its implementation and monitoring
- Control of agriculture and livestock-related diseases, pests, and epidemics
- Development and promotion of agribusiness and industrialization
- State-level laboratories, regulation, and management
- Quality determination of agro-products
- Seed quality determination and genetic improvement
- Food security

- Agriculture-related research, data system, source conservation, and cooperative farming system
- Price determination of agro-products
- Infrastructure development and management (agri-roads, agri-markets, farm centers)

Local Level

- Policymaking for local level agriculture extension
- Human resource management and distribution in local level
- Capacity building, technical assistance, skill development, and empowerment of farmers
- Supply and usage of seeds, fertilizers, chemicals, and pesticides
- Coordination between farmers' group, cooperatives, and local bodies
- Agriculture-related information and communication
- Technology adoption and dissemination
- Development and management of farm centers
- Crop and livestock insurance-related planning and implementation
- Infrastructure development for agro-market

Extension, research, and education are three pillars of agriculture. Without one, the other would not be able to function properly. For example, research undertakes investigation on issues or problems facing farmers. Recommendations or technologies that research comes up with must reach farmers (the end users) through extension. Education is key to produce a workforce that can contribute to research and extension. Extension should also be able to complement research and extension's work. This being said, extension is the bridge connecting farmers, research, and education, thus a critical component for sustainable agricultural development. Countries with effective extension services can achieve much in agriculture. Therefore, in Nepal too, restructured extension units should be proactive to connect to and get new technologies from research and disseminate those technologies to farmers and vice versa.

Issues & Challenges

Various challenges facing AES have been highlighted in Sharma and Bhandari (2005), which are still relevant and are discussed here.

Low Service Coverage and Negative Impression About Public Agriculture Extension: Coverage of extension in Nepal is low (about 25%). This is a serious issue as 75% of the farmers in the country are still unable to access extension services. A vast majority of farmers and other stakeholders feel that agriculture extension is not efficient and is infective despite employing a large number of staff.

Extension Services Not Adequately Addressing Diversities: Nepal is diverse socially and ecologically, as well as in crop and livestock production systems. The crops and commodities feasible in Terai are not feasible in hills and mountains. Accordingly, farmers in different regions have different advisory needs. Technicians should be able to cater diversified services as per the need of the area. This is a difficult job and it goes unmet most of the time. Farmers have high socioeconomic diversities as well. Some farmers are resourceful enough to invest in high-cost technologies, whereas many others cannot. Marginal and small farmers require and demand low-cost technologies. The extension staff and services system is yet to be prepared to address these diversities.

Lagging to Adapt to Increasing Globalization: Globalization aims at creating more interactions and linkages among countries in the matters of trade, information flow, and technology dissemination. It encourages open competition under fair and relatively equal conditions. Nepal is lagging in many areas to understand and adapt to the changes happening around the globe. For example, Nepal has a long way to go to ensure quality of agricultural products and services employing competent, ethical, and equitable laws, standards, protocols, and employees, and accredited laboratories.

Inadequate Infrastructures and a Weak Supply System: Infrastructures such as roads, market centers, information and communication technologies, warehouses, and others are necessary to sustain agricultural growth. Transportation of agricultural inputs to the production pockets help increase the production in a cost-effective way. Similarly, roads are needed to transport the produce from the production pockets to the market centers. Road networks can also attract traders to have direct contact with producers, resulting in farmers' initiatives toward commercial production. In addition, many other infrastructures essential to promoting overall agriculture development are yet to be established in the country. Similar is the case with the supply system. Insufficient local production, a weak transportation system, and poor intra- and interagency communication and coordination has further constrained the agricultural system.

Figure 4-3. Live animal market in southern Nepal. (Photo courtesy Ramjee Ghimire)

Gender and Disadvantaged Groups: Agriculture extension has clearly manifested the importance of women farmers in agriculture, and therefore, a policy of involving at least 40% of women farmers in agriculture programs has been in effect for several years. However, more attention has to be given to formulate women farmer specific programs and increase their participation. Women farmers should be provided with opportunities for more trainings, visits, and interactions, so that they can build their capacity to carry out agriculture programs efficiently. Similarly, priority has to be given to women to be in leadership positions. Additionally, disadvantaged groups are either marginal farmers or landless, so the normal extension program has difficulty in benefitting them.

Figure 4-4. Agrovet (supply store for farmers selling seed, fertilizer, animal feed, veterinary supplies, etc.) operated by a female technician. (Photo courtesy Ramjee Ghimire)

Weak Monitoring and Evaluation: Nepal is yet to realize the importance of monitoring and evaluation in agricultural development including extension services (Ghimire & Suvedi, 2017). Extension activities are rarely monitored as a result. When done, they are a ritual. Relying on output monitoring to gauge success or failures of any extension program or services is a fallacy that is misleading the whole extension value chain. For example, in the quarterly and annual review workshops that the Department of Agriculture and Department of Livestock Services and other MOALD departments organize, if an extension office is able to distribute 100 improved maize kits as stated in its program target, the implementors rejoice as if it's a 100-percent accomplishment. This is so adjudged irrespective of whether farmers sow those seeds, and the crops perform fairly and so on. In the same vein, another example to note is the annual progress reports of the ministry and the associated departments do not document program outcome and impact and instead report outputs only.

Ritual Communication Methods: Communication is an integral part of extension. Extension should use communication methods that suit its beneficiaries. Although a small country geographically, Nepal has many cultures and languages and not all people understand or speak the Nepali language. Much variation exists in the economic and educational level of farmers and agri-entrepreneurs, leading to vastly different information and educational needs. Extension workers may have to employ different communication strategies to reach out and educate them. Extension messages are only available in one language and mostly in paper forms that many users do not have access to or do not understand.

Poor Database: The following is critical to planning and implementing agricultural development programs: having a sound and updated database and profile of agricultural and allied industries that include but is not limited to arable and cultivated lands, crop types, livestock raised, production and productivity, farmer population in different ecozones, crop and livestock disease profile, market infrastructures, price of agricultural commodities, market operators, value chain of production systems and their players and their roles in the chain. However, data management and data updating have often been overlooked at all levels of agricultural services from the grassroots to the national levels, and by farmers and field workers to policymakers, which is affecting the entire agricultural planning.

Restructuring of Extension Organization: After the promulgation of the new constitution in 2015, agricultural extension services have been restructured into federal, provincial, and local levels. This restructuring was meant to streamline agricultural development. On the contrary, implementation of many agricultural development programs including those envisioned by Agriculture Development Strategy (ADS) 2015, has been affected. It is because ADS envisioned working through district offices that no longer exist. Further, ADS was supposed to support the implementation of the Local Self-Governance Act of 1999, which has since been replaced by the Local Government Operation Act 2017 (Devkota & Thapa, 2019). In the same way, District Agriculture Development offices and District Livestock Service offices do not exist anymore, the responsibilities of agriculture services delivery have been transferred to local agriculture units at municipalities and rural municipalities, which were not envisioned in the ADS.

Newly established institutions such as Knowledge Centers, units in villages and municipalities, seem to be understaffed. Staffs working in those offices also seem to be confused as nobody gives them clear guidelines about agricultural programs. Being new to the restructured system, local elected leaders also appear to be less effective in providing vision to their local services units. Resources there are also either limited or are not properly channeled. This could be the reason that many of the staff members who are asked to work in those offices are hesitant to go there. Hence, the numbers of extension agents deputed to these local units are far less than required for quality service delivery. The report of the 2018–2019 fiscal year showed that the major chunk of the budget allocated for agricultural programs could not be spent.

Weak Human Resource Capacity: Nepalese people have high expectations of elected officials as local government came into existence after a gap of more than a decade. Civil services should be strengthened in a timely manner to be effective to serve needy people. For this, public services have to be effective. None of this seems to be happening. First, newly elected people themselves seem to be less aware of their responsibilities, and they may have adequate knowledge to provide policy advice. Second, there appears to be a lack of culture of mutual respect, collaboration, and information and knowledge sharing between elected officials and public servants. Third, extension professionals from the senior level to those working in the field have basic degrees in a technical field but lack training on soft skills. Soft skills are critically important to connect with and effectively train beneficiaries. Fourth, there are minimal opportunities for refresher and in-service training or opportunities for higher education for extension professionals. This prevents them from updating their knowledge base that would otherwise be a catalyst to boost their performance.

Weak Implementation: First, there are over 100 plans, policies, strategies, and working procedures related to agricultural extension in Nepal, but only a few of them are being implemented. Implementation has been weak for all sectors including agricultural extension. It could be because sufficient preparation is not done about what, who, when, how, and where to implement the program. Second, individuals who are responsible for leading the implementation are not made accountable for any failure or slow implementation. Third, since there is no effective monitoring in place, if some issues arise during the implementation, they go unidentified and are not corrected.

Poor Coordination Between Extension, Research, Education, Farmers, and Private Sectors: Extension should be complemented by research and education, and research and education should get feedback from extension. Similarly, linkages of extension with the private sector including farmers, farmer organizations, and nonprofit sectors is essential for effective extension services. Such linkages are nicely mentioned in the planning documents but are rarely practiced. If at all practiced, such practices depend on individual extension workers' interest and initiation. There is a lack of a system that pushes and pursues such linkages. Linkages here mean functional linkages where all the parties meet, not necessarily in person, and share their knowledge and information and experiences. They give something and take something, fostering reciprocity among those involved.

Conclusions & Way Forward

The world is changing fast. Technologies are advancing and the world is being digitalized at a faster rate. Within a few seconds, development and changes happening in one corner of the world can reach the other corner. Countries, people, and markets are affected and influenced by those changes, technologies, and communication and information, no matter where they originate. Nepal, Nepalese, and Nepalese markets are affected and influenced too. Likewise, demands and needs of Nepalese farmers and agri-entrepreneurs are changing and they need improved technologies to improve their efficiency. This warrants new approaches, methods, and tools in extension and development. For example, climate change was not a big issue in the past, but it is the most pressing issue now. Similarly, food insecurity, migration, youth mobilization, gender equality, agribusiness and marketing, information and communication technologies (ICTs), animal welfare, and quality control are becoming more important than ever in agricultural systems. Extension professionals in Nepal who are the frontline workers should be competent to handle these agendas. Extension services must keep examining stakeholder needs and demands and be prepared to advise them accordingly. AES authority in Nepal should initiate a discussion inviting all agricultural stakeholders, farmers in particular, and assess what worked in the past and what did not work. If some activities did not work, extension professionals must identify why they did not, and what could be and should be done to address the needs and demands of the current and upcoming farmers.

The discussion leads to the conclusion that first and foremost, AES should train its extension personnel with new competencies. Poor performance of the extension services system is also attributed to the attitude of the extension staff. Factors contributing to the attitude of the staff members include incentives, training, rewards, housing facilities, office environment, workload, office supplies and office aids, among many. Second, extension professionals should be made accountable to their clients, the farmers, the entrepreneurs for their work. Those who are serving effectively should be rewarded.

Nepal should bestow high priority to demand-driven, decentralized, pluralistic extension services, and ICTs. Decentralized units have decision-making authority and are physically close to their beneficiaries. They plan and implement development programs with their beneficiaries' participation, making them sustainable.

ICT has virtually narrowed the world and has affected almost every walk of life. It is a power that could be harnessed by every services system including extension. The potential of this technology can be exploited to strengthen the capacity for educating rural farmers who have access to media. Information technology can address the difficulty in making face-to-face contact with the farmers and the problems with transportation.

Privatization of services is gaining momentum worldwide. The underlying reasons for privatization are the dwindling budgets of government, less productive government workforce, and discontent among people toward government services. Conversely, there are more resources, innovative ideas, and better services in the private sector. Several developed countries have fully or partially privatized their agricultural extension services through outsourcing, cost recovery, or contracting out mechanisms. Nepal can and should also try this approach at least with big and commercial farmers.

Pluralistic service delivery, the modality of using more than one organization, whether public or nonpublic for delivering extension services to farming communities, is gaining popularity. The pooling of all available resources reduces unhealthy competition, deletes redundancy of services, and compensates for low government budgets in agriculture. The main challenge is in ensuring effective coordination among various agencies. The government should take the responsibility for coordination, technical supervision, support, and quality control.

Nepal should give high priority to research, training and education, effective implementation and effective monitoring and evaluation of extension services. Research leads to creativity and innovation, helps diagnose problems hindering development, and foresees the future. Information important today may not be so a few weeks from now. Constant research and exploration must examine what is changing, how it is changing, who is involved or affected by it, and how to adapt to such changes.

Monitoring and evaluating the program is necessary to know how the program is running and what outcomes and impacts result. Output monitoring is essential, but more important and critical are the outcome and impact monitoring. Every extension staff member from senior officials in the ministry to those working in the field should be trained to monitor and evaluate the program they execute and then do it. External monitoring and evaluation through outsourcing are also suggested because it is more transparent and reliable.

Training and education are inevitable to hone knowledge, skills, and competence. Newly recruited extension professionals should get induction training where they will learn the basics of administrative procedures and processes to implement the program they are assigned to. New staff members should, as public servants, receive training on integrity and ethics. They should be taught how they will be evaluated and how they should behave with and be accountable to service seekers. Staff members already in service need in-service and refresher training on both technical and soft skills.

Extension is no longer just extension only. Extension is the umbrella or core area every technical professional whether in the field or in the regional or central office should be aware of. All personnel within agricultural services

should attend sessions on extension theory, approaches, methods, and tools in basic induction and refresher training.

Importantly, an institution grows, succeeds, and sustains, and is applauded and appreciated by both staff and beneficiaries if there is a proper learning environment, which is defined as "learning organization" and "organizational learning" (Merriam et al., 2007). Thus, extension management should underscore and understand the urgency of motivation and capacity development of extension staff. For this to happen, AES should provide working environment that is employee and learning friendly.

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CHAPTER 5

Revitalizing Agricultural Extension & Advisory Services in India

SPREAD NE INITIATIVE

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Introduction

Agricultural extension (broadly, the "delivery of information inputs to farmers") has traditionally been the primary means of reducing the information asymmetries related to technology adoption in both developed and developing countries (Andersen & Feder, 2007). In many parts of the world, extension services are constrained by several factors such as distance, time, and costs involved for farmers accessing these services. As a result, conventional face-to-face extension services meet the needs of only a small proportion of farmers (Anderson & Feder, 2004; Graeub et al., 2016).

Research and extension played a major role in bringing about the green revolution in India. Extension services however, face important challenges in the areas of relevance, accountability, and sustainability in the post-green revolution era (Ferroni & Zhou, 2012). India's changing economic scenarios and the need for appropriate agricultural technologies and agro-management practices to respond to food and nutritional security, poverty alleviation, diversifying market demands, exports opportunities, and environmental concerns are posing new challenges and threats to the technology disseminations and rural development systems (Sharma, 2002). Therefore, any future agricultural growth would accrue from improvements in productivity of diversified farming systems with regional specialization and sustainable management of natural resources, especially land and water.

In India, public extension began long before the green revolution, evolving with national priorities (Singh & Swanson, 2006). However, with the ever-increasing agriculture production demand, it is becoming increasingly evident that public extension by itself can no longer respond to the multifarious demands of farming systems. There is need for reappraisal of the capacity of agricultural extension to effectively address the

contemporary and future needs of the farming community. Public funding for sustaining the vast extension infrastructure in the country is also under considerable strain due to the need to extensively cover large areas. Meanwhile, in response to market demand, the existing public extension network is being complemented, supplemented, and replaced by private extension. As the nature and scope of agricultural extension undergoes fundamental changes, the outlook calls for a whole new pluralistic approach of institutions and agencies (Birner & Anderson, 2007; Christoplos & Kidd, 2000). Agriculture extension is no longer only a public sector phenomenon; it now involves a more complex range of actors providing a wide range of services. This has therefore allowed various actors and private agencies to provide extension and advisory services. The Society for Promotion of Rural Economy and Agricultural Development in North East (SPREAD NE) (or "the society") is the quintessential example.

SPREAD NE Genesis

SPREAD NE has its roots in 2005 when Samir Bordoloi, an agricultural graduate, started a one-room plant health clinic in Jorhat, Assam, India, to give prescriptions to people about their plants. When no one showed up, Bordoloi began riding his bike, toting a backpack filled with organic input, to the remotest villages of Upper Assam. He gave out unsolicited advice about sustainable organic ways of farming. Slowly, as farmers saw the benefits of his methods, they started warming up and accepting his services. Within a year, the farmers would be waiting for Bordoloi's bike. Later, Bordoloi ventured into rural schools. These village schools provide free standard education to rural low-income children who were enthusiastic learners keen to learning anything that they could relate to. Due to the success he had with one of the school visits, he ended up launching a vermicompost brand named after the school: Chitralekha. From this little project, the children started learning. Very soon, their mothers wanted to learn. The students had become an agent of change. This inspired him to think of ways and means to further scale his work and expertise.

Since he was a graduate of Assam Agricultural University (AAU), Jorhat, Assam, he was offered a job as agricultural extension officer in the government of Arunachal Pradesh. However, with the urge to get more exposure to farming practices in different parts of the country, he chose to instead join Rallis India Limited (a Tata Enterprise) in their agrochemical division. He was assigned to Jorhat, which exposed him to hundreds of farmers in Upper Assam. With some qualitative training programs on self-development and time, he developed the self-confidence to start something on his own to serve farmers of his area. They were pushed to monocropping of tea using lots of chemicals and fertilizers, making their village life amidst a cocktail of chemicals. He began his first venture in 2003, SS Botanicals, an agri-clinic, agri-business center, and plant health clinic, established in Jorhat. The clinic aims to provide curative solutions to farmers about raising plants and judiciously utilizing the land. Trained under the National Institute of Agricultural Extension Management (MANAGE), Hyderabad, Telangana, with the Indian Society of Agribusiness Professionals, Guwahati, Assam, Bordoloi was supported by the State Bank of India and the Indian Bank to reach more and more farmers and steer them toward organic farming initiatives. He could reach more than 20,000 farmers through his clinic. He introduced the concept of the Krishok Bandhu (Farmers' Brother) Help Card, making the

farmers members of the clinic and offering them profit-making and value-added services. SS Botanicals provided organic solutions, soil testing, agro-tourism ventures, publication of farmers' monthly magazines such as *Prakriti* (Nature) and *Seuj Chinta* (Green Thinking), and forward and backward linkage development. MANAGE, Hyderabad, provided him with hand-holding support and promoted his works in various platforms. With time, the demands for his services increased making him aware of the urgent need to develop innovative ideas to diversify his reach and approach.

SPREAD NE Initiatives

SPREAD NE aims to get local people of the northeastern (NE) states of India to eat local food from local resources and stresses promoting ethnic people, ethnic food, and ethnic economy for achieving sustainability. (We define *ethnic* as that pertaining to characteristics people who identify with each other share based on similarities in culture and food habits.) The society seeing the potential of the NE region has a mission to promote organic farming to make its farmers "independent self-sustaining entities." With an attempt to revolutionize farming in the NE, Bordoloi through SPREAD NE now teaches and trains budding farmers and small entrepreneurs to use innovative farming and food techniques. Apart from training, the society has developed the Farm Learning Centre (FLC) and various others programs to train, educate, expose, and instill among the children, youth, and farmers to be custodians of their natural resources. Some of the extension programs and initiatives of SPREAD NE particularly to empower the youth on ecological farming skills and entrepreneurships are explained in the following sections.

SPREAD NE FLC

FLC is a three-day camp in various centers in the NE: Sonapur, Jorhat, and Tinsukia in Assam; Dimapur and Jalukie in Nagaland; and Imphal in Manipur. These organic farm model camps created by the society consist of a fishery and food forest that provides youngsters a platform for hands-on training in organic farming. The camping sites are open-air natural classrooms with farm tents to teach youth to learn life at its best. The youth come from different parts of the NE states and train to be Green Commandos.

Figure 5-1. A session at the Farm Learning Centre in Sonapur.

The *biophilia connection* is an innate affinity or connection of humans toward the natural world. The concept behind the FLC is recapturing the biophilia connection in NE India by re-establishing that human relationship with nature by creating an edible food forest. SPREAD NE and its members

believe that children have to be prepared to think as extended ecological selves to have biosphere consciousness. This ability might well determine whether they will be able to create a new, sustainable relationship with the Earth in time to reverse the climate change trend and halt human extinction. The FLC aims to develop youngsters' innate connections so that they act as a part of a universal family that includes not only fellow human beings but all fellow creatures and nature as a whole. One major step to care for the environment and for a sound health of humanity is to conserve the local food wisdom to escape the invasion of unhealthy foods, which are products of industrial big sale farming. We must grow our own food based on the principle of "Indigenous People—Indigenous Food—Indigenous Economy."

> *"At the FLC, I learnt to manage organic waste, composting and ecological farming at the camps. Then I started taking this concept to our urban spaces where I tried to link it with rooftop gardening and urban waste management. Moreover, we also realized that we are eating unhealthy food."*
>
> —Ms. Ittisha Sarah, one of the participants of the FLC

Green Commando

A practical approach is needed to combat the adversities of climate change and that must be led by the young people. With this in mind, SPREAD NE intends to create a green tribe of human beings by the action of their trained Green Commandos, whose mission is to spread ecological food production practices and green living concepts to the communities.

Figure 5-2a. Green Commando training at the Farm Learning Centre.

Figure 5-2b. Hands-on Green Commando training on working with raised beds at the Farm Learning Centre.

Figure 5-2c. Hands-on Green Commando training at the Farm Learning Centre.

Green Commandos are trained agents in the FLC and social entrepreneurs who promote the Indigenous People—Indigenous Food—Indigenous Economy concept in their communities. A Green Commando must undertake the following training modules:

- Level 1 Green Commando training program for three days at the farm camping sites and various centers
- Level 2 Green Commando training program for five days at the farm camping sites
- Level 3 Green Commando training program for 10 days at multi-location farm sites
- Green Commandos refresher training program for three days

> *"The first time Ittisha Sarah, a 25-year-old resident of Guwahati used a koor (a heavy-duty spade), she did it effortlessly. She was with a group of 20, on a hilltop in Sonapur, about 15 km from Guwahati, digging and planting saplings in silence. Now when she looks back, she realizes that it was probably a sense of zeal instilled by just being in nature that made the process of wearing gum boots, using a koor, digging a pit, and planting saplings so effortless. Of course, it is hard work, but somehow when it is all done and dusted she did not feel it was. Since May 2018, Sarah has been a certified Green Commando—a new-age farmer, whose primary aim is to bring back to the plates of the population, healthy, wholesome, indigenous local food.*
>
> *"Prerona Probor Gogoi, a 27-year-old technical officer at the National Food Security Mission in Dibrugarh, Assam, devotes his second and fourth Saturdays 'to the community.' He, too, is a Green Commando, and has adopted a local school where he teaches kids how to make vermicompost beds, rustle up bio-pesticides, and grow vegetable patches at home."*
>
> —Samir Bordoloi

"I was always interested in sustainable farming but there was very little opportunity in urban spaces like Guwahati. When I was told about Spread NE, I immediately applied for their training programme to become a Green Commando. Our job as a Green Commando is to spread awareness about organic farming and bring as many farmers as we can under our wing. Not everyone knows the exact meaning of organic farming and it is up to us to teach them that."

—Chandeep Gogoi, participant of the Green Commando program

"As part of my work as a Green Commando, I adopted the Malowpathar village. I started teaching how to make vermicompost to the farmers here and soon enough, the kids also joined us. My work is to support the locals and ensure that local food brings money to the villages. The village was adopted about two months ago and already, 27 families are benefitting from the initiative."

—Kirtiman Borah, participant of the Green Commando program

Farmer's Exposure-Cum-Training Program on Zero Budget Ecological Farming Practices

SPREAD NE conducts an exposure-cum-training program for farmers in the already established FLC. They are also given hands-on training on Zero Budget Ecological Farming Practices (ZBEFC) in the following modules:

- One-day exposure to the Zero Budget Edible Food Forest and hands-on training on soil management practices
- Three-day Farm Camping and Training Program on ZBEFC
- One-day Meet the Expert Program on ZBEFP
- Five-day Exposure-cum-Training Program on fish farming
- One-Day Homestead Garden Development Program for women
- One-day Solid Liquid Resource Management Program (Waste to Wealth)

Figure 5-3. Exposure-cum-training program on the Zero Budget Edible Food Forest.

Farm Extension Services

The society has experts from various domains of national and international repute who work extensively when called upon to provide advisory services in the following fields:

- Ecological and organic farming practices
- Fisheries

- Animal husbandry
- Social mobilization and group dynamics
- Agricultural finance
- Farm and village tourism
- Value addition and marketing
- Micro-irrigation
- Apiary

SPREAD NE has time and again on a continuous basis supported the various government extension mechanisms in agriculture as a private extension system by rendering the latest and practical solutions for the farmers through their consultancy services. They assist budding agripreneurs in drafting their Detailed Project Report providing hand-holding support.

Attracting Students to Agripreneurship Program

Green space and an edible food forest in the school campus support healthy child development. Children today have less opportunity to explore themselves in nature and understand practically the world around them. Through the Attracting Students to Agripreneurship Program, the students are drawn to eating healthy food by having the experience of growing it themselves. It builds nutritional stewards who learn to grow their own local food and also sows the seed of agripreneurship in the minds of the students.

Under this program, the following services are offered:

- Three-day farm camping and hands-on training on creating an edible food forest
- One-day exposure visit to the society's Edible Food Forest and interaction ecological farming expert
- Formation of school green tribe club and establishment of school edible food forest
- Meet the Expert: One-hour interactive session with National Awardee Zero Budget Ecological Farmer Samir Bordoloi
- Back to the Roots: One-day exposure trip to the society's model villages

Figure 5-4. Samir Bordoloi during one of his visits for establishing an edible school forest.

YATRA: Farm & Village Tourism

Yatra is a Hindi word meaning "a journey." The society conducts group yatra for its trainees and visitors so they can adapt, learn from nature, and enjoy the roots from which they emerged. It's a learning process where the trainees visit the society's farms in the NE and one near Goa. The visit to the farm and villages allows them to interact with the society's farmer friend, motivating them toward good food production, and also to learn from the farmers' practical skills. The concept behind organizing yatras is to slow down the pace of life and find the inner self and our biophilic attraction. The society organizes three yatras in a year with 20 *yatris* (pilgrims or individuals).

Farm Connects

Market-led extension services are extended to the society farmers and gardeners by providing market linkages for the farmers' product and by helping them in Fair Price Recovery. SPREAD NE motivates urban consumers to "adopt a farmer" for their food and utilities produced in their farms and villages thereby ensuring them an assured market.

Vision

The SPREAD NE aims to connect the indigenous farmers and the local consumers through local and natural food. To conserve the local food wisdom by making our farmers grow local food crops and rear animals through low cost ecological farming practices and to involve the Green Commandos (Social Agripreneurs) to connect people to small farmers through healthy food.

The food items at the Farm Connect at AAU, Khanapara, Assam, comes from the FLC at Sonapur; the model villages of Bandorgok, Kolongpur, and Dondoral; from the farmers of the Green Commandos working in the states of Meghalaya, Nagaland, Manipur, and Arunachal Pradesh; and all districts of Assam. After the Green Commandos complete their training, they adopt a community of small, marginal, and tribal farmers and train them on low-cost ecological farming practices under our flagship program "Amar Bari Amar Proichoy" (Our homestead gardens are our identity). Through the Green Commandos' help, the farmers' cost of cultivation is reduced by training them on Zero Budget Ecological Farming Practices. The Green Commandos ensure proper nutrition of the farm families, and then convert the surplus into marketable products by creating community enterprises of farmers. When finalizing the price of the farmers' produce, 15% is added on the farmers' price per kg for the sustenance of the Green Commandos and another 15% for the transport, packaging, logistics, and maintenance of the store, and 5% for the organization.

Figure 5a. Farm connect outlet at AAU, Khanapara, Assam.

Figure 5b. Farm connect outlet at AAU, Khanapara, Assam.

Figure 5c. Farm connect outlet at AAU, Khanapara, Assam.

Conclusion

"To start a change, one must change oneself first." The SPREAD NE, through its various programs, strives to inculcate and educate millennial farmers who can in turn spread awareness and act as agents of change through their extension services in any form. Since the extension services required are changing rapidly, they should suit the current context, from production orientation and profit making to long-lasting benefits of sustainable farming.

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CHAPTER 6

Agricultural Extension, Education & Outreach Programs

CASE STUDY OF INTEGRATED PEST MANAGEMENT PROGRAMS IN CENTRAL ASIA

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Executive Summary

Since independence from the former Soviet Union, countries of Central Asia are putting concerted efforts to enhance agricultural productivity, food security, and livelihoods of mountain communities. Rebuilding extension and outreach programs for effective transfer of advisory services and technologies has been one of the key components of agricultural and rural development programs. In this context, Michigan State University (MSU) in collaboration with local institutions and international organizations implemented a 10-year program of integrated pest management (IPM) from 2005 to 2014 focusing on food security crops. The project was implemented in three countries: Kyrgyzstan, Tajikistan, and Uzbekistan. This paper describes innovative extension and outreach programs implemented to empower local farmers and students through farmer field schools (FFS), student field schools (SFS), and on-farm demonstrations as well as the lessons learned from these programs. Continued efforts and investments will be required to enhance and sustain extension and outreach programs in Central Asia.

Introduction

Central Asia consists of five countries of the former Soviet Union: Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, and Turkmenistan. Since independence from the former Soviet Union in 1991, these countries are working to rebuild their agricultural research education, extension, and outreach systems to enhance agricultural productivity, food security, and livelihoods. Central Asia with a total population of about 74 million and a land area of 3,926,790 km2 (worldometer.com, 2020), which occupies about 10% of the Asian continent, represents an important geostrategic region of the world.

During the former Soviet Union rule, the agricultural food system was centrally planned with each country specializing in specific crops (Babu & Pinstrup-Andersen, 2000; Hofman, 2018). The policy reforms during the past 25 years have led to land reforms from state-owned cooperative farms (known as *sovkhoz* and *kolkhoz*) to family-owned private farms (Abazov, 1999). Agriculture continues to play a key role in the economic revitalization of the region. Kyrgyzstan and Tajikistan are both mountainous countries with less than 10% of arable land for farming. In Kyrgyzstan, agriculture, forestry, and fishing contributes to 11.6% gross domestic product (GDP), while in Tajikistan, agriculture, forestry, and fishing contributes to 19.2% GDP (World Bank, 2018). Moreover, the mass migration (more than 2 million people) of the able-bodied population has devastated the country and hampered the development of agriculture. Currently, mainly women, children, and elderly people work on the family farms.

For the past several years, the national government and international development agencies are putting concerted efforts toward rebuilding research, education, and outreach systems to develop and disseminate new technologies and provide technical assistance and advisory services to family-owned private farms and support diversification agricultural systems for enhancing food security and family livelihoods. In the post-Soviet era, in the absence of government-supported extension programs, nongovernmental organizations (NGOs) have played a dominant role in providing advisory services and technical assistance to family-owned farms. The policy reforms, however, are encouraging development of extension programs through government-supported institutions, local universities, and civil society organizations. In this way, new technologies and knowledge generated by public institutions can effectively reach local farmers and end users.

To contribute to government efforts to develop and enhance agricultural extension and outreach programs, MSU, in partnership with the International Center for Agricultural Research in the Dry Areas (ICARDA), designed and implemented a regional program in IPM in Central Asia. Through the support from the U.S. Agency for International Development (USAID) IPM Innovation Lab and MSU, this collaborative research, educational, and outreach program was implemented in three countries from 2005 to 2014 covering Kyrgyzstan, Tajikistan, and Uzbekistan. The program focused on development and implementation of ecologically based IPM packages for three food security crops: potato, wheat, and tomato.

The regional IPM program focused on bringing new knowledge and approaches for ecologically based IPM including landscaped ecology,

conservation biology, biological control, and resistant varieties as well as cultural practices for pest management. The project focused on development and delivery of IPM packages for potato, wheat, and tomato through on-farm demonstrations, FFS, SFS, and other approaches (Maredia & Baributsa, 2007; Maredia et al., 2016).

Participatory Approach to Design Development & Implementation of IPM Extension & Outreach Programs in Kyrgyzstan

In 2005, the first stakeholder`s forum took place in Tashkent, Uzbekistan. In 2008–2009, as part of the ICARDA–MSU project, a field study was conducted in Kyrgyzstan to reflect farmers' knowledge on some elements of management of soil, plant pests, and irrigation practices. Such type of work was carried out as part of the project activities in Tajikistan in 2009–2010.

Figure 6-1. Participants at the 2005 Central Asia IPM Stakeholder Forum in Tashkent, Uzbekistan.

The study included a survey of the farms' owners by applying a random-selection method. The selection of households was carried out in the following way: if a village had up to 100 households, then every tenth household was interviewed; if a village had from 100 to 300 households, each fifteenth was surveyed; if a village had from 300 to 500 households, then each twentieth was surveyed. A total of 105 household owners were interviewed, including 96 men and nine women.

The study outcomes revealed that in Kyrgyzstan, mainly middle-aged and older people practice agriculture, which is typical for the whole region. Young people generally study in the higher and secondary educational institutions and move to the cities.

In rural areas of southern Kyrgyzstan, people who work in agriculture are from 46 to 58 years old, whereas, in northern Kyrgyzstan people who work in agriculture are from 36 to 44 years old. Members of their families on average consist of seven people in the southern regions and six people in the northern regions. To have sufficiently good harvest on their land shares, on average, five to six adults and two to three children work. In recent years, the interest of young people wishing to stay in the rural areas and to engage in agricultural activities declined sharply. Many of them grow tobacco and vegetables by leasing land in Russia and Kazakhstan. They also raise livestock, engage in construction work, run small businesses, and work in other capacities. This is largely due to the limited arable land and the socio-economic situation of the republic. In southern Kyrgyzstan, a medium farmer has from 0.3 to 1.4 hectares, while in the north, a medium farmer has 1.2 to 2.2 hectares of irrigated land.

Farmers mainly grow several types of crops on their fields, but the third part of the land is usually reserved for wheat. Onion, potato, cucumber, and tomato are the main vegetable crops for cultivation. The goods produced are sold at the local market or directly from the field to middlemen or traders. These crops account for 80% of the total income of the rural population. The price of the produce in the market earns from 6 to 20 kgs or 0.1 to 0.2 USD. Farmers of the northern region of Kyrgyzstan grow mainly potato, garlic, wheat, cabbage, perennial herb, bean, and medicinal herb. The produce they sell earns on average 8 to 20 kgs or 0.3 to 0.25 USD per 1 kg to middlemen or dealers from Kazakhstan and Russia. Farmers rarely sell directly to the wholesale markets.

The study's outcome revealed that the main decisions in the farms in the northern region are made by men. For example, a decision to purchase pesticides in a household is usually made by a man. Perhaps this is due to cultural norms. However, in southern Kyrgyzstan, decisions are often made by women. This might be explained by the great migration of men from southern Kyrgyzstan to Kazakhstan and Russia. While in the north, the main decisions are made by men, since the migration in this region is much less compared to the southern regions of Kyrgyzstan (see Table 6-1).

Table 6-1. Who purchases pesticides in households, by region.

#	Region	Husband Purchases	Wife Purchases	Both Purchase
1	North region of Kyrgyzstan	66	27	54
2	South region of Kyrgyzstan	44	63	46
3	Total	100	100	100

All the interviewed farmers realize that pesticides detrimentally affect the health and environment, but none of them gave arguments or examples of family members having some health problems associated with the use of pesticides. However, the majority of farmers indicated in the questionnaire that pesticides might contaminate the water, which in turn contributes to its losing taste and clarity. In their views, only application of the large quantities of pesticides affect the quality of agricultural products. Farmers

from the southern region of Kyrgyzstan compared to the northern region use different types and more varieties of pesticides.

The interviewed farmers get information about sale of seeds from various sources. According to the survey, 22% of farmers received information from the FFS where they took part, 25% of farmers from advisory services, and 44% from their neighbors. Thus, vegetable growers have more confidence in their neighbors than in other sources. Farmers often do not apply to the government agencies to get information and knowledge. They are more satisfied with the information received from the neighbors, FFS, and advisory services.

Figure 6-2. Students preparing soil for planting tomato seedlings in the SFS Field, Bishkek, Kyrgyzstan.

Knowledge About Vegetable Crop Pests

Kyrgyz farmers who were interviewed reported they have problems with pests such as aphids, Colorado potato beetle, cotton and winter cutworm, cabbage white butterfly, slug, thrips, onion fly, and spider mite. They mainly use chemicals to control these pests, with the exception of only a few farmers in the northern region who said that they use botanical pesticides (for example, extract from the tomato tops, potato, garlic, and hot pepper with soap emulsion). Given the importance of knowledge and information for farmers, the Central-Asian IPM project has released a brochure in the Kyrgyz, Uzbek, and Tajik languages. The Proven Folk Medicine describes more than 40 recipes of botanical pesticides. To control pests of vegetable crops, 49% of farmers reported using chemicals, while 30% use traditional/folk methods, including botanical pesticides; 12% have an idea of the biological method; and 9% do not know of any of the previously mentioned methods.

Knowledge About Beneficial Insects

It was interesting to find that 62% of farmers surveyed agreed with the general opinion of farmers that pesticides increase or help to increase crop productivity, and at the same time, they confirmed that the natural beneficial insects on the fields treated with pesticides are reduced by 8 to 10% or 3 to 4 times per cropping season, whereas 25% of them did not agree with this opinion.

The respondents, 86% of whom were older (age 50 and older) agronomists-farmers had a fairly good knowledge of natural beneficial insects. They listed three or four species of beneficial insects such as lacewing, lady bird, ground

beetle flies, and Trichogramma. The older (age 50 and older) farmers (who were former employees of the collective and state farms) could name two beneficial insects such as Trichogramma and lacewing. Young (younger than 50) farmers were able to name only one type of beneficial insects—lady bird.

While inspecting the fields, the majority of farmers focus on the growth of plants, the presence of pests, or diseased plants. Many of them do not even think of visual observations of beneficial insects either by type or simply by their presence in their fields. This largely is caused by the inaccessibility of information and insufficient knowledge of farmers about beneficial insects. However, they could easily list the names of pesticides and their use.

More than 85% of the farmers surveyed, with the exception of the older (age 50 and older) agronomists, believe that the destruction of beneficial insects in their fields does not lead to the spread of pests, and 14% did not observe or hear about such allegations. Four regional biological laboratories function in Kyrgyzstan; however, out of the interviewed farmers, only 7 to 12% use biological products from these laboratories. Sixty-five percent of the surveyed farmers from the northern and southern regions of Kyrgyzstan control pests of vegetable crops by the use of chemical pesticides; 10% of farmers use irrigation methods; 14% of the farmers use resistant varieties; and the rest of the farmers control pests by traditional methods.

Farmer Field Schools in Kyrgyzstan & Tajikistan

The FFS built on the previous experiences and other programs of NGOs in Central Asia. In the absence of an organized extension system, the FFS approach was most suited to empower local farmers and disseminate information and best practices through training of farmers.

FFS in Kyrgyzstan and Tajikistan had the following tasks: (1) transfer technologies; (2) develop human capital, including technical and management skills and knowledge in all categories of farmers; (3) create and develop a social capital, or unite farmers into the groups in various production areas, including forming groups of the rural youth aiming at sharing experiences, for example, experience of the United States; and (4) educate farmers on sustainable management of natural resources to mitigate the consequences of the climate change.

Over the past 10 years, the methods and approaches for dissemination of the agricultural advisory services in Kyrgyzstan underwent changes. The establishment and expansion of the FFS played a big role. The FFS experience was introduced in the Gissar region of Tajikistan in 2006 through the ICARDA–MSU project, and with NGOs such as Public Association AgroLead and Training and Extension Center (Saidov et al., 2007). The IPM program through FFS (IPM/FFS) has been successful and widespread in more than 90 countries around the world because of demonstrating effectiveness in improving farmers economic situation by increasing yields via sustainable agriculture (Kaseeva & Geraedts, 2007).

In 2007–2008, the ICARDA–MSU project demonstrated and provided the FFS farmers from the Chui region and the Alai, Chon-Alai region of Kyrgyzstan and the Kyrgyzstan Mountain Societies Development Support

Programme (MSDSP KG)/Aga Khan Foundation (AKF) with pheromone traps from Uzbekistan and MSU to be used against cutworm and cotton worm. It was the first step in introducing and promoting methods of pest control in Kyrgyzstan (https://bit.ly/3oxl1CJ). Gradually, FFS have been introduced in all regions of Kyrgyzstan. In 2008, a network of IPM trainers was established with the official name Public Association "Talaa Mektebinin Trenerleri" (Trainers of Farmer Field School), which had received an official registration in the Ministry of Justice of the Kyrgyz Republic as a legal entity. Moreover, the trainers developed their brand "Altyn Tushum" (Golden Harvest) and logo: "Trenerlerdin emgegi—Altyn tushum bergeni." (Trainers' labor results in golden yield.). In total, in Kyrgyzstan, more than 10 consulting biological companies have been engaged in training of farmers on the approaches of the IPM/FFS program. Some of the companies successfully proceeded with implementing this program and continue to do so.

One of the main components of the FFS program is to perform icebreakers and games. Given the importance of this component, the Training of Trainers (ToT) in Kyrgyzstan with the support of the ICARDA–MSU project published a collection of icebreakers and warm-ups titled *The Group Dynamics and Team Building*, the collection was distributed to other FFS in all regions of Kyrgyzstan.

In a 2006–2008 collaborative project by ICARDA–MSU, Dr. Utto (The German Academic Exchange Service Deutscher Akademischer Austauschdient) and Dr. Chylpakova (The National Academy of Sciences, Kyrgyzstan) implemented a master's project "Physiological Observation of Nectariferous Plants in the Conditions of Chui Valley," which was done by Ms. Duishenaliva a student from the Kyrgyz National Agrarian University (KNAU). Her master's research aimed to impart research skills to the KNAU students and to study the attractiveness of beneficial insects in the local nectariferous plants with different flowering periods. ICARDA–MSU gave an opportunity for KNAU students to work on 1 ha of the experimental plot in the Botanical Garden of the National Academy of Science.

The FFS farmers have never received direct answers to their questions from the facilitators and trainers. Instead, the farmers analyze the situations, conduct experiments, and receive answers to their questions as a result of their own studies. In 2008, ICARDA–MSU supported FFS MSDSP KG/AKF in the mountainous region of Kyrgyzstan (2300 m above sea level) by providing 14 varieties of seed potatoes from MSU. At the beginning, in the middle, and at the end of the physiological season of potato production, ICARDA–MSU conducted three field days for farmers in which the participants became acquainted with the new potato varieties developed by the scientists from MSU. The participants shared their experiences, tasted chips made from all the potato varieties, and took the initiative to organize an annual festival, Potato Day, in the mountain regions. The ICARDA–MSU staff members for the first time introduced and showed farmers how to manage potato fields by intercropping of nectariferous plants and other crops based on the results of master's work.

For the first time in FFS, the farmers have seen the principles and approaches in constructing the flower-nectariferous conveyor for additional nutrition of beneficial insects in agro-pastoralism. During the first year, FFS farmers have established a flowering nectariferous conveyor, planting such plants as cumin, dill, fennel, coriander, and buckwheat and by using the principle of multiple planting dates. Plants have been planted with double

sowing dates with 7 to 10 days intervals in every 10 rows of potato. In the first and the second year, the FFS farmers conducted an agro-ecosystem analysis and obtained the following results: cumin, dill, fennel, and coriander are able to extract a large amount of nectar in the mountain regions, and thus, they attract beneficial insects during the day. However, buckwheat is not nectariferous below 15 °C and above 25 °C, and does not attract beneficial insects at all.

The FFS farmers and participants of the field days have learned how to use nectariferous plants along with the potato plants and have benefits from both plants. The farmers have seen two simple methods for inspecting soil quality and in the future, they will be able to do it themselves. The first method is to roll out the wet soil between the fingers. The second method is to dig out a hole, then to put the soil back into the hole, and if the soil is good, then it will not fit into the hole. This method was taught by researchers from the University of California–Berkeley. Thus, during the field day, farmers realized that humans are not able to stop the flow of dust alone, but they can help and initiate its start. It was a new FFS approach of the ICARDA–MSU.

IPM MSDSP KG/AKF has been developing the entire value chain: from eliminating the restrictions in the field of regulation to facilitating the farmers' access to credits, resources, and equipment necessary for production. The program is implemented in accordance with the integrated approach that allows improving the agronomic systems, to reduce costs and to enhance the ability of farmers in marketing of their produce.

Thus, the key reason for the success of FFS in Central Asia is creation of "social capital," expressed in the experience of human resources, which have been developing over the past 12 years. With increasing the number of trainers and experienced farmers, as well as enhancing their skills in each of the countries, the potential of the IPM program is increasing too, which after the expansion and improvement could become an important regional factor in supporting agricultural development in all its diversity.

In 2006 and 2007, the ICARDA–MSU project in Kyrgyzstan and Uzbekistan took photos of the diseases, pests, and weeds in potato and tomato plants, which subsequently were used in creating a pocket book for farmers. In 2007, the experience of Kyrgyzstan was introduced in Tajikistan, with the support of the ICARDA–MSU project. The project has trained six national trainers from the Scientific-Research Institute of Plant Protection of the National Academy of Sciences of Tajikistan, which established three FFS with the support of the ICARDA–MSU researchers (Aitmatov et al., 2007).

In 2011–2013, the ICARDA–MSU project in partnership with the University of Central Asia (UCA) conducted the study on monitoring and scientific research activities carried out at demo plots within the frameworks of the project "Increasing Biodiversity and Economic Development in Mountain Areas of Kyrgyzstan."

Due to growth of social vulnerability and reduction of biodiversity in the areas of the Pamir-Alay and the Tien Shan, two agencies, including MSDSP KG/AKF and the UCA proposed objectives on implementation of the project. These objectives were aimed at collection of information and knowledge as well as at performance of experiments in uplands with regard to planting of aboriginal ethno-crops. This was for the purpose of improvement of nutrition quality and stimulation of economic development of the population of mountainous regions.

With the help of the Aga Khan Foundation and in cooperation with local experts, the MSDSP KG/AKF and scientists of the republic performed analysis, collection, and documentation of aboriginal fruit-and-berry plants as well as shelter break plants, inherent to conditions of the Pamir-Alay and the Tien Shan on the basis of literature resources.

Based on the recommendations of experts, at the end of April, the MSDSP KG/AKF through its program "Mountain Societies Development Support" performed planting of the recommended, economically and ecologically expedient plants on five demonstration plots of Alay, Chong-Alay, and Naryn.

Fruit-and-berry plants, presented and recommended by experts, are valuable; the most actively used types were introduced into culture as cultivated cultivars, which are vegetative propagated clones or mixtures of clones.

The demonstration plot is located in the Boz-Karagan village of Alay Region in the household plot of farmer Mr. Matiev.

Student Field School at Kyrgyz Agrarian University, Kyrgyzstan

The governments in Central Asia have been encouraging local universities to play a role not only in teaching and research but also in outreach to farmers and local communities, as well as in the building of the next generation of leaders for service to society. In this context, a novel concept of the SFS was introduced at KNAU based in Bishkek, Kyrgyzstan. First, the SFS was launched in 2008 with a group of five students. Several faculty members from KNAU were engaged in SFS programs, providing their expertise to students in various areas of IPM. The goal was to apply basic principles of IPM to a real-world field situation using tomato crop as a case study.

SFS included three interrelated educational components: (1) **general component**, where students were provided with general knowledge on agriculture, entomology, research design, methodology, and plant protection; (2) **practical component**, where students' training was based on experiments, observations, discussions, decision-making, skills enhancing, and preservation of the biodiversity of agricultural landscape by applying the FFS-IPM approaches; and (3) **ToT component**, which was aimed to show students trained as specialists in agriculture to train some categories of farmers (adult trainees). Courses had two target groups: teachers-trainers of the university and students. In 2007, the first group consisting of five teachers completed the full program of seasonal ToT/IPM/SFS course through the ICARDA–MSU project at KNAU.

The outcome of the SFS was significant. A total of 32 students completed SFS, receiving a certificate of completion. Students were able to do hands-on field research experiments to enhance their classroom knowledge. Their research results were reported at conferences and meetings and also gave students opportunities to interact with students, farmers, representatives from NGOs, and researchers from national and international universities and intuitions. The new approach that was used in the SFS motivated 13 students to continue their studies in graduate school. Five students successfully completed their master's degree at local universities and one student was selected to study in the U.S. Lastly, six post-graduate SFS

students organized one-month short-term ToT at Tajik Agrarian University, Institute of Zoology and Parasitology of the Academy of Sciences of Tajikistan, and Plant Protection and Plant Quarantine Institute, which led to establish new FFS in Tajikistan. At the end of the program, students received a certificate of completion. Moreover, through the FFS project, a number of books, pocket books, field guides, terminology manuals and dictionaries on diseases as well as pest manuals and training manuals were developed and published both in local Kyrgyz and Russian languages.

Figure 6-3. Students planting tomato seedlings in the SFS field, Bishkek, Kyrgyzstan.

Lessons Learned & the Way Forward for Enhancing Agricultural Outreach & Extension Systems in Central Asia

This decade-long project produced remarkable results and impacts in the Central Asia region. The key achievements of this long-term project included:

- **Broken isolation from the global IPM community:** The project helped reconnect IPM specialists and other stakeholders in the region with the U.S. and global IPM community.
- **Ecologically based IPM packages for food security crops:** The ecologically based IPM packages were demonstrated to local farmers in Central Asia for wheat, potato, and tomato systems where these crops are traditional food security and staple crops.
- **Empowerment of local farmers, scientists, and students:** The project empowered more than 1,500 participants through FFS and advisory services. More than 15 students from Central Asia underwent training at research and demonstration sites through collaboration with local universities. Three students from Tajikistan, Kyrgyzstan, and Uzbekistan received opportunities to earn graduate degrees at MSU. Sixteen scientists from countries in the Central Asia region attended International Agroecology, IPM, and Sustainable Agriculture short courses at MSU.
- **Publications and sharing of information with stakeholders:** The project team prepared more than 100 publications and extension

materials such as leaflets, bulletins, brochures, proceedings, scientific papers, posters, crop calendars, and book chapters on various aspects of IPM in tomato, wheat, and potato crops. These materials were widely distributed to more than 5,000 Central Asian stakeholders (researchers, students, extension specialists, and farmers) during extension and outreach programs such as FFS, SFS, farmer field days, workshops, and five regional IPM forums in Central Asia. The majority of publications were made available in Russian and local languages. More information on the project is currently available at https://bit.ly/2TwukEw.

At the end of the project, a regional workshop was organized in Tajikistan in August 2014 to share its results and achievements with stakeholders and seek their input for future collaboration. The workshop participants produced the following recommendations:

- Conduct additional research and provide extension services on IPM for horticultural crops, with a special emphasis on apricots, grapes, melons, and apples.
- Enhance extension and advisory services for farmers, including use of cellphones and other information and communication technology tools.
- Establish pest diagnostic laboratories/clinics and centers in various countries of Central Asia, possibly including mobile diagnostic units.
- Strengthen crop improvement programs and seed systems for providing good-quality seeds and enhancing seed delivery systems.
- Assess the impact of climate on agricultural pests and develop IPM programs to adapt to and mitigate the impacts of climate change.
- Collect, publish, and disseminate information on traditional pest control practices and traditional knowledge.

This decade-long regional project established an excellent network of IPM specialists and institutional linkages in the Central Asia region. The project demonstrated the value of collaborating and partnering with regional and international organizations such as the Consultative Group for International Agricultural Research, other international centers, international NGOs, and U.S. land-grant universities.

With an excellent IPM knowledge network and linkages established through this project, the collaborative research, education, and outreach programs with local researchers, extension specialists, and other stakeholders in Tajikistan, Kyrgyzstan, and Uzbekistan have continued. The research scientists and extension specialists of MSU and other partners are continuing to collaborate programs with local institutions and programs in the Central Asia region with emphasis on continued strengthening of human and institutional capacity for research, extension and outreach; development of a critical mass of well-trained human resources in diverse areas of agricultural research and development; continued networking, exchange programs, and exposure visits; and long-term collaborations to facilitate access to new technologies, knowledge, and scientific innovations from the global community.

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CHAPTER 7

Scientific Animations Without Borders

A CASE STUDY ENGAGING EXTENSION IN NORTHERN MOZAMBIQUE TOWARD A BROADLY APPLICABLE RESEARCH-CREATION-DEPLOYMENT SYSTEMS KNOWLEDGE LOOP

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Abstract

Since 2010, Scientific Animations Without Borders (SAWBO) has collaborated with a virtual network of global and local experts to create more than 80 educational animations in over 140 languages. SAWBO focuses on the delivery of scientifically validated educational content to low-literate learners in developed and developing nations alike, but especially in Africa. While empirical research demonstrates the capacity of these animated videos to effectively educate, transfer information, and elicit buy-in from users, an indispensable component of this success involves translating the content into the locally most comfortably spoken dialect of the animations' recipients. Given the approximately 6,500 living languages spoken globally by people, with 2,000 of them in Africa alone, a key challenge exists to make any such animated educational content accessible to all people, in whatever dialect they speak. As one strategy for surmounting this challenge, SAWBO has created and made freely available an Android-based "SAWBO Deployer App" that allows educators globally to easily access and download any one, or a combination, of these animations—thus making the animations available for both offline viewing, redistribution, or both to other phones in practically any corner of the world. A complementary strategy involves engaging extension agents in a cost- and time-effective way, such that they not only have access to already existing SAWBO-animated content but can also have those materials translated into any needed and most comfortably spoken dialects of local people they serve.

In this case study, we explore how an extension agent in northern Mozambique was engaged virtually by the SAWBO team, collaborated to translate already-available SAWBO-animated content into a locally most comfortably spoken dialect in the area (Lomwe), and then accessed and used those translated videos locally to educate farmers on an agricultural innovation. Results from this study identified three key steps in a research-creation-deployment (RCD) loop that built on remote (online) U.S. university and African extension agent interactions to build the needed capacity to deliver educational materials locally (to farmers in Mozambique): the extension agent (1) determined local needs (researched the local concerns), (2) co-created with SAWBO the local content needed (in terms of languages), and (3) deployed and redistributed that content through the SAWBO Deployer App. While implications from this process are discussed, the deployment component of the loop also provides insights and a basis for future research into content development and deployment in multilingual contexts, developing world contexts, or both. This case study demonstrates how U.S. university programs can engage global partners in a virtual collaborative manner, which is both time- and cost-effective.

Introduction

Mobile Education for Sustainable Development: Information & Communication Technology for Learning

While the utility of digital information and communication technologies (ICT) in Africa have been expanding exponentially over the last decade (Aker & Mbiti, 2010; Asongu & Nwachukwu, 2016; Bello-Bravo, Lutomia, Songu, & Pittendrigh, 2017), the reach and effectiveness of these channels for educational purposes, informational purposes, or both remain in need of further research, especially where use-gaps or demographic exclusion, especially of women and youth, occur (Bello-Bravo et al., 2020; Bello-Bravo & Pittendrigh, 2018; Clouse et al., 2015; Hampshire et al., 2015; Wyche et al., 2016). Nevertheless, educators, extension personnel, and other professionals continue to integrate digital ICT into their educational programs as a way to teach and train people about scientifically proven and other life-critical knowledge and innovations that can help improve the lives of people in rural, remote, inaccessible, or overlooked areas (Bello-Bravo, 2014; Bello-Bravo, Nwakwasi, Agunbiade, & Pittendrigh, 2013; Dlamini & Worth, 2019; Dlodlo, 2009; Dzansi & Amedzo, 2014; Jebet et al., 2018; Lee & Schaefer, 2019).

Among these digital ICTs, the cell phone has emerged as the most widespread, technologically familiar, and affordable form of ICT in Africa, although one with important accessibility caveats and limitations (Aker & Mbiti, 2010; Bello-Bravo et al., 2020; Etzo & Collender, 2010; James & Versteeg, 2007; Mocumbe, 2016; Wesolowski et al., 2012). Acknowledging these limitations, the portability, simplicity, and affordability of mobile phones compared to other ICTs nonetheless make them more suitable for educational knowledge delivery, especially in places where computers, internet connectivity, and electrical infrastructures are limited (Bello-Bravo

& Pittendrigh, 2018; Donner, 2007, 2008). Likewise, Kumar et al. (2010) have recognized the potential of mobile phones for accessing educational content by children in rural areas, and Brown (2003) noted that mobile phones can play an important role in education, especially in developing countries. Ally (2009) also emphasized the accessibility of mobile phones as key for making access to learning materials feasible via mobile devices generally. In particular, this enhanced accessibility of mobile phones vastly increases opportunities for informal learning (Bello-Bravo, 2017).

However, the use of mobile phones for informal learning generally requires the following steps: determining which educational content (1) is most appropriate and technically accurate for an identified and given application, preferably in consultation with locally affected populations, (2) is visually, auditorily, and culturally understandable by the local population, especially around the identified local problem, and (3) ultimately provides a pathway for easy (low-transaction cost) use of distributed content in local contexts. As one specific implementation of this approach, SAWBO, a Michigan State University-based program, has deployed key components for this three-step strategy to collaboratively create educational content with a global network of volunteer local and global knowledge experts. For step 1, when possible, this can extensively involve focus groups and problem and solution identification with locally affected populations (Mocumbe, 2016). At other times, such advance work is not possible. A key component in step 2 involves placing any developed educational content into local most comfortably spoken dialects, via additional (usually virtual) collaborations with local technical and dialect experts (including extension agents, students, or other volunteers). This task of translation not only involves moving the linguistic content of the video from one dialect to another but also culturally translating the content's steps so that they are culturally feasible, relevant, and comprehendible in its new cultural (local) context.

Lastly, a key component in step 3 involves ensuring that any developed content has a maximum accessibility to people no matter how resource- or infrastructure-constrained the settings. Here, the SAWBO Deployer App serves to empower extension agents (and other actors) with an easy and low-transaction cost approach for deploying, using, and redistributing such content. In particular, this pathway represents an operationalization of a "two-step approach" for the use of educational content in rural areas, especially within developing nation contexts (Ihm et al., 2015). Such an approach specifically involves using strategies that surmount effects due to local digital divides and also explicitly consider local message recipient-users.

ICT & Mozambique

In Mozambique specifically, although a Mobile Solutions Technical Assistance and Research Project survey (mStar, 2015) found that only 18% of survey respondents indicated that they had internet access, more than 82% had mobile coverage (particularly in Manica, Nampula, Tete, and Zambézia provinces). As of 2018, there were approximately 14 million mobile network subscriptions in Mozambique, down from a peak of 20 million in 2015 (Global Economy, 2019). For the country generally, however, the gender gap and rural-urban divide play a large role. In addition, Mozambique continues to have one of the lowest mobile and smartphone penetration rates compared to other African countries, predominantly due

to cost and that approximately 50% of the people in Mozambique still have no access to energy (Gillwald et al., 2018).

Moreover, given that "Mozambique has about 1,000 public extension workers for the entire country's 3.8 million farming households" (Peterson, 2018), this massive shortage adds to a perfect storm of resource and infrastructure shortages that mandates intense, creative innovations for reaching all of the population who could benefit from critical information around health, agriculture, and other public-interest issues. Thus, unless some unforeseen and unlikely dramatic increases occur in extension agent numbers, the local path forward will instead involve providing platforms that allow extension agents to deploy knowledge in a highly scalable manner at low transactional cost. In this way, northern Mozambique represents a logical place to further research the potential for the previously mentioned "two-step" approach to localization and deployment of appropriate educational content using existing extension capacity.

Learning & Knowledge Transfer

Learning occurs both formally and informally. It is delivered formally at specific places, at specific times, and in specific ways. It is delivered informally virtually anywhere, anytime, through a wide variety of delivery means (Cook et al., 2008; Malcolm et al., 2003; Marsick & Watkins, 1990; Sharples, Arnedillo-Sánchez, Milrad, & Vavoula, 2009; Sharples, Taylor, & Vavoula, 2010; Traxler, 2007, 2010; Watkins & Marsick, 1992; Winters, 2007). This paper focuses on nonformal learning—in part, due to the infeasibility of more formal approach settings in resource-straitened situations in Africa—through the use of an educational App. Such nonformal learning takes place outside of formal classroom settings (Billett, 2002). While it typically "combines individualized (or personal) learning with anytime and anywhere learning" (Motiwalla, 2007, p. 582), to focus primarily on the anytime and anywhere aspect of such nonformal learning (its accessibility) can sometimes prioritize message delivery itself over reception of the message by learners (Winters, 2007). In this study, while activities related to the use of an App—including, but not limited to, downloading, sharing, and uploading educational animations—are necessarily a part of the informal activities that learners explored during their learning experience, how the App successfully guides or orients a user in the process of constructing new knowledge and learning remains critical (Winters, 2007), if not actually more important (Bello-Bravo, Tamò, Dannon, & Pittendrigh, 2018).

Research into adult education has long recognized that connecting any knowledge to be delivered to the lived realities of its recipients is a key need (Knowles, 1980; Vygotsky, 1978). On the "user" side of an educational App, then, mobile content learning where the learner can choose the content from the App and more interactively control the experience of using it may likely better afford this connecting relevance in contrast to less interactive, less personalized interfaces. At a minimum, linguistic translation of the content into locally most comfortably spoken dialects of the recipient indispensably helps to connect users to content (Bello-Bravo, 2017; Szulanski et al., 2004), especially within postcolonial settings in Africa where dialect variance has social consequences and can often reproduce social inequalities (Bunyi, 2008; Kiramba, 2018). Importantly, however, this linguistic translation cannot be text-based only if it would reach the widest possible demographic

in an area—not only due to nonliteracy in some dialects but also because many local dialects in Africa have no printed form (Bello-Bravo & Pittendrigh, 2018; Ong, 1982).

Lastly, both formal and informal learning in rural Africa, whether though ICT, traditional extension services, or in more official school settings, face the familiar set of "wicked problems" (Rittel & Webber, 1973) that plague resource-straitened environments, including lacks of infrastructure, resources, and personnel; geographical remoteness; the reproduction of social inequalities (inadvertently or not); and bureaucracy and corruption (Aker, 2010; Anastasios et al., 2010; Benor & Harrison, 1977; Berger et al., 1984; Christoplos, 2010; Cunguara & Moder, 2011; Kiramba & Harris, 2019). It seems generally a given, even commonplace, that if we would meet the United Nations' Sustainable Development Goals, then an imperative exists for the development of maximally cost-effective, resource-efficient, and widely scalable solutions for knowledge dissemination around critical areas such as agriculture, crop-pest management, public health and disease prevention, and social equality for women, children, and other marginalized persons (Bello-Bravo & Pittendrigh, 2018; UNESCO, 2017).

Strategies for Solutions

Given the unlikeliness of an expansion of extension personnel numbers adequate for reaching every demographic in a country that would benefit from a public-interest messaging campaign, this effectively mandates the development of some variety of "viral," "do it yourself," or "training of trainers" intervention approaches that can leverage these several current inadequacies of personnel, resources, accessibility, and management (Bello-Bravo, 2010; Quizon et al., 2001; van de Fliert et al., 1995). The "mobile ESD" (education for sustainable development) systems approach operationalized by SAWBO (Bello-Bravo, 2018a; Bello-Bravo, Tamò, et al., 2018) represents one such cost-effective, resource-austere, and highly scalable method that successfully effects learning gains and knowledge retention not only in message recipients (Bello-Bravo, Tamò, et al., 2018; Mocumbe, 2016) but also among extension or activist community educators disseminating knowledge (Bello-Bravo, 2019; Bello-Bravo et al., 2020; Bello-Bravo, Lutomia, & Pittendrigh, Under Review).

As a support for mobile ESD, SAWBO has developed a Deployer App that allows anyone with a smartphone and internet access to select and download educational animation content from a digital library of more than 80 topics in more than 140 languages, including but not limited to animations for agricultural improvement and pest control, disease prevention and general health, food and water safety, and other local issues that people identify as affecting them (Agunbiade et al., 2010; Bello-Bravo, Diaz, Venugopal, Viswanathan, & Pittendrigh, 2010; Bello-Bravo & Pittendrigh, 2012). Because localization of content is critical and central to effective mobile ESD, SAWBO collaborates with local translators and college youth to expand and make available to everyone the variety of dialects that each animation has been translated into (Bello-Bravo, Olana, Enyadne, & Pittendrigh, 2013; Bello-Bravo, Olana, & Pittendrigh, 2015). This critical need, however, also comes with particular challenges.

Challenges in Translation

Whether translation is an art or simply a craft may never be settled (Ajiboye, 2016), but a broad consensus acknowledges that it is rarely, if ever, a mechanical, one-to-one movement of meaning from one dialect to another (Filkins, 2016; Hofstadter, 2018; Kelly, 1979; Metleaeva, 2016). Beyond these always-present challenges to translation, for translation of scientifically validated educational content into locally most comfortably spoken dialects in rural Africa, additional challenges arise. Many African dialects have no print version and thus are spoken and used by people in an oral-only paradigm (Ong, 1982). To correctly place into a local dialect some of the unavoidably technical scientific distinctions or concepts used in a video (even after framing those concepts in the least-technical way possible) not only often requires a metaphorical use of language but also a sufficiently cultural understanding of the locale by the translator able to decide which metaphor will correctly carry the intended scientific meaning. Braçaj (2015) describes this challenge as perhaps the most difficult task facing a translator. As such, this task involves not simply translating dialect but translating culture (Fernández Guerra, 2012).

For these reasons, it takes a particular set of skills to translate scientifically validated educational video content into locally most comfortably spoken dialects. In this study, the extension agent Euphrates José John (EJJ) had previous experience as a translator, particularly around translating Portuguese (the national dialect of Mozambique) into local dialects, including Lomwe and other lesser-known dialects. Tasked with being an agent to train others on the use and deployment of the SAWBO Deployer App and associated tools, he initially garnered participatory interest from others simply by informing people in his network (family, friends, and acquaintances) about the availability of a new and interesting technology that was particularly important for areas such as agriculture and healthcare—two issues of both national and local import to Mozambicans (Armand et al., 2019; dos Anjos Luis & Cabral, 2016).

Case Study: Toward a Research-Creation-Deployment Loop

Background

From 2013 to 2017, the SAWBO team in collaboration with researchers from Iowa State University and the Instituto de Investigação Agrária de Moçambique (IIAM) in Maputo, Mozambique, researched knowledge gaps in bean value-chain pathways to develop and test an intervention into those gaps. This research included focus group discussions with Mozambican farmers to identify both a perceived major problem (postharvest loss of beans for use in next season's planting) as well as various feasible, culturally relevant, and cost-effective solutions to that problem. From these criteria, one solution using hermetically sealable jerrycans emerged as the best fit for local farmers, after which researchers conducted a six-month proof of concept for farmers to demonstrate this solutions' efficacy for securely storing postharvest beans. Also using any feedback from focus farmers on

the procedures involved in this technique, SAWBO produced a short video animation describing the postharvest storage process in eight key steps and then had the video translated into the locally most comfortably spoken dialect (Lomwe) for general dissemination to farmers in 10 villages in Gurúè District in northern Mozambique. Quantitative measure of knowledge transfer during this study found a very high (91.3%) rate of knowledge transfer (Mocumbe, 2016), while this current two-year follow-up measured a 97.9% knowledge retention among farmers for this value-chain intervention (Bello-Bravo, Abbott et al., 2019).

Scaling up the pool of available translators for the widest possible number of local dialects represents a key component for increasing the reach of any mobile ESD knowledge-dissemination campaign (Bello-Bravo & Pittendrigh, 2018). Another key element involves incorporating a feedback loop to capture local users' insights and experiences as inputs for further refining or reworking existing animations (or developing new ones in light of local people's concerns or desires). These two goals, taken together, form what we call an information and communication for development (ICT4D) research-creation-deployment (RCD) loop.

This project explored one such RCD loop between SAWBO and a local extension agent contact in Gurúè District, Mozambique. While the background research (described previously) generated content that was locally deployable using the SAWBO Deployer App (Mocumbe, 2016), the extension agent, EJJ, subsequently assessed what other needs in the community might be met through other existing SAWBO animations. Through virtual collaborations, EJJ and SAWBO collaborated to translate an additional 36 animations into Lomwe and uploaded them via the App into the SAWBO library so that they were available and could be integrated into other local extension programs by anyone with internet access. EJJ also used the video and Bluetooth functions of his smartphone to display, share, and further redistribute the animated videos to local people. While future work may identify still other existing animations needing translation into Lomwe, the potential also exists for the development of entirely new animated video content based on local people's expressed desires or needs as reported to the local extension agent.

SAWBO-Extension Agent Online Collaboration

Over a one-year period, SAWBO team members collaborated with EJJ remotely (via digital communications) to identify existing SAWBO animations that EJJ and his team determined would be logical and beneficial for use locally, and then deployed those animations to local people. This collaborative RCD loop process had eight basic elements: (1) EJJ and his team researched and identified animations for local use and translation; (2) SAWBO provided English scripts of those videos to EJJ; (3) EJJ translated those scripts into local and national dialects (Lomwe and Portuguese), iteratively working with SAWBO as necessary to ensure the scientific accuracy of the translation, and (4) then made voice recordings (using his phone) that were emailed back to SAWBO; (5) SAWBO overdubbed the videos with the translated script, (6) checked them for accuracy and quality with EJJ and his colleagues, and (7) then uploaded the translated videos to the SAWBO Deployer App database for access by anyone who wanted to use

them, (8) including EJJ, who then downloaded, shared, and redistributed the content using the SAWBO Deployer App in his own local extension activities.

In-Field Use of SAWBO Deployer App & SAWBO Animations

This study explores the RCD loop capacity of one cost-effective, resource-efficient, and (potentially) highly scalable knowledge-dissemination system at two levels: thus, (1) it describes the processes by which an extension agent (EJJ) used the SAWBO Deployer App and SAWBO animations to teach use of those materials to college students (particularly as potential future translators of SAWBO content), and (2) explores qualitative data from students around the use, relevance, and attractiveness of the SAWBO RCD loop approach. Findings from this study not only offer further insights into the efficacy of the SAWBO mobile ESD approach generally but also insights for practitioners who wish to actionably scale-up campaign messaging to wider numbers of people and demographics than are currently being reached.

To recruit students for training in the use of the SAWBO Deployer App and SAWBO animations, EJJ made educational visits to schools where, in collaboration with already present ICT teachers, the students were introduced to the SAWBO program. ICT in schools was first promoted in 1997 by SchoolNet Mozambique and subsequently launched in 2002 as a flagship program of the National ICT Implementation Plan, with a goal of promoting access to ICT in all secondary schools in Mozambique (Isaacs, 2007). Recruited trainees were from four provinces in Mozambique, where trainings also were conducted. In all, 221 trainees were recruited, with a total training time of 69 hours 7 minutes overall and 2 hours 8 minutes per training session.

Recruited participants at each training session, divided into groups of five, were instructed in methods for accessing, downloading, and installing the SAWBO Deployer App on their phones, and then introduced to its use and interface by the trainer, EJJ. Importantly, although all of the students' phones could play videos, none of them were smartphones. As such, these (and other digital-access activities) were performed by students on their own phones using the trainer's (smartphone) WIFI connectivity, and access to the internet. This kind of provision of accessibility to knowledge recipients by trainers exemplifies ICT4D scalability.

Among digital ICTs (for example, laptops, desktops, tablets, mainframe workstations, WebTVs, mobile phones, and other devices), in Africa, mobile phones (and usually not smartphones) constitute the most widespread and technologically familiar type (Aker & Mbiti, 2010; Brouwer, 2010; Duncombe, 2016). Consequently, although the trainer introduced participants to new processes for downloading, installing, and using the SAWBO Deploy App interface (including the use of its menu, filtering by topic, language, or country, downloading and locating videos using URLs as alternative options, and then sharing and receiving videos with others through online and offline, Bluetooth, and other methods), he did not have to spend training time on the basics of performing such actions on a mobile phone. In contrast, for instance, Tata and McNamara (2016) highlighted training delays due to near-total nonfamiliarity among participants with

how to use computer interfaces (including no familiarity with how to use a mouse). The kind of recipient familiarity with the technological means for training in this study not only facilitates ease of training overall but also helps to make the key link between the knowledge to be transferred and the already lived realities of the participants (Knowles, 1980; Vygotsky, 1978).

Results & Discussion

Following the training, an open-ended, group interview was conducted to collect data on the participant experiences of the training and the use of the App. While trainees expressed an interest in continuing to use the SAWBO Deployer App—especially for useable information on healthcare and agriculture they could also share with friends and family members—they noted that online use might be limited due to the costs of internet access; indeed, mobile data in Mozambique is among the top 10 most expensive for Africa (Oludimu, 2019). The trainer explained that not only are downloadable SAWBO videos size-minimized (while maintaining image quality), he also clarified that once video content has been downloaded onto a phone, it can then be further shared (using Bluetooth or other means) without have to re-access the internet—which, in many cases, may not be feasible if the internet is not accessible in a given area.

Additionally, despite efforts to place the video voiceover into accurately local speech, some participants nonetheless raised questions about unfamiliar accents in the recording and recommended including more specifically local dialects on the App. This highlights the exceptional importance of dialect variation in the delivery of audiovisual media (Bello-Bravo, 2018b), insofar as a perceived inaccuracy of language, dialect, or accent can affect how a message is received, if it is not simply dismissed outright (Abbott et al., 2017; Bello-Bravo, 2017; Szulanski et al., 2004). In fact, differences of accent within the same dialect often provide essential orienting clues when strangers (and especially youth) encounter one another (Kaviti, 2015); in many cases, accent can prompt perceived prejudices by one group about another (Rombo & Lutomia, 2016). In Africa, facing the challenge of translating educational material into as many as 2,000 dialects (to say nothing of the rest of the world) may already present an insurmountable task; to further account for every accent exponentializes this problem. Alternatively, and similarly to how EJJ answered participant concern about the costs of internet access, research has found that a facilitator-led discussion following mobile ESD content presentation yields even higher learning gains than mobile ESD alone (Bello-Bravo, Zakari, Baoua, & Pittendrigh, 2018). As such, if message recipients register accent differences as impacting message delivery (whether due to cultural factors or difficulties in understanding), the facilitator or trainer is on hand to field those concerns or effects.

Participants stated that the most useful SAWBO App content included videos for cholera prevention, prevention of malaria using bed nets, tuberculosis prevention, the effectiveness of oral rehydration solutions, biocontrol of the bean pod borer (*Maruca vitrata*), and microfinance. Given that Mozambique has the third highest incidence of malaria in the world and has experienced recurrent epidemics of cholera over the last two decades (Aide et al., 2019; Langa et al., 2015), that the participants' expressed interest in videos related to these concerns illustrates a connection of that educational content to the lived realities of the learners (Knowles, 1980; Vygotsky, 1978). Importantly, EJJ selected these videos to show based on his research that such issues are

relevant to Mozambican people, but the later feedback from the participants themselves confirming that relevance is a key part of the RCD loop well; that is, out of the total range of videos that EJJ selected, these six topics in particular especially elicited interest with participants. Participants also stated that the training information was structured in such a way that it was clear, brief, easy to understand, and shareable offline through simpler means (nonsmartphones) with the ability to receive and play videos.

With respect to determining how likely trainees would be to recommend the training sessions to others, most agreed that face-to-face interaction was important for first-time users to familiarize themselves with the SAWBO App, especially for people who had no previous interaction with video tutorials. This echoes the finding that people training in ICT can prefer face-to-face (rather than computer-only) instruction (Tata & McNamara, 2018). Other participants suggested that occasional refresher trainings would be useful, consistent with findings from a very wide range of disciplines, but often medical and health, or ICT domains (Ablah et al., 2009; Eriksson et al., 2011; Loeb et al., 2009; Pouezevara et al., 2014; Sawyer et al., 2014). While the achieved benefits or optimal timing of refresher training remain open questions (Ganju, 2015; Woollard et al., 2006), besides reinforcing past training, such refreshers would also offer opportunities for past participants bringing in word-of-mouth (new) participants and also introducing all participants (old and new) to any new video content added to the SAWBO Deployer App database since the last training. This might be an optimal, or only, opportunity for past participants to re-access the internet if they have not, since the last training, been able to use the Deployer App online.

Conclusion

The long-term goal of SAWBO is to develop a platform that is accessible to extension agents globally who can download and use such content locally. Such content needs to be both of international standards of content accuracy (being backed by scientifically valid expert input) and yet localized such that the content is both understandable in a local context and appropriate for the experiences lived by the target audiences. Extension agents in developing nations are often too few, and they have limited resources, in comparison to the large networks of people they serve. Engaging them in content developed, in terms of adaptation to local languages, through virtual collaborations, has the potential to in turn provide them with accessible materials that they can use when and where they deem fit with their own clientele. However, their experiences also potentiate the opportunity for co-research efforts in the field with platforms like SAWBO to drive future content creation and more effective deployment strategies toward the concept of an RCD loop. However, the ultimate goal is to build a large enough pool of localized content (both in language and content) to allow development extension agents to have a broad, but localized set of extension tools for their efforts, whereby the supporting research helps to drive recommendations toward the most effective use of such content.

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CHAPTER 8

Agricultural Extension Services & Seed Systems for Agricultural Technology Transfer in Nigeria

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List of Abbreviations

AATF	African Agricultural Technology Foundation
ADP	Agricultural Development Program
ARCN	Agricultural Research Council of Nigeria
DUS	Distinctiveness, uniformity, and stability
FDAE	Federal Department of Agricultural Extension
FMARD	Federal Ministry of Agriculture and Rural Development
IAR	Institute for Agricultural Research
IFPRI	International Food Policy Research Institute
IRM	Insect Resistance Management
NAERLS	National Agricultural Extension Research and Liaison Services
NARIs	National Agricultural Research Institutes
NASC	National Agricultural Seed Council
NBMA	The National Biosafety Management Agency
NOTAP	National Office for Technology Acquisition and Promotion
NRCRI	National Root Crops Research Institute
NVRC	National Committee on Naming, Registration and Release of Crop Varieties, Livestock Breeds/Fisheries
QMS	Quality Management Systems
REFILS	Research-Extension-Farmer-Input-Linkage System
SOP	standard operating procedures
VCU	Value for cultivation and utilization

Introduction

Agricultural systems globally have benefited from the application of innovative technologies leading to continuous improvement in the effectiveness and efficiency of food production (United Nations Conference on Trade and Development, 2005; Juma & Serageldin, 2007; Spielman & Pandya-Lorch, 2009; International Food Policy Research Institute [IFPRI], 2013). Africa, particularly the sub-Saharan Africa (SSA), has been significantly left out in this upward trend due to a number of factors that constrain access to these innovative technologies (United Nations Conference on Trade and Development, 2005; Juma & Serageldin, 2007) and the result has been a characteristic low productivity of agricultural resources in the region. Despite the fact that agriculture is central to the livelihood of millions of people in SSA, the region has not been able to reach its agricultural potential (Organization for Economic Cooperation and Development/Food and Agricultural Organization of the United Nations, 2016; Christiaensen, 2017; Tai, 2012), mainly due to low output of agricultural assets resulting in low yields (Alliance for Green Revolution in Africa [AGRA], 2016).

The low agricultural productivity in the SSA region is evidenced by huge yield gaps between landraces, local varieties, which are predominantly cultivated by farmers and their counterpart improved varieties (AGRA, 2016). Appropriate agricultural technologies are essential to reversing the low productivity and unlocking the agricultural potential of sub-Saharan African farmers who are mostly smallholders (African Agricultural Technology Foundation [AATF], 2017). Developing systems for agricultural technology transfer is key to accessing appropriate agricultural technologies including good quality seeds and planting materials.

Agricultural extension and seed systems are undoubtedly critical elements of technology transfer in agricultural systems and a vital determinant of agricultural productivity and competitiveness leading to increased food security and improved rural livelihoods. Agricultural extension is a major conduit for pro-poor economic growth through provision of critical support services, which can enable rural communities to confront new challenges of transforming into global food and agricultural systems occasioned by the rise of supermarkets and the growing importance of standards, labels, and food safety (Huber et al., 2017). Seed systems, on the other hand, represent a set of arrangements and processes that guarantee availability, access, and use of high-quality seeds of a wide range of crop varieties by farmers and other stakeholders. In Nigeria particularly, farmers have not been able to optimize the potentials of agricultural livelihoods due to inefficient agricultural extension services and poor seed delivery systems (Okojie, 2020). Challenges imposed by climate change and depletion of natural resources on agricultural productivity have intensified the need for functional extension services and seed systems in Nigeria and other sub-Saharan African countries. Yet, in Nigeria, there are profound challenges to achieving good extension services and seed systems that work for the smallholder farmers. With a focus on the cowpea seed delivery chain, this chapter provides a description of the Nigeria agricultural extension services and seed systems toward developing resilient systems for agricultural technology and knowledge transfer.

Agricultural Sector in Nigeria

Nigeria, with a population of over 200 million, is the most populous country among the 55 member countries of the African Union. Agriculture is an important sector of the Nigerian economy, providing livelihoods to nearly 70% of the population. The agricultural sector offers high potentials for employment generation, food and nutritional security, economic growth, and poverty reduction. Agriculture in Nigeria is dominated by smallholders. Large-scale agriculture is not common. Agriculture contributed 22% to the gross domestic product in 2019 (Statista, 2020). The Nigeria Agricultural Policy has provided the framework for implementation of programs and guidelines for agricultural development. The broad objective has been to attain self-sustaining growth in all the subsectors of agriculture and realization of the structural transformation relevant for overall socio-economic development of rural areas (Huber et al., 2017).

In spite of existing infrastructure for extension services, Nigeria's agricultural extension and advisory services are proving to be the weak link in the country's plan of revolutionizing the agriculture sector. Nigerian smallholder farmers have continued to lag behind their peers in the region, owing to their inability to raise productivity due to the weakness of the country's agricultural extension and advisory services. The inability of farmers to access vital information and dissemination of that information by extension agents have reduced agricultural productivity in the country for decades.

Agricultural Extension & Technology Transfer Services in Nigeria

Policies of agricultural extension in Nigeria have not been strategically documented over the years. It has been operated within government programs. The Nigerian agricultural extension system has evolved over several decades. It started during the colonial era where it was operated from the regional ministries of agriculture (Naswem & Ejembi, 2017). Historically, the theory and practice of agricultural extension services in Nigeria is as old as the country itself. The establishment of the School of Agriculture at Moor Plantation in 1921 marked the formal beginning of extension work. Its main objectives included carrying out experiments on the production of export crops, improving soil fertility, marketing agricultural produce, and offering rudimentary extension services (Adejobi et al., 2008). Fadiji and Adeniji (2011) emphasized that the 1950s was a period of substantial progress in the development and organization of agriculture and extension in Nigeria. Through constitutional changes, the Regional Ministries of Agriculture were created. Hence, an extension or Field Service Division was created in each of the Regional Ministries of Agriculture, thus setting a pace in the modern organization of agricultural extension. The extension system in Nigeria has evolved through many policies and actions and arrived at the current practice.

Nigeria has 36 states, which are governed independently. The federal government gives guidance and coordination support to the states in terms of agricultural programs and implements some agricultural projects. Each state has a network of Agriculture Development Programs (ADPs) with several extension agents, which provide extension services across the country. This system of extension was established in the 1980s and 1990s. As a part of the agricultural development reforms, in 2012, a Department of Agricultural Extension and a national extension policy was established, which replaced the Federal Agriculture Coordinating Unit (Federal Ministry of Agriculture and Rural Development [FMARD], 2019). Under the current system, the federal government provides most of the funding for agricultural extension, and state governments do most of the implementation through ADPs.

There is a growing involvement of the private sector in extension and advisory services.

The Agricultural Transformation Agenda Policy on Extension

In 2011, the government of Nigeria launched an agricultural transformation agenda under the FMARD to promote agriculture as a business, integrate the agricultural value chain, and make agriculture a key driver of the economic growth in Nigeria (Ojo, 2019). The aim of this agenda has been to change the perception about agriculture as a development. The agriculture transformation vision and strategy aim at a hunger-free Nigeria. This can be obtained through a transformed agricultural sector that enhances income growth, and food and nutritional security as well as generates employment opportunities (Ajani & Igbokwe, 2014).

To achieve this vision, the value chain approach has been in use. Fertilizer procurement and distribution, marketing institutions, financial value chains, and agricultural investment framework are poised for a change using this approach.

E.N. Ajani and E.M. Igbokwe published the following ideas for driving agricultural transformation.

> To effectively drive the agricultural transformation agenda, an agricultural extension transformation agenda was articulated. The objectives of this agenda are to:

- Establish a Federal Department of Agricultural Extension (FDAE) which will oversee, monitor and provide the leadership needed for an efficient and effective agricultural extension and advisory service delivery in Nigeria;
- Review the agricultural extension policies within the subsisting agricultural policies and recommend appropriate policies that will ensure the effective participation of all stakeholders in a stable policy environment and adequate funding for the delivery efficient and effective agricultural extension and advisory services;
- Recommend appropriate institutional structures and arrangements for the delivery of effective and efficient multi-plural agricultural extension and advisory services in Nigeria, using the value chain approach; and

- Recommend demand-responsive extension systems/approaches and tools that will ensure the delivery of efficient and effective agricultural extension and advisory services for all the multi-actors in the targeted commodity value chains of interest to government (FMARD, 2011, as cited in Ajani & Igbokwe, 2014, p. 239).

> The report of the agricultural extension transformation agenda has provided a clear road map to address the critical challenges of agricultural extension and advisory services to transform it into a participatory, demand-response, market-oriented and ICT driven service that will provide for extension needs of all actors along the targeted commodity value chains of interest to the present administration, starting with the review and articulation of a functional, all-encompassing and friendly agricultural extension policy with inputs from all the key stakeholders in the agricultural and rural development sector (FMARD, 2011, as cited in Ajani & Igbokwe, 2014, p. 239).

The strategy was well thought out but was truncated with a change of administration before it became a legalized policy.

Agriculture Research System & Its Linkage to Extension Services in Agriculture

The agricultural research system in Nigeria is coordinated by the Agricultural Research Council of Nigeria (ARCN) with a mandate to support, promote, and guide sector development programs. The ARCN supports the agricultural research system through establishing policy options to promote innovation, establish a knowledge management capacity, and strengthen Nigeria's agricultural research system. The council coordinates 15 National Agricultural Research Institutes (NARIs) and 10 Federal Colleges of Agriculture in Nigeria. Each of the institutes under the council have their specific mandate commodities, which keep each institute focused on a specific commodity. For instance, the Institute for Agricultural Research (IAR) has a mandate for cowpea research in Nigeria in addition to some other commodities, and the National Root Crops Research Institute (NRCRI) supports cassava research. The FDAE is responsible for the agricultural extension policy, while the National Agricultural Extension and Research Liaison Services (NAERLS) is responsible for extension research and has linkage with the State Agricultural Development Programs (ADPs). The ADPs are the direct links to the farmers. Furthermore, all the institutes have extension units, which also liaise with the NAERLS. The NAERLS has a mandate to promote agricultural technologies developed at any of the institutes through their ADPs linkages. Extension data generated by the NAERLS through linkages with ADPs and other NARIs often inform policy decision by the FDAE. All these make NAERLS/ARCN to be central to agricultural extension activities in Nigeria.

Seed Production System: Breeder, Foundation & Certified Seed

Nigeria has a three-tier system of seed production and multiplication: breeder seed, foundation seed, and commercial (or certified) seed. The NARIs are responsible for breeder seed production. Private seed companies and seed production units of many of the NARIs produce foundation seed. Private seed companies can produce both foundation and certified seeds but under separate trade names. The National Agricultural Seed Council (NASC) is a regulatory agency that controls all activities in the seed industry including licensing of private seed operators and process-based certification of all classes of seeds.

Figure 8-1. Cowpea at flowering stage in Bakura Zamfara State of Nigeria. (Photo by Francis Onyekachi)

The Bt-cowpea and cassava provide a classic example in understanding the functioning of the seed production system in Nigeria. The IAR, having the national mandate for cowpea research, collaborated with the AATF and other partners to develop the Bt-cowpea, which was approved for commercial release in Nigeria by the National Biosafety Management Agency (NBMA) in 2019. The breeder seed of Bt-cowpea was produced by the research team at IAR, which also maintains the breeder seed. IAR Seed Unit is a commercial business entity owned by IAR, which specializes in early generation seeds (foundation seeds) and has been issued a sub-license to produce Bt-cowpea foundation seeds. Commercial certified Bt-cowpea seed production is by private seed companies under a non-exclusive license agreement.

Seed Varietal Registration & Certification

Seed varietal naming, registration, release, and certification are regulatory activities performed by two different and distinct bodies in Nigeria. The National Committee on Naming, Registration and Release of Crop Varieties, Livestock Breeds/Fisheries (NVRC) is responsible for naming, registration, and release of new crop varieties for commercial cultivation by growers,

while the NASC is responsible for seed certification. Every crop variety from a breeding line that will be cultivated in Nigeria must go through the NVRC to ascertain its distinctiveness, uniformity, and stability (DUS) as a new crop variety. The NVRC also looks out for value for cultivation and utilization (VCU) as criteria for variety naming, registration, and release. Once the variety is released for cultivation, the NASC steps in through the seed certification program to ensure that pure and good quality seeds are delivered to the farmers. Specifically, the NASC takes a process-based approach to ensure that the planting material (1) must be of acceptable variety and genetic purity, (2) must be of prescribed physiological and health status (disease and pest free), and (3) must have undergone the certification process.

Certification is compulsory for all classes of seeds (breeder, foundation, and certified seeds) as well as all stages of production, which also includes transportation and storage of all planting materials. Anyone with the desire to produce or multiply seeds or be a seed entrepreneur must be registered with NASC. For example, Bt-cowpea was named, registered, and released as Sampea 20-T in Nigeria in December 2019, having satisfied the requirement for DUS and VCU by the NVRC. Thereafter, the NASC certified the various classes of Bt-cowpea seeds for the 2020 cropping season.

Transfer of Agricultural Innovations to Farmer Fields & Use of Demonstration (On-Farm) Centers

As in most countries in Africa, the transfer of new technology and innovation from research to farmers in Nigeria is mainly carried out by the public agricultural extension services and scarcely by the private sector. With insufficient funds for extension and restructuring of public extension services, there has been a decline in the delivery of agricultural information and technologies as well as widening gaps between the extension agents to farmer ratio, thereby causing constraints in the delivery of extension services. The private sector has not responded adequately to fill the gap in service provision to smallholder farmers created by the withdrawal of the state. This is due to lack of enough trained personnel, unprofitability of providing services, the complex farming systems, and inability by farmers to pay for the services (Kormawa et al., 2001, 2004).

For circulation of information, traditional dissemination methods coupled with the use of social media have been found to be vital in the transfer of technology to farmers especially for seed varieties that are usually introduced by the public or private sector (Babu et al., 2020; Faure et al., 2016; Huber et al., 2017). Within the process of participatory technology development, attempts have been made to build on farmer-based knowledge. These include the design of extension methods that would have greater impact on the technology dissemination and transfer of new production inputs and methods. Communication among farmers is still an important factor as farmers prefer their fellow farmers as the primary

information source. This is the basis for farmer demonstrations, which has often worked well at increasing adoption.

According to Koyenikan (2008), Nigerian extension is the decentralized type, but the Federal States coordinate agricultural extension-related programs. The Federal States carry out extension programs, and manage and control activities and resources. This was also corroborated by Contado (1997), who opined that the pluralistic type of extension organization is emerging in many countries, and this is true for Nigeria. This has been reflected in the agricultural extension policy because the need for extension service is high. Public, private, and nongovernmental organizations are supporting and implementing agricultural extension programs. For example, the oil companies such as Shell Petroleum Development Company in the Niger Delta Region, universities, agro-business firms, and religious and farmers' organizations such as the Farmers Development Union are among the organizations supporting extension programs in Nigeria.

The Research-Extension-Farmer-Input Linkage System (REFILS) has been identified as an exciting and viable extension instrument for effective technology transfer and provides a sustainable approach to linking research to policy and development in the agricultural sector (Nnadozie et al., 2015). The NAERLS is central to the implementation of REFILS in Nigeria. NAERLS has a mandate to (1) advance the frontiers of extension research and services; (2) conduct agricultural performance assessment and provide feedback; (3) build the capacity and skill of key actors for effective extension service; (4) plan, coordinate, mentor, and evaluate REFILS activities; and (5) package and disseminate improved agricultural innovations in Nigeria (NAERLS, 2020). The NAERLS work closely with the National Office for Technology Acquisition and Promotion (NOTAP) to ensure technology licensing, which is a critical aspect of technology transfer. (NOTAP was established by Decree No. 70 of 1979, amended by Decree No. 82 of 1992 now referred to as NOTAP Act Cap N68 LFN 2004 Laws of the Federation of Nigeria.) The mission of NOTAP is to ensure the acceleration of Nigeria's drive toward a rapid technological revolution by an efficient acquisition and absorption of foreign technology and a concerted development of indigenous technological capability through a proactive promotion of innovation and commercialization of technology (NOTAP, 2020).

The functions of NOTAP include but are not limited to the commercialization of viable research and development (R&D) results emanating from both private and public research institutions, promotion of intellectual property rights, and encouragement of innovation among Nigerian scientists, researchers, and inventors, as well as establishment of a network of linkages among researchers, inventors, industry, and research institutions. NAERLS and the entire ARCN must build synergy with the NOTAP to have a wholistic approach to technology transfer that adequately caters for technology licensing thereby achieving desired results in Nigeria agricultural space.

Research-Extension-Farmer Linkages & Stewardship

Commodity Case Study: Bt-Cowpea

The government of Nigeria has taken positive steps toward harnessing modern biotechnology for enhancing agricultural productivity and food security. Last year, the government gave approval for the commercialization of insect-resistant cowpea varieties developed in collaboration with the AATF. The successful deployment, use, and management of biotechnology-derived crops will require appropriate extension education services to empower farmers on technology stewardship aspects.

Figure 8-2. Trangenic cowpea. (Photo by Francis Onyekachi)

The Bt-cowpea stewardship requirement provides a practical platform to strengthen linkages between research, extension, farmers, and all stakeholders along the seed value chain. The stewardship program of Bt-cowpea aims to ensure the product quality and integrity, provide sustainable access of good quality seeds for farmers, promote adoption, and enhance regulatory compliance for biotechnology crops as well as enhance consumer confidence. The components of this stewardship program include identity preservation, trait performance, insect resistance management (IRM), integrated pest management (IPM), good agricultural and agronomic practices, high-quality seeds, consumer acceptance, marketing, labeling, and intellectual property management. A life cycle approach to product management primarily through the technology developers, seed producers and distributors, and users has been established as follows:

- **Standard operating procedures (SOPs) and quality management systems (QMS):** To support a comprehensive stewardship program, the technology developer (AATF/IAR) is collaborating with NASC and NAERLS to review and optimize the existing SOPs and QMSs to ensure proper documentation, effective seed testing, proper seed packaging and labeling, traceability, and proper recordkeeping that meets stewardship audits at each stage of product development, seed production, and distribution as

well as rapid and effective communication between different teams on emerging issues. Farmers are also encouraged and supported on recordkeeping and stewardship compliance procedures.

- **Insect resistance management:** The evolution of resistance to the Bt (*Bacillus thuringiensis*) toxins by insect pests is a major concern in application of Bt-cowpea like other Bt-based technologies. The rate of evolution of resistance can be delayed or prevented using appropriate insect resistance management (IRM) and integrated pest management (IPM) strategies to reduce the selection pressure on target pests. The IRM/IPM plan has been deployed in adherence to existing agroecosystems, cropping, and other local agricultural practices and implemented in line with local conditions for social acceptability and economic viability of smallholder farmers in Nigeria. The AATF/IAR/NAERLS are working together to ensure that the IRM plan is appropriately supported and implemented by farmers and other stakeholders through education and compliance monitoring programs to prevent the development of resistance, thereby extending the efficacy and durability of Bt-cowpea technology for a long-term period.
- **Anti-counterfeiting and adulteration of seeds:** With the success of Bt-cowpea, it is expected that counterfeit and adulterated seeds will become a major threat that can destroy the farmers confidence in the product. To combat this threat, methods of detecting counterfeit seed are being tested. The first one is the Seed Assure technology, which has not been introduced in Nigeria yet. The second method is the Mobile Authentication Service (MAS) method, which has been in use in Nigeria by the National Agency for Food and Drug Administration and Control since 2012 to detect fake anti-malarial drugs and antibiotics. This method uses scratch codes and Short Messaging Service (SMS) to enable buyers to verify the authenticity of the medicine at the point of purchase. The buyer scratches a panel on the product, which then reveals a unique, one-time-use PIN (personal identification number). The PIN is sent toll-free to a short code using any of the GSM (Global System for Mobile communications) operators and the consumer receives a response in form of a text message (SMS) stating that the product is either genuine or suspected fake. Many smallholder farmers in Nigeria are conversant with the use of mobile phones for agricultural services through the E-Wallet program and this gives credence to a successful implementation of MAS for Bt-cowpea farmers.
- **Stewardship Sustainability Framework:** A multi-prong approach is being taken to ensure sustainability of a stewardship program for Bt-cowpea. First, is the stewardship obligation given to seed companies through the license agreement. Second, the cost of stewardship will be included in the seed cost to the seed companies while a sustainable model of administering the funds will be worked out by AATF/IAR/NASC and the seed industry stakeholders. Third, the project will collaborate with the extension services to mainstream Bt-cowpea stewardship programs into the routine activities of extension agents across cowpea producing areas of the country. This is ongoing in Nigeria and will be replicated in other project countries. It will involve training of field extension agents as well as subject matter specialists who manage the NAERLS E-extension services and Farmer Help Line.
- **Farmers and Stakeholders Training:** In Nigeria, sustainable use and success of the Bt-cowpea technology will require training of various stakeholders along the value chain including researchers, seed regulators, private seed companies and seed production companies, multiplication

and distribution experts, extension professionals, and farmers. Training will include seed production, multiplication and distribution channels on specific stewardship SOPs, QMS, IRM, incidence management, and anti-counterfeiting approaches. The Training of Trainers Internship program is ongoing. This will help to create a team of "product stewardship champions" in Nigeria. Training programs in stewardship program implementation will be conducted for local stakeholders including farmers through in-country national and regional workshops. Key elements of the training will be seed quality control and assurance, implementation of on-farm and community refugia for insect resistance management, and overall stewardship program planning and implementation.

Private Sector Participation in Agricultural Extension

Privatization of extension service delivery has been considered lately as the only option to remedy the decline in both the funding and overall organization and administration of extension due to so many challenges facing the effectiveness of publicly funded extension delivery, particularly since the withdrawal of the World Bank sponsorship of agricultural programs in Nigeria (Babalola, 2015). The development of Bt-cowpea technology demonstrates a successful public-private sector partnership. Facilitated by the AATF, the technology was donated by a private company and the technology testing and development was performed by the public research institution in Nigeria with the technology commercialization and deployment to be carried out through partnership with local seed companies. The government-supported extension services will conduct the farmers' education and outreach. The AATF provides the overall coordination of the project, including in-house expertise on intellectual property management, business development, regulatory compliance, communication and outreach, seed delivery, and stewardship.

Another example is the cassava seed system, one of the few emerging seed systems as cassava has been classified as one of the "orphan crops." A project funded by the Bill and Melinda Gates Foundation was initiated to establish the cassava seed system as an economically sustainable integrated seed system. The project created a new paradigm for the development of cassava seed systems. One of the components for this program was the creation of a cadre of seed entrepreneurs in rural villages to produce certified cassava seeds within their locality. The Catholic Relief Services involved with the project created a quasi-extension system to teach and extend information to all the village extension service units to ensure proper maintenance of their seed production fields. This corroborates the thinking of Adebayo (2004) that information and advice are not necessarily public goods: they can fall into different categories within the public-private goods matrix. Advice tailored to the specific circumstances of an individual farmer, who will, in principle, be prepared to pay for it, should therefore be supplied at an appropriate level by the private sector.

Conclusion & Way Forward

As an integral component of the agricultural transformation agenda, the government of Nigeria has taken positive steps and made a strong commitment to enhance agricultural extension and advisory services to better serve millions of smallholder farmers. The agriculture sector is rapidly changing all over Nigeria and across the African continent from a production-driven to a market-driven enterprise. The private sector is playing an increasing role and joining the efforts of the government to accelerate this process. The improved varieties of crops such as cowpea, cassava, and maize, developed through public-private partnerships, are serving as an excellent platform to enhance national agricultural extension and advisory systems. The emerging tools of ICTs are providing unique opportunities to enhance real-time and rapid information delivery to local farmers and stakeholders.

The role of the NASC as a foremost seed regulator in SSA has been very instructive. The council has used pragmatic measures to ensure sanity and quality assurance in the seed industry especially in partnership to develop seed systems for orphan crops such as cassava. Despite the huge challenges and institutional lapses in the agricultural extension systems in Nigeria, the technical information dissemination within its cassava program has yielded great impacts and as such, can be further developed for cascading into other crops. Furthermore, NASC has reinforced the fact that the private sector takes the lead in the seed industry. This has helped in the rapid transformation of the seed sector to a business- and income-generating sector, which in essence affirms that:

- Private extension should be encouraged to ensure stakeholders get their specialized information without the technical hitches of the public extension system.
- Public-private collaboration in extension should be strengthened and more coordinated. This will eradicate the duplication and conflicting channels of information dissemination to stakeholders.
- Specialized seed extension programs should be introduced and institutionalized. This is to engender the robust development of seed information channels among seed stakeholders.
- Seed tracker developed by the seed council should be further explored as a tool for extension service delivery.
- There is a need to unbundle the extension system and be recognized as a key sector of the agricultural system that is cross-cutting along all the value chains with active engagement of all the key stakeholders.

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CHAPTER 9

Linking On-Farm Extension Research Field Trials to Outreach

MICHIGAN'S THUMB AG RESEARCH & EDUCATION CASE STUDY

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Introduction

Farmers want nonbiased information from local sources regarding field crops they grow. While there are many different sources of information, such as seed, chemical, and agribusiness company trials, replicated evidence-based testing trials that are analyzed for significant differences provide a trusted resource they can use to make management decisions.

Michigan State University (MSU) Extension has used organized teams to provide integrated educational outreach, research, and teaching to reach public leaders and groups (Leholm & Vlasin, 2006). One of the MSU Extension teams in agriculture is the Field Crops Team. The team members include MSU specialists and educators who work with commodity crops such as corn , soybeans, wheat, forages, and dry edible beans, as well as farm management. Educator team members have historically been housed in county-based offices throughout the state of Michigan. Each educator covers multiple counties with varying areas of expertise such as forages, corn and soybeans, or wheat.

The goal of the Extension service is not only to conduct unbiased research but also to disseminate the results. For Extension clientele to be satisfied with their service, the research must be relevant to the local famers and the information must be current and accurate. Extension educators must assess and respond to the needs of the farmers as well as evaluate the programs they perform (Terry & Israel, 2004). One way to provide relevant information to farmers is to bring the information to them by providing in-person programs in their county (Galindo-Gonzalez et al., 2008).

Challenges occur on how to diffuse or increase the outreach of MSU Extension programming. Diffusion is the process through which an innovation is communicated through certain channels over time among the members of a social system (Dearing & Kee, 2012). In 2006, MSU Extension Field Crops Team members in the Thumb Region of Michigan (see Figure

9-1) saw an opportunity to collaborate in a new programming effort to increase diffusion.

Figure 9-1. Michigan Thumb regional team brochure.

The program, Thumb Ag Research and Education (TARE) (see Figure 9-2), took place for 10 years. The TARE project focused on generating and disseminating educational information for field crop producers based on locally generated field research and demonstrations. The program enhanced the outreach of MSU Extension, its Field Crops Team, and regional team members by providing results from evidence-based, on-farm research trials and programs to farmers and agribusiness professionals to increase production efficiency and increase profitability. In addition, educators increased technical capacity in their field of expertise by direct experience with growing and harvesting a commodity crop. The self-directed regional team of field crops educators included educators whose areas of expertise each contributed to a diverse cross section of crops from the area. Team members were highly engaged in the generation of information through field research and demonstrations in partnership with agribusinesses and farmer plot cooperators. The educators had expertise in corn, soybeans, wheat, nutrient management, farm resources management, and forages.

The TARE Program became a trusted resource that featured local farmers and agribusinesses in the same area as the farmers. The information was locally disseminated to other farmers, agribusinesses, and government agencies in the region.

To some extent, the project gained more positive response than originally anticipated. In part, this was due to an appreciation for the replicated, evidence-based, technical information that was locally generated. At the same time, it was evident that MSU Extension educators gained valuable technical experience and received positive recognition and acceptance from

farmers and agribusinesses stemming from the high-profile engagement and commitment required for carrying out the project.

In Michigan's Thumb region, agriculture is one of the primary businesses and hosts 21% of the state's farms. Corn, soybeans, wheat, forages, sugar beets, and edible beans represent the majority of crops grown (see Table 9-1) in the Thumb region. These crops also support a thriving livestock industry, primarily dairy, in the region.

Figure 9-2. TARE (Thumb Ag Research & Education) program graphic.

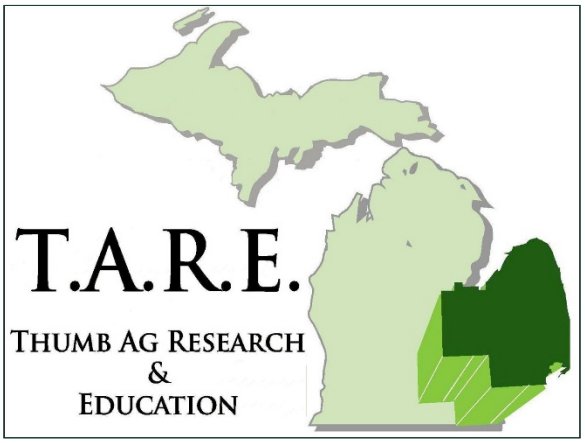


Table 9-1. Hectares of commodity crops harvested in Michigan and its Thumb Region according to the 2017 U.S. Agriculture Census.

Hectares Harvested	Michigan	Thumb Region	Percentage of State Total
Hay and Haylage	408,567	63,035	15
Soybeans	1,006,614	325,847	32
Wheat	197,091	92,074	47
Corn Grain	877,460	228,357	26
Corn Silage	134,008	27,355	20
Total	**2,623,740**	**736,667**	**28**

Note. According to the U.S. Agriculture Census, there were 47,641 farm operations in Michigan in 2017. Of those, 9,971 (21%) were in the state's Thumb Region.

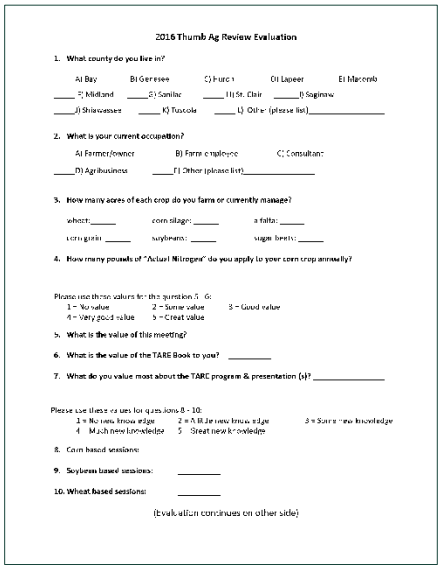
This chapter will discuss the process, funding, opportunities and challenges, results, and lessons learned from the TARE Program. Each element of the discussion has unique facets that helped guide the TARE educators in their decision-making progress and contributed to its success. The process included an annual needs assessment with an advisory committee composed of local field crops producers and agribusiness personnel. The opportunities and challenges of the program were addressed annually, and the advisory board provided guidance that increased the overall effectiveness. The results of the program were distributed and evaluated annually. The outreach efforts included the research trial report and winter meetings in the region for clientele following each growing season. The results were also disseminated through news articles, MSU websites, emails, and printed media (https://www.canr.msu.edu/tare_variety_trials/.)

Educators presented the results of their field research to farmers, agribusiness professionals, and government agency personnel in December at grower programs following harvest at locations in the region, which were convenient for farmers (see Figure 9-3).

Figure 9-3. Thumb Ag Review grower program where TARE (Thumb Ag Research & Education) educators presented growing season results. (Photo by Bob Battel)

Educators used Microsoft PowerPoint presentations referencing the research trials report. Producers were asked to complete a post-session evaluation to document knowledge gained and effectiveness of the materials. They were also asked for suggested areas of future research (see Figure 9-4).

Figure 9-4. Thumbnail views of the 2016 Thumb Ag Review post-session evaluation.



2016 Thumb Ag Review Evaluation

1. What county do you live in?

A) Bay B) Genesee C) Huron D) Lapeer E) Macomb

F) Midland G) Sanilac H) St. Clair I) Saginaw

J) Shiawassee K) Tuscola L) Other (please list)_____

2. What is your current occupation?

A) Farmer/owner B) Farm employee C) Consultant

D) Agribusiness E) Other (please list)_____

3. How many acres of each crop do you farm or currently manage?

wheat:_____ corn silage: _____ alfalfa: _____

corn grain: _____ soybeans: _____ sugar beets: _____

4. How many pounds of "Actual Nitrogen" do you apply to your corn crop annually?

Please use these values for this question 5 - 6:

1 = No value 2 = Some value 3 = Good value

4 = Very good value 5 = Great value

5. What is the value of this meeting?

6. What is the value of the TARE Book to you? _____

7. What do you value most about the TARE program & presentation (s)? _____

Please use these values for questions 8 - 10:

1 = No new knowledge 2 = A little new knowledge 3 = Some new knowledge

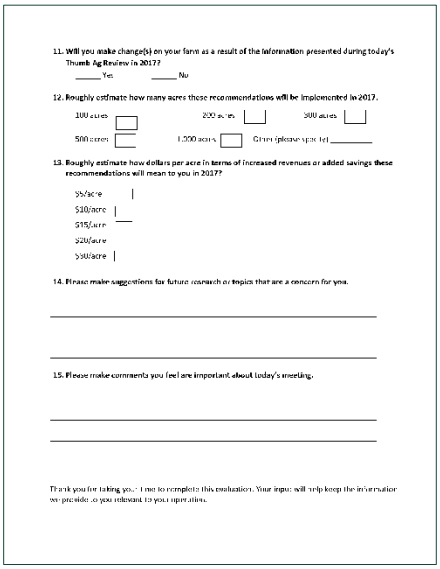
4 = Much new knowledge 5 = Great new knowledge

8. Corn based sessions:

9. Soybean based sessions: _____

10. Wheat based sessions: _____

(Evaluation continues on other side)



11. Will you make change(s) on your farm as a result of the information presented during today's Thumb Ag Review in 2017?

_____ Yes _____ No

12. Roughly estimate how many acres these recommendations will be implemented in 2017.

100 acres ☐ 200 acres ☐ 300 acres ☐

500 acres ☐ 1,000 acres ☐ Other (please specify) _____

13. Roughly estimate how dollars per acre in terms of increased revenues or added savings these recommendations will mean to you in 2017?

$5/acre

$10/acre

$15/acre

$20/acre

$30/acre

14. Please make suggestions for future research or topics that are a concern for you.

15. Please make comments you feel are important about today's meeting.

Thank you for taking your time to complete this evaluation. Your input will help keep the information we provide to you relevant to your operations.

Process

During the initial concept meeting held by the TARE educators, there was a unanimous decision to have a multi-county approach for evaluation of corn hybrid and soybean varieties and verify the effectiveness of other production practices and agricultural input products through replicated field trials. Corn and soybeans are the two major commodity crops grown in

Michigan. As part of the planning process, it was determined that a volunteer advisory committee composed of local field crops producers and agribusiness personnel would provide input on the needed research for the program. Great care was taken to ensure the members of the advisory committee represented the major commodity groups in Michigan. This step was important since funding of the program was a major concern of all. Each of the commodities groups administer funds from a mandatory assessment for commodities grown or a checkoff program, used for research, education, market development, and new uses. Corn and soybean checkoff dollars were secured annually through a competitive grant program to support TARE. (The checkoff programs for Michigan will be discussed in the "Funding" section of this chapter.)

Each educator selected two influential producers to serve on the advisory committee for a total of 10 producers from the region. Six additional influential agribusiness representatives from the region were also selected to serve on the committee for a total of 16 in the committee. This committee had a crucial role in ensuring that the TARE educators were meeting stakeholder's research and educational needs.

While corn and soybean growers were the primary audience of this project, an important secondary audience was the agribusiness personnel involved in the sale of seed, fertilizer, pesticides, and general farm supplies. In addition to being an important audience of the project, agribusinesses were critically important partners as they participated in the fee-based variety performance trials and donated supplies or provided special services. This is consistent with university performance fee-based trials where seed companies pay an entry fee for each corn hybrid or soybean variety entered into the trial. The fees are used for operational expenses over and above the cost of any grant monies obtained.

Corn Hybrid & Soybean Trials

The backbone of the TARE Program were the corn hybrid and soybean trials. These two crops are the two largest commodities for the region, and seed represents a major portion in the annual cost of production for each crop. One of the most important management decisions corn growers make each year is selecting corn hybrids (Henninger, 2012). Before the TARE Program, MSU Extension agriculture educators conducted seed variety research and demonstration plots by asking cooperating farmers to plant the seed trials for them. Farmers perceived the seed trials as a cost, in both time and effort, and were hesitant to place a priority on planting the trials. Additional challenges associated with planting seed trials include the ability to plant in a timely manner, proper sizing of equipment, land availability, trial design, statistical analysis, and the ability to be open to all seed companies. Most often, a small cross section of companies and their hybrids and varieties would be selected for testing. Widespread testing of seed company hybrids that included every company that wanted to participate would be overwhelming to the producer. Thus, some seed companies would be excluded, thereby violating one of the core values of the Extension system, which is to be open to all. Additionally, many times early planting of plots was a low priority for farmer cooperators due to weather concerns and wanting to get their own crop planted first, and subsequently, many variety trial plots were planted late. This limited the use of a wide range of maturities and decreased potential yields.

The advisory committee prioritized research trials focusing on corn hybrid and soybean variety moisture, test weight, and yield performance. The performance of the seed combined with the cost of the seed have a large impact on profitability. Seed costs are one of the highest variable costs for farms and therefore, their performance will have a large impact on farm profitability. The seed trials under the direction of the TARE educators were viewed as an unbiased source of information. In the United States, seed companies spend large amounts of their advertising budgets on comparison plots to entice growers to their products. Seed companies have their hybrids and varieties tested in plots across their marketing area. Although the companies see this as a service when they compare corn hybrids or soybean seed, the plots are rarely planted in a design that would allow for statistical analysis. In addition, the companies may or may not include all the data from their plots to put their products in the best position. Without all the facts, farmers find it difficult to make informed decisions. The companies have a stake in their products doing well, and farmers view them as a biased source of information.

Methods

The TARE group had their own planting and harvesting equipment, which took the burden of early planting off the farmer cooperator. Educators provided seed for each of the plots that was donated by the seed companies (see Figure 9-5) and had a goal of providing cooperators with the same income per acre as the rest of the field that contained the trials.

Initially, the educators purchased a used six-row planter (see Figure 9-6) and combine. These two pieces of equipment were the most important but proved to be unreliable at times. Newer, more reliable equipment was needed. The Corn Marketing Program of Michigan provided a grant to purchase a 2144 Case IH combine with an attached HarvestMaster weigh system to record grain weight, moisture, and test weight. The cost of the Case IH combine (see Figure 9-7) was $60,000. The project equipment also needed trailers and spray equipment. Case IH, one of the primary tractor manufacturers in the United States, has a program for educational entities to use tractors at a reduced rate. The program provides equipment to the local community and improves visibility of their products. A new tractor was either rented or donated to TARE for $1 per year by the local equipment dealer to promote local research.

Figure 9-5. Inventory of donated corn hybrids by seed companies.

Figure 9-6. Six-row planter for corn and soybeans.

Figure 9-7. TARE (Thumb Ag Research & Education) combine harvesting wheat.

With rapid commercialization and adoption of autosteer technology in agriculture, GPS was purchased and used by the TARE Team. The advantages of the precision agriculture equipment include reduced operator fatigue, elimination of machinery overlaps and skips, and improved efficiency in fuel usage and planting accuracy (Mulla & Khosla, 2016). The program grew and subsequently hired a full-time technician who had skills in equipment operation and repair.

Multiple farmer cooperators agreed to allow educators to use their land to plant the trials. At the height of the program, seven corn locations and five soybean locations were planted, applied pesticides, and harvested by TARE. Seed varieties and hybrids were selected by company representatives and entered into the trials. Companies paid an entry fee for each variety or hybrid and provided enough seed for all plots. For corn, each location had three blocks of corn hybrids (120 total) grouped by maturity (early, mid, and late season). For soybeans, there were four blocks of soybean varieties (98 total) grouped by type (conventional and glyphosate resistant) and maturity (early, mid, full season). Additional agronomic trials researching products and practices to improve yield and profitability were planted within the blocks (see Figures 9-8 and 9-9). The corn (see Figure 9-10) and soybean trials were established in plots 15 feet wide and 75 to 90 feet long (0.013 ha) with four replications in a randomized complete block design. The randomized complete block design (RCBD) is a standard design for agricultural experiments in which similar experimental units are grouped into blocks or replicates. It is used to control variation in an experiment by, for example, accounting for spatial effects in field or greenhouse. The defining feature of the RCBD is that each block sees each treatment exactly once (Clewer & Scarisbrick, 2001). Additional locations were also used for wheat and forage trials.

Figure 9-8. Example of field layout for soybean variety and agronomic trials.

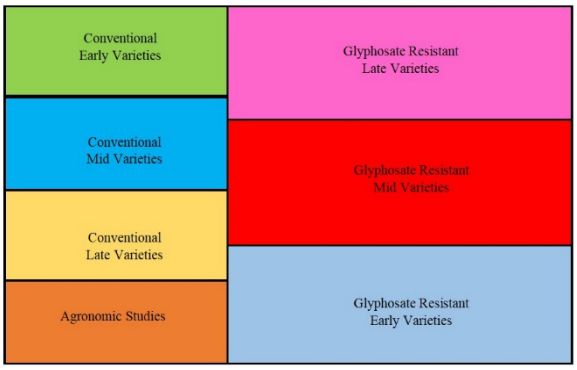


Figure 9-9. A diagram of the TARE corn trial layout.

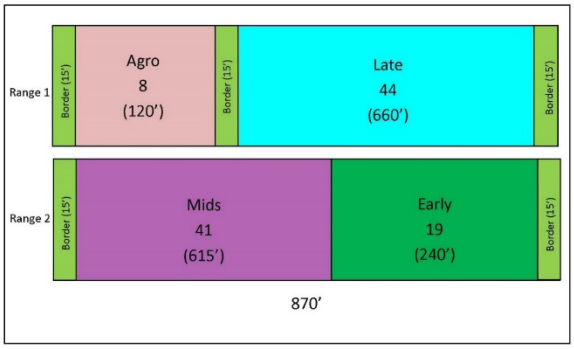


Figure 9-10. Aerial view of TARE corn trials. (Photo by Jim Vincent)

At the completion of harvest, the educators were responsible for providing statistical analysis of the data. The analysis included coefficient of variation (C.V.), a common indicator of the natural variability in an experiment expressed as a percentage. Least Significant Difference was also used to indicate when data values represent treatment differences with 95% certainty. The statistical analysis of yield data has been used by MSU Extension for many years; however, many farmers failed to understand the significance of the analysis, so an emphasis was placed on providing educational information on how to interpret the data.

The yield and moisture data provided farmers with gross income per acre that could assist them in making buying decisions for the next growing season. For example, in 2011 when comparing full season corn hybrids, the magnitude of difference between the highest and lowest corn hybrids was 59.1 bushels per acre. When you consider the average price for corn in 2011

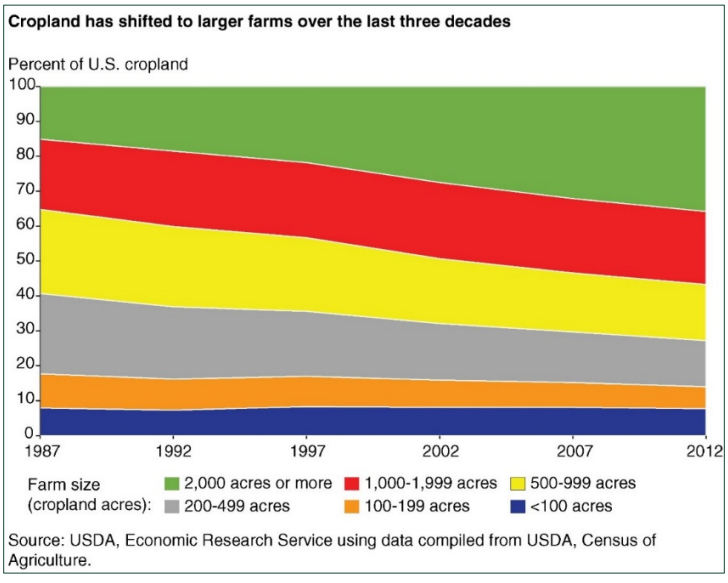
was $6.20 per bushel for the marketing year, gross income differences could have been $366.42 per acre of corn grown. These are not typical prices for corn in the United States, but show how great the value can be for picking the correct hybrid for planting.

Funding

To pay for the program, TARE was dependent on soft dollars from outside sources. The educators secured grants from the Michigan corn and soybean commodity groups. The Corn Marketing Program of Michigan is a checkoff program established by Public Act 232, 1965 as amended. Public Act 232 allows for the establishment of checkoff programs for commodities grown in Michigan and sold. Commodity checkoff programs collect funding from agricultural commodity producers and then use the money for market development, promotion, and research that will stimulate the demand for that commodity. The Michigan Soybean Promotion Committee directs the soybean checkoff. These commodity groups supplied annual funding for the duration of the program, and supplemental funding was used to purchase or update necessary equipment and hire personnel to coordinate a large-scale testing program.

Support by the seed companies was a critical component of the trials. When the seed company with the largest market share in the region withdrew from TARE, other major seed suppliers followed suit, lessening the perceived impact of the corn and soybean trials. The consequences of having a voluntary program funded by registration fees made sense to the planners of the program since there had been great support by the seed companies in the past. According to the United States Department of Agriculture, agricultural production has shifted to larger farms over the last three decades (see Figure 9-11). Additionally, technology has been the primary driver of this shift, which has been large and widespread across crop and livestock commodities. This shift in production has led to agriculture supply companies being able to capture a larger proportion of market share with fewer farms (MacDonald & Hoppe, 2017).

Figure 9-11. Percentage of U.S. cropland and farm size comparison.



The seed suppliers also have consolidated and are relying on their own research data rather than the unbiased university data from programs such as the TARE Program or university variety trials. Farms will increasingly expect and demand total solutions to their unique business problems. The fundamental issue will be whether a particular supplier provides a total system solution or only selected components of that solution (Langemeier & Boehlje, 2017).

Opportunities & Challenges

During the initial planning stages of the program, the Thumb area had five field crops educators housed in the region. Each educator had been involved with field trials in their local county or counties and had participated in a year-end program to highlight the results of their local trials. With TARE, the idea of a joint educational program brought a sense of excitement to the work. Synergism between the educators was at an all-time high and helped the group to develop new approaches and thinking in their work. We had anticipated some inherent challenges. However, many more obstacles were hidden underneath the excitement.

TARE was similar to large-scale farming. This may not seem like an issue to someone that has not been involved with a modern agriculture business. Successful farmers in the region are business people with many enterprises that need to be managed successfully. Farmers use remarkable skill when managing their time and resources to plan, develop, and execute their cropping plans. The TARE Team required the same set of skills to be successful. There was a need for securing capital, procuring land and equipment, managing additional labor needs, handling logistics for getting the work done over a large geographic area, marketing, and managing data, and the TARE Team needed to be excellent Extension educators as well. Each of the educators had a full-time job prior to taking on the responsibility of this project, and at times were overwhelmed. None of the educators were "real" farmers with all the expertise or time needed to do the needed work; therefore, a technician was necessary for the project. With additional labor, additional funds were required. The initial technician worked for a wage far below what was warranted by the work. However, he was part of the initial planning committee and donated much of his time to help the program get started.

The turnover with technicians was unanticipated and so additional funding was sought and obtained, for a time. Since the time needed for this job involved blocks of full-time work, and at other times, part-time work, keeping a technician busy and employed full-time during the year was a great challenge. They needed to be able to use modern up-to-date equipment, service and troubleshoot machinery repairs, and use computer-based programs.

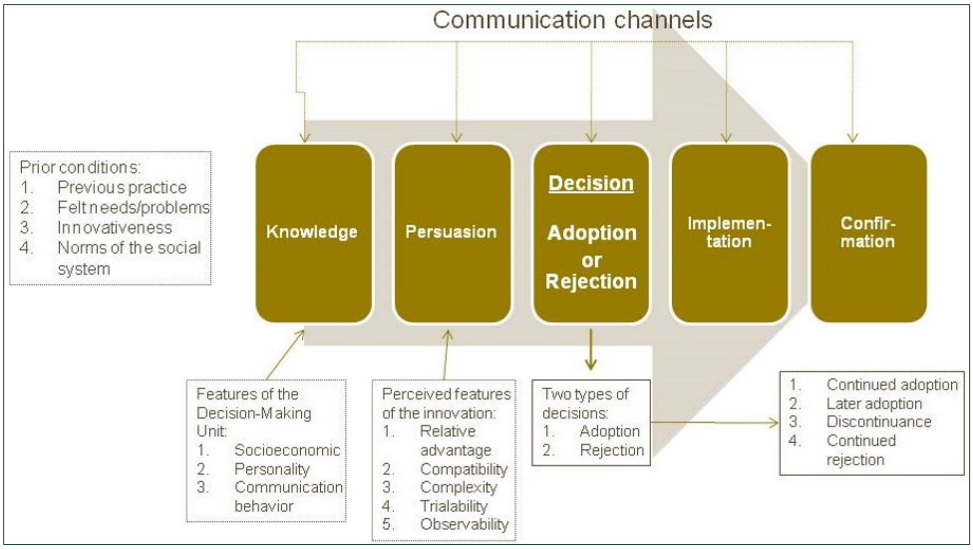
The geographic area of the Thumb is roughly 730,000 hectares, so transferring machinery from plot to plot was difficult. As much time was spent moving long distances from site to site as was spent in actual planting time. The farthest distance between locations was approximately 115 kilometers.

Another challenge for the educators was the ability to disseminate the information to all the producers in the region. The Thumb area has nearly 10,000 farms (see note following Table 9-1). The largest number of TARE

Variety Trial reports printed was 2,000, so there were approximately 80% of the farms not receiving the printed yield information. This opportunity for the target audience to view unbiased information was a continuous concern. Dissemination through the MSU Extension website, email, social media, and delivery through agribusinesses were all used during the years of the program.

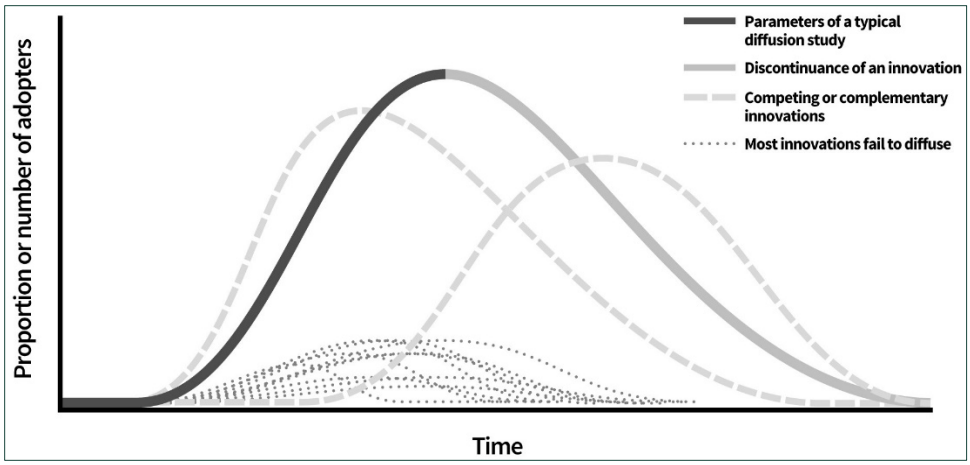
The farmers and agribusiness representatives chosen to serve on the advisory committee were invaluable partners to the program. Educators expected the committee to help with adoption of the information and disseminate the results. The individuals chosen by the MSU Extension TARE educators were perceived as leaders in their respective communities and opinion leaders for agriculture policy. These leaders understand what it takes to be successful in farming. They felt all the right pieces were in place for the TARE Program to be successful. When you consider the classic innovation attributes of cost, effectiveness, simplicity, compatibility, observability, and trialability (Dearing & Kee, 2012), there was anticipation the program would thrive in the region with a strong group. In hindsight, the model worked in many ways to provide farmers and agribusinesses the knowledge to improve profitability by following the progression outlined in figures 9-12 and 9-13. Farmers considered the research information and if they chose to implement a concept, validation of the practice and profitability would be done using the management system they use for their farms.

Figure 9-12. Innovation adoption process.



Source: *Diffusion of Innovations: From Rogers to Today*, by J. W. Dearing, 2019 (Presentation at University of Wisconsin, Madison).

Figure 9-13. Diffusion in context.



Source: *Diffusion of Innovations: From Rogers to Today*, by J. W. Dearing, 2019 (Presentation at University of Wisconsin, Madison).

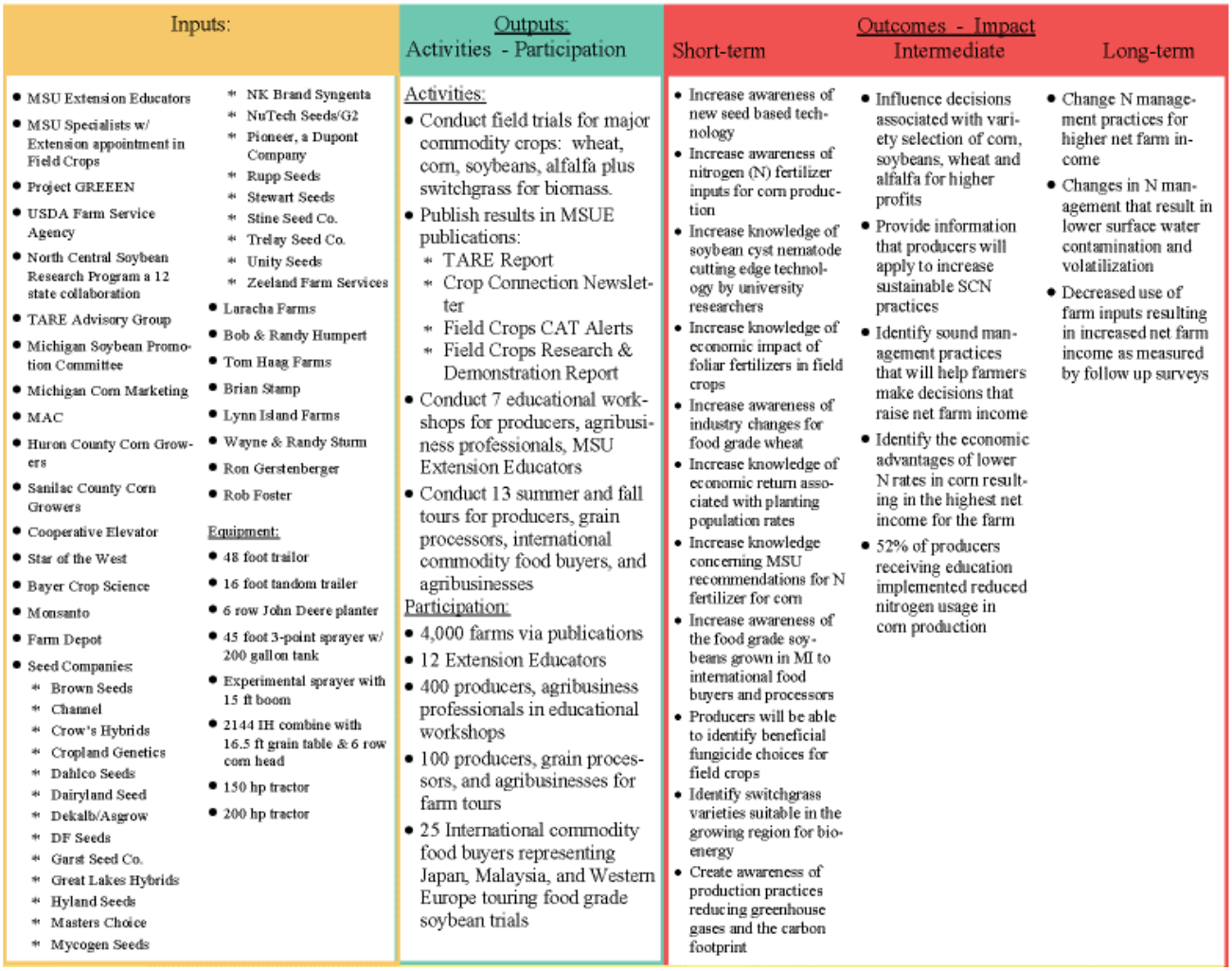
Many of the farmers and agribusiness representatives served on the committee the entire tenure of the program.

Farms numbers continue to consolidate according to the United States Department of Agriculture Census of Agriculture (https://bit.ly/35iFNyd). Agribusiness suppliers also continued to consolidate into larger entities with multiple locations within the area. This limited the ability of the TARE educators to have a rotation of representatives. This was both a positive, and in some cases, a negative connotation. There was a sense of ownership and pride of the program by all who served on the committee. It also provided more opportunity for influence over the program. Although the outputs were considered unbiased and served to provide an impartial depiction of results, some representatives would question the validity of the results if their products performed poorly. The farmers also began to question the results when the two largest seed suppliers withdrew from the trials. The company with the largest market share in the area never provided a reason for withdrawing from the program; however, there was a companywide shift away from unbiased university seed trials to company-based trials. The company with the second largest market share then withdrew from the TARE trials the following year, citing that their primary competition in the market had withdrawn.

Lessons Learned

Within MSU Extension, there is great diversity in programming and personnel. However, one of the core guiding principles of the TARE educators was a unified vision for excellence of the program and the unbiased validity of the data produced each year. The logic model (see Figure 9-14) prepared for the 2009–2010 season served as a blueprint for the team. Each member strived to reach short, medium, and long-term impacts for the program. The first lesson learned from the TARE Program was that farming and the factors that affect growing crops will vary year to year. These factors may make it difficult to get the type of consistent data needed, but the goal is to seek the best possible outcome, even in difficult conditions.

Figure 9-14. TARE (Thumb Ag Research & Education) logic model for 2009–2010.



Note. Adapted from Taylor-Powell & Henert, 2008.

There were originally seven educators when the plan for TARE was developed. As discussed earlier, the consolidation of agriculture for both producers and agribusiness affected the program. The consolidation also affected the educator staff. At the end of the program in 2016, there were three educators with the program. From the initial group, four educators either had left Extension or had elected to shift their responsibilities to other programming areas. This highlights the second lesson learned. When planning a major program, plan for change. It is inevitable! The ability to stay flexible and maneuver around shifting influences will be important for long-term success. Continuity of a program is a thing of beauty when you have consistency in personnel, funding, sound leadership with a shared vision for excellence, industry, and organizational and community support. The current political landscape often affects how programs are funded, thereby affecting how programs will operate. This leads to the third lesson learned. It is imperative to maintain your local, regional, and state support. They control aspects of funding. It is important to keep your legislators, clientele, and influential opinion leaders well informed and satisfied of the work being done.

The reasons for keeping stakeholders well informed is tied to the funding of a program such as TARE. The average projected project income, which

included grants, entry fees, and donated materials, for 2010–2014 was $52,000 U.S. The educators were convinced there was a need to have a contingency fund available in the event of a major expense such as a combine breakdown or in grant funding shortages. Even with the best of intentions and annual budgeting, there were simply not enough dollars to build a contingency fund. We learned programs are expensive and funds will be used quickly as operational dollars for any annual initiative. The funds may seem to be a large amount. However, like a typical U.S. farm, the expenses generated annually were used in operational expenses of labor, fuel, rent, and printing of the annual report.

The TARE Program was successful because there were committed farmers (plot cooperators). They allowed the educators the opportunity to do large-scale field trials on excellent farms. Each farm chosen had the proper drainage, improved soil fertility based on soil testing, and growing conditions to achieve maximum yields with our equipment. The farmers were the recipients of the crop grown and typically had similar income compared to their normal rate of return. Without great cooperators, the educators believed there would be a low probability for a successful program. With great cooperators, you have the opportunity for a great program.

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CHAPTER 10

Rural Democratization for Broad-Basing Extension

EXPERIENCES FROM INDIA

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Introduction

Enhancing the role of the rural masses in decision-making on matters related to their lives and livelihoods has been widely acclaimed as a trusted pathway that would lead to their empowerment and development. Even though it is apparently difficult to achieve, this has been realized in many places through the collective action of people. Many development theorists and practitioners have underlined the significance of fostering participation of people as a major intervention for sustainable development at the grassroots level (Bosc et al., 2002).

In fact, the concept of participatory development has been construed and implemented differently in different sociopolitical situations. Getting involved in the development process is a highly contextual proposition, which draws immensely from the idea of democracy and representative governance. Political participation has figured in the discourses on these topics since ancient times as a means of providing citizens with opportunities to communicate their views and take part in decision-making. From that point of view, participation could be some degree of representation of people in decision-making bodies, which would ensure that they have a stake in decisions regarding matters about them. The idea of participation in decision-making on matters related to development is obviously an outcome of this democratic process. However, in practice, the level of participation may range from nominal to deeper involvement, based on the power and influence wielded by the group and nature of the activity (White et al., 1994). Participation as a concept eludes specific definitions, as it changes from context to context, according to the priorities and conviction of the key actors of a decision-making process.

In spite of the amorphous nature of its definition, participation has become an integral part of development debates across the world. Nevertheless, a participation process assumes different levels and has been categorized as pseudo participation and genuine participation (Deshler & Sock, 1985). According to them, while pseudo participation is only peripheral and limited to merely domestication and assistance, genuine participation aims at cooperation and citizen control. The degree to which a stakeholder is

prompted to participate is evident from the nomenclature of these two categories. The formal is superficial participation with minimal involvement of the stakeholders; they would just be informed of the details or they would be manipulated by pretending that they have been informed. Meager consultation with the stakeholders would also be considered as pseudo participation if they are not taken along during the project life cycle and afterward. On the other hand, genuine participation would involve partnership, delegation of powers, and thereby, empowerment.

Due to this paradigm shift in the approaches to grassroots-level development, every development intervention has varying provisions to ensure participation of people, at least nominally. It is more evident in rural development interventions in the developing economies, with room for its beneficiaries to involve in any of the various phases: formulation, implementation, monitoring and evaluation, or the entire course of the project.

Even while the rhetoric on participation is on, ensuring participation of people in the development process would be difficult due to the uneven socioeconomic conditions, mainly in developing economies with wide socioeconomic diversity. With the interplay of several complex factors that contribute to inequality in terms of endowments and opportunities in action, participation of people is difficult to materialize in its absolute sense under such premises.

Translating Participation Into Actionable Programs

In most of the rural and agricultural milieus, particularly in the developing economies, collective action is often regarded as a condition for achieving long-term ownership of development-oriented actions. It may also be considered as a condition for expanding individual strategies and evolving common wisdom (Bosc, 2018). Collective action and participation are corollary to each other. In other words, this implies that individuals get together to achieve some common goal and thus accept to face the constraints and difficulties linked to collective action. Collective action and participation in matters related to agriculture and rural development are more relevant than what is apparently seen, as these sectors undergo substantive transformations quite frequently. However, given the dissimilar perceptions on participation, translating the rhetoric of participation to reality would warrant humongous efforts on the part of development planners and implementers to integrate the ideals of participation in development administration. In fact, participation and the strategies to ensure participation of people in development interventions have evaded the attention of the priority of planners for a long time. This has led only to nominal and ineffective participation of people, without any impressive outcomes. As White et al. (1994) observed, this has been pseudo participation, wherein the control of the project and decision-making power lay mostly with planners, administrators, and the community's elite and not with the people. Genuine participation would happen only when the development bureaucracy, the local elite, and the people work cooperatively throughout the decision-making process and when the people are empowered to control the action to be taken.

The world over, one of the most important methods of translating the ideal of people's participation in development is democratic decentralization, which envisages delegation of political power and resources to local governments, which are truly representative and democratically elected and have robust systems for decision-making and implementation. In developing economies, democratic decentralization assumes more importance as it would empower the rural population by enhancing their access to resources and decision-making power. Experiences on feasible paradigms of democratic decentralization across the world show that the process of democratization is a highly evolved form of political empowerment and can enhance participation, transparency, and efficiency. However, connecting democratization with development requires a whole set of innovative institutions and processes that would warrant enhancement of financial resources to local government; participation of stakeholders in deciding development intervention; generation and management of human resources, social capital and financial resources for being invested in the process; devolution of fiscal and administrative authority to undertake administrative decisions at the local level on key development issues; transfer of key development agencies to local self-governments; establishment of stakes for people's representatives, local resource persons, and local organizations in the functioning of development agencies; and responsive and participatory auditing systems to enhance transparency (Vijayanand, 2009).

Rural Democratization as a Driver of Development

Rural democratization is a long and difficult process that involves struggles to build social and political organizations capable of representing the diverse interests of the rural poor and amplifying their voices in public policy processes (Franco, 2008). Further, rural democratization involves attempts to increase state accountability to previously excluded or marginalized members of the rural population, especially the landless poor and rural women. It also implies deploying strategies for effectively protecting and claiming rights of these sections of the community. This would invariably trigger far reaching changes in the rural development sector as it offers proper definitions of problems and realistic efforts to address them. Moreover, this will help evolve innovative ways to engage the state and make its development policies more accountable to the less endowed segments of rural society (Franco, 2008; Bebbington, 1999). Though specific approaches and strategies to be adopted might change in different countries based on the nature of rural societies, it has been observed that regardless of the rural poor population in the country, what goes on in the rural political arena is important because it can affect the lives and livelihoods of large numbers of people, including those living in more urban areas. Though in varying degrees, the democratization process has been able to address several pertinent and long-standing issues related to rural poverty, and access to resources, health, housing, education, and sanitation with better outcomes (Jayal et al., 2007).

Successful experiences of rural democratization have shown that it would primarily facilitate a more inclusive decision-making process, which might warrant better articulation of the requirements of the people concerned.

This is a departure from the conventional ways of addressing development problems under a centralized paradigm of decision-making and implementation. This transition must be seamless and orderly for expected results. As observed by Bhattacharyya (2008), for democratization to be relevant and fruitful, sustainable measures have to be adopted to create legally protected bodies of local governments, especially in the rural areas. Functions of these bodies should be periodically renewed following institutional norms in the transaction of their business. They should also be made suitably responsible for administering policies pertaining in particular to the population and resources of their respective jurisdictions. Even if such institutional arrangements are put in place, the democratization process would stagnate unless people become aware of its significance and become convinced of its effectiveness by seeing measurable impacts. Apart from this, a skewed local power structure marked by the presence of influential local elite would deter free transactions among the community. Nevertheless, any attempt to revamp the centralized system of decision-making is a welcome change in developing communities, as it may evolve into a more inclusive system eventually by imbibing impetus from the beneficiaries themselves. The rural democratic process, as pointed out earlier, should envisage rigorous inner drivers to facilitate participation of people, formal structures to articulate people's opinion, proper processes to delegate authority and resources (both human and financial), dynamic institutional structure to convert people's needs and aspirations into action plans, and a system to implement and monitor the process by involving all possible stakeholders as much as possible. To put it otherwise, rural democratization as a political process provides a plausible framework to translate the theory of people's participation in development into an actionable program.

Rural Democratization in India: The Process & Evolution

The rural democratization process in India has been made possible by the historic legislations on democratic decentralization spelled out in the 73rd and 74th amendments of the constitution that rendered the local self-government institutions mandatory and powerful. The amendments envisioned revival of the archaic systems of local governance as designated authorities for local development. The local governments turned out to be legal entities that could be involved liberally in local development. As outlined in the amendments, elections to rural and urban local bodies were made mandatory, and they were bestowed with significant powers to spearhead and direct local development initiatives. The amendments also envisaged local-level planning in key development sectors as a mandatory function and suggested various financial resources that could be utilized to plan and implement local development initiatives. The structure and functions of the subsystems of this process of local governance were also broadly outlined in the amendments. For instance, the amendment had formalized village councils for people to meet and engage in dialogue with local authorities.

While the amendments suggested the broad framework of democratic decentralization and its objectives, the respective state governments were given freedom to improvise the provisions in the amendments and draw up newer forms of institutional arrangements to facilitate the democratization

process to reach far and wide. Nevertheless, it did not take up momentum, as most of the constituent states of the country had not expedited these interventions to carry democratization and decentralization of development administration forward (Isaac & Franke, 2002). However, the state of Kerala, located in southwestern India, which had its own legacy of democratic decentralization, drew up a specific plan in 1996 for democratic decentralization. The state, with laudable track records of accomplishing the highest literacy rate in the country as well as universal education and health care, had already ventured into decentralization with plans to devolve authorities to the district level and further below, much before the amendments. This new opportunity for strengthening local self-governments had in fact created an impetus for thoroughly exploring the provisions of the constitutional amendments to convert them into hubs of grassroots-level development processes. This was made possible by establishing three levels of local governments at the district, block (the middle tier), and villages and devolving political and financial authority to these institutions. This included four distinct measures: (1) transferring key development departments in the rural sector and their personnel to the local self-governments; (2) devolving administrative authority to plan, implement, and monitor development program at the grassroots level; (3), devolving as much as 30% of development grants of the state government to the local governments; and (4) formulating an innovative framework of processes and procedures to draw up local-level development plans in all key sectors that have direct impact on the people.

As observed by Jayal et al. (2007), revival of local self-government institutions in the country had been paralleled by a proliferation in the number and variety of actors involved in governance at the local level. In fact, the local self-government institutions had remained archaic without any relevant role in local development and the new legislative framework had infused significant vigor into these systems.

As the local governments were transformed into institutions with greater mandates, more authority and resources, a new web of linkages with other institutions and agencies became necessary. First, as much as twelve development departments were transferred to the local governments to work under the supervision of the political leadership. Second, the state government formulated a robust system of delegating powers and resources to the local governments and drew up a well-orchestrated process to formulate grassroots-level development projects. The most striking aspect of this exercise is that the planning process was made characteristically inclusive with adequate options for the people to articulate their needs and aspirations. This was primarily done by means of engaging people in the village councils by facilitating free interaction and recording their needs and reflections systematically to formulate development projects. This would be followed by prioritization of the proposals by the local body leadership and verification and approval by a team of experts and officials at the district level. Projectization of needs and suggestions would be led by the official of the development department deployed at the local body. Approved projects would also be implemented by this official based on broad fiscal guidelines and priorities decided by the state government from time to time.

Consultation with the people takes place at different levels in this process. Village councils are the primary fora where the dialogue on needs, requirements, and priorities take place. These deliberations are consolidated and projectized by working groups consisting of

representatives of people and a few selected citizens who could be instrumental during the projectization phase. Subsequently, projects are finalized and prioritized by the local government, which is formed by elected representatives of the people. Similarly, the people's participation is ensured in implementation and monitoring as well. Beneficiaries of the projects are selected based on well-laid-out criteria and approved by the village council. Monitoring of implementation also is made in a participative manner by committees that include people's representatives and volunteers constituted for this purpose. This process is adopted in formulating and implementing development projects in all the key sectors of rural development: agriculture, animal husbandry, fisheries, health, education, sanitation, irrigation, housing, energy, roads, and social welfare. This is also accompanied by innovative methods of ensuring transparency and accountability in governance, mainly through computerization of the activities of local bodies and establishment of responsive systems for redressing citizen's grievances. The whole system of local governance is also moored to a strong system to ensure citizen's rights, which include citizen charters, judicial bodies for preventing corruption, and other means.

Many authors have commented that this new system of participative decision-making and project implementation through a structured system of rural democratization has made the development administration more focused, target oriented, responsive, and transparent. Though it has not yielded promising results in all the sectors, a growing body of evidence proves that investment in all development fronts relevant to the rural sector has increased considerably. It has been reported that sectors such as rural housing, agriculture, enterprises, infrastructure, and education have recorded higher investment and commendable social returns with great positive impact on women's empowerment, public consciousness on rights and privileges, social capital formation, and collective action.

This innovative method of inclusive development planning, which would impact the lives of people much more positively than the traditional bureaucratic system in the public sector, has opened up new vistas of partnership and joint action among different actors. This system, which relies on local ingenuity and freedom to devise solutions for local-level development problems, has thrown open possibilities for establishing functional linkages among different development agencies. The provisions of the decentralized governance give considerable freedom to the local bodies to harness the support of institutions and agencies at the local level in innovative ways. For instance, investment in agriculture could be enhanced by seeking partnership from cooperative financial institutions in the locality. Similarly, small and marginal producers could be organized to establish a network of producer collectives to safeguard their interests more easily than before. The platforms of rural democratic institutions offer innumerable opportunities for human resource development, social capital formation, negotiation, consensus building, conflict resolution, and creative thinking in several ways.

Rural Democratization to Broad-Base Extension & Rural Advisory Services

Agricultural extension in India as well as in other developing economies can draw valuable lessons from the experiences of decentralization and rural democratization. It appears that this would be a plausible solution to the issue of strengthening the extension delivery systems. Experiences show that the new system of rural democratization has made the public extension systems vibrant and responsive more than ever before. As investments in agriculture for the common good have been showing declining trends during the post-reform period resulting in serious setbacks for the less endowed farmers (Jha, 2007; Mani et al., 2011), this system of devolving power and financial resources at the grassroots level would boost the local economy and improve the livelihood options of the rural poor. As extension is an important instrument that catalyzes development, it will have new roles to play in supporting and facilitating this participative and inclusive system.

National extension systems in many developing countries have declined over the last couple of decades due to lack of political and financial support, reduced investment, attrition of human resources and physical infrastructure, and lack of clarity on the roles of the public extension institution in relation to other stakeholders and service providers (Rivera, 2011). Governments guided by the provisions of the structural adjustment agenda tend to shirk their responsibility by assigning the interventionist role to multiple actors, private and nongovernmental sectors included. Though this might enhance pluralism of intervention, social control over the agencies given this responsibility would lessen. This is one reason why many authors solicit public extension systems with social control as a pre-condition to safeguard the interests of the poor farmers in developing economies (Sajesh & Suresh, 2016). Rural democratization, on the other hand, offers immense scope to involve all the actors and bring back a growth model propelled by the logic of redistributive growth, grounded on the rights of the communities and the collective ownership of their resources, and promptly linked to the market.

Deliberating on the scope of decentralization of agricultural extension, Swanson and Rajalahti (2010) observe that decentralization not only gives local government control over personnel and finances, but also in theory, focuses control closer to the level of farmers and thus can improve extension accountability to their needs. Rural democratization, supported by efficient systems of service delivery and functional linkages, can bring about substantial changes in the delivery of extension services. Since there is better scope for wider consultation with stakeholders, identifying critical problems and applying precise solutions would be easier. Experiences of the rural democratization process in the state of Kerala have reaffirmed the efficacy of this system in harnessing the collective action of people in many sectors.

The effectiveness of the rural democratization process has clearly manifested in the attempts of rural local self-governments to restore precious natural resources such as wetlands and other ecosystems through

intensive campaign and public action. Many local governments have evolved beacon programs that showcase better management of common resources and productive initiatives by collectives of farmers, farm women, and rural entrepreneurs aided by the collective wisdom of the community and public funds. Another immense possibility has been the integration of financial resources for assisting local-level development interventions. The efforts of various agencies that work in a locality with the same objectives and same set of clientele in focus could be integrated to build up synergy. This has resulted in better capital mobilization producing better results. It has also offered adequate room for linking rural enterprises with value chains duly supported by credit and micro finance institutions. This new regime of rural democratization has also facilitated coordination of small and marginal farmers for group farming, which improves productivity and efficiency. Above all, compartmentalization of development agencies without mutual cooperation and interaction has also been reduced to a considerable extent through this process, as there are provisions to coordinate the efforts by different agencies that are complementary to one another. For instance, coordination among the departments of agriculture, animal husbandry and fisheries, which is important for integrated farming, would be easier in this new framework. This new paradigm has also given way to public–private partnership initiatives and association with nongovernment organizations to enhance the effectiveness of development interventions in the rural settings. The productive sectors such as agriculture and allied enterprises have been given emphasis in response to the requirement of the people, and this has reflected in the emergence of a multitude of enterprises in agriculture throughout the state. Intensive involvement of people of all hues, prompted by the mobilization in rural democratization, has made the development agencies more conscious of their significance.

All these new systems have necessitated reorientation of the roles and functions of extension agencies. This has prompted customized service delivery to various types of client groups. Roles of development personnel have also undergone substantial changes. Instead of remaining as bureaucrats, these officials now must address several professional challenges as planners, organizers, analysts, technocrats, problem-solvers, and managers of various types of development interventions, which are closely monitored by people. However, not everything is well with such decentralized public systems. Bureaucracy, local politicking, and lack of innovation and updating have had their share in setting in the signs of degeneration of the system. Devolution of authority and financial resources may have to be enhanced to take up new challenges. Building capability of the actors at the grassroots level to manage the institutions that have been formulated for facilitating decentralization would be the biggest challenge. The ways of preventing deterioration and improving efficiency also necessitates detailed enquiries about this system. Building up autonomous and sustainable systems would remain as uphill tasks unless these vulnerabilities are addressed.

Learning From the Praxis of Democratization: Implications for Extension & Advisory Services

Extension scientists as development interventionists and social researchers should explore the dynamics of rural democratization in detail. While doing this, they should be able to characterize the policy environment required to revive rural institutions democratically. Innovations in linking the grassroots-level democratization process with better livelihoods would show the way ahead for effective utilization of rural resources. How efficiently such systems address important concerns such as sustainability and ownership of common resources could be of interest to an extension researcher. Evolving a robust system of rural democratization warrants critical social action and departure from the conventional norms of participation.

The rural democratization process in the state of Kerala has led to creation of new knowledge domains and skill sets that have to be internalized by extension functionaries. An analysis of a set of beacon projects implemented by rural local bodies as part of this rural democratization process and decentralized planning has shown that the development personnel have to assimilate new knowledge and skills for effectively managing these rural institutions (Alex & Sulaja, 2012). They should also be skilled in training and orienting the stakeholders to accomplish pre-decided development goals. Extension advisory services must now respond to a wide range of issues other than technical solutions to farmers. The new domains are mostly on planning for development, building institutions, organizing people with diverse interests, creating interfaces with the political leadership, resolving conflicts, community managing of common property resources, managing value chains, negotiating with partnering agencies, coordinating with diverse institutions, integrating financial resources, managing data and drawing inferences for long-term planning, and assessing impacts, to name a few.

Conclusion

Rural democratization is a lengthy sociopolitical process, which would help extension scientists learn how new institutional arrangements in a decentralized and democratic framework could bring about changes in various development sectors. As discussed earlier, it would also unearth the difficulties in making participation work, even while the framework and settings are conducive. The new paradigm of development planning may create new insights about the dynamics of collective action in the community and how it could be supported by technological interventions. Bringing diverse institutions and their programs together for sustainable and comprehensive development of a region is a challenging task. Managing the web of relationships that would emerge out of the interactions among these institutions warrants innovative approaches and methodologies of rural management. The rural democratization process would also help us identify the new skill sets to be acquired by extensionists. However, these experiences would enrich our understanding on the scope of broad-basing

extension in the developing economies. It would be unfair on the part of extension scientists to leave out this important innovation from the realm of their academic interests.

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CHAPTER 11

The Role of Community & Government Engagement for Successful Delivery of Extension Services

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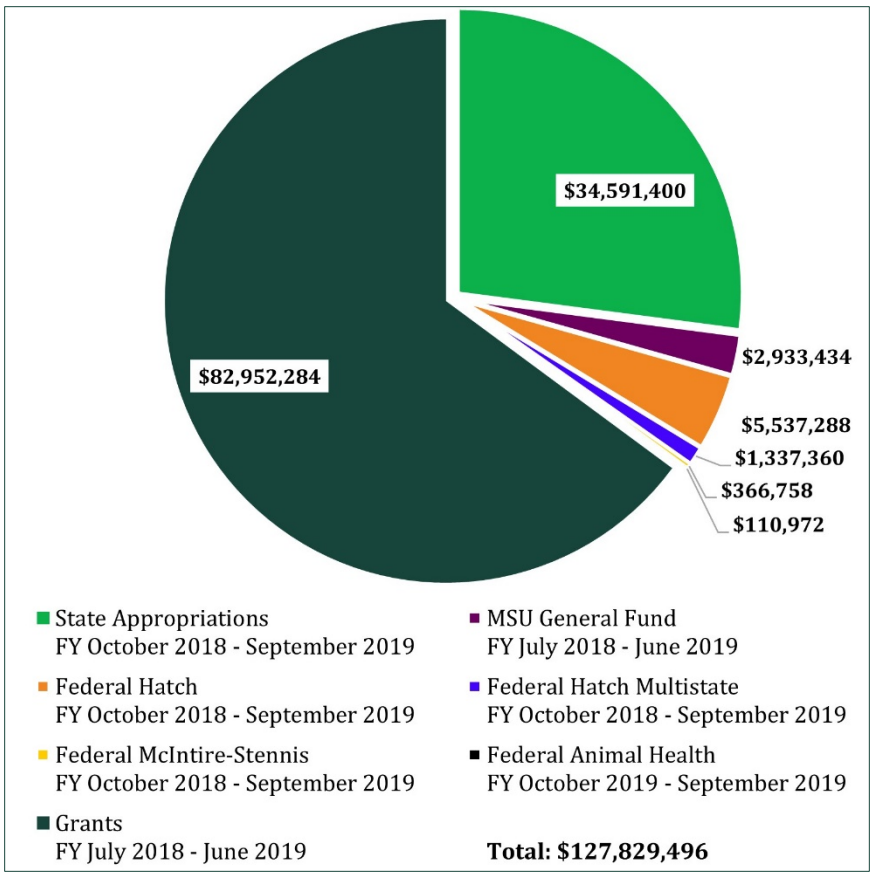
Introduction

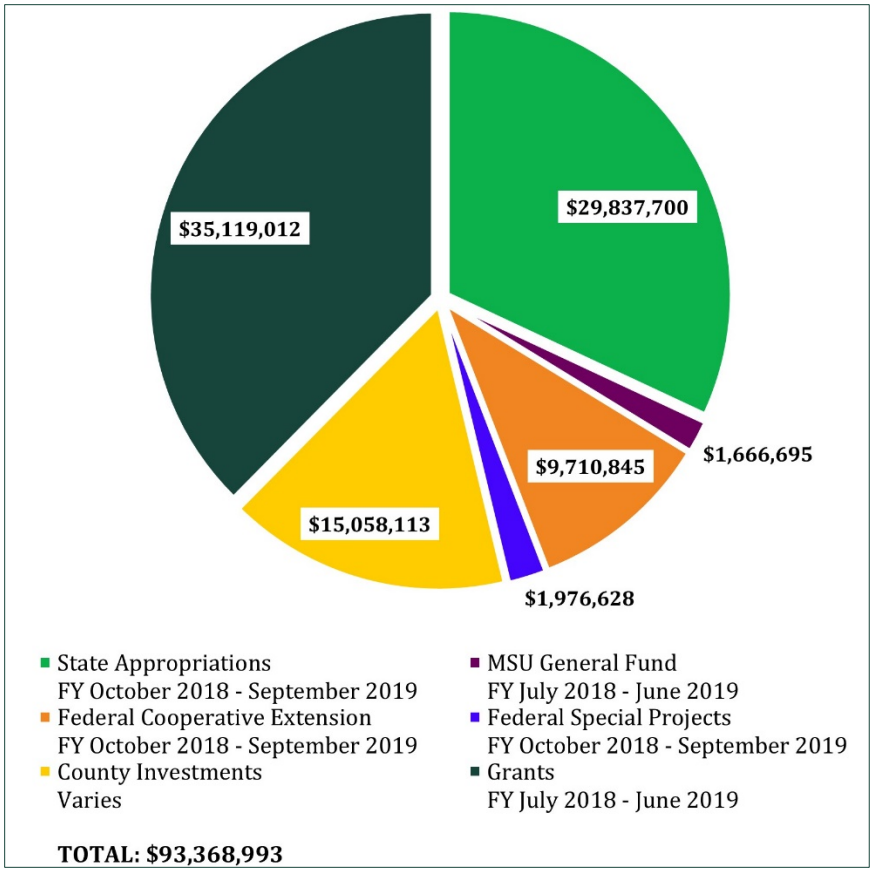
Extension systems in the United States have long been touted for their three-legged funding model based on investments made by federal, state, and county governments. Though this model has evolved over the years, with additional emphasis on grant acquisition, philanthropy, and special projects, the foundational core remains the same. Michigan State University (MSU) Extension's program model is successful due in large part to the government engagement strategy with all three of these funding levels and complemented through a multitude of community engagement strategies. In Fiscal Year (FY) 2018–2019, MSU Extension's budget was $93,368,993 and the accompanying AgBioResearch budget amounted to $127,829,496 (see Figure 11-1).

MSU Extension funding was established first through the Morrill Act of 1862, which put into place the land-grant university system, and then was expanded through the Smith-Lever Act of 1914. This historic funding allowed each of the land-grant universities to receive federal funding to support an educational outreach system. There are 112 land-grant institutions in the U.S., of which 33 are historically black colleges and universities, and 19 are tribal.

Years later in 1919, the state legislature in Michigan passed Michigan Public Act 315, that allowed county governments to raise money through taxation. These historical legislative acts were the roots that allow MSU Extension's current programming model to exist. Today in 71 out of 83 of Michigan counties, MSU Extension was financially supported in 2020 by the local governing body: the county board of commissioners or the county executive. The remaining counties are supported by resident-imposed property taxation called a *millage*. MSU Extension now has established offices in each of the 83 counties in the state of Michigan.

Figure 11-1. FY2018–2019 funding sources for MSU AgBioResearch (top) and MSU Extension (bottom).





At its inception, MSU Extension was created to serve rural areas by educating farmers on agricultural practices. Though MSU Extension continues to have strong roots in agriculture and agribusiness, today's Extension has evolved to meet the diverse needs of all communities in Michigan. MSU Extension is composed of four institutes: Agricultural and Agribusiness; Health and Nutrition; Children and Youth; and Community, Food and Environment. Through these four institutes, MSU Extension delivers over 200 types of programs.

Engaging With the United States Federal Government

The U.S. federal government is primarily funded through income taxes levied on individuals and organizations, predominately businesses and corporations. Congress authorizes federal funding for Extension, through our land-grant institution, every five years through the passage of the Farm Bill. The U.S. Department of Agriculture (USDA) oversees national Extension programs through the National Institute for Food and Agriculture (NIFA). NIFA provides capacity grants for extension activities on the basis of statutory formulas. There are administrative and fiscal requirements that grantees such as MSU Extension use in managing these funds. Find more detailed information online at https://bit.ly/36L3cbn.

In addition to receiving capacity funding, MSU Extension is becoming increasingly successful in securing competitive federal grant funding. One example is the Supplemental Nutrition Assistance Program-Education (SNAP-Ed), which is a federal grant that provides funding to supply nutrition education to low-income individuals and families through evidence-based interventions. In the federal FY18–19, MSU Extension received $7,073,850 to implement nutrition education throughout Michigan. MSU Extension is a successful implementer of these federal funds because of its ability to engage with local partners in all parts of the state. Additionally, Extension maintains relationships with its federal funding partner, USDA, and specifically, the Food and Nutrition Services branch.

Engaging With the State of Michigan Government

The State of Michigan is funded primarily from income and businesses taxes with some additional funding from sales tax, fees for services, and ordinance and law violations. It is governed by 110 state representatives, 38 state senators, and the governor. The State of Michigan provides funding for MSU Extension through its annual appropriation process. MSU Extension is a line item in the state higher education budget, which includes state aid for Michigan's 15 public universities, financial aid programs, and the Michigan public school employees' retirement system. Annual gross appropriations for higher education total more than $1 billion.

In addition to the annual appropriation for general operating, MSU Extension also focuses on maintaining strong partnerships with state agencies including the Michigan departments of Agriculture and Rural

Development; Natural Resources; Environment, Great Lakes and Energy; Education; and Health and Human Services. These agencies often administer federal funding or additional state grants.

Each member of the Michigan Legislature votes on the annual appropriations budget. Therefore, it is important for MSU Extension employees to engage with these individuals so that they know and understand the value that MSU Extension provides their constituents. MSU Extension created a set of resources for its staff to use to build their own capacity for engaging with legislators and policymakers at all levels of government. Examples of topics covered are reporting impacts, getting to know policymakers and stakeholders, maintaining support for MSU Extension, and telling the MSU Extension story through public value statements. To explore these resources, visit the Strategic Connections and Communications website: https://bit.ly/2Iz7ACh.

Engaging With County Government

Michigan is divided into 83 counties for administrative management. Each of Michigan's 83 counties has a county executive or a governing body called a Board of Commissioners. This governing body is chosen by voters every two years and is composed of five to 35 members depending on the county population size or form of government (Amrhein et al., 2019, p. 2-2). MSU Extension provides services across Michigan with the mission of helping all people in the state improve their lives by bringing the vast knowledge resources of MSU directly to individuals, communities, and businesses. This is done by strategically dividing the state's 83 counties into 14 districts.

MSU Extension recognizes the diversity of challenges that different regions of the state face, and as such, has established the position of district director to engage with local stakeholders to better understand local issues and to bring MSU Extension programs out to address them. Of note, Michigan ranks second in the nation for its diversity of agricultural products (Michigan Department of Agriculture and Rural Development, 2019). It is also home to large urban hubs such as Detroit, Grand Rapids, Ann Arbor, and Lansing, where the population's needs are quite different from the rural areas. One of the district directors' main responsibilities is to establish and maintain relationships with the county executive or County Board of Commissioners, which is one of MSU Extension's most important partners.

Historically established as Cooperative Extension Systems in the Smith-Lever Act, MSU Extension is funded through a county government buy-in, or agreement of services, which in turn allows MSU Extension to draw down state and federal funds to support local initiatives. The role of the district directors is to continually gauge what the needs of the county are, market and promote MSU Extension programs that can ameliorate those needs, or advocate for programming that addresses identified needs. Each county passes an annual operating budget in which it funds MSU Extension services. The district directors ensure consistent engagement with the county leadership and deliver annual progress reports that include MSU Extension's yearly accomplishments. In 2019, partnerships with county governments brought in just over $15 million to support MSU Extension. This represented

16% of the organization's budget. As these are reoccurring funds, maintaining relationships with county government is vitally important.

County Government Engagement Buy-Ins

As mentioned, county governments fund MSU Extension through an annual agreement of services, with the amount determined by an assessment that includes population size. Each county government may also choose to provide MSU Extension with additional funds, or *buy-ins*, on specific personnel if they feel that their county would benefit from having dedicated services.

One example of this is in Ottawa County (District 7), where the county government funds a half-time small-fruit educator. Michigan ranks third in the country for blueberry production (Kloosterman, 2017), and Ottawa County ranks second in the state (USDA, 2017). Blueberries are a difficult crop to grow with serious weather and pest considerations for successful harvests. As such, a dedicated small-fruit educator can disseminate information to the blueberry growers in the county in a coordinated and timely fashion.

Local Government Training Programs & Support

In addition to working directly with county commissioners and executives to identify needs of the county, and ultimately serve their constituents, MSU Extension has created programs that directly serve county commissioners. One example of this work is the biannual implementation of the New Commissioner School. Every two years, the state holds elections for the Board of Commissioners in all 83 counties. Although many commissioners are re-elected year after year, turnover also occurs throughout the state. New county commissioners have two months from their election to the beginning of the service to become acquainted with their new job duties. MSU Extension, in partnership with the Michigan Association of Counties, hosts a training for new commissioners, which covers governing locally, making policy decisions, and understanding the county finances, as well as understanding the roles and responsibilities of a county commissioner.

MSU Extension offers another successful local government training program, Citizen Planner, a land use educational program for locally appointed and elected planning officials. The program focuses on zoning, an important topic that often comes across the desks of county commissioners, as more development and growth strategies are often at odds with the need to ensure agricultural lands be protected.

Lastly, while MSU Extension does not lobby government agencies on any topic, it does provide nonbiased education on changes in laws and policies. For example, in the renewal of the 2018 Farm Bill, production of industrialized hemp became federally legal for the first time. In the 2018 election, a statewide proposal for legalizing marijuana passed and became statewide law in December 2018. During election years, MSU Extension staff members develop nonpartisan, unbiased white papers on ballot proposals to

educate the electorate on their choices. With the change in both federal and state laws around hemp and marijuana, MSU Extension is working to interpret these changes and educate stakeholders. Hemp production has piqued the interest of the agricultural community in Michigan; however, because prior to 2019 it was illegal to grow, little research existed on production strategies and growing requirements. MSU Extension put together a webinar series for potential growers *Industrial Hemp Production 101* that tackled both business and production considerations.

Engaging With Community Stakeholders to Successfully Address Local Issues

As a publicly funded agency, MSU Extension must augment the work of its stakeholders. Since the list of MSU Extension stakeholders is quite lengthy, only a few best practices are highlighted.

Agriculture commodity groups: Michigan is the second most diverse agricultural producing state in the United States. Over 300 agricultural commodities are produced across the state (Michigan Farm Bureau, n.d.). Many of the major fruit, vegetable, and field crops, as well as livestock commodity producers are represented by organized commodity groups. Examples of these groups include the Michigan Apple Committee, Michigan Soybean Promotion Committee, Michigan Milk Producers Association, and the Michigan Vegetable Council. Some of these organizations are funded from producer assessments on those commodities, also known as *check-off dollars*. These funds are used for administering the organizations, marketing and promoting the industry, funding industry research, and funding Extension positions to support producers of their respective commodities. These research and Extension partnerships enable the producers to stay current with industry trends and receive in-season consultation on production issues, as well as educational workshops in the off-season.

Michigan Farm Bureau: Michigan Farm Bureau's history is intertwined with that of MSU. In 1914, when the Smith-Lever Act established MSU Extension, the caveat was that Extension agents be supported by local "farmer's bureaus" (Michigan Farm Bureau, 2019). Today, both organizations have evolved and grown, but the relationship between the two entities is symbiotic. While MSU Extension continues to contribute to evidence-based research and conducts educational programs for the agriculture industry, Farm Bureau helps to market programs and expand MSU Extension's reach. One specific example of how these two entities work in partnership is with the rollout of workshops on delayed planting around the state. In 2019, heavy rains occurred during the late spring and into the summer. By June, when corn has typically grown over a foot, only 84% of the crop was in the ground. Similarly, only 53% of soybeans were planted by that time. In partnership with Michigan Farm Bureau, MSU Extension took action and hosted 12 workshops that served 650 farmers affected by the delayed planting. MSU Extension provided the facilitation and subject matter experts in areas of soybean production, farm business management, and cover crops and soil health, while the local county farm bureau offices provided space, funding, and event promotion among their constituents.

Local nonprofits: Much of MSU Extension's success comes from its ability to elevate local partners' missions and goals. Local stakeholders such as community foundations, the United Way, and small nonprofits are essential for engaging with specific audiences. Many nonprofits in Michigan offer specific services or target specific demographics. Examples of these partners include women's centers, food banks, area agencies on aging, local libraries, nonprofit health clinics, youth programs, and veteran service agencies. While food banks run daily programs that provide food to individuals and families dealing with food insecurity, MSU Extension conducts nutrition education classes and works with food banks to ensure healthy food options are available. After-school youth programs offer safe spaces for youth while their parents work. MSU Extension, through the 4-H program, offers structured programming in science, engineering, technology, art, and math to support both the youth and the organization with additional resources. MSU Extension engages with community partners to augment the work they do by providing free or low-cost supplemental education.

County health departments: Partnerships with county health departments are a natural fit for MSU Extension. Extension serves both internal and external clients of health departments with a robust offering of various types of health programming. MSU Extension is a leader in providing nutrition education for low-income households. In addition, MSU Extension provides courses in diabetes prevention, food safety, suicide prevention, and social and emotional health. County health departments across Michigan refer their clients to MSU Extension programming to further their education in maintaining healthy lifestyles.

Natural Resources Conservation Service and the Farm Service Agency: The Natural Resources Conservation Service (NRCS) and Farm Service Agency (FSA) organizations are divisions of the United States Department of Agriculture (USDA). The NRCS provides financial and technical assistance for farmers to implement systems to protect land, water, and air quality. Many of these assistance programs come in the form of cost share grants, where NRCS staff design conservation systems and provide partial to full funding to implement the projects. Examples of these systems include cover cropping, wetland establishment and protection, livestock grazing and manure management, and pollinator protection. The USDA implements the federal Farm Bill. The Farm Bill outlines federally funded programs to financially support agricultural production to help sustain a profitable industry. FSA manages a low-interest loan program to help farmers obtain working capital. It also assesses the impacts of weather-related disasters such as droughts and floods on local crops and requests emergency funding to assist growers in those areas. Both agencies work collaboratively with Extension staff to provide the farmers with relevant and detailed information to help them make informed decisions about their operations.

Soil conservation districts: Soil conservation districts are independent county-based entities that work with local farmers to address conservation concerns. These districts are managed by local boards and primarily self-funded, much like commodity groups. These districts allow farmers to play an active role in the conservation programs and practices that are most relevant in their specific areas. Conservation districts raise local funds and pursue grants to research and implement conservation practices in the areas they represent, often in partnership with Extension staff and university researchers. These data are then used to help farmers implement the most successful and economically viable practices. Often, funding for the

implementation of these practices comes from a combination of conservation districts, NRCS, or FSA programs.

Advisory Councils

While MSU Extension works diligently to understand the needs of local Michigan residents and community stakeholders, this work is supplemented by district advisory councils that are managed and run by the 15 district directors. The District Advisory Council is a group of individuals selected to collectively provide advice, direction, and support to MSU Extension in each of its administrative districts. Council members each have different backgrounds and networks of influence in their districts, which provides the diversity of representation essential to Extension's educational efforts.

The district advisory councils advocate on behalf of MSU Extension with local, state, and federal officials that have influence in their districts. Advisory council members promote MSU Extension programs and raise awareness of Extension in the community to ensure that Extension programs and services stay relevant in the community. Frequently, advisory councils will host events within the district to showcase the work that MSU Extension does and raise awareness about the diversity of programs offered.

Perhaps one of the most important roles that the District Advisory Council plays is identifying community issues and concerns that Extension has the capacity to address. In 2019, an Extension council representative brought forward a state-funded proposal to dredge a river in southwestern Michigan popular for its local fishing and small-boating activities. MSU Extension hosts the Michigan Sea Grant Program, whose mandate is to support coastal communities through research, extension, and education. It was therefore uniquely positioned to pull together a white paper that outlined the benefits and environmental risk factors of the proposed project. The Michigan Sea Grant educator then presented to the County Board of Commissioners and worked with multiple stakeholders to educate the community on the project proposal. This is just one example of how district advisory councils can support the work of MSU Extension.

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CHAPTER 12

Information & Communication Technology

AN OBLIGATORY & RELIABLE PLATFORM IN AGRICULTURAL INFORMATION DISSEMINATION

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***Note:** Some of the information in this chapter comes from www.manage.gov.in.*

Introduction

Information and Communication Technology (ICT) is the blending of information technology, communication technology, and computer technology. ICT has become a power tool to disseminate accurate and reliable information with a faster rate to all the stakeholders of agriculture for qualitative decision-making. ICT encompasses various techniques that improve performance, accelerate the growth of any economy, and reduce the drudgery in acquisition and processing of information. In this context, this chapter highlights the importance and applicability of various concepts of ICT and their relevance in agriculture.

ICT consists of all technical means used to handle information and aid communication, including computer and network hardware, communication middleware as well as necessary software. In other words, ICT consists of information technology as well as telephony, broadcast media, all types of audio and video processing and transmission, and network-based control and monitoring functions. The use of ICT in education extends beyond equipping classrooms with computers and an internet connection. There are a wide variety of ICTs currently available to schools and universities that can be implemented to enhance students' overall learning experiences in numerous ways. The universities that have implemented ICTs primarily use these technologies to fulfill the objectives of increasing the networking opportunities, providing distance learning, and supplementing traditional learning.

Agriculture is not an exception in applying the concept of ICT to pass on the information among its stakeholders. The majority of research findings do not reach farmers due to the inadequate and insufficient transfer of technology mechanisms. The spirit of ICT can be applied in the following forms to draw maximum benefit in agriculture.

- Cyber extension (ICT-based initiatives)
- Remote sensing
- Geographical Information System
- E-Governance
- Expert Systems
- Professor Jayashankar Telangana State Agricultural University (PJTSAU) interventions

Cyber Extension

Cyber extension is defined as the "extension over cyber space." It means "using the power of online computer networks with the help of communication channels to deliver content in the form of text, graphics, audio and video either passively or interactively to facilitate dissemination of agricultural technology." Nagarjuna Kumar et al. (2009) observed that among all the users (scientists, extension workers, students, farmers, and others) of the email facility created by the Central Institute for Arid Horticulture, Bikaner, Rajasthan, the majority of the users are farmers (48.35%) followed by students (22.35%).

Major Cyber Extension Initiatives

Cyber Kiosks: Changing Lives

National Institute of Agricultural Extension Management (MANAGE) has established internet connectivity in 24 districts in seven states: Andhra Pradesh, Bihar, Himachal Pradesh, Jharkhand Maharashtra, Odisha and Punjab under the National Agricultural Technology Project. Ten villages have been connected in Andhra Pradesh. MANAGE has selected successful Mutually Aided Co-operative Thrift and Credit Societies (MACTCS), organized by the Development of Women and Children in Rural Areas groups in 10 villages of the Ranga Reddy district. One multimedia computer system with uninterrupted power supply (UPS), UPS only printer, and internet connectivity was provided to each MACTCS. Four members identified by the group were trained in basic computer operations, and internet browsing. Multimedia CDs on agriculture; watershed management; the *vyavasaya panchangam* (a farmers' almanac that consists of varieties and production technology of various agricultural crops); cultivation aspects of major crops such as paddy, cotton, mango and coconut; expert systems on selected crops and rural development; pickle making; child labor; child development; nutrition and health; and other topics were given to all the groups.

ITC–IBD Choupals

ITC–IBD is an international business division of ITC, a large agribusiness company in India. Their core competency lies in establishing strong relationship with farmers. They have innovated a unique network of internet kiosks. These are one-stop shops for farmers called *choupals*. This

concept helped not only in building a strong relationship with the farmers but also to significantly optimize their procurement cost. ITC–IBD has successfully implemented several projects: soya choupal, acqua choupal, and coffee club. There are separate websites for each component.

e-Sagu: ICT-Based Personalized Agriculture

In view of technology and extension gaps in Indian agriculture and to take advantage of the ICT revolution, the International Institute of Information Technology, Hyderabad, Telangana, India, had developed the e-Sagu model of extension system and implemented it for the cotton crop in three villages of Oorugonda, Gudeppad, and Oglapur, covering 749 farmers and 1041 farms during the 2004–05 crop season. The main objective is to build a cost-effective and scalable agricultural expert advice dissemination system to all farmers. The three-tier system consists of farmers as end users, and coordinators as intermediaries to obtain crop status through digital photographs and text, and an information system for communications and digital advice to the farmers. Scientists with the knowledge system prepare the farm advice for the system.

Hooked to the Net: Information Village Research Project

The Information Village Research Project (IVRP), funded by the International Development Research Centre in Canada, was established in 1998 through the M.S. Swaminathan Research Foundation (MSSRF). Under this project, MSSRF funds the equipment and supplies expert guidance while the villagers provide office space and four volunteers to staff a center. The fisher folk of Veerampattinam and seven other villages in and around Pondicherry (Villianur, Thiru-kanchipet, Kizhur, Embalam, Kalitheerthalkuppam, Pillayarkuppam, and Pooranankuppam) all have praise for IVRP. Each village has an information center, with Villianur acting as the hub, connected to the MSSRF Centre via intranet.

Warna Wired Villages

A group of villages in Maharashtra, India, has been the site of a cooperative project meant to improve lives through improvements in agriculture by making knowledge accessible. The “wired villages” have been provided access to and training on using computer networks to disseminate evidence-based information on agriculture to local farmers. Computer booths in each village are manned by a booth operator, and local farmers visit the booths for information relating to crop cultivation, pest management, and marketing. This cooperative movement has been highly successful and was described as follows:

> Ushering in the IT revolution to villages where more than 70% of the Indian population lives is a dream that has come true at Warna Nagar in the Kolhapur district of Maharashtra. The special IT task force set up by the prime minister recommended modernizing the cooperative movement through use of state-of-the-art IT. This led to the “Wired Village” project initiated by the prime minister’s office. The key objective of the project is to demonstrate the effective contribution of an IT infrastructure to the socioeconomic development of a cluster of 70 contiguous villages around

Warna Nagar in the Kolhapur and Sangli districts of Maharashtra (www.indiachi.com, as cited in UNICEF, n.d.).

The project uses IT to increase the efficiency and productivity of the existing cooperative enterprise by setting up a state-of-the-art computer communication network (www.indiachi.com, as cited in UNICEF, n.d.).

Self Employed Women's Association

The Self Employed Women's Association (SEWA; www.sewa.org) was founded in 1972 in Ahmedabad, India, as a union of women working in the informal sector. SEWA has now begun to introduce ICT to its quarter of a million members. It has also developed technology information centers, which are distance-learning classrooms, to provide training to their "barefoot managers," to build capacity of their women organizers and leaders, and to help members strengthen their micro-enterprises (embroidery, agriculture, incense, gum, and salt).

The Akshaya Project

The Akshaya Project was first started in the rural Malappuram district of the state of Kerala and now spread over to seven more districts in the state. It was the first district-wide e-literacy project in India and one of the largest known internet protocol-based wireless networks in the world. In November 2002, the state government of Kerala put into place a project, piloted in Malappuram, that aimed for one person in every family to be computer literate in Kerala. That individual would be familiarized with the basic use of the computer and empowered to access innumerable services that ICT offers. Malappuram is now what is said to be India's first e-literate district. The mission continues to make Kerala the first e-literate state in India.

Remote Sensing

Remote sensing is a technology that provides the means to collect and use geographic data to assist in the development of agriculture. It is the practice of measuring an object or a phenomenon without being in direct contact with it. The prominent tools used in remote sensing are weather satellite collection platforms, ocean and atmospheric observing weather buoy platforms, Magnetic Resonance Imaging (MRI), Positron Emission Tomography (PET), and space probes. A timely, comprehensive, transparent, accurate, and unbiased agricultural monitoring system prevents excessive market speculation and resulting price spikes. Probably the best way for gaining unbiased information over large areas is through satellite-based remote sensing (Atzberger, 2013).

Kinds of Remote Sensing

The phenomenon of remote sensing facilitates the access of remote and adverse locations to ascertain and forecast a catastrophe or havoc that may inflict huge damage on the flora and fauna, which may directly or indirectly ruin the farmer financially. This allows for the development of models and forecasts for alternate cropping and risk management in climate change and for finding coping mechanisms in rainfed agriculture.

Passive sensors detect natural radiation emitted or reflected by the object. *Active sensors* emit energy in order to scan objects and measure the radiation reflected back from the target (for example, radar).

Data Acquisition Techniques in Remote Sensing

Data in remote sensing is acquired through electromagnetic radiation with the help of sensors. The types of sensors used are *analog*, which uses dynamic physical properties (for example, chemical changes) and *digital*, which uses numbers (0s and 1s).

Remote Sensing Software

The software that captures the data through remote sensing is developed by the Environmental Systems Research Institute. The prominent software used in remote sensing are ERDAS, RSI ENVI, IDRISI, GRASS, ERMapper, and AutoDesk.

Geographical Information System

Technology provides the means to collect and use geographic data to assist in the development of agriculture.

The classification of soils based on land capability by integrating remote sensing and Geographical Information System (GIS) technologies helps in estimating soil resources available for different purposes and for appropriate use of soils without deterioration (AbdelRahman et al., 2016).

It is the system for capturing, storing, analyzing, and managing data and associated attributes, which are spatially referenced to Earth. It enables the user to input, manage, manipulate, analyze, and display geographically referenced data using a computerized system. Components of GIS are software, hardware, data, people, and methods.

Use of GIS in combination with remote sensing enhances the decision-making in:

- Processing identification to enable comparison of different acquisitions through time.
- Identifying agricultural and other development problems.
- Evaluating possible technical interventions for conservation or reclamation measures.
- Monitoring soils, water, and land degradation processes.

E-Governance

E-governance refers to the use of ICT applications, to provide access to and deliver information and services to the public faster, cheaper, easier, and more efficiently. *E-government* is the delivery of more convenient, customer-oriented, and cost-effective public services and sharing of information through electronic media. When applied to the agricultural sector, e-governance refers to use of ICTs in delivering governance products and services, which are of use to the agricultural community, including farmers,

livestock breeders, herders, dairy workers, agriculture extension workers, traders, scientists, middlemen, and nongovernmental organization workers working in the field of agriculture and allied sectors.

Amit Wasukar and Yavatmal Mrunal have evolved a new loan concept through e-governance in which:

> To remove bank concept between government and farmer, Government can implement new scheme in which farmer who requested for seeds sack scheme online would be provided with seeds sack from agriculture department without giving money by farmer, But before giving seeds sack to the farmer. Department have to take farmer's land documents as evidence and farmer have to fill agreement with government terms online and have to submit request. (Wasukar & Shidurkar, p. 24)

Benefits of E-Governance

- Faster, easier service
- Convenience, near to home, more services at one place
- Faster processing, shorter wait, shorter queues at government offices
- Less number of trips to government offices
- Better interaction environment, no harassment
- Reduced transport cost
- Avoids wage loss for daily-wage earners
- Better quality service

Expert Systems

Expert systems are mostly based on a specific problem domain and are a traditional application of artificial intelligence. The expert system behaves like a human expert to solve the problem with the help of pre-set conditions in the software application. A wide variety of methods can be used to simulate the performance of the expert, which are (a) the creation of a *knowledgebase*, which uses some knowledge representation formalism to capture the subject matter experts' (SME) knowledge, and (b) a process of gathering that knowledge from the SME and codifying it according to the formalism, which is called *knowledge engineering*.

Expert systems can be one of the most useful tools for accomplishing the task of providing growers with the day-to-day integrated decision support needed to grow their crops.

Components of Expert Systems

- User interface
- Knowledgebase
- Inference mechanism (IF-THEN-ELSE). For example, if the symptom of crop is X, then the nutrition deficiency is Y.

Advantages & Disadvantages of Expert Systems

Advantages

- Ready to use by end user
- Provides consistent answers
- Holds and maintains significant levels of information
- Encourages human expert to clarify and finalize the logic of their decision-making
- Never "forgets" to ask a question, as a human might

Disadvantages

- Lacks common sense
- Cannot make creative responses
- Domain experts not always able to explain their logic and reasoning
- Cannot adopt to changing environments

Cases of Expert Systems in Agriculture

Rice Doctor: National Institute of Agricultural Extension Management has developed an expert system to diagnose pests and diseases for rice crop and suggest preventive or curative measures. It is available as a free mobile phone app, which farmers can download and use as a diagnostic tool. The Rice Doctor (https://bit.ly/35rG2Hu) highlights the use of expert systems focusing the area of agriculture and explicitly rice production by designing a prototype by inserting major pests and diseases of the crop as well as a few pertinent deficiency issues of the crop.

> An Expert System Shell is an interface for strengthening, refining, and maintaining the knowledgebase of an Expert System by directly interacting with it. The expert system shell is a complete development environment for developing and maintaining Knowledge-Based Applications and Expert Systems. It provides a step-by-step methodology for a knowledge engineer that allows the domain experts themselves to be directly involved in structuring and encoding the knowledge through an expert interface. Agriculture being a multidisciplinary science there is a scope of developing multiple expert systems for various crops, disease, insects, irrigation scheduling, fertilizer management and various other issues needed for a sustainable agriculture. There has been no such system or software that supports information management in this area. Developing such a platform for developing multidisciplinary and multi crop expert systems is a new approach that can provide computational convenience to replicate it for multiple crops (Islam, 2013, Abstract).

Table 12-1 gives a few examples of expert systems shown with authors and their usage.

Table 12-1. Examples of expert systems.

Authors	Name of Expert System	Utility
Fermanian et al.	PLANT/tm	Diagnosis of weed in turf
Jones and Haldeman	CHAMBER	Management of environmentally controlled crop research facility
Lemmon	COMAX	Cotton crop management
Palmer	COMAX	Soybean crop variety selection
Shroyer et al.	WHEAT WIZ	Cultivator selection tool

ICT Initiatives of PJTSAU

- **Annapurna Krishi Prasara Seva (AKPS):** AKPS is a communication system that disseminates authenticated information on agriculture and allied aspects from primary sources such as university centers to the end users (farmers). The use of the AKPS in various extension centers of PJTSAU is a new ICT initiative to meet the information needs and expectations of farmers. It has developed as an alternative ICT model under the Interactive Information Dissemination System (IIDS) to meet the information needs of farmers. Timely season-based agro-advisories in the form of short messages in both audio and video are delivered to the registered farmers in the AKPS portal instantly. Farmers also have an opportunity to interact with scientists over a toll-free number to get the answers to field problems. Sowjanya et al. (2018) in their study stated that the majority of the respondents have a moderately favorable attitude (44.16%) toward AKPS agro-advisory service where the messages were partially understandable (41.66%), needful (83.33%), timely (53.33%), saves time and money (83.33%), increase in knowledge (79.16%), increase productivity (83.33%), and information can be adoptable in field conditions (43.33%).
- **YouTube channel:** The PJTSAU YouTube channel is an initiative of PJTSAU that uses and shares videos for agricultural development particularly regarding agricultural development, farmer's success stories, agricultural innovations, extension approaches, events, and guest lectures of eminent personalities for the benefit of farmers, entrepreneurs, and students. The unique components of the PJTSAU YouTube channel are (a) timely and need-based content production, (b) a locally generated video database with scientific and technical expertise, (c) scientist-led instruction for dissemination, and (d) regimented sequencing to initiate a new community. It works with existing Krishi Vigyan Kendras (KVKs), (https://kvk.icar.gov.in/), which are agricultural science centers, and District Agricultural Advisory and Transfer of Technology Centre services of extension systems and aims to amplify their effectiveness. The goal is building a model for the use of ICTs in meeting the knowledge and information requirements of rural families by taking into account the socioeconomic context and gender dimension. Prashanth et al. (2019), as part of their study, an analysis of video modules posted in the PJTSAU YouTube channel, revealed which topics were generating the most interest. They found that viewers mainly sought information on milky mushroom production, brown plant hopper management, bacterial leaf

blight symptoms in paddy, and bacterial leaf blight management, whereas, the least preference was given to chili post harvesting technology and sugarcane early shoot borer.

- **Chenukaburlu:** Chenukaburlu is another innovation in use of media. This radio program caters to the information needs of communities living in surrounding areas. The poorest of the poor or farmers or farm women can be helped by providing them with the most basic information so that they can learn to sustain in their environment by the most efficient use of the resources available to them and henceforth improving their worsening condition. One such ICT strategy is Chenukaburlu, which caters to the needs of the rural community, promoting a bottom-up approach, and providing a voice to the voiceless. The Chenukaburlu is characterized by the active participation of the student community in the process of creating news, information, entertainment, and culturally relevant material, with emphasis on the program using local voices. The success of Chenukaburlu essentially depends on the extent of the students' production quality control over the topics and programming. While radio programs managed by agriculture and home science students broadcast a diverse portfolio of programs, those managed by other institutions are run on very rigid lines, with the content obviously influenced by the expertise in or objective of the educational institution. Prashanth et al. (2019) in their study on Chenukaburlu found that the respondent students mostly broadcasted farm information regarding extension, crop production, food and nutrition followed by central and state developmental programs covering mainly climate change, women entrepreneurship, youth development, weather forecasting, and agricultural marketing aspects.
- **Gyankisan app (under development):** The Gyankisan app is being developed by PJTSAU in collaboration with Western Sydney University, Australia, and River Bridge Ventures, India. Gyankisan is an application, which delivers scientific knowledge as context-specific actionable knowledge to the farming community via a mobile system and thereby empowering them with the right knowledge at the right time. It enables all stakeholders of agriculture to effectively optimize and coordinate their offerings based on both published knowledge and real-time information generated by aggregating farmer actions and transactions.
- **University website:** The university website (https://pjtsau.edu.in/) updates the public on the happenings in the university on research, education, and extension aspects.
- **Online Agro-Advisory bulletins:** Twice a week (every Tuesday and Friday) the university releases Argo-Advisory bulletins to educate farmers on practices to be followed in agriculture based on existing weather condition.
- **Distance education to the farmers:** Started in 1993 for the benefit of farmers through private TV channels like E-TV, distance education has continued with more than 30 news channels.
- **Digital Extension:** The electronic wing of the university has developed many agriculture DVDs in multimedia to alert stakeholders (students, teachers, scientists, extension workers, and farmers) of the access to the information to get easy understanding and quick adoption in the field.
- **Blog:** The Department of Agricultural Extension, College of Agriculture, Rajendranagar, has created a blog (http://www.aecar.in) to document and reveal its activities. The desired audience is undergrad and doctorate students in particular and farmers in general.

Conclusion

The fast-changing scene of liberalization, competition, and globalization combined with a never-before-seen emphasis on quality, timeliness, innovation, customer orientation, and efficiency puts a premium on accurate, super fast, and timely dissemination of information across the globe. The unprecedented developments in computing and communication technology have indeed made such demands translatable into realizable goals. Thus, a large portion of the world population has its stake in information processing. It is time to apply ICT technologies to derive maximum benefit to all stakeholders of agriculture to make Indian agriculture more competitive in the international market.

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CHAPTER 13

Strategies for Implementing Digital Technology Within Extension Programs

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Overview

The roots of information and communication technology in the United States can be connected to Extension work in the early 1900s. The Morrill Act of 1862 and the Morrill Act of 1890 were instrumental in the foundation of higher education in the United States and the emergence of the distance education movement (Miller et al., 2014). Land-grant colleges were a leader in agricultural production and disseminated evidence-based information to rural families through the Rural Free Delivery mail correspondence system (Miller et al., 2014). The generations of distance education began with correspondence courses and were followed by broadcast radio and television, open universities, teleconferencing, and the internet (Moore & Kearsley, 2011). As times have changed, and with the invention of the internet in the 1990s, so have the methods of communication and learning. To meet the current needs of our communities, Extension offers learning through tools ranging from podcasts to mobile apps, text messages, websites, social media, online courses, and more. These types of learning opportunities are flexible in their approach and offer opportunities to individuals with constraints on time and financial resources.

Even as digital tools continue to evolve, core elements of adult learning still drive how we design our educational programs. Mutual respect between the educator and learner can have a positive effect on the satisfaction, motivation of learners, and their ability to learn (Stavredes, 2011). Adult learning theorist Malcolm Knowles developed the concept of the six principles of adult learning including: (1) adults need to know why they need to learn something and what value it will give them, (2) adults are responsible for their own decisions and seek self-directed learning, (3) adults bring life experiences to learning, (4) adults are ready to learn things that relate to real-life situations, (5) adults have a life-centered orientation to learning that focuses on problem-solving, and (6) adults are motivated to learn new skills, which may increase opportunities, job satisfaction or an improved quality of life (Knowles et al., 2005). Incorporating these principles is challenging to instructors and designers who strive to make

online curriculum that is interactive, includes peer-to-peer learning, and is engaging to multiple audiences.

As technology improves and is more accessible to learners, Extension programs must focus on reaching out to clients in new and creative ways. According to the Pew Research Internet/Broadband Fact Sheet, roughly 90% of American adults use the internet and one-in-five Americans only use their smartphone to access the internet rather than traditional broadband (Pew Research Center, 2019). Rural Americans have made large gains in adopting technology over the past decade; however, they are less likely to have broadband or own a smartphone (Perrin, 2019). Smartphone use across the world has been growing with an estimated more than 5 billion people with mobile devices and half of those being smartphones (Silver, 2019). Offering Extension programs in an online format is a method often used to reduce expenses and reach audiences that may not have previously been served. In doing so, educators must be responsive to the needs and preferences of online learners by offering content that is relevant, of high quality, accessible to learners, and available through the use of mobile devices.

Examples of Technology Use in Extension

This section features examples of Michigan State University (MSU) Extension programs that use digital methods for content delivery such as online courses, blended courses, train-the-trainer models, mobile learning, and webinars. Learning experiences should be designed in a flexible way to meet the needs of a specific target audience. For example, adult learners may be receptive to webinars, self-paced online courses, and podcasts, whereas members of a youth audience may be more engaged with short videos and social media. The following seven programs include background information and a link to more information.

Farm Stress Blended Program for Industry Organizations

Financial stress relating to low commodity pricing, increased debt, and unfavorable weather conditions can negatively affect farmers. MSU has been successfully partnering with organizations that work with farmers by offering a variety of training for their staff. In 2018, MSU Extension began working with the United States Department of Agriculture Farm Service Agency (FSA) to train their staff on how to better communicate with farmers showing signs of stress through a blended program, which included a self-paced online course, interactive videoconference sessions, and an in-person training. The topics covered in the training included sources of stress, signs of stress, effective communication strategies, warning signs of suicide, reduction of stigma relating to mental health concerns, and connecting farmers with mental health resources. In the initial phase of the program, 500 FSA staff members completed a three-module self-paced course. They then registered for a one-hour videoconferencing session. These sessions included small groups of around 20 individuals facilitated by a trained

expert in farm stress. The interactive sessions focused on discussion questions that reflected on what they had learned in the self-paced online training. Five months later, FSA staff participated in a face-to-face training involving small group role-playing exercises. Once again, Extension staff from around the country who have expertise in the area of farm stress facilitated these sessions.

For more information on farm stress programs at MSU, visit MSU Extension Farm Stress Programs at https://bit.ly/32KUbxD.

Text Messaging Study: Farm Stress

Stressors such as weather and economic concerns may cause farmers a great deal of stress. Farmers' chronic stress can be associated with negative outcomes including mental illness, substance abuse, poor physical health, risk of injury, and suicide. The purpose of this project is to develop a text-messaging mental health intervention to educate farmers about farm-related stress, as well as coping strategies to manage that stress. A pilot test is being conducted with Michigan farmers to assess feasibility, usability, and acceptability. The study will also assess the initial efficacy of the intervention in increasing knowledge about farm stress and coping strategies, the use of adaptive coping strategies and perceived social support, as well as the reduction of perceived stigma surrounding mental health, farm stress, and the use of maladaptive coping strategies. This innovative intervention has the potential to overcome multiple barriers farmers face to access mental health information. Participants in the project will complete a pre-test, receive text messages over a three-month period, and complete a post-test. Selected participants will be recruited to participate in telephone interviews.

For more information on farm stress programs at MSU, visit MSU Extension Farm Stress Programs at https://bit.ly/32KUbxD.

Pollinator Champions Online Train-the-Trainer Courses

The MSU Pollinator Initiative launched the Pollinator Champions program in June 2018. This free online course is designed to educate the public about the importance of pollinators in Michigan. After completing the course, individuals can pay a fee to become a Certified Pollinator Champion. This gives them access to presentation materials so they can educate others about pollinators at garden clubs, libraries, and schools. In the first year the course was offered, the course had over 1,300 participants, 193 of which became Certified Pollinator Champions.

This course provides a quality learning experience including engaging reading materials, videos, and interactive games. For example, the course includes an animation of a blueberry bush, where blueberries will appear or disappear based on selected inputs to show the importance of pollination. Enrollees learn the objectives through multiple avenues and are provided links to further learning. This program relies on trained volunteers for assisting in outreach based on growing public interest in evidence-based information about pollinators and pollinator decline.

For more information, visit Pollinator Champions at https://bit.ly/3nngUYn.

Floriculture College of Knowledge Online Course Series

The Floriculture College of Knowledge Online Course Series began in 2015. It was built upon curriculum taught in a face-to-face format for commercial floriculture growers. The series includes three courses: (1) Biological Control for Greenhouse Growers, (2) Greenhouse and Horticulture Lighting, and (3) Root Zone Management. The courses are offered in both English and Spanish. Each of the courses include recorded lectures, handouts, additional resources, as well as a pre- and post-test. The self-paced courses are offered twice a year in a cohort-type format where the participants have 90 days to complete the curriculum. In 2018, data from participant pre- and post-tests indicated significant increases in knowledge with scores increasing from an average of 68%–73% in the pre-test to 92%–92% in the post-test (Lindberg et al., 2018).

For more information, visit the MSU Extension Online College of Knowledge at https://bit.ly/36se0uw.

My Horse University Online Program

My Horse University (MHU) was established in 2005 at MSU through a partnership with the MSU Department of Animal Science, MSU Extension, and MSU Global. The goal of MHU is to connect research and expertise from equine experts to horse enthusiasts across the country through online courses, webinars, podcasts, educational products, and more. MHU launched its first online course in 2006 and now offers 11 courses on topics ranging from horse health and nutrition, to a course focused on keeping youth safe while working with horses. The majority of courses are self-paced; however, some are offered annually in a cohort-based format. Since inception, MHU has received several awards, grants, and sponsorships.

Over the past 15 years, MHU has created brand awareness through a variety of marketing channels. It has a list of over 7,600 email contacts built from course participants, webinar participants, and online sign-up forms. The MHU website receives an average of 14,000 views per month. The program is also active with social media including over 5,400 likes on Facebook, and through a YouTube channel, MHU has had approximately 1.5 million views on horse-related videos.

MHU has been creative in finding new ways to partner with experts across the country. In 2012, through a grant funded by the North Central Regional Center for Rural Development, a live videoconferencing event connected four states across the Midwest section of the United States. Each state had one live speaker and was broadcast to each of the other three remote locations. The following year, the program continued through a five-part webinar series, which was the basis for an online course.

For more information, visit MHU at https://www.myhorseuniversity.com/.

Beginning Farmer Webinar Series

The Beginning Farmer Webinar Series is an educational videoconferencing program that connects experts with new and future producers on topics

ranging from livestock, fruits and nuts, machinery, soil health, marketing, and more. The series began in 2012 in an area of Michigan where participation in live workshops was limited due to a widely scattered farming population and long driving distances. The webinars are offered during the winter months when participants are more likely to have time to participate. Participants are charged a small fee for attending the webinars to cover costs such as closed captioning of the recordings. In a survey conducted in 2016, 57% of the participants indicated the series contributed to them starting a business and 78% indicated they made changes to production practices based on what they learned (Wardynski et al, 2018).

For more information, visit the Beginning Farmer Webinar Series at https://www.canr.msu.edu/beginning_farmer_webinar_series/.

Ask an Expert Online Question-and-Answer Forum

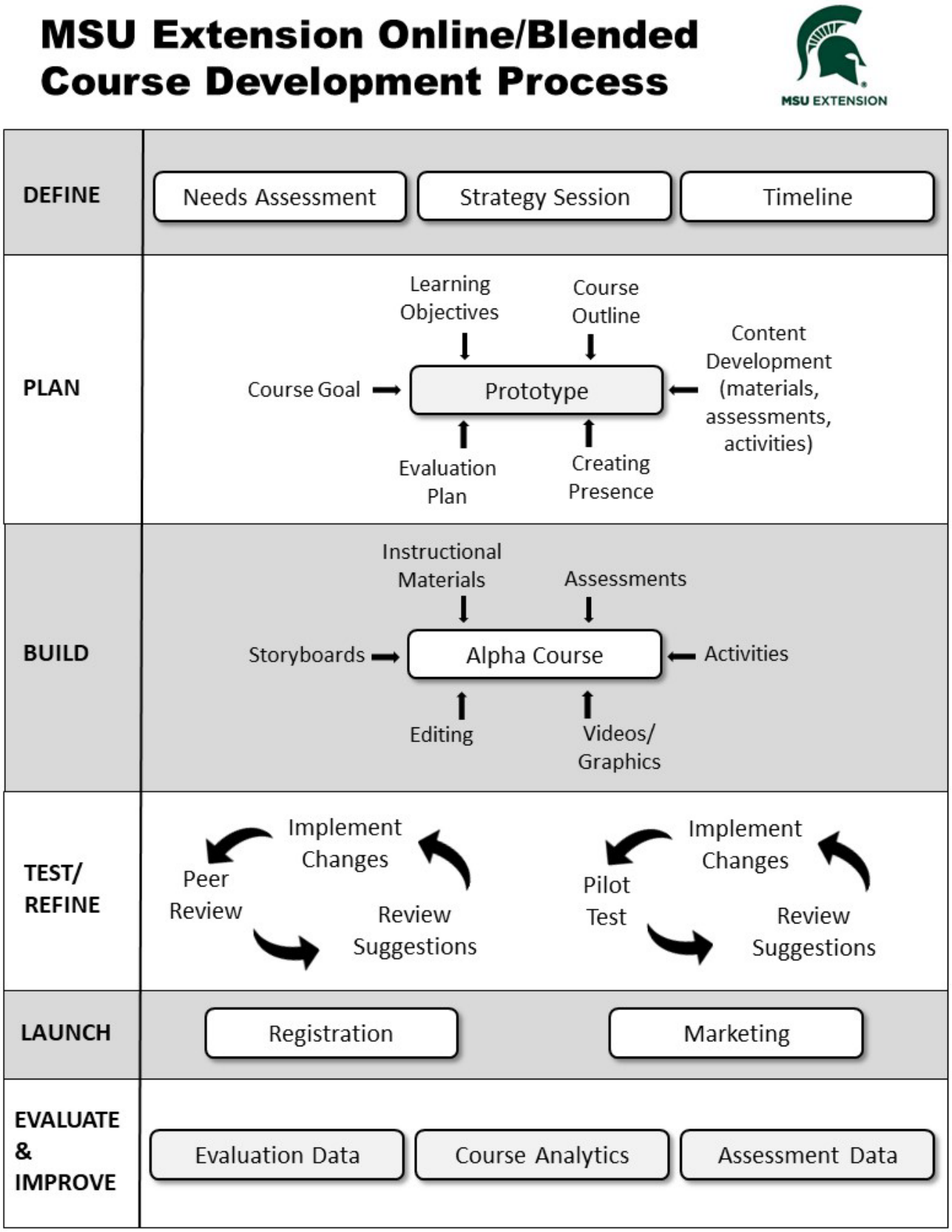
Through Ask an Expert, an online question-and-answer system, Michigan residents are able to ask questions and quickly receive expert answers on a broad range of subjects. This tool was developed by eXtension, a foundation that supports land-grant institutions and is available to all land-grant universities in the United States. Through this tool, university evidence-based information is provided to help residents improve their quality of life, families, gardens, businesses, and communities. Participants can submit a question online, a staff member assigns the question to an expert, and the expert sends back a response. In 2019, MSU Extension experts and highly trained Extension Master Gardener volunteers answered 6,500 questions. The majority of questions are related to plants and pests; however, additional topic areas include zoning and land use, food safety, agriculture, human nutrition, and water resources.

To view the MSU Extension Ask an Expert form, visit www.extension.msu.edu/ask-an-expert.

Course Development Process for Online & Blended Courses

MSU Extension has developed a framework for staff to follow when designing an online or blended course. The framework includes six phases: define, plan, build, test/refine, launch, and evaluate. Each segment of the framework builds upon each other to develop a high-quality, cohesive learning experience that meets the needs of the intended audience. This process is applicable to any type of online course including self-paced courses where participants have the flexibility to complete the content at their own pace but typically with a specific timeframe and cohort-based courses where participants must complete assignments or tasks by given deadlines. It also applies to blended courses, which include a combination of online and face-to-face instruction. Each step of the process, which is shown in Figure 13-1, is described in detail throughout this section.

Figure 13-1. Michigan State University Extension online and blended course development process.



Phase 1: Define

The define phase of the framework focuses on needs assessment and creating a strategy for the intended learning experience. Knowing the specific needs of your target audience is imperative to develop curriculum that participants can connect to and use for solving problems or challenges that they face. As we know from adult learning theory, adults are more likely to be engaged in the learning experience if content is relevant to their own needs (Knowles et al., 2005). It is also important to gain insight from other sources such as stakeholders, external organizations, community groups, volunteers, and others.

A needs assessment can include a combination of both formal and nonformal methods. A formal needs assessment may include an online survey, focus group, or interview. For example, the MSU Extension My Horse University (MHU) program conducted a formal needs assessment at the beginning of the program to identify content areas, appropriate pedagogical approaches to learning, and insight into marketing aspects of the program such as how much potential participants would be willing to spend on the courses. The results of the needs assessment were used to build the foundation of the MHU program. Approximately a decade later in 2019, this team developed an 18-question marketing survey to once again ensure that they are meeting the needs of the target audience, to find preferences for learning as technologies have changed, and to find preferences for marketing. To date, there have been 903 responses to the survey. Initial results indicate that the preferred method for receiving information is email, followed by communicating with professionals, social media, and websites. In terms of learning preferences, 94.3% indicated they were either interested or very interested in learning through online courses. When considering online learning, respondents valued scheduling flexibility as demonstrated by being very interested in self-paced courses (75.2%), and recorded webinars (51.1%) as compared to scheduled instructor-led courses (32.6%) and live webinars (33.0%) (Skelly et al., 2019).

Informal needs assessment can also play an important role in curriculum development. An informal needs assessment may include meetings with stakeholders, advisory committees, or feedback from clients. A specific example is from the MSU Extension Equine team, which invites stakeholders to their monthly meetings for lunch to discuss the needs of their program and the ways MSU Extension can be of assistance. In 2019, this team invited representatives from therapeutic riding programs, the Michigan Department of Rural Development, veterinarians, and representatives from the horse showing industry.

The define phase also includes time for planning the general strategy for the program. During this process, the subject matter expert(s) will review other online courses, discuss technology needs or limitations with an instructional specialist, and develop a timeline. The subject matter experts should also make decisions regarding the format of the program, such as online or blended, and self-paced or a cohort model with a specific timeframe.

Phase 2: Plan

In the plan phase of the framework, experts develop their course goal and learning objectives, and begin to explore ideas for the format of the course. The learning objectives identified by the subject matter expert should connect the learning materials, activities, and the assessment. They should be written so the objectives are measured through the activities and assessments that the participants complete. The learning objectives should also reflect the need or problem identified in the define phase.

To assist staff in connecting learning objectives to the content of their course, the MSU Extension Course Development Learning Objective Outline tool was designed (see Figure 13-2). This tool was initially created through a project that found adaptive learning, a method for creating personalized learning paths based on data and learning objectives, to be in an innovative method for online teaching and learning within Extension programs (Shelle et al., 2018). As shown in Figure 13-2, by using the learning objective outline tool, those developing courses can map learning materials, activities, and assessments to learning objectives. This outline is completed before any content is added to a learning management system.

During the plan phase, experts should review and reflect on existing courses to assist in shaping the format of the learning experience they are designing. After the course outline is developed, they can begin to add detail to the learning objective outline in terms of defining the materials, assessments, and activities. The learning objective outline becomes the framework for the intended course.

As experts begin to think about the design of the curriculum, they should also think about creating an online presence. The Community of Inquiry model was designed to assist those teaching online to build meaningful online experiences through *social presence*, which allows students to identify with their community of learners; *cognitive presence*, which focuses on the learners gaining meaning through reflection and discourse; and *teaching presence*, which is the design of meaningful and worthwhile learning outcomes (Community of Inquiry, n.d.). Creating online presence is critical for connecting with learners. Methods such as short videos from facilitators or experts, online discussions or chats, and webinars are all ways to connect the instructor to learners, as well as to promote peer-to-peer learning. Keeping instructor presence in mind when developing online curriculum challenges experts to move beyond just making content available—and moving toward a rewarding learning experience.

Figure 13-2. The Michigan State University Extension course development learning objective outline tool.

MICHIGAN STATE UNIVERSITY | Extension

This template is meant to be a guide for developing an outline for a course or program based on learning objectives. If you have any questions regarding this template please contact Gwyn Shelle, Instructional Technology Specialist at heyboerg@msu.edu or 517-432-5131. (This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License)

Title of Course (Add Title)			
Learning Objective Examples (Need to add	**Supporting Content Examples**	**Activity Examples**	**Assessment Examples**
		Scavenger Hunt	
		Games (Ex. Jeopardy)	
		Online Flash Cards	
		Webinar	
		Online Chat	
		Virtual Tour	
		Case Study Review	
		Online Debate	
		Group/team Activities	
		Scenarios w/ Questions	Pre/Post Assessment
		Ice Breakers/Discussion	Paper
	Lecture Video	Forum	Discussion Forum
Learning objectives must be measurable	Podcast	Read, Reflect, Report	Wiki
Do not use "understand" or "know" as a verb	Article	Role Playing	Blog
Align learning objectives with the level of the course Align learning objectives to assessments	Digital Storytelling	Article Critique	Portfolio
	Screen Recording	Brainstorming	Project
	Guest Speaker	Concept Mapping	Literature Review
	Video Clip of Expert	Interviews	Presentation
	FAQ	Simulation	Quiz/Exam
Unit 1 (Add Title)			
Learning Objective #1	**Supporting Content**	**Activities**	**Assessments**
Learning Objective #2	**Supporting Content**	**Activities**	**Assessments**
Learning Objective #3	**Supporting Content**	**Activities**	**Assessments**

Phase 3: Build

The build phase can be the most time intensive part of the development process. In this phase, the content for the course is developed. This can include recording videos, designing activities, writing assessments, and more. A good practice is to begin with a storyboard. In this document, the expert writes out content of the course, scripts for videos, and assessment questions. Having the content initially written in a storyboard format allows a professional editor to give feedback on flow, consistency, and grammar. The storyboard should follow the organization framework created through the Course Development Learning Objective Outline.

The course content should also be organized within units or modules. The units can be organized by topic area for a self-paced course or by week for a cohort-based course where the content would be made available to the participants one week at a time. Each unit should contain instructional content, activities for participants to practice what they have learned, and a way for them to assess their knowledge.

The instructional content, activities, and assessments within a course will be unique based on the target audience, purpose, and the need that the content is expected to fulfil. Many options for instructional content exist including text the participants must read, recorded videos, links to websites, podcasts, digital storytelling, a recorded interview with an expert, and others. The activities should also be designed based on the learning objectives. One way to build activities is to reflect on the learning objectives and think about the most important areas of content that the participants must know or demonstrate. It may be easy to create a simple activity such as matching terms with definitions; however, this may not help the learner apply the most critical areas of content that they learned through the instruction. Examples of activities include scenarios with feedback, knowledge recall activities, classification, decision trees, virtual tours, an online chat, or games such as Jeopardy. Often quizzes are used for assessments in online courses as they can be automatically graded for the participants, in addition to features such as automatic feedback on questions they answered incorrectly and the ability to take the quiz more than once to achieve a certain score. Applied assessments can also be integrated within a course such as using discussion forums, having the participants complete a handout and submit it to the instructor for feedback, or completing a project. These types of activities do require more time of the instructor as the assessments should be graded and the participants should receive feedback. Examples of instructional content, activities, and assessments can be found in Figure 13-2.

When creating content, the expert should always keep accessibility of online content in mind to remove barriers from the learning process. Some examples of accessible content include using materials that include appropriate contrast to make graphics more readable, using more than color when describing a graphic, using alternative text for images so that a screen reader describes it to a learner, and using closed-captioned video content. Making content accessible not only removes barriers to learners but also increases the quality of the content.

A list of best practices for building instructional content in an online course follows. Remember that the content within every online course will be different and should focus on meeting the needs of the target audience.

- **Learner Needs:** Always focus on the needs of the learner. If participants need to learn about tractor safety, graphics of equipment and safety videos might be included. If participants need to learn about making a nutritious meal, recipes and cooking demonstration videos might be included.
- **Different Ways of Learning:** Remember that the target audience may include a variety of learners, and their preferences for learning may differ. Some individuals may prefer written text, while others would prefer short videos. Including a variety of instructional content will also help to increase engagement with your audience.
- **Video Content:** Keep videos short, about 5–7 minutes. Include a variety of videos in a course such as a recording of an expert on a specific topic, a demonstration, a video clip from the field, and other types.

- **Instructor Presence:** Incorporate content in ways that allow you to make the instructor's presence known such as short introductory videos from the instructor for each module.
- **Accessibility:** Think about color contrast, alternative text for images, and closed captioning for videos. Find a basic accessibility checklist from MSU at https://webaccess.msu.edu/Help_and_Resources/checklist.html.
- **Finding Content:** Curate online resources to see if there are relevant and accurate resources online. Make sure to always cite your sources accurately, and use photos and videos with permission or those with a Creative Commons license.

Phase 4: Test/Refine

Throughout the test and refine stage, the content is reviewed at two different levels including peer review and pilot testing. First, the content is peer reviewed by one to three individuals who have expertise in the subject matter. For example, peer reviewers may include faculty or staff who have a certain level of expertise in the content area. Other examples of peer reviewers may include graduate students or outside consultants. Often peer reviewers are acknowledged on a page within the course and may receive a stipend for their time if funding is available. At this level, the reviewers look for areas that may need more detail and are expected to give suggestions for additional content based on their area of expertise.

The second level includes a pilot test of the content by individuals who represent the target audience. The pilot group may include up to 10 individuals who will give feedback on the course in terms of instructions, relevance of content, and any areas that need to be explained further.

Feedback from both peer reviewers and pilot testers can be obtained through templates or online surveys built within the course.

Phase 5: Launch

When preparing to launch an online course, instructors should consult with experts on developing a marketing plan for advertising the course to potential participants. A marketing plan is going to be unique to each target audience. Some ways of connecting with potential course participants include:

- **Email Campaigns:** Building a marketing list of potential participants can be helpful for advertising a course. Email campaign tools such as Constant Contact and MailChimp can be useful in managing email lists, designing email blasts, and automating communication. A sign-up form for an email list can be advertised on a website, during online events such as a webinar, and through face-to-face events.
- **Websites:** Having a web presence is key for allowing potential participants to find information about a course. Using proper metadata can make a course more findable online.
- **Social Media:** If the target audience is active on social media, tools such as Facebook and Twitter can be useful in advertising.
- **Events:** Courses can be advertised through other related events whether they are in-person or online such as a webinar.
- **Print:** Postcards, handouts, and fact sheets can be handed out at events or mailed to a list of potential participants.

Phase 6: Evaluate

As part of a continuous improvement process, courses should be routinely evaluated for effectiveness and quality of the content, and to make sure participants are gaining knowledge. Data such as the amount of time spent in the course, number of logins, and number of certificates issued are typically available through learning management system metrics. This data can help build a picture of the user experience. On a set schedule, content should be reviewed for quality including broken links, instructions that need updating based on new versions of software, and other areas. Data from both quizzes and pre- and post-tests can give instructors insight on knowledge gained by the participants and if there are any gaps in content. The content should also be evaluated for effectiveness in terms of participant satisfaction, suggestions for improvement, and ideas for future courses.

Best Practices for Online Meetings & Webinars

The integration of videoconferencing tools for online meetings and webinars can increase communication channels for internal staff within an organization and increase outreach to local, national, and international communities. Specific examples include community-based online education, broadcasting of live events, and professional development for staff. MSU Extension offers many webinars and facilitated online meetings on topics relating to agriculture, health, youth development, gardening, and natural resources. As an example, MSU Extension's Beginning Farmer and Field Crops webinar series had 438 registrants in 2017 with a combined total of over 2,400 viewers. At times, MSU Extension will also partner with external organizations. Each year, the MSU Extension Health and Nutrition Institute in partnership with the Michigan Department of Health and Human Services offers an annual webinar on vaccinations. In 2019, they had approximately 900 attendees in this webinar.

Some of the many benefits for offering learning experiences through an online meeting or webinar follow:

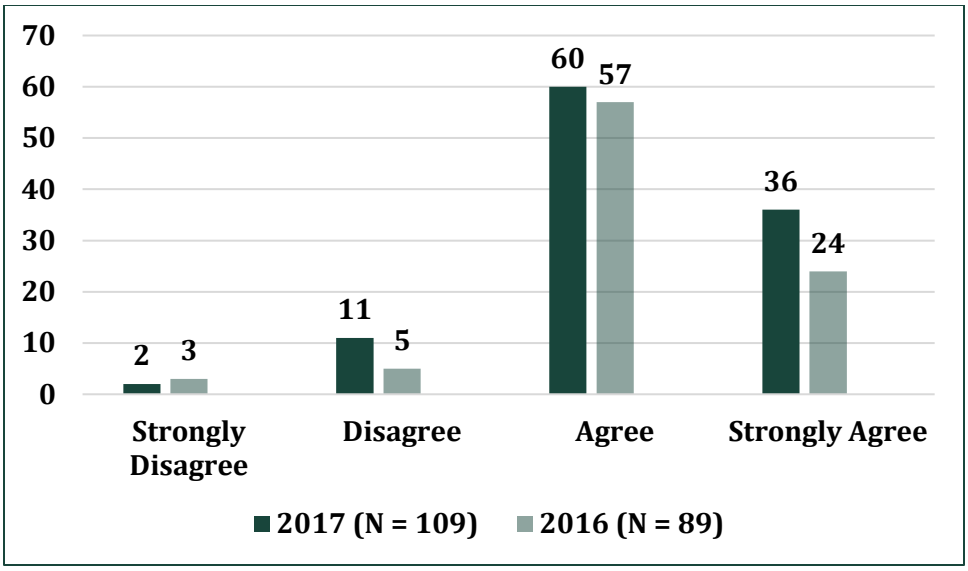
- **Access:** This format allows participants who are located at various geographic locations to attend a live event that they may not have been able to attend otherwise. It is a convenient option for learning.
- **Cost:** Webinars and online meetings can save travel time and money for both speakers and participants.
- **Marketing:** Offering free webinars can be a method for building email lists for other events or online programs. Note that participants should always be allowed to opt in to an email list and must always have an option to opt out of receiving emails. It is also a way to build rapport and brand awareness.
- **Re-usable Content/Recordings:** Recorded content can be made available online and repurposed in other curricula such as a blended or online course.

A variety of formats for designing webinars or virtual meetings exist. Base the option you select on what is best for the content you present and for the target audience. Some examples include:

- **Series:** A webinar series can be offered in a variety of ways such as a week-long series with one webinar a day, or a series in which a webinar is offered once a week for a period of time such as over four weeks. Typically with a webinar series, the content focuses on a specific theme or topic area.
- **Connecting Multiple Locations:** A webinar or virtual meeting can be an aid for connecting two or more face-to-face sites. In this instance, it can be helpful to have at least one in-person speaker at each location for audience engagement.
- **Blended:** A blended approach combines both online experiences and face-to-face instruction. It allows for shorter in-person meeting time, as well as time for preparing for in-person training and reflection after the training. An example of this would be scheduling a webinar or virtual meeting prior to an in-person training to set the stage and get participants acquainted with each other. Offering an online experience after an in-person event or training allows time for reflection and application of content to scenarios or case studies.
- **Ignite Style:** In Ignite style presentations, you may have multiple speakers who have a short time period to present. For example, MSU Extension held an Ignite style event where half of the participants were in-person and half were virtual. The in-person presenters all had 5 minutes to present and were able to answer up to two questions. In this instance, you must have a moderator to keep the event on schedule.
- **Panel of Experts with Q&A:** At times a dialogue between several presenters may be more effective than a formal presentation. In this instance, a moderator is needed to ask question and to keep the conversation focused. It is a best practice to write and share the questions ahead of time with those speaking.

For a webinar experience to be successful, some key areas need to be addressed including participant engagement and quality content development. Presenters can improve the effectiveness of their delivery in many ways. Participants can be encouraged to be involved within the webinar through the use of tools such as a poll, chat, and Q & A, and having participants virtually raise their hands. Facilitators should be purposeful in designing webinars that engage with their audiences. For example, in a face-to-face program, a facilitator should stop every 10 minutes and ask for feedback, engage with the audience, and ask questions. This same format should be followed in a webinar by stopping at various points in the presentation and asking for feedback, asking a poll question, or other methods. Another way to improve the effectiveness of the content delivery is to include the video of the person presenting. In a survey of past webinar attendees in the MSU Extension Beginning Farmer webinar series, participants were asked to rate their agreement in terms of if the presenter video added interest and/or value to the webinar. As shown in Figure 13-3, the majority of respondents in both 2016 and 2017 agreed or strongly agreed that the presenter video added interest and/or value.

Figure 13-3. Michigan State University Extension Beginning Farmer Webinar Series—value of presenter video in webinar.



If using a presentation tool such as PowerPoint in a webinar or online meeting, keep these best practices in mind. A common mistake by presenters is to put too much text on each slide. One way to avoid this is to limit the number of bullets and amount of words on each slide, such as only have 5 or 6 bullets and up to 5 or 6 words for each bullet. Any additional information can be put in the notes section and made available to participants in the form of a printed or online handout. Pictures and charts will also help engage with the audience. Photos and graphics should relate to the content and often they may help in telling a story or giving an example. Presenters should try to limit the number of slides and practice giving the presentation to make sure there will be time for questions and interaction with the audience.

The archived recordings can be just as important as the live presentation as they give participants the opportunity to review the content or view it at a later time. The webinar recordings are also at times integrated within MSU Extension online programs. When sharing a recording, keep accessibility in mind. Video captioning results in many benefits such as making the content available to all including those who are deaf or hard of hearing, being legally compliant, increasing comprehension of content in online courses, allowing for flexible viewing in sound-sensitive environments such as a library or public transportation, and increasing the searchability of your content (Edelberg, 2019).

When thinking about designing a quality webinar experience, a facilitator should focus on:

- **Date/Time of Webinar:** Those planning the webinar should schedule it for an appropriate date and time. For example, it may be more effective to reach farmers in the winter months when they are not as busy. The time of day can also make a difference in attendance. If the target audience would typically be working during the day then scheduling a webinar for the evening may increase attendance.
- **Technology Equipment:** Having the right equipment is going to make the webinar experience more fluid and will result in a higher quality recording. Those speaking in the webinar should either use a headset or

microphone if they are in an individual office area or a conference room microphone if they are in a group setting. Built-in computer microphones result in lower quality audio.

- **Quality Content:** A high-quality presentation is important in order to engage with your audience. Techniques for engagement include using less text on a slide and more images, and adding interactivity such as video clips or showing websites.
- **Audience Engagement:** Planning ahead for ways in which you can engage with your audience will help with retention throughout the webinar. Examples include stopping and asking the audience for questions throughout the webinar, asking them to share ideas through a chat tool, or using poll questions to increase engagement.
- **Practice Session:** Scheduling a practice session with the presenters may only take a few minutes but will ensure that equipment and technology are appropriate. Presenters should join the webinar 30 minutes prior to the start time for one last test before the live event.
- **Co-Host Support:** Many times, it is helpful to have a co-host who also has expertise in the content area so they can help in answering questions through the chat or Q&A tool.
- **Sharing the recording/tracking data:** Think ahead in terms of how the recording will be shared using a platform such as YouTube or Vimeo. Make sure that all guidelines are followed for branding and accessibility.
- **Evaluation:** If collecting evaluation data on the webinar, ask participants at the end of the webinar to take the survey by sharing the link in the chat. You can also follow-up with those that registered, share the recording, and ask them to complete the survey.

Summary

This chapter covered best practices for offering content in a virtual way to increase the reach of MSU Extension programs and offer flexibility to both content experts and participants. Technology changes at a rapid pace, which requires Extension staff to stay engaged with emerging tools and practices. Extension staff should continuously improve their stills through formal and nonformal professional development opportunities such as reading blogs, attending trainings, reading articles, and attending conferences. Building a community with peers for ideation and to test new technologies can also be effective. Extension staff should build a toolkit of resources and best practices that they can rely on to effectively meet learners in their space.

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CHAPTER 14

The World Is My Village

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List of Abbreviations

CNF	Community Natural Farming
COCO	Connect-Online-Connect-Offline
CRP	Community Resource Person
DoAC–GoAP	Department of Agriculture and Cooperation, Government of Andhra Pradesh
DPM	District Program Manager
DPMU	District Program Management Unit
ICT	Information and Communication Technology
IVRS	Interactive Voice Response System
SME	Subject Matter Experts
VRP	Video Resource Persons

Imagine the world to be one village and all of us being extension functionaries. We have the motivation, but not the wherewithal, to get farmers to have a life that is better than normal. Then, came along many a tool that gave us the strength to support our motivation. This is a true story of all the possibilities that could happen if the world were one expansive village and Aarthi was our friendly, cheerful extension functionary reaching out to everyone.

The Precursor

In 2006, since the farming community in India still did not have much access to communication technologies, disseminating agricultural-related information to farmers was challenging. Disseminating information to farmers on improved agricultural practices was the need of the hour.

Rikin Gandhi (the co-founder of Digital Green and currently its executive director), then a researcher at Microsoft, was considering the need for information dissemination to the farming community and studied various modes of information dissemination. Those were audio Green (information through audio), poster Green (information through posters), and digital Green (information through audiovisual). While all these modes included

human mediation, digital Green (the video-based approach) proved to be more efficient in terms of better understanding, retention, and reach to address a wide audience (including the semi-literate).

The research project evolved into Digital Green, an independent organization, in May 2009. From then on, the organization has been working closely with its partners as a resource agency to maximize their extension efforts by using the "Human Mediated Extension" approach. Digital Green itself, as well as the approaches it has been demonstrating and propagating, have evolved over the years.

This case study is an effort to portray the evolution of both the organization as well as its innovative approaches through the experiences of a field-level extension functionary. The narration from the foci of an extension functionary may give the reader an idea of the technologies that Digital Green has been espousing, solely to empower extension functionaries like her, and hence, create an ecosystem for efficient flow of information to the farmers.

Over the last decade, the extension model has undergone multiple iterations and has been adapted to the needs of the community as well as the service provider. Even within these iterations, it has still retained the basic spirit of providing information to the farmers through a visual medium with a protagonist whom the farmers can identify as being one of their fellow community members. This simplified process of creating and distributing hyperlocal content provides the flexibility to adapt to the community's needs and be adopted by the service provider (both within the governmental and nongovernment organizations) and has driven the success of this extension system across multiple places.

Additional tools have come together to enhance the effectiveness of the extension system. These have been tested as components of various projects that Digital Green has implemented. The utilization of these additional tools enhances the capability of the extension agents to provide services beyond the information needs of the farmers. The narration that follows describes some of these innovative and important tools.

The Early Users

A tree-lined and shaded road in Yemmiganur *taluk* (a collection of villages and small towns) leads to the village of Kanakaveedu. At the end of this broad and metaled road is the modest dwelling of Aarthi Kumari and her family. About 8 years ago, Aarthi had come into this house as a daughter-in-law and since then had been supporting her agrarian family by toiling in the family's land, like other women in her neighborhood.

But her sharp acumen of picking up new concepts of farming led to conversing with her neighbors. When the opportunity came, she joined the extension force of the Department of Agriculture as a community resource person (CRP). For the first time, this woman, who had not been able to complete high school due to economic compulsions, had a chance to be employed as well as become a facilitator at the village level.

With support from her husband as well as her in-laws, Aarthi had been striving to get information to the farmers that the Department of Agriculture and Cooperation, Government of Andhra Pradesh (DoAC–GoAP) wished to reach out with. Like clockwork, for six days a week, she connected with

farmers twice each day. Generally in the morning, she conducted Farmer Field Schools, and in the evening, she conducted video disseminations.

Early in her job, officials from the DoAC–GoAP provided her with the skills to conduct Farmer Field Schools. Shortly after the department decided to introduce the video-based Human Mediated Extension System for motivating farmers to adopt practices of Community Natural Farming (CNF), Aarthi and her batch of CRPs had been called to the District Head Quarter for a training on the extension system.

Despite the best of extension interventions, influencing passive listeners has always been a major challenge. In this context, DoAC–GoAP collaborated with Digital Green to document and disseminate best practices in the form of videos to farmers to enhance their learning. As part of this initiative, the Digital Green team conducted training to build the capacity of lead farmers and extension staff in video production and dissemination.

Designated as "Video Dissemination Training" and spread over three days, these trainings were conducted at the Technical Training and Development Centre of the government. This training was ". . . most interesting and one of the best I had ever attended" in the words of Aarthi. The main purpose of the training was to introduce the nuances of digital extension to Aarthi and her fellow CRPs of the district. The training aimed at improving the extension skills of the CRPs and using the community videos through the Pico projectors, which are small, portable, lightweight projectors.

At almost all the trainings, the trainers from Digital Green encountered a set of heterogenous participants. Participants at the same training could be lead farmers, extension staff members of the government, or of their associated organizations. While most felt that mobilizing farmers was the biggest challenge, some felt that extension itself was a time-consuming activity. Others, who were not exposed to modern modes of Information and Communication Technology (ICT) were apprehensive about the use of gadgets, especially in areas of erratic electricity supply. Still others had doubts about the ability of farmers to accept and learn farming techniques, which required them to undergo a paradigm shift from what they might have learned from the elders of their family or community.

The general feeling among the trainees at the start of most of these dissemination trainings was that each day in the field situation brought a new challenge. In an effort to satisfy the expectations of the trainees, the trainers focused on aspects of group mobilization, addressed the apprehensions about the use of new technology as well as showed the enhanced value of using videos at the grassroots level. Many times, the heterogeneity of the groups turned out to be a boon in disguise. There always would be some very active participants who would raise the spirits of others, especially during the group activities. As discussions and debates were encouraged, apprehensions gave way to enthusiasm with the participants, who tried to relate their field-level experiences to the topics that were discussed.

"I believed I was always right in my thinking and I rarely considered other's points of view. But after this training program, I realized and learnt that I needed to respect the viewpoints of others and especially the farmers with whom I work," said Aarthi.

While traversing through a series of logical sessions, including sessions on adult learning principles, the participants reflected on various aspects of their work and tried to relate it to the functions that they were expected to fulfil in their roles as frontline functionaries.

Figure 14-1. Practice session at a dissemination training.
(Photo courtesy Digital Green Foundation.)

A session on visualization gave them the opportunity to foresee the conditions of the farmers in their villages in the ensuing five years. The responsibility to expand the adoption of practices among their fellow farmers and thereby improve the overall health and economic status was looked at through a series of practical and achievable milestones. This assisted the outreach functionaries to be strategic over a long term. They would not be overawed by the responsibility of bringing about a huge attitudinal change in their immediate neighborhood.

The training schedule was planned and conducted so that the functionaries immersed themselves in a theoretical framework. They were also provided practical examples from their work so that they could relate to the concepts shared in the lectures. During the same training sessions, they practiced approaches to mobilize the groups by establishing trust and strengthening positive dynamics. They were provided skills on interpersonal communication that they could use while mediating a video at the farmers' meeting.

As shared during the feedback session at the end of the dissemination training, the functionaries expressed that they felt a multitude of emotions. For some it was a reinvigoration of concepts that they would have already used and additionally learned new techniques of community mobilization. The amalgamation of these would help them have greater clarity of the task at hand. But for many, it was the first time ever that they had a chance to experience a process of using community mobilization tools, coupled with the excitement of using an electronic projection system. With these new feelings, the trained outreach functionaries would leave for their *karma-kshetra* (Sanskrit for work region or place of work) and also with an assurance that the Digital Green team will be there with them for continued support.

As the trainings would draw to a close, there was a palpable sense of urgency among the trainees to use the new technology. By this time, almost all of them would have realized the importance of having access to audiovisual content and an innovative (as well as practical) Pico projector to use this content. They would acknowledge that this was a creative and a practical solution. The use of audiovisual content in Kurnool, a district in Andhra Pradesh of India, as well as in other far-flung and tribal hinterland

was surely a gamechanger. Aarthi and her other friends echoed the thought that they could now easily engage the farmers by using these audiovisuals during the discussions. Almost every trainee would share that Digital Green's training methodology was "creative and thought provoking."

A belief of Digital Green is that language will not remain a barrier for a learner if there are efficient learning systems. This was reinforced over and over again when extension staff would later share that this extension approach was more than just a technological intervention, but a critical path to share knowledge that the farmers could comprehend easily.

Aarthi returned from the training with renewed enthusiasm and many skills. She also came with a new gadget that she had seen for the first time in her life. It was a projector, so small that it could fit into her handbag. When she showed it for the first time to her family, they were amazed. The word quickly spread around the village that Aarthi would now show "cinema" about undertaking better agriculture practices to all those interested. At the next meeting she conducted, a larger than normal crowd waited to see what the gadget was. Taking this as an opportunity to garner interest within the farmers, she announced a schedule of cinema shows, which we would call *video disseminations*.

At sundown, farmers gathered at the veranda of the local primary school. As Aarthi opened the box in which the Pico projector came, a distinct murmur arose from the gathering when they saw a "mobile-like device," which was supposed to be used to show videos. When Aarthi set up the projector and started disseminating the video, a palpable amazement occurred within the crowd—more so when they realized that the people featured in the videos were farmers from the same district.

Figure 14-2. Dissemination at a village.
(Photo courtesy Digital Green Foundation)

As the video dissemination progressed at Kanakaveedu and hundreds of villages across India (under collaboration with the National Rural Livelihood Mission of the Government of India) as well as in Ethiopia (with the Ministry of Agriculture), the use of these hyperlocal videos through the Pico projectors worked magic for functionaries like Aarthi. Extension functionaries have expressed that these videos and the training to disseminate them have been the most helpful tools for them.

"This has been a friend in need, who can provide information without getting tired throughout the day at any number of meetings, while we explain the finer points" was one thought that has been shared by numerous extension functionaries.

The Content Creators

Aarthi and many of her fellow outreach functionaries used to wonder where these short videos featuring local farmers and other extension functionaries came from. Little did they know that they could also get featured in some of those. When the farmers saw people like themselves in the videos, they too were fascinated. Their curiosity grew when they got to know that the characters in the videos were real-life farmers from their own district (or the neighboring one).

Videos made with local farmers in the local dialects were an important tool in the process of facilitating behavior change. Homophily attracted farmers to the video disseminations.

". . . when someone like their own self talks about a practice that they have done and have gained some tangible benefits, this makes the farmers sit up and think. That is the time when I motivate them to try out a new practice," explained Aarthi.

While the farmers may not be completely convinced the first time around, showing similar videos coupled with practical demonstrations to groups of farmers helped to gain their confidence and to convince them to undertake the practice in the field.

One day, Aarthi received a call from the District Program Manager (DPM). Due to her proactive work and her ability to get many of the target farmers in her village to adopt innovative CNF practices for managing soil nutrition, she was recommended to be featured in a few practice demonstration videos. While her joy knew no bounds, she was also a little nervous about the whole process. She was assured by the DPM who told her the video team would contact her soon.

True to the words of the DPM, Aarthi received a call from a woman who introduced herself as Laxmi, a video resource person (VRP) working for the District Program Management Unit (DPMU) of the Kurnool District. Laxmi mentioned that she and two of her other team members had been instructed to get to Kanakaveedu to shoot the assigned videos. On the decided date, Aarthi was pleasantly surprised to find a team of three women at her doorstep. They introduced themselves as the VRPs.

Aarthi talked to the village headman to get the three VRPs accommodated at the spare room in the local primary school. Over the next three days, the VRPs worked with Aarthi, a few farmers, and a couple of volunteers to shoot a video, which was later produced as a method of preparation and use of *panchagavya* (a growth enhancer in liquid form that can be used at the time of irrigation).

Figure 14-3. Video shoot at a village.
(Photo courtesy Digital Green Foundation.)

During the course of their stay in the village and the shoot, Aarthi, Laxmi, and her two friends interacted at length. Aarthi was truly fascinated by the way the three women carried about and used the video production equipment. In 2012, this was a sight to behold. Neither Aarthi nor the villagers of Kanakaveedu had ever seen women wielding a camera and walking to the site of a shoot with a tripod as well as a reflector in their hands. As the camaraderie grew, the four women talked about their families as well as the way they delivered on their work targets in spite of all the household chores.

Fascinated by the skills of the VRPs, during their discussion, Aarthi got interested to know how the three women from rural areas of Kurnool, who had never held a camera or even a smartphone (which was a rarity at that time) became competent video film makers. They said that their whole outlook on life changed the day they had separately decided, with their respective spouses, that they would try for a "part-time" job advertised in the local newspaper. After having decided to go for it, they landed an interview where members from the organization called Digital Green gave them cameras and asked them to take photographs of "anything their heart desired."

What followed their selection was even more fascinating. At a five-day training program, Laxmi and her friends learned the nuances of video production to become skilled VRPs. Starting from the process of identifying content with the DPM, storyboarding, and identifying the parts of a camcorder, they learned the process of capturing audio as well as looking at correct camera angles and light. They learned the all-important skill of narrating the story in a visual format that fit within the duration of 8 to 10 minutes.

With all that enthusiasm, Laxmi and her friends started working on producing the visual content at Kanakaveedu. As per the standard procedures, they arrived at the location of the shoot before the break of dawn. For them, the days of the shoot started at 3 a.m. After completing their chores, they traveled to the shooting spot early in the morning and got ready to follow our superhero—the farmer. The aim was to be candid in narrating the story and for this, the VRPs kept following the superhero for the days when the shoot went on. In between the shots of capturing the agriculture practices, they also motivated the farmer to share his experience about these practices and his message to fellow farmers. Though it sounds simple, it took

a lot of patience, practice, and efforts of Laxmi and her friends. This was not just a job for them. The efforts of these women (and the others in the training) as to how they transformed from housewives to content developers following the training should be recognized.

With the shoot for the video over in 3 to 4 days, the three VRPs returned back to the DPMU office at Kurnool. All the post-production activities took place at the district office and the videos (together with all the others produced over that month) were sent for review by the subject matter experts (SMEs). The DPMs, SMEs, and members of the Digital Green team would meet every 30 to 40 days and review these videos to ensure content quality. While the officials of the DoAC–GoAP ensured that all the non-negotiables of a practice were captured, the Digital Green team would ensure that the quality of visuals, the audio as well as the editing was good. After the videos passed strict quality control, they were approved by the DoAC–GoAP officials and only then were they sent out to functionaries like Aarthi to be disseminated in the villages across the same district or the neighboring one. Across multiple geographies where Digital Green engaged with partners to create such content at the community level during the first decade, over 3,500 community videos were produced in about 25 languages.

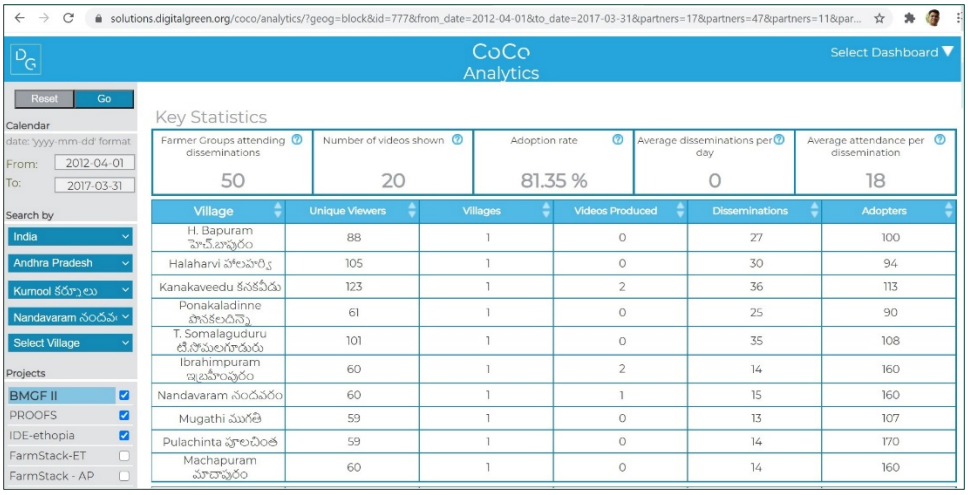
Within a month or 45 days of the shoot, Aarthi had access to the video, which was shot at Kanakaveedu. This featured her explaining the nuances of preparing a CNF growth enhancer. When the video was disseminated at the villages, the farmers were pleasantly surprised and also happy that such a practice was being ". . . taught to many farmers across the state by a lady from their village."

A Quality Achievement

As work progressed, Aarthi kept reporting back the data to the district level. She reported about all the disseminations she conducted as well as followed up with the farmers on the adoptions and other interventions that the DoAC–GoAP had trained her to do. Each month, she would submit these reports to the data entry operator at the district office of DoAC–GoAP. The dissemination and adoption data would be keyed into an open-source system called Connect-Online-Connect-Offline (COCO) that Digital Green had developed. This was used across the geography where the government departments as well as other partners of Digital Green implemented the "Human Mediated Extension System."

COCO has a simple data entry process that presents the results in analytics, which allows for management personnel to look at the trends in the program processes. The flexibility within COCO is such that the program managers can get access to trends regarding their complete program areas (country/state/district) as well as regarding the smallest program units such as a village. With the possibility of getting near real-time information, COCO became a tool for the program managers to review their cadres. Initially, there was paper-based reporting but within a few years, to make the process easier for extension functionaries like Aarthi, a mobile-based app was developed. Government departments who provided the extension functionaries with smartphones rolled out the use of the mobile application.

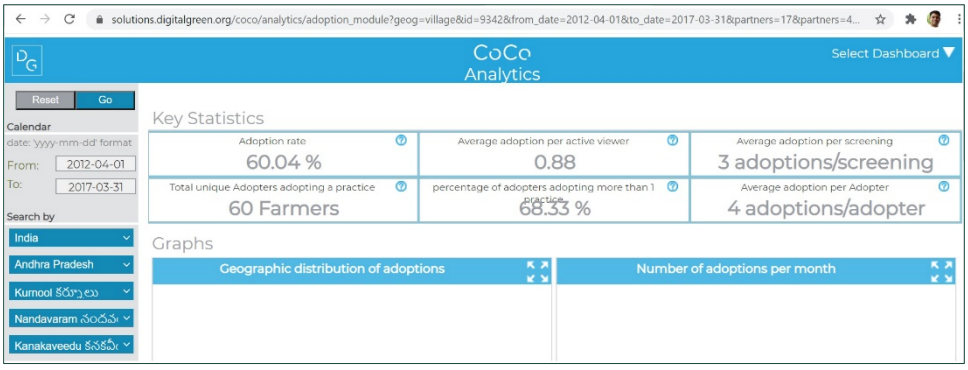
Figure 14-4. Nandavaram Mandal analytics. (Image courtesy Digital Green Foundation)



Village	Unique Viewers	Villages	Videos Produced	Disseminations	Adopters
H. Bapuram హెచ్.బాపురం	88	1	0	27	100
Halaharvi హాలహర్వి	105	1	0	30	94
Kanakaveedu కనకవీడు	123	1	2	36	113
Ponakaladinne పొనకలదిన్నె	61	1	0	25	90
T. Somalaguduru టి.సోమలగూడూరు	101	1	0	35	108
Ibrahimpuram ఇబ్రహీంపురం	60	1	2	14	160
Nandavaram నందవరం	60	1	1	15	160
Mugathi ముగతి	59	1	0	13	107
Pulachinta పూలచింత	59	1	0	14	170
Machapuram మాచాపురం	60	1	0	14	160

Across all partners (government or otherwise) Quality Assurance (QA) as well as State/Woreda (as in Ethiopia)/District-level reviews were done based on data made available in COCO. At one such review at the district level in Kurnool, Aarthi was surprised to see that the progress made in each village was being displayed within the DPM's presentation. She was euphoric with the commendations she received at the review and when the DPM showed everyone that the achievements of the project in Kanakaveedu was one of the best among all villages. When the members of the DPMU as well as the Digital Green team traveled to the project villages for their field trips, they would use the data from COCO during the community level meetings. They would discuss the problems around disseminations and encourage farmers to adopt as many new practices as possible over multiple crop cycles.

Figure 14-5. Kanakaveedu village analytics. (Image courtesy Digital Green Foundation)



As months passed by, Aarthi and her fellow extension functionaries mastered the art of disseminating a video and also motivating the farmers to adopt new practices. A dissemination did not remain just as a video show; it was a play-pause-discuss-play approach to elicit the farmers' interest in adopting new practices. These late evening disseminations became a time when the farmers would gather at a place and discuss much more than the practice. When the disseminations get underway, the focus of course shifts to the practice. A range of questions and emotions get attached to the practice being discussed, with the room almost always having some farmers

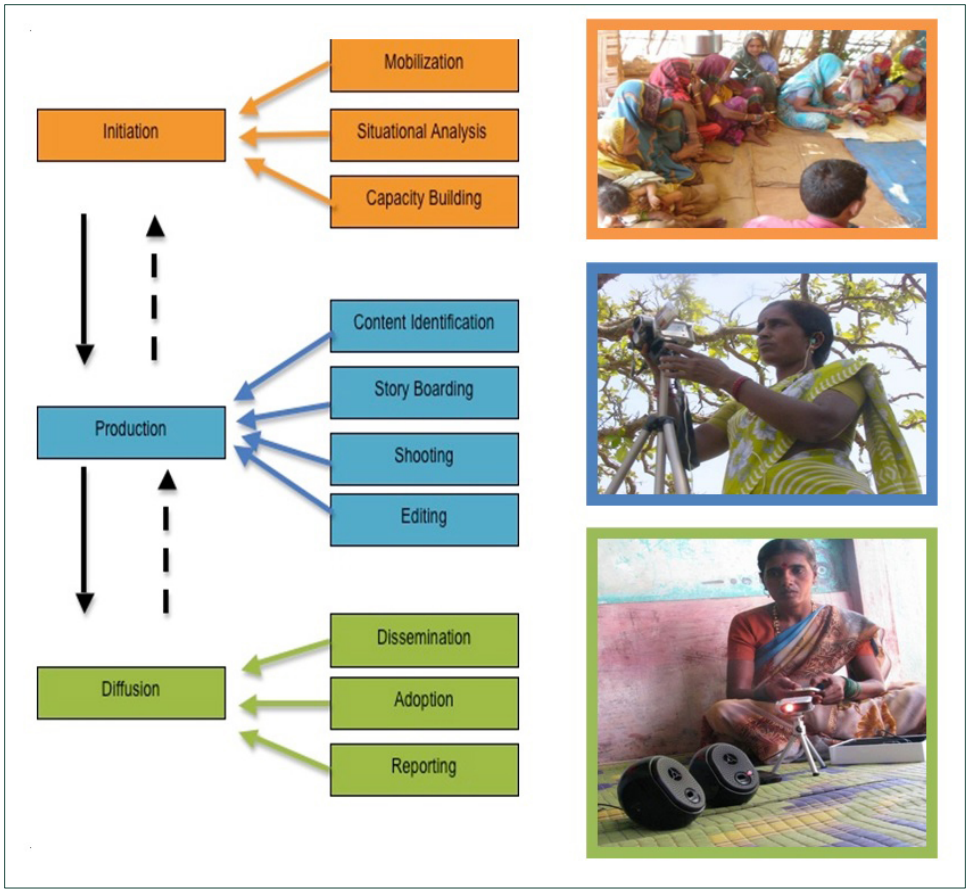
who agreed from the beginning to surely adopt the new practice, some who were sceptics, and many who needed a little push to change their behaviors. Over the first decade, across nine states in India and across eight other countries, it was extension functionaries like Aarthi who brought about a positive change of behaviors in over 2.8 million farmers.

New Tools, New Methods

As Aarthi and her fellow functionaries mastered the Human Mediated Extension System, the field-level extension process got streamlined across locations. The district-level supervisors and policymakers at the state level could see the difference that it made. By the fifth to sixth year, the number of government departments, nonprofit organizations, and federations who had started using this extension system and the places in which this system was being used had dramatically increased.

This was also a time when Digital Green had started thinking about its new manifesto. It was time for change, time for a shift from being an innovator in the digital extension segment to becoming an innovator in the agriculture-technology domain.

Figure 14-6. Basic processes of Digital Green Extension System. (Image courtesy Digital Green Foundation)



Excerpts From the 2016 Digital Green New Manifesto

"We embody a curious, problem-seeking attitude that puts ourselves in the place where the people that we work with are, actively listens, and strives even when confronted by adversity on the inertia of the status quo.

"We innovate not for the sake of innovating, but to make an impact in the lives of the poor.

"We use technology to amplify good and partner with organizations and individuals that have the hearts and minds to realize its potential.

"We are committed to the long game of our moonshot by starting with the poor, and relentlessly seeking to improve ourselves.

"We will never be satisfied until poverty is history and every individual is able to live a life of dignity. We believe if we are successful, we will have worked ourselves out of a job and our culture will remain our legacy."

With a new manifesto as its sounding board, the Digital Green team embarked on a brave and challenging journey of change. It was about going beyond the comfort zone of only implementing the now well-accepted Human Mediated Extension System and pushing into the new horizon of agri-technology. The team had started to conceptualize technological innovations and pilot them across multiple locations, with the aim to set examples of new ways to assist farmers to access information and services.

A Responsive Voice

With the belief that there is potential to augment behavior change and increase rates of adoption of new practices by supplementing the video-based approach with reinforced messages, Aarthi and the farmers she worked with were enrolled into an Interactive Voice Response System (IVRS). Through this automated technology, farmers could communicate through a computer-operated phone system using their voices or keypads. This was one of the first innovations that was scaled up. The systems for interactive voice response were built to create demand for the practices (based on the government partner's priority) and included providing personalized advisories to farmers based on their crop stage, the soil type, and the predicted weather forecast.

Additionally, the functionaries received reminders, ensuring that disseminations are conducted at the right time and that these can contribute a lot to increased adoptions. While the system was nothing new, the way it was utilized was surely innovative. This was aimed at assisting farmers to achieve improved decision-making and hence better yield. This process was not only rolled out in Kanakaveedu but across multiple districts of Andhra Pradesh as well as many other states covering over 9,000 farmers.

"Initially I thought it would be like any other call-center person calling and disturbing me. But right in the first week I could understand that this process was surely going to be of use. I received calls to remind me of the next video I should disseminate and it also reminded the farmers about the next one they should watch. The best part was it provided the farmers with the opportunity to call in and hear all about the practices that they wanted to. Suddenly the demand grew. There was a time when I had to go about pulling farmers to come to meetings, now the farmers would know about the

upcoming dissemination and sometimes also reminded me in a friendly manner, if they would meet me on the street somewhere," said Aarthi.

Overall, the intervention resulted in increased demand for services by new and existing farmers enrolled within the project, improved knowledge and better decision-making by farmers, increased adoptions, and improved crop production.

A Trainer Who Is Always By Our Side

Continuous capacity building of frontline extension workers is an essential part of an effective extension system. However, delivering these trainings (and any refreshers) in a scaled-up program is both costly and time consuming. Due to the sheer numbers and the logistics involved in repeatedly getting field-based extension functionaries into the training halls, like many other government departments, the DoAC–GoAP could offer limited in-person training/refreshers to its frontline extension force. Even though the department could afford it financially, it was not an economically viable option. On the other hand, Digital Green's partner also knew that less contact with the extension force leads to lower performance. Together with the DoAC–GoAP, a virtual training process was established. The process provided on-demand access to video content with quizzes and allowed frontline functionaries to refresh and test their knowledge whenever they wished to and respond to farmers' queries with greater ease.

"This was like a book in my hand, except for the fact that I did not have to search the pages but could immediately get to the essential sections in two or four touches of the screen. When I was provided with a phone by the department that had a large screen, little did I realize that I could actually gain knowledge through this device, which would be beneficial for me at my work. At one of the district-level meetings the Digital Green managers taught us how to get started on this ready reckoner or guide. We were told that we had to go through the information on about seven topics at our own pace. At my village, after all the work for the day was done, I used to explore all that was in there. I watched the first video and tried answering the first four to five questions about what I learnt from the video.

"This seemed so interesting that I got addicted to it and within the stipulated time finished all the seven courses which were allocated to me. My friends, who were functionaries in the nearby villages and I would always call each other to ask how many lessons each of us had completed. There was so much information about all that I needed to know that post training, if ever needed, I would refer to these practices at the field and could also show these videos to individual farmers on my mobile set, while explaining the concepts to them at their farms.

"The certificates that I received at the end of the course as well as the fact that I always had the lessons on my mobile boosted my self-confidence. The way I conversed with the farmers on the old as well as the new practices became much better. The farmers also saw this confidence in me and opened up to me. The continuous learning over the months provided me with an opportunity for lifelong learning and to reflect on my work. I felt connected.

I felt as if there was an expert who was always by my side, who was guiding me," Aarthi reminisced.

The Digital Green team kept improving upon the virtual training process by collaborating with the teams from government departments as well as the technology service provider. Digital Green partners agreed that this process:

- Was a very cost-effective one for capacity building of frontline workers (saves resources for the government department),
- Saved time by replacing the classroom-based refresher trainings,
- Met the diverse training requirements of the extension functionaries,
- Helped to increase knowledge among frontline workers, and
- Resulted in effective disseminations by frontline workers due to improved skills.

The virtual training process targeted the problem of refreshers and capacity building at scale to teach the crop package of practices and spread uniform knowledge. The process was tested with 450 of the best extension functionaries within the government departments and then, because of its effectiveness, was opened to over 2,900 more users.

Figure 14-7. A virtual training course. (Courtesy Digital Green Foundation.)

Figure 14-8. A lesson-quiz on a virtual training course. (Courtesy Digital Green Foundation.)

A Little Skill That Goes a Long Way

A little over a decade ago, Digital Green started with the vision of empowering extension functionaries to use technology. It was about ". . . using the power of technology and social mobilization to increase the efficiency of extension systems," as its philosophy went. The basic premise was that if we can provide extension functionaries with appropriate tools, they would be able to motivate and assist farmers to transform their own behaviors toward adopting better practices and hence strive to attain a better quality of life.

The "normal" had to be changed by a process where the farmers are motivated by the members of their own community to adopt a "new and better normal." This surely did happen. The application of a simple, cost-effective technology of using videos made by the community and the skills of human mediation attained by the extension functionaries helped them to motivate farmers to attain a new and better normal. That was a few years ago.

These days, a rapidly changing and ever-evolving ecosystem of Information and Communication Technology (ICT) provides a myriad of opportunities. While extension functionaries can be equipped with better skills and knowledge away from the formal classrooms, farmers too can attain soft skills that allow them to use communication technology and make important agronomic decisions about their crops and access markets as well as let markets and consumers find them.

Digital Green, through its new manifesto, continues to strive with partners and like-minded organizations to use the opportunities provided by this rapidly developing ICT ecosystem. It aims to bring about a positive change in the skills and mindsets of farmers and the people who serve them. We believe that by empowering both the farmers and the extension functionaries, through the use of technology, we can bridge the gap between the villages where they reside and the world outside. Digital Green sincerely wishes the whole world was just one single and expansive village, with motivated functionaries like Aarthi present everywhere to serve the people.

References

Digital Green. (2016, February). *Going global* (Unpublished Internal Document).

Note: Ideas and examples in this document also appear in part in the following Digital Green monographs:

- Digital Green Key Facts
- Digital Green in Health
- NRLM Partnership
- Quality Assurance in Digital Green
- Training in Digital Green
- Digital Green in Africa

CHAPTER 15

Interactive Information Dissemination System

AN ALTERNATIVE INFORMATION & COMMUNICATION TECHNOLOGY MODEL TO MEET THE INFORMATION NEEDS OF INDIAN FARMERS ON ECO-FRIENDLY AGRICULTURE

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List of Abbreviations

AKPS	Annapurna Krishi Prasaar Seva
ANGRAU	Acharya N. G. Ranga Agricultural University
CAU	Central Agricultural University
DAATTCs	District Agricultural Advisory and Transfer of Technology Centers
DIC	Digital India Corporation
ICAR	Indian Council of Agricultural Research
ICT	Information and Communication Technology
IIDS	Interactive Information Dissemination System
IVRS	Interactive Voice Response System
KVKs	Krishi Vigyan Kendras (Agriculture Science Centres)
m4agriNEI	Mobile Based Agro Advisory Services in North East India
MeitY	Ministry of Electronics and Information Technology
MIE	Meghalaya Institute of Entrepreneurship
MIS	Management Information System
NAIP	National Agricultural Innovation Project
1917iTEAMS	1917–Integrated Technology Enabled Agri Management System

PJTSAU	Professor Jayashankar Telangana State Agricultural University
SMS	Short Message Service
USP	Unique Selling Point

Introduction

The Interactive Information Dissemination System (IIDS) has been conceptualized and designed after rigorous field study of various information and communication technology (ICT) initiatives in agriculture in India and information from needs assessments of farmers by the Digital India Corporation (DIC) (formerly Media Lab Asia) under a consortium project awarded by the National Agricultural Innovation Project (NAIP) under the Indian Council of Agricultural Research (ICAR). The partners in the consortium included Acharya N. G. Ranga Agricultural University (ANGRAU); the National Institute of Rural Development and Panchayati Raj, Hyderabad; and the Mudra Institute of Communication, Ahmadabad. The project was taken up with an idea to propose an alternative ICT model based on a study and analysis of the major ICT initiatives in agriculture in India to meet the information needs of Indian farmers in 2009.

Based on the feedback received in several workshops organized across the country, findings from the needs assessments study of farmers through individual surveys, and analysis of major ICT initiatives in agriculture, the appropriate ICT model of IIDS was configured, discussed, and designed to meet farmers' information needs for various selected scenarios considering the infrastructural and socioeconomic conditions. This model is an integration of the toll-free interactive voice response system (IVRS), a smartphone application, and a web-based agro-advisory system for farmers to deliver timely information to the farmers "as and when they require."

Our Approach

The objective of the study was assessment of the major ICT initiatives in agriculture vis-à-vis the information needs of the farmer in various agro-socioeconomic situations. The team followed a logical approach for selecting the ICT initiative samples. Initially, regional workshops were conducted in five regions of India: North, South, East, West, and North-East with the objective of gaining knowledge on the ICT initiatives in agriculture that were in operation in the selected region. This helped the research team to prepare a list of ICT initiatives that were actually in place. The team then used a taxonomical approach to classify ICT initiatives into various categories based on region, modality, technology used, and sectors belonging to agriculture, allied, and both.

Twenty-six ICT-based initiatives representing these categories were chosen for detailed study. Fifty-seven villages were chosen for the sampling of which 23 are control villages in four geographic regions. The data were collected from May 2009 to December 2010. A *participatory village* is one in which the ICT initiative has been implemented and farmers have been using the project and are benefitting from it. A *non-participatory/control village* is one in which the ICT initiatives were not implemented and thus, farmers are not benefitting. The participatory and non-participatory/control villages were selected randomly out of a list provided by the ICT initiators to avoid bias (Gidda Reddy et al., 2011b).

Findings From the Study

The major findings of this study were crucial for choosing and designing the future strategy and system to provide information to the farmers as and when they require. There was a requirement for an integrated approach that would cater to the problems of farmers in using ICT applications in agriculture. Issues addressed would include accessibility, acceptability, simplicity, and timely and useful information in a location-specific manner. The issues involved would range from the choices of inputs in the farming system to marketing of the farm products. The following needs and requirements were envisaged in an ICT-based holistic extension system.

Needs:

- Aggregating farmer queries in multimedia or voice mode in the local language through voice, text, images, and videos.
- Developing a combination push- (experts) and pull-based (farmers) interactive system (essentially pull-based) so that a two-way communication exists from farmers to experts and vice versa.

Requirements:

- Designing and developing farmer-friendly and simple interfaces to access information and advisory services in an effective manner preferably through mobile phones.
- Interlinking location-specific information from various service providers to cater to the specific farmers' needs.
- Maintaining farmers' database with farming details so experts can provide appropriate solutions to concerned farmers' queries by referring to databases.
- Developing and integrating an expert support system with user-friendly interfaces and reference content (for example, State Agricultural University's Knowledge Repository, farmers' details, FAQs from the farmers' queries) for fast and proactive delivery of advice. The system should also facilitate experts to be virtually available by giving farmers anytime, anywhere access to the experts.

The way forward from the findings of the study was not possible without confronting major gaps. These and possible solutions are summarized in Table 15-1, which follows.

Table 15-1. Gaps identified and way forward: basis for designing the Interactive Information Dissemination System (IIDS).

Gaps Identified	Way Forward
Mobile-Based Initiatives: Text SMS (Short Message Service)	
Generic information delivered	Requirement for farmers' specific information
Language/literacy barrier	Requirement for voice and image-based information exchange
Limited records of the farmers and their farming details	Requirement for updated information
No direct interaction with expert (for push-based services)	Requirement for personalized advisory
Mobile-Based Initiatives: Voice Calls	
Largely push-based services and information delivery at undesired time	Requirement of right information at right time as time desired by farmer

Gaps Identified	Way Forward
No direct interaction with expert (for push-based services)	Requirement for personalized advisory
Call Center/IVRS	
Information provided (at both ends) on voice alone is not always complete	Requirement for other modes of information exchange for better understanding
Service available only at prescribed time (that is, office hours)	Service timing required as convenient to farmers
Limited records/database of the farmers	Requirement for complete and updated database of farm and farmers
No/very limited follow-up of services	Requirement for expert's field visit and other feedback mechanisms
Web-Based Initiatives	
Accessibility and adaptability is low	Requirement for user-friendly interfaces
Abundant/generic information is provided	Requirement for region and farmer-specific filtered information
Mass Media Initiatives—Community Radio Station	
One-way communication	Requirement for two-way communication medium
Largely push-based information	Requirement for personalized information

Project Output

Interactive Information Dissemination System

IIDS is a push- and pull-based system where agriculture-related information can be pulled from the farmers using mobile phones. IIDS is a combination of smartphone application, interactive portal, and IVRS. A mobile interface is at the front end and a web interface is at the back end. Data is transmitted through voice, text, images, and videos from both ends (farmers to expert and back). This system provides options to farmers to subscribe to the various services. Farmers will then receive individual needs-based information for only those services to which they have subscribed. Farmers have an option at a later date to either select more services or unsubscribe to some of the existing services. The system is connected to a centralized database, which has all information on the farm, farmer, and previous transactions. The experts at the back end (the web application) have access to the farmers' database while responding to the farmers' queries (Anurag et al., 2014).

IIDS has two major components:

- **Personalized agro-advisory system**: Mobile and web interface for interaction between farmers and experts through multimedia IVRS solutions including voice, text, images, and videos. Farmers can seek advice during pre-cultivation, mid-cultivation, and post-cultivation.
- **Information services**: Mobile interface to receive location-specific information. For example, farmers receive information on input dealers,

local weather, market price, finance/insurance providers, government projects, current news, and other subjects.

Figure 15-1. IIDS framework: pull- and push-based system.

Unique Selling Point of IIDS

The calls from the farmers are received at the centralized server and routed to the relevant expert. The query information is saved for building context for later queries by the same farmer or other farmers in the local area. The agri-expert has access to the knowledge database of information available and linked with the system. In turn, the expert better understands the farmer or the field problem and facilitates an appropriate solution. The benefits of IIDS to farmers include:

- Personalized agro-advisory based on farm and farmer profile
- Personal assistance to raise a multimedia query through a smartphone
- Live interaction with scientists
- Ability to refer critical problems to relevant crop specialist available virtually
- Round-the-clock query registration ability through IVRS, and smartphones
- Anywhere, anytime access on past advisories
- Ability to push emergency message to farmers based on location and crops
- Network independent: accessible from all networks

Technology Components

The IIDS application has been developed using open-source technology such as PHP and MySQL for the web portal; Asterisk, an open-source communication software for IVRS; and Android Platform for mobile application. The major features of the system follow:

- Web, mobile, and IVRS-based solution
- Centralized database
- Role-based access permissions to various operations
- Multimodal: voice, text, images, and videos
- Multiplatform: backend, web-based; frontend, mobile interface, and IVRS
- Domain: agriculture, horticulture, fisheries, and animal husbandry
- SMS alert/notification
- Search and Management Information System (MIS) reports

Pilot Testing

IIDS was launched in 2013 as a pilot by the then secretary of Ministry of Electronics and Information Technology (MeitY), Government of India, in two agricultural universities: (1) ANGRAU, Hyderabad, as Annapurna Krishi Prasaar Seva (AKPS) and (2) Central Agricultural University (CAU), Imphal, as m4agriNEI (Mobile Based Agro Advisory Services in North East India) to test the IIDS in Meghalaya, and piloted IIDS as m4agriNEI in five districts of Meghalaya.

Figure 15-2. Deployment of Interactive Information Dissemination System (IIDS) in Andhra Pradesh, Telangana, and Meghalaya states.

Upscaling & Long-Term Sustainability—Annapurna Krishi Prasaar Seva

Based on its utility and demand from the farmers, the pilot of AKPS has been scaled up from 12 villages in 2013 to more than 6,300 villages in 2019 across Andhra Pradesh and Telangana, catering to 70,000 farmers. ANGRAU for Andhra Pradesh and Professor Jayashankar Telangana State Agricultural University (PJTSAU) for Telangana and DIC has entered into a memorandum of understanding for continuing and upscaling the IIDS model through its Krishi Vigyan Kendras (KVKs) (agricultural extension centers) and District Agricultural Advisory and Transfer of Technology Centers (DAATTCs). The AKPS is being continued post-NAIP period without any break in services from April 1, 2014, onward as an independent project without any grants-in-aid from any agencies. The implementation of the services are being taken care of by the respective universities (ANGRAU and PJTSAU), and DIC has been providing all its technical support for hosting and developing modules for IIDS.

The current deployment model is a regionally centralized approach, which happens at the agriculture university or institution. The experts sit in remote locations (in their KVKs, research stations, or colleges). The approach of establishing decentralized agro-advisory labs has been adopted keeping the aspects of language as well as demographic and cultural differences. Currently, there are 24 agro-advisory labs established in the KVKs and DAATTCs to assist all the districts of Andhra Pradesh and Telangana states.

The calls from the farmers are received at the centralized server (DIC Mumbai). The calls are routed to the relevant experts on their smartphones. The farmer's data (farmer and farm profile, soil properties and past queries, and other data) pop up in the expert's laptop or desktop (if the expert is logged in). In return, the expert can understand the farmer or the field problem in a better way (the objective is "KYF, Know Your Farmer," before answering the query) and facilitate in providing an appropriate solution to the farmer. The agri-expert can access the knowledge database of information (crop manuals, advisory content, links with search option, and other information) linked with the system only if they are in front of the system.

Services Offered

Through AKPS, farmers are provided:

- Personalized advice on agriculture, horticulture, animal husbandry, and fisheries from their KVK or DAATTC on the toll-free number (1-800-425-3141);
- The ability to record their queries 24/7 through the toll-free number;
- Text and voice messages in the local language of Telugu;
- Emergency messages and alerts on their smartphones from KVK or DAATTC; and
- The ability to record their best practices and experiences to share with other friends on the toll-free number.

Every farmer must register to get the services offered through IIDS. There is no registration fee. Concerned district KVKs and DAATTCs are attending to this farmer registration process. The IIDS services are also available through the AKPS mobile app under the Unified Mobile Application for New-age Governance of MeitY, Government of India. It can be downloaded free from the play or app store. Through this mobile app, farmers can raise queries in multimedia format (voice, text, images, and videos) from the field itself and can get the solution from the respective district scientists.

Mobile-Based Agro-Advisory Services in North-East India

Digital India Corporation (DIC) has implemented the m4agriNEI project in the state of Meghalaya along with Central Agricultural University (CAU), Imphal, from 2012 to 2017. Based on the success and utility of the m4agriNEI implementation, the project has been completely taken over (including manpower, farmer database, software framework, and other aspects) by the Government of Meghalaya for large scale deployment in the entire state of Meghalaya as of December 27, 2017. The Meghalaya Institute of Entrepreneurship (MIE), Meghalaya Basin Development Authority, and DIC entered into an agreement to upscale and enhance the m4AgriNEI system and its constituents across Meghalaya through a collaborative process by leveraging and building upon the pioneering work done by DIC in piloting the m4AgriNEI platform and network. For this, the Government of Meghalaya has set up a unique farmer-centric innovative project 1917–Integrated Technology Enabled Agri Management System (1917iTEAMS) with MIE as its Project Management Unit, in collaboration with DIC (the technical partner) for the benefit of farmers of Meghalaya. The number 1917 is the national toll-free number provided to the farmers, buyers, and sellers to reach out to the iTEAMS experts for the services.

The 1917iTEAMS is a dedicated supply chain logistics, marketing, evacuation, and advisory service of the Department of Agriculture, Government of Meghalaya, which aims to address the issues of lack of organized evacuation logistics, limited access to remunerative and sustainable markets, knowledge and informational isolation, and the absence of transparent processes and platforms that can facilitate healthy buyer-seller interaction and activities, all major pain points for Meghalaya farmers. The major objectives of 1917iTEAMS as set by the Government of Meghalaya are as follows:

- Provide access to the best markets, information, practices, packaging, and safety.

- Facilitate organized aggregation and evacuation logistics across the state.
- Provide transparency in all transactions and a state-wide trade facilitation platform with highest governance standards to facilitate healthy and competitive buyer-seller interaction and activities.
- Provide universal access to market intelligence using Artificial Intelligence technology so that buyers and sellers can make informed choices of where, how, and how much to buy or sell for.
- Provide quality, security, and minimal wastage for consumers, and higher returns for farmers.
- Converge farmers' needs, markets' needs, technology trends, and development.
- Open up opportunities for the growth of enterprises and entrepreneurs in the value chain.
- Be the first in the country to set up and operate an integrated technology enabled agri-management system in a convergent framework combining public sector commitment and experience with private sector expertise.
- Enhance the visibility and credibility of government for all citizens.

Enhancement of IIDS for 1917iTEAMS

Since the signing of the agreement and based on the requirements of 1917iTEAMS, DIC has enhanced the IT platform (IIDS 2.0) by adding many additional and new features: the ability to register farmers and buyers on call through the toll-free number (1917) and the ability for farmers to book a vehicle for transportation of their produce or crops, to take requests and share information on buyers and sellers, and to provide technical advisories on agriculture, horticulture, livestock, and fisheries.

Table 15-2. Enhancement of Interactive Information Dissemination System (IIDS) for 1917iTEAMS.

Serial No.	Major facilities	Previous application	New application
1	Open for all	X	✓
2	Registration of farmers on toll-free number	X	✓
3	Registration of buyers on toll-free number	X	✓
4	Agro-advisory services on toll-free number	✓	✓
5	Booking of agriculture resource vehicle on toll-free number	X	✓
6	Request for selling produce on toll-free number	X	✓
7	Request for buying produce on toll-free number	X	✓
8	Reports and dashboard	X	✓

The following new logins with specific roles and features have been created in IIDS:

- Member Secretary 1917iTEAMS
- Program Manager
- Agri Resource Center Coordinator
- Incoming Communication Officer—Level 1

- Incoming Communication Officer—Level 2
- Business Development Executive
- Dispatch Officer

Certain new modules have been incorporated in the new portal for 1917iTEAMS apart from a new look and feel. Table 15-2 shows the differences between previous and new IIDS application.

Efficiency & Improvement (2013–2019)

The IIDS model is useful in enhancing the extension outreach through KVKs and DAATTCs. The implementation of IIDS has elevated the images of the ANGRAU and PJTSAU extensions in terms of increased direct interaction of farmers with scientists through the toll-free number, dissemination of farm information through mobile phones (text and voice messages in Telugu) and AKPS information corners, and functional linkages among the Indian government departments of Agriculture, Cooperation and Farmers Welfare; Animal Husbandry and Dairying; and Fisheries; and the Indian Council of Agricultural Research (ICAR).

Scientists are using IIDS and providing farm- and farmer-specific information and solutions to farmers' queries in real-time or offline mode. The scientists used ICT tools in wider dissemination of information services to the farmers.

Challenges Faced & Lessons Learned

The following challenges were faced in implementing process change:

- Getting farmers to disclose their complete information to maintain the farm database
- Not having the availability to the complete soil data for each farm as well as other parameters to maintain the farm history for each farmer
- Making the agri-scientist habitual in attending the farmers' queries through phone calls on the computer system and in referring to the farmer database while responding to the queries
- Getting farmers accustomed to using a multiple-option-based IVRS

The following lessons were learned from the process re-engineering exercise:

- Requiring continuous training and feedback sessions for field force to understand their issues
- Increasing sensitization meetings and linkages with various service providers for need-based services
- Minimizing the options for farmers to become accustomed to the IVRS
- Sensitizing farmers to use a multiple-option-based IVRS to get the solution from experts on their daily agricultural practices

The following challenges were faced in change management and capacity building:

- Changing the mindset of villagers and creating enthusiasm among the farming community that using the information is more important than receiving subsidies through government programs

- Not having the availability to the field data to maintain the farm history for each farmer

The following lessons were learned from the change management and capacity-building exercise:

- Requiring location-specific data on crops, weather, soil, markets, and other areas from various authentic knowledge institutions
- Requiring linkages with service providers such as those involving input, finance, insurance, procurement, and other issues to meet the farmers' requirements apart from the agro-advisories

The following challenges were faced related to technology:

- Dealing with irregular service of internet, primary rate interface lines, and electricity due to weather and other local conditions such as road construction specifically in the North-East region for m4agriNEI
- Dealing with high network fluctuation rates in rural areas
- Dealing with 2G/3G connectivity in rural and hilly areas causing difficulty in uploading the images and videos of crops from smartphones
- Dealing with high operational cost due to the necessity for a virtual private network (VPN) to connect the central server to each node to receive the voice calls on desktop and simultaneously view the farmer data

The following lessons were learned from technology choices and the implementation strategy adopted:

- Minimizing the dependency on wired communication lines to achieve uninterrupted services
- Requiring development of sync-based offline applications for capturing the farm data and queries in multimedia mode
- Developing mobile-based applications to reduce the size of high-definition images and videos to enable uploads in poor connectivity areas

Specific Steps Taken to Address Digital Inclusion

Throughout the project, care was taken to make sure all the interested farmers were included digitally. The following actions were taken to ensure inclusion.

- Because users of IIDS are mainly farmers who interact with the system on their mobile phones, simple IVRS navigation guides the farmer in their local language. Alternatively, farmers can also approach project staff for the agro-advisory facilitation through the farmer coordinator.
- Agro-advisory labs are decentralized, keeping the aspects of language, demographic, and cultural differences.
- Location-specific content was developed based on the baseline and needs assessments of the farmers from the project locations. Farmers' location-specific needs are met in their native language.
- Sensitization meetings were organized in regular intervals, and the farmers were given training on use of their smartphones to receive advice for their day-to-day farming practices.
- Needs-based training and awareness programs were organized on crop cultivation and livestock management.

Farmers' Feedback—AKPS

Farmers benefited from AKPS in the following ways:

- Farmers can talk to the scientists directly over a smartphone.
- Farmers receive the messages in their local language, even with basic phones.
- Farmers receive text as well as voice messages on their smartphones.
- Farmers use the text messages as references, directing them to the input dealers to get the right pesticides from the shops.
- Timely information helped in reducing the number of chemical sprays and applications of excessive use of fertilizers.
- Farmers who cannot read are also comfortable in receiving messages since information is given through voice messages.
- Messages related to production, protection, post-harvest, and weather are sent to farmers' smartphones.
- The text and voice message facility in IIDS helped the farmers of Srikakulam, Andhra Pradesh, during the Phailin and Hudhud cyclones.
- The weather forecasts helped the farmers to avoid irrigating unnecessarily before rains, postponing crop harvests, and other related activities.
- Farmers have access to short films loaded in their smartphones, allowing accessibility to the information with a multimedia experience.
- Production costs are reduced.
- Farmers have increased awareness about use of ICTs in agriculture.

AKPS Farmers' Perceptions

While interviewing the respondents regarding the perception of IIDS through the AKPS program, 98% of the respondents agreed that the IIDS service is giving clear information on the subjects they required; 91.7% of the respondents agreed that the IIDS service is providing the farmers with timely information; and 98.3% of the respondents agreed that information provided by the IIDS service is easily understandable (Gidda Reddy et al., 2011a). In addition:

- Scientist-farmer interaction was appreciated by 66.2% of the respondents.
- Only 46.4% of respondents agreed that field diagnostic visits are useful since respondents didn't get much exposure to them.
- The interaction between the innovative farmers and other farmers has been accepted as a useful system by 69.3% of the respondents.
- The majority of the respondents were informed that usage of chemical fertilizer (88.8% of respondents) and pesticides (91.2% of respondents) has been reduced due to the fertilizer and pesticide management information provided by the IIDS model.
- A shift in the "source of information" was found among the IIDS farmers. It was noted that 92.5% of farmers who were earlier dependent for agricultural information on their friends and neighbors is now reduced to 56%; and 68.7% of farmers who were dependent on input dealers is now reduced to 35% due to the provision given to the farmers to directly interact with the KVK and DAATTC scientists on the toll-free number.

Figure 15-3. Perception about the AKPS (Annapurna Krishi Prasaar Seva) model.

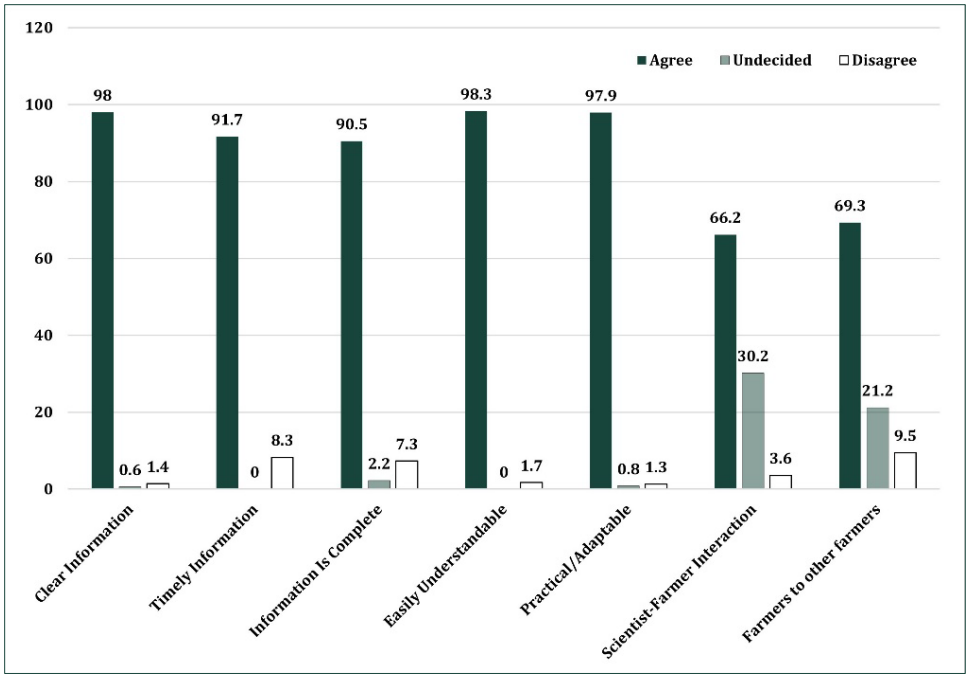


Figure 15-4. Progress in agriculture due to the AKPS (Annapurna Krishi Prasaar Seva) services.

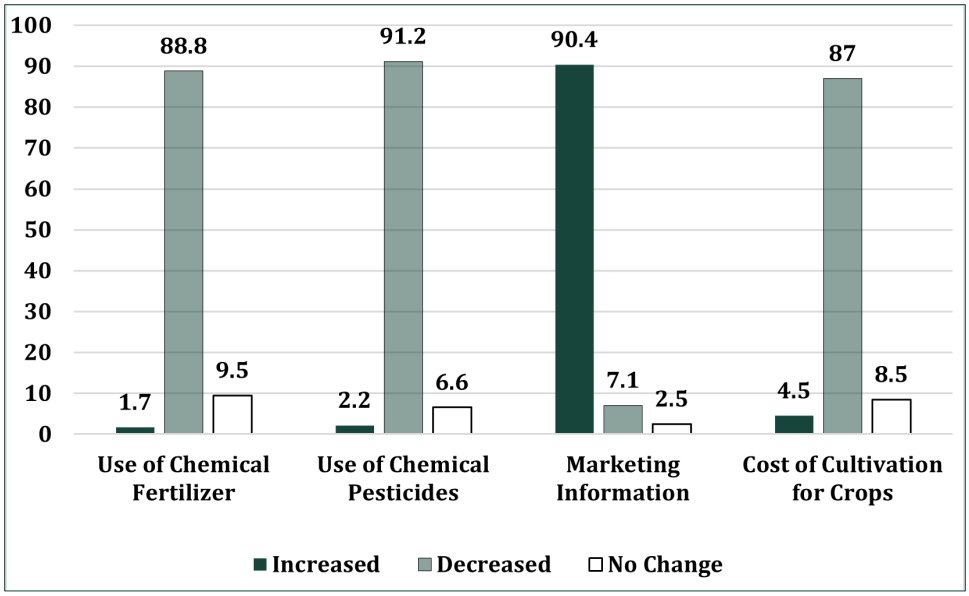
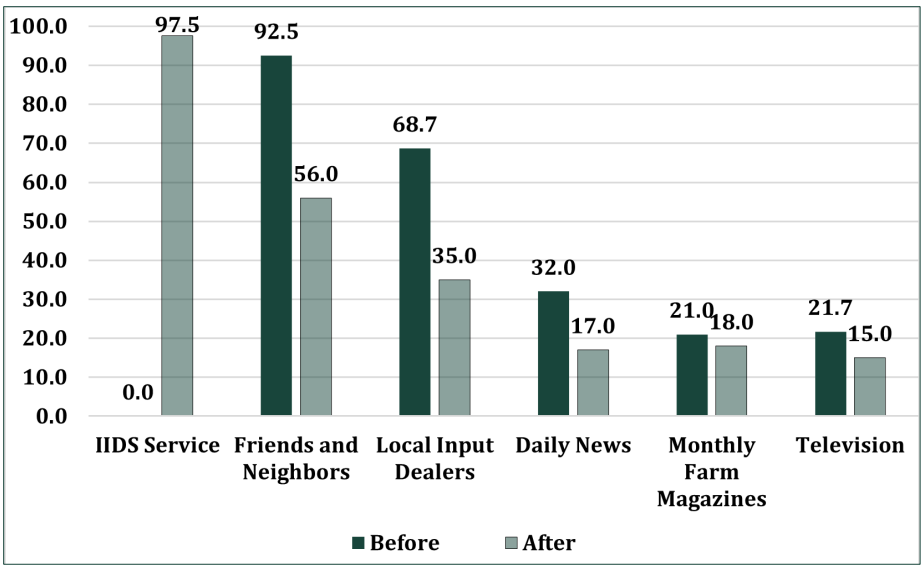


Figure 15-5. Source of farm information before and after the initiation of the AKPS (Annapurna Krishi Prasaar Seva) service.



Case Studies of Farmers

Case studies of farmers in the Indian states of Andhra Pradesh and Telangana follow.

Andhra Pradesh

Sri. S. Bali Reddy, Diguvapalli Village, Tadipatri Mandal, Anantapur District

ID: 16214854, number of calls made: 347. Registered in IIDS through KVK, Reddipalli.

Sri. S. Bali Reddy has cultivated Bengal gram crop on 20 acres, cotton on 3 acres, and jowar (sorghum) on 2 acres. He received advisories on management of *helicoverpa larvae*, wilt and root rot, fertilizer management, chemicals for seed treatment, weather and market information on Bengal gram crop, and management of sucking pets and pink bollworm in cotton crop as well as others. He has used the text messages as reference to buy the pesticide from dealers' shops. He has reduced the number of pesticide sprayings (from four to two) and applied the recommended dose of fertilizers reducing the cost of cultivation up to Rs. (Indian rupees) 1500 per acre in Bengal gram crop. Also, he has received market rate information from time to time though this IIDS, and because of that, he sold his produce for a better price and finally received the extra income of Rs. 19,200 per acre in Bengal gram crop.

He was able to reduce two sprays against sucking pests and one spray against pink bollworm in the cotton crop and thereby, he has reduced the cost of cultivation of Rs. 2000 per acre.

Sri. T. Venkata Ramana, Chettupodilam Village, G. Sigadam Mandal, Srikakulam District

ID: 10113731, number of calls made: 303. Registered in IIDS through KVK, Amadalavalasa.

Sri. T. Venkata Ramana has cultivated rice, maize, Bengal gram, and Greengram crops. He received advisories on weather forecasts, high-yielding

varieties, weed management, fertilizer management, and management of stem borer, BPH, sheath blight, and zinc deficiency as well as other issues. He has used the text messages as reference to buy the pesticide from dealers' shops. Voice and text messages are helpful to protect the crop from time to time. He has reduced the cost of cultivation of Rs. 3000 per acre in rice crop by reducing two sprays against pest and diseases and reduced three bags of urea per acre and finally got a yield benefit of five bags per acre.

The maize crop grown was severely infested with shoot borer. He followed timely advice given by scientists of KVK through IIDS and sprayed the recommended chemicals compared to other maize farmers of the village who are not registered under IIDS. He was able to reduce the cost of cultivation from Rs. 5,200 to Rs. 4,680 per acre and reduced sprays from two to one with an increased yield of 200 kg/acre. It is quite interesting to note that Mr. Venkata Ramana brings up the problems of fellow farmers also through IIDS.

Sri. N.V.V. Challa Rao, Kuppanapudi Village, Akiveedumandal, West Godavari District

ID: 14234247, number of calls made: 536. Registered in IIDS through KVK, Undi, West Godavari district.

Sri. N.V.V. Challa Rao was growing the rice crop on 6 acres. He received the advisories on soil testing, weed management, fertilizer management, management of zinc deficiency, BPH, and other issues. He has used the text messages as reference to buy the pesticide from dealers' shops. He was able to reduce the cost of cultivation of Rs. 4,500 per acre (by reducing two sprays against BPH, two sprays against weeds; by reducing four bags urea per acre) and finally received the yield benefit of two bags per acre.

He has a 7-acre fishpond and practices polyculture. He received the advisories on fish species selection, water quality management, plankton improvement practices, feed management, disease management, harvesting, and post-harvesting practices. He got a yield advantage of 360 kg/acre (before IIDS: 2200 kg/acre and after IIDS: 2560 kg/acre and 16.4% of yield increase) and reduced cost of cultivation of Rs. 17,200 per acre (by reducing cost on feed and pesticides) and finally received a net income of Rs. 72,000 per acre.

Sri. K. Sai Babu, Gangireguvalasa Village, Komarada Mandal, Vizianagaram District

ID: 16182538, number of calls made: 258. Registered in IIDS through DAATTC, Vizianagaram.

Sri. K. Sai Babu has cultivated rice, tomato, cabbage, guava, and apple-ber crops. He received advisories on management of stem borer, BPH, sheath blight, fertilizer management, weed management in rice crop, intercropping in guava with tomato and cabbage, and other issues. He has reduced the cost of cultivation from Rs. 8,400 to Rs. 7,400 per acre in rice crop by reducing the number of sprays from six to four and increasing the yield from 2600 to 3200 kg per acre in rice crop. Finally, he received the net income of Rs. 11,800 (Rs. 8,400 before IIDS) in rice crop.

Sri. C. Chandrasekhara Reddy, Tadigotla Village, C.K. Dinnemandal, Kadapa District

ID: 23413708, number of calls made: 270. Registered in IIDS through KVK, Utukur, Kadapa district.

Sri. C. Chandrasekhara Reddy cultivates the rice crop on 5 acres. He received the advisories on weather forecasts, seed availability, seed treatment, management of stem borer, BPH, zinc deficiency, and other issues in rice crop. He was able to reduce the cost of cultivation of Rs. 1700 per acre by reducing two sprays against pest and diseases and reduced two bags of urea and finally got a yield advantage of five bags per acre.

Telangana

Sri. V. Husya Naik, Turuputhanda Village, Damarcherla Mandal, Nalgonda District

ID: 76208990, number of calls made: 46. Registered in IIDS through KVK, Kampasagar, Nalgonda district.

Sri. V. Husya Naik received the advisories on pest and disease management, fertilizer management, seed treatment chemicals, weather information, and other areas. He has used the text messages as reference to buy the pesticide from dealers' shops.

He has reduced the cost of cultivation by Rs. 3,500 per acre of rice and got an increased yield of six bags per acre, with the net benefit of Rs. 8,000 per acre.

Sri. Gopal Rao, Lingala, Village Kamepalle Mandal, Khammam District

ID: 10437669, number of calls made: 67. Registered in IIDS through KVK, Wyra, Khammam district.

Sri. Gopal Rao received advisories on seed selection, management of viral diseases in chilli crop; management of BPH rice crop, and management of sucking pest and pink bollworm in cotton crop. He had followed the expert's advice and finally, he received a 30% increase in yield, reduced cost of cultivation of Rs. 1500 per acre in cotton crop by reducing three sprays against pest control and received a total benefit of Rs. 6000 from 6 acres of cotton crop.

Sri. Suresh Shetti, Atmakur Village, Gadwal Mandal, Mahabubnagar District

ID: 24148436, number of calls made: 51. Registered in IIDS through KVK, Palem, Mahabubnagar district.

Sri. Suresh Shetti received the advisories on management of pink bollworm, flower dropping in cotton crop; management of root rot in redgram crop; management of viral diseases in chilli crop; and fertilizer management in castor crop. He had followed the expert advice, receiving the net benefit of Rs. 6,250 per acre and a total benefit of Rs. 50,000 from 8 acres of cotton crop.

Sri. Kurlepu Prabhu, Rampur Village, Kotagiri Mandal, Nizamabad District

ID: 17185160, number of calls made: 66. Registered in IIDS through KVK, Rudrur, Nizamabad district.

Sri. Kurlepu Prabhu received the advisories on fertilizer management, control of stemborer, brown plant hopper, and blast in rice. The information received on the importance of alleyways in rice, soil test-based fertilizer management and its importance in soil health management, and judicious application of pesticides enabled him to attain 250 kg of higher yields than earlier with cost savings of up to Rs. 2,500 per acre.

Sri. Kamatam Venkanna, Aparaju Palli Village, Gudurmandal, Warangal District

ID: 17228436, number of calls made: 43. Registered in IIDS through KVK, Malya, Warangal district.

Sri. Kamatam Venkanna received the advisories on management of sucking pest, pink bollworm in cotton crop; and management of thrips, mites in chilli crop. He has used the text messages as reference to buy the pesticide from dealers' shops. He was able to reduce the cost of cultivation of Rs. 3,000 per acre by reducing three sprays in cotton crop and two sprays in chilli crop.

Conclusions & Recommendations

The primary use of IIDS as envisioned was for the agro-advisories. As time has progressed, we see the use of the framework not only for agriculture but also for animal husbandry and fisheries. Apart from the farmers, the research institutes in the country can use this system for accessing the current data and for increased outreach to the farmers regarding research for specific crops and geographies. IIDS can be implemented and upscaled through the research institutions and agriculture universities in India. The usefulness of IIDS in extension and research has been proven in AKPS and m4agriNEI. IIDS is relevant for academics and research institutions as the system can create and maintain the crop history and the history of queries being received from the field. Also, analytics can be produced on location, season, farmer, and crop queries based on the data being generated on IIDS. ICAR has 706 KVKs, 64 state agricultural universities, two central agricultural universities, 60 All India Coordinated Research Projects, 19 network projects, and 10 other projects in which IIDS can be implemented as their IT mediated outreach platform.

Going forward, IIDS can be deployed in a centralized, "plug and play" and "anytime and everywhere" model. The advantages of having a centralized IT is optimization and efficiency of both financial and operational aspects. Centralizing IIDS with the appropriate technologies increases the ability to scale the size of IIDS deployment. This model will also allow the operations to introduce new hassle-free services in the system with one installation. The "plug and play" model would decrease the time to deploy and scale with the use of the right technologies.

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CHAPTER 16

Sustainable Information Resource Centre

ICT-BASED EXTENSION APPROACH FOR ANIMAL HUSBANDRY

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Introduction

> "Knowledge and information are essential for people to successfully respond to the opportunities and challenges of social, economic, and technological changes. But to be useful, knowledge and information must be effectively communicated to people." – Kofi Annan

It need not be overemphasized that information empowers farmers in many ways. Information is nowadays the most important input for any production system and especially for decision-making. Therefore, the information needs of the rural masses must be properly addressed for sustainable production. The continuing rapid development of telecommunications and computer-based information and communications technology (ICT) is probably the biggest factor for change in extension, and one which will facilitate and reinforce other changes. Be it production or marketing, a farmer has to be equipped with the right information at the right time and in the right place. On this front, the present extension system, more so in animal husbandry, leaves much to be desired. Therefore, the need of the hour is to adopt an ICT-enabled extension mechanism that will go a long way toward plugging the loopholes of the existing system to measure up to the expectations of farmers.

Animal husbandry is one of the major components of the Indian rural economy and moreover, it is an asset for the small and marginal farmers and landless laborers. This sector contributes around one-fourth of the total agricultural Gross Domestic Product (GDP) in India. Livestock extension information is an important component of the information needed at the village level, and knowledge dissemination plays a pivotal role in animal husbandry. Lack of information on various aspects such as scientific management of animals, balanced feeding, and animal health management ultimately results in production losses.

This chapter focuses on the status of animal husbandry extension in India, various limitations of conventional information dissemination methods, and the potential advantages of ICT in animal husbandry extension. Further, it explores ICT application in the form of the "Information System," and based on this, the National Institute of Agricultural Extension Management (MANAGE) has come up with the information dissemination model "Sustainable Information Resource Centre" (SIRC) in animal husbandry. The methodology, outcome, and utility of SIRC is shared in this chapter.

Status of Extension Services in Animal Husbandry

Various institutions are engaged in livestock extension services such as the State Department of Animal Husbandry (SDAH), producer cooperatives, feed and pharma companies, contract firms, print and television media, and nongovernmental organizations (NGOs). However, by and large, extension in animal husbandry continued to remain sporadic, casual, occasional, and highly unorganized and therefore, did not effectively meet the requirements of a vast majority of livestock keepers (Chander, 2013). As evidence, only 5.1% of farmer-households are able to access any information on animal husbandry but 40.4% can access information on crop farming.

The importance of extension policy has been sufficiently emphasized internationally and in Asian countries (Sulaiman & Hall, 2005, as cited in Chander, 2013); however, there is no policy for livestock extension in India. The SDAH is the major stakeholder in livestock development, having vast infrastructure including veterinary hospitals, dispensaries, personnel, and budget. However, its primary focus is on diagnosis and treatment of animals and breeding services for which it has a clear mandate.

The 12th Plan Sub-Group on Animal Husbandry constituted by the Planning Commission observed that extension services for livestock have so far been a nonstarter severely hampering its growth (Planning Commission, 2012, as cited in Chander, 2013). To address these challenges in livestock extension service delivery, the Planning Commission recommended "building up an exclusive cadre of livestock extension workers" with appropriate skills and knowledge (Vet Helpline India [P] Ltd, 2013). Accordingly, the states had to create a "separate wing" within the SDAH for livestock extension service delivery (Model-I) or some of the veterinary officers of SDAH had to be deputed exclusively for this purpose and known as *designated officers* (Model-II). So far, out of 28 states and eight Union Territories, only eight states created a separate wing. However, the number of extension personnel in the separate wing model is meager and placed mostly either at headquarters or the divisional level. The rest of the states have appointed designated officers for extension, but it has been observed that these officers are overburdened with multiple roles and therefore extension remained neglected (Kareem & Phand, 2018).

The shortage of human resources in the SDAH is already resulting in poor and inadequate veterinary services to the farmers. The limitation of the workforce hinders not only the input services but also the dissemination of the desired quantum of knowledge to the target audience. This approach has left the majority of the farmers uncovered by the present extension system. This gap remains a challenge for the extension system even today. To reach

over 120 million farmers, spread over more than 600 districts and over 6,000 blocks, is an uphill task. (A *block* is an administrative unit below a district.) The diversity of agro-ecological situations adds to this challenge further. Farmers' needs are much more diversified, and the knowledge required to address them is beyond the capacity of the grassroots-level extension functionaries. Moreover, veterinary officers are supposed to act as middle-level livestock extension professionals (Rama Rao et al., 2011; Anon., 2012; Anon., 2013; Sasidhar & Reddy, 2013; Rao et al., 2015, as cited in Sasidhar & Suvedi, 2016). Most of them have not undergone any extension management training and thus lack in extension techniques to disseminate technology to farmers (Matthewman & Ashley, 1996; Delgado et al., 1999; Ahuja et al., 2000; Chander et al., 2010; Hegde, 2010; SAPPLPP, 2012, as cited in Sasidhar & Suvedi, 2016).

The dairy cooperatives play a predominant role although it is confined to the geographical area with high growth in the sector. Similarly, the private dairies have been established over dairy cooperatives and operate with the farming community through a contract agreement in which they provide a variety of input services such as breeding, feed, treatment, disease prevention, and extension services to the farmers. The entire formal milk sector (consisting of cooperatives and private dairies) handles about 40% of the milk sold in the market. The remaining 60% of milk, which is handled by the unorganized sector (Department of Animal Husbandry, Dairying & Fisheries, 2018), are not addressed by the extension system effectively. The contract farming in the poultry sector has made inroads especially in southern states mainly because of the integration of the three types of services (supply of inputs, extension advisory, and technical service) provided by one agency. Due to assurance of the market, at the end of the production period, the farmer will get a fixed amount as rearing charges. Though considered exploitative, integrated poultry farming is gaining more popularity as the farmers are free from investment, production, and marketing risks (Rao et al., 2011).

The investment in terms of budget allocated as well as the expenditure incurred on livestock extension activities by most of the SDAH in general is very low (1% to 3% of the total SDAH budget).

The Global Consultation on Agricultural Extension recommended that

> in countries where more than 60% of the economically active population are engaged in agricultural production, approximately 1% to 2% of the AGDP (depending on the size of the country and factor costs) should be considered the minimum level of financial investment to achieve both human resource development and technology transfer goals of a public sector agricultural extension system. (Swanson, 1990, p. 26–27, as cited in Contado, 1996)

India is yet to attain this level of investment in agricultural extension services. In recent years, the Government of India has spent only about 0.14% of the agricultural GDP extension services funding (Chand et al., 2011, as cited in Chander & Prakashkumar, 2013).

To summarize, extension services in the animal husbandry sector provided by various institutions such as producer cooperatives, feed and pharma companies, contract firms, and NGOs are effective but limited in their reach. On the other hand, the SDAH has widespread coverage in the form of

veterinary clinics or dispensaries. The department has doorstep reach through their veterinarians and para-vets at the village level. However, their extension services are confined to the organization of a few health camps, training programs, exhibition, and Krishi Melas (three-day farmer education events) due to inadequate infrastructure, limited time, budget allocations, and human resources capacity. Presently, there is no mechanism in operation that will continuously address and sustain the changing information needs of livestock farmers.

Limitations of Conventional Extension Methods of Information Dissemination

The presently used conventional extension methods for dissemination of information have a number of lacunae, or gaps, due to which the information does not reach the end users. A discussion of the major lacunae follows.

Inherent Weaknesses

The conventional ways of information dissemination through folders, leaflets, pamphlets, newspapers, magazines, radio, and other forms of communication are not meeting the expectations of the farmers due to their inherent weaknesses. The conventional media don't have much scope for inclusion of interactive modules and are not effective enough to arouse learning senses, thereby failing to develop interest for active involvement of the audience. Most of the time, the information is of a general type based on the perceived needs of the farmers, which may not cater to the specific needs of all categories of farmers.

Poor Communications Capacity

Most technical staff within the SDAH find it difficult to communicate with both the research system and the stakeholder groups due to weak linkages. First, the flow of information from research to extension tends to be top-down, rather than a two-way interactive process aimed at identifying and solving serious problems. Second, there is little use of up-to-date communications technology, including (a) the use of mass media to create farmer awareness for new technologies, (b) the use of print media to publish a regular newsletter to keep the field staff updated on technical and administrative developments, and (c) the effective use of electronic communications to improve feedback and technical support between research and extension personnel, and to facilitate administrative communications. Such technologies can increase the efficiency and effectiveness of extension in its technology dissemination functions. Very often it has been reported that not more than 30% of the technology reached the farmer.

Expensive

It costs a lot of money to produce and print extension materials and to train a whole chain of livestock extension personnel to understand the new technology and to answer the possible queries from the livestock owners.

Time-Consuming

For a message to pass from a research station or university to the livestock owners, many actors must understand and deliver the message to the next layer. The process takes a lot of time and effort on the part of livestock extension personnel.

Distortion

A number of evaluation studies of the training and visit system indicate that the quality of the extension message gets heavily distorted and eroded when it ultimately reaches the end users. The distortion increases as the number of actors and channels in the communication process increase.

Potential Advantages of ICT in Animal Husbandry Extension

There are many possibilities for the potential applications of ICT and social media in animal husbandry extension particularly for information dissemination ICT offers several advantages over conventional methods of extension for dissemination of information. A discussion of the advantages follows.

Savings of Money, Time & Effort

Scientists can prepare and update electronic versions of messages and on-farm research results themselves and load into computers, which saves money and time to reach curious end users instantly.

Steps in the Diffusion Process % Distortion Cut

Cyber outreach will remove a number of steps altogether from the traditional extension process. The information can be directly posted on the internet, which will be available to extension functionaries and farmers at the district, subdivision, and block and village level without any distortion. All the concerned will get the information immediately, and queries and clarifications will also be addressed quickly without involving a chain of extension functionaries.

Information Rich & Interactive

It appeals to the curious extension workers and analytical farmers and allows them to search and locate information they need.

Instant International Reach

Cyber extension will eliminate the time and distance barrier that gets in the way of knowing the latest information on any particular livestock problem from any part of the world. Discussions take place with the best scientist and experts in the field.

Continuous Availability

The key attribute of cyber extension is its availability all the time, 24 hours a day, and 365 days a year.

Better Control of Users

The farmers, as users, will have much greater control than over current information channels.

Concept of Information System

"An Information System can be defined technically as a set of interrelated components that collect (or retrieve), process, store and distribute information to support decision making and control organization" (Chauhan, 2006).

The Information System helps mainly in three types of activities:

- To present relevant information for making the right decision in the organizations
- To control, implement, and analyze any problem in the organization
- To impart necessary information for producing new products

These three activities can be distributed into three parts: input, processing, and output. Through input, unevaluated facts and figures (data) are collected. Under processing, the collected data are changed into meaningful and useful context using text, graphics, and animations with the help of multimedia tools. Through output, the information is transferred to an individual or where it is needed. This timely and accurate information can act as an aid to decision-making.

Concept of Expert System

"An Expert System is a computer application that guides the performance of ill structured tasks which usually require experience and specialized knowledge i.e. expertise" (Davis & Olson, 2000).

An Expert System is a major subdiscipline of the field of artificial intelligence and can partially represent human knowledge and use it to solve complex problems within a specific domain. An Expert System attempts to capture the knowledge and experience of human expertise to make their expertise available on demand. It has a store of knowledge consisting of facts and rules. By prompting the right questions and then considering the user's reply, it decides which element of its knowledge and which facts and rules to use as the basis for furthering questions until a specified goal is reached. It operates in the same manner as a human expert. Using an Expert System, even a nonexpert can achieve performance comparable to an expert in that particular problem domain.

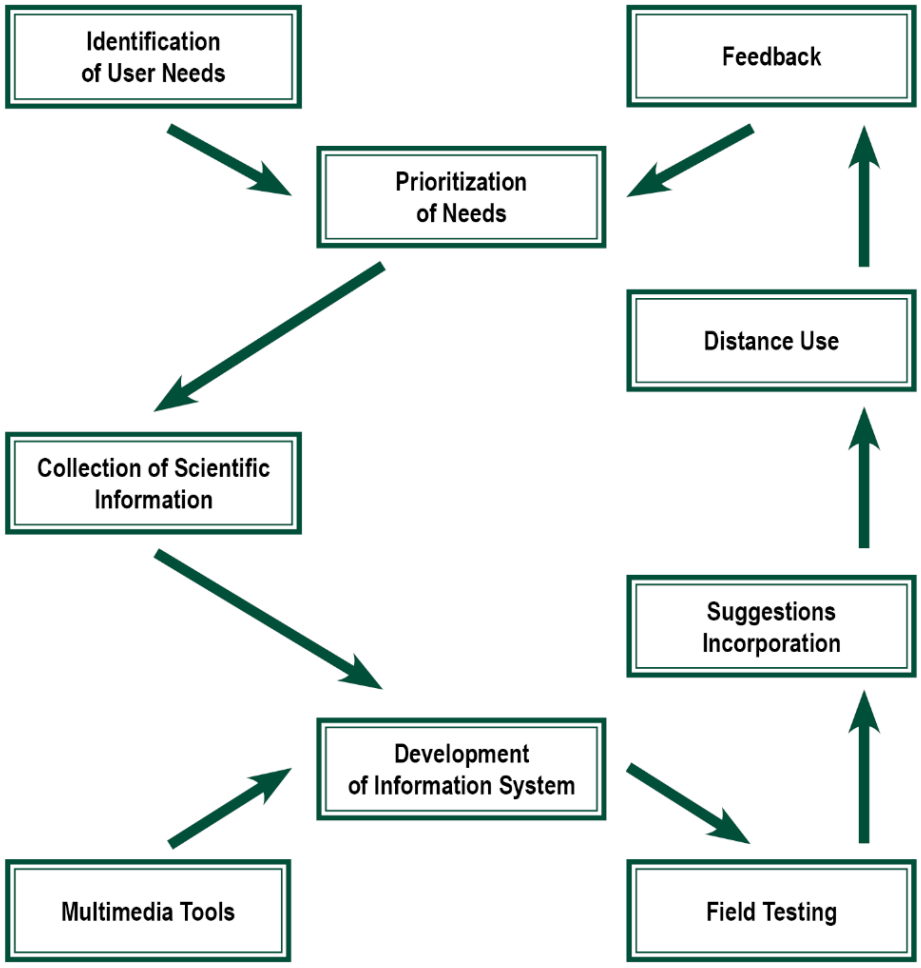
Feasibility of Information System Versus Expert System in Animal Husbandry

The Information System as well as the Expert System both are basically decision support systems, but there is a difference in terms of their role in decision-making. The Information System imparts the comprehensive scientific information on a particular topic that will be helpful to users for solving a problem by choosing appropriate options available in the situation. On the contrary, the Expert System provides the ready-made solutions (one or a few) on a particular problem, which are suggested by the expert. Thus, the Expert System can be considered an instant decision support system. However, it may happen sometime that the advice or solution given by the Expert System is difficult to follow in the user's situation. For example, suppose a calf is suffering from diarrhea due to a parasitic infestation and an Expert System advises the user to give a particular anti-parasitic drug, which sometimes may not be available to the user. In such a situation, the user may be unable to follow the given advice. On other hand, the Information System has given scientific information on the same problem with respect to its causes, first aid, and preventive measures and all possible means to solve the problem. In such situations, it may be possible that the user finds information on an indigenous drug (such as the juice of *neem* leaves), which is more useful since the inputs for that piece of information are readily available. Then, in that situation, the Information System is better than the Expert System in animal husbandry.

Further, animal management is a complex task and entirely different from crop management. In cases of animal diseases, particularly of acute diseases, the role of users (livestock owners) is to identify the disease tentatively in the initial stage with the help of information given by the Information System and to make a quick decision to call a veterinarian since users are not supposed to treat animals by themselves. In such situations, if the Expert System diagnosed the particular disease and advised a particular drug with respect to its dose and route of administration, then also the user will not be in a position to treat the animal as livestock owners don't have the required skill of drug administration. Further, if somehow the user manages to give the recommended drugs to his animal, still there are chances of a wrong diagnosis by the Expert System as its biological science and confirmative disease diagnosis can be done only through laboratory tests. An expert or trained person such as a veterinarian who can make an appropriate decision by examining the animal is needed and not the Expert System that delivers expert advice but is located distantly from the user situation.

Therefore, in the field of animal husbandry, the Information System rather than the Expert System is needed. On the other hand, the Expert System is more appropriate in the field of agriculture, and feasible to some extent in animal husbandry particularly on feeding, housing, and other areas where there is involvement of qualitative and quantitative parameters.

Figure 16-1 Suggested model for development of the Sustainable Information Resource Centre.



Conceptual Model of SIRC

Much information on animal husbandry is generated at research and educational institutions in the form of textbooks and journals. However, many times it is not given in the local language and therefore, cannot be useful even to literate farmers. Moreover, scientific information available in such textbooks and journals is mere data for the farmers and not useful information. Further, for information to be useful, it should be demand driven rather than supply driven. It should be timely and readily available to end users so it can be used as per their need, convenience, and pace. The information available through such a system should be simple, relevant, and precise and in the local language. The users should have enough choices and control over the mechanism of information delivery. Moreover, information should have certain features such as a combination of text, pictures, animation, videos, and audio backup in the local language so it will hold the learner's attention and interest. Is there any method by which individual information needs can be addressed? Can there be any mechanism by which a user can give feedback directly to researchers? Further, the field level trial is an essential step for the development of any technology. Therefore, such mechanisms and systems should also have enough scope for testing and refining. Finally, it should have not any distance barrier for its use. The

concept of the SIRC is mainly aimed to address all these issues by taking advantage of potential applications of ICT particularly for information dissemination.

Development & Implementation of SIRC

Computer-based educational aids have a great scope of incorporating all such features discussed in the previous section. The conceptualized model of SIRC has tried to incorporate all these features. A description of the steps in the development process follows.

The identification of the information needs of livestock owners was the first and foremost step considered important to make the SIRC need based. After identification, the information needs were prioritized to address the maximum number of users with the most needed information. Scientific information was collected from reliable sources and made relevant, simple, and precise. Further, it was translated into the local language in the form of text as well as audio to be understood easily even by illiterate users. Further, that information was used to develop SIRC by incorporating various multimedia features to hold the learner's attention and interest. To update the information in SIRC, an inbuilt feature was incorporated to record a brief socioeconomic profile as well as users' feedback. After development of SIRC, it was tested in the field for six months to assess its effectiveness and lacunae. After field testing, the SIRC was placed at veterinary clinics for its regular use. Thereafter, with a regular interval, users' feedback was collected from SIRC's inbuilt feedback record features and information was updated in SIRC for its sustainable use.

Among all the institutional arrangements for the animal husbandry sector, a veterinary clinic was selected for installation of SIRC. The present network of veterinary clinics or dispensaries proves to be a promising solution for various extension activities because of its physical presence and reach through veterinarians and para-vets at the village level. On average, each veterinary clinic has four to five staff; however, there is ample scope to realize the full potential of this dispensation with the help of ICT. There is much scope for the utilization of these institutions as SIRC to address the changing information needs of livestock farmers.

The SIRC can be installed in the veterinary clinics and dispensaries where farmers frequently visit for various livestock-related services. The basic idea behind the concept is to educate farmers with the new knowledge and skills of various aspects of animal husbandry and thereby improve their livelihood. Extension plays an important role in changing the knowledge and skills in management practices and attitudes toward newer livestock technology. Bringing change at the right time will result in improved livestock farming practices. When a farmer comes to a veterinary clinic to resolve some problem (treatment of an animal or other services), he is psychologically well prepared to learn a permanent solution to avoid repetition of the same problem in the future. The mindset of the farmer at this time should be utilized for important dissemination as it is the best moment for him to learn.

On the other hand, when the farmers are compelled to wait for their turn to get their animal treated by the veterinarian, they can utilize the SIRC to explore the information available with the help of a trained operator available at the veterinary clinic. As such, the waiting time is converted to value-added time and the farmer's needs may be addressed during this time. Once farmers become familiar with using the interactive touch screen, they help their fellow colleagues to learn. Moreover, nowadays, most of the mobiles available in the Indian market are of touch-screen type, so the users, including livestock farmers, are well-acquainted with operating touch-screen-type electronic gadgets. The same content will also be developed in the form of leaflets, pamphlets, posters, and other print publications and distributed to the SIRC users (livestock farmers), which will reinforce the learning activity. In this way, the problem of limitation of time with the veterinarian and para-vets for information delivery can be addressed to some extent.

Once the farmers start using SIRC, a detailed database of visiting farmers can be collected in the form of feedback at the center with respect to socioeconomic profile, herd size, information needs, contact information, and other data. Moreover, the veterinarians and para-vets can collect the contact numbers of different farmers during their field visits. These can be used for dissemination of information through short message service (SMS) voice messages by connecting to the prevailing public and private services of various companies that are providing mobile-based advisory services to the farmers in a cost-effective manner.

Thus, the basic concept of SIRC is to supplement and complement the potential of animal husbandry institutions veterinary clinics and their human resources with the help of modern ICT tools. Further, the SIRC will create a learning atmosphere for the farmers to find solutions for pressing problems relating to animal health and to adopt scientific management practices to enhance production and productivity.

With the frequent assessment of information needs through feedback, observation, and close contact of farmers, the SIRC can be updated with locally relevant information from time to time with the help of various educational and research institutions of the states. Thus, a successful implementation of the SIRC concept will go a long way toward emerging sustainable development in the animal husbandry sector.

The present model of SIRC was implemented by MANAGE at the District Veterinary Dispensary, Bhongir, one of the districts of Telangana state in India, 70 km from MANAGE headquarters. The District Veterinary Dispensary was selected purposefully to install SIRC, since along with the Veterinary Dispensary, there were other units associated with farmers such as the Farmers Training Centre and the Animal Disease Diagnosis Laboratory, which ensured the continuous flow of farmers. For the development and upgrade of the content (information) for SIRC, MANAGE had collaborated with P. V. Narasimha Rao Telangana State University for Veterinary, Animal and Fisheries Sciences, Hyderabad. The developmental work of the SIRC, which includes the software development, programming, and use of multimedia was outsourced by MANAGE.

Figure 16-2. Sustainable Information Resource Centre (SIRC) illustration. User interface-1.

Figure 16-3. User interface-2.

Figure 16-4. About the SIRC.

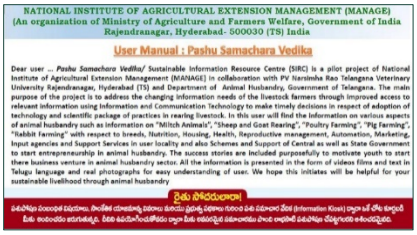


Figure 16-5. Steps to access the SIRC.

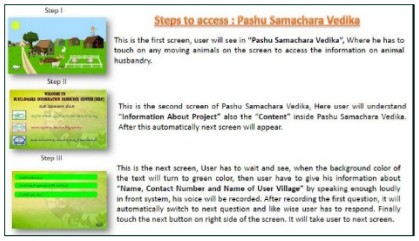


Figure 16-6. Steps to access the SIRC.

Figure 16-7. Steps to access the SIRC.

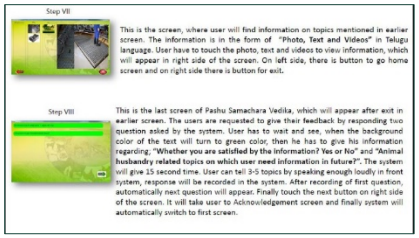


Figure 16-8. Index of the SIRC website.

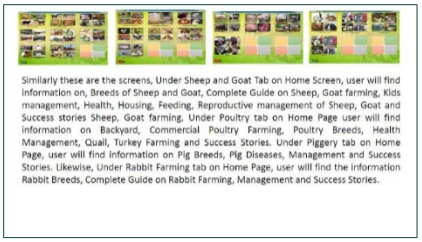


Figure 16-9. Acknowledgment page.

Outcome & Lessons Learned From SIRC

The SIRC was inaugurated on July 2017 at District Veterinary Polyclinic, Bhongir, Telangana. It was kept for pilot testing for a period of six months (October 2017 to March 2018), and after that, users' suggestions were considered, mainly related to its accessibility and operational issues. Finally,

SIRC was placed for its regular use for a period of 1.5 years up to September 2019. During this period, more than 1,000 farmers visited SIRC for information. The structured interview schedule was developed for collection of data. Among the total visitors, 60 farmers were selected randomly to assess the effectiveness and perceived utility of SIRC on the following variables. The variables are listed and then explained further.

- Effectiveness of the system in enhancing knowledge
- Opinion of respondents about SIRC
  - Relevance of content
  - Preciseness of content
  - Simplicity in understanding of information
  - Visual quality
  - Audio quality
  - Arousal of curiosity and interest
- Perceived utility
- Perceived problems in accessibility

Figure 16-10. Inauguration of Sustainable Resource Information Centre (SIRC) on 21 July 2017 at District Veterinary Dispensary, Bhongir, by Director General, MANAGE and District Collector, Bhongir.

Effectiveness of the System in Enhancing Knowledge

The assessment showed that 56.67% of respondents perceived the SIRC to be “very effective” in enhancing knowledge regarding animal health management, while 43.33% reported it is “effective.” Not a single respondent felt that it is “not effective” for knowledge enhancement.

Opinion of Respondents About SIRC

Many research and experiences have shown that for effective learning, the learner’s interest and attention is important, and selection and presentation of content play a vital role. The content should have relevancy with the subject, preciseness, and simplicity. Similarly, to hold interest and arousal of curiosity, the content should be presented with the help of multimedia features incorporating text, graphics, pictures, animations, and audio and videos in the local language. During the data collection, respondents were asked their opinion on these aspects of SIRC and the results follow.

Relevance of Content

The assessment showed that 61.67% of respondents were of the opinion that the content of the SIRC is "appropriate" to the topic presented, followed by 35% who said it was "relevant." However, only 3.33% of respondents felt it was "not relevant" to the topic, which may be due to their higher knowledge level and their need for more detailed information about certain aspects of the topic.

Keniston (2002) reported that the development of locally relevant content is essential; whatever the mode of communication, the need to present locally relevant information intelligibly both in terms of language and in terms of the level of explanation is imperative. Czech (2006) in his evaluation study pointed out that most of the information provided through Drishtee (an India-based business) portals was highly relevant to users; otherwise, operators would not be able to make a profit and people would not pay for the services.

Preciseness of Content

The preciseness of content is important for better understanding of users. Of the total evaluated sample size, 59.17% of respondents felt that the content of SIRC had been presented in a "precise" way, while 36.67% felt it is "very precise" that is, not enough to understand the topic and seek more information. Similarly, 4.17% of respondents were of the opinion that the content can be further precise ("not precise").

Simplicity in Understanding of Information

To understand the subject, the content should be present in simple and common language. The respondents were asked their opinion about the simplicity of the content of SIRC. The result shows that 61.67% of respondents felt that it was "very simple" to understand, and 33.33% of respondents felt it was "simple." But only 5% of them reported it was "difficult" and needs more simplification.

Raju and Rao (2006) have developed the Poultry Expert System (PES) and its perceived complexity was tested among 60 veterinarians and veterinary students through laptop computers. They reported PES was easy in its operation, navigation, and understanding of the content through simple language, compared to the traditional way of using a knowledge system.

Visual Quality

A visual appeal is necessary to hold attention and interest of the learner. Regarding the SIRC, 90% of respondents reported that it had "very good" ability to hold interest, and 10% considered it was "good." Not a single respondent reported that it was not enough to hold attention ("poor").

Raju and Rao (2006) reported that the user-centered design of PES has ensured the users to identify themselves with the system, which was developed for them only. User interactiveness of the PES satisfied the end users' basic instinct to interact, be it with the computer or human beings.

Audio Quality

The content of the SIRC is supported by the voice backup in the local language (Telugu), so that even nonreaders can understand. The

respondents were asked about the audibility of voice in terms of its clarity, pitch, and pronunciation. The results reveal that 60% of respondents reported the voice quality of SIRC is "very good," followed by 36.67% who informed as "good," but only 3.33% of respondents reported it needed improvement ("poor").

Arousal of Curiosity & Interest

The learners' psychology plays an important role in learning, arousing curiosity, and sustaining interest to facilitate learning. Of the respondent, 81.67% reported that SIRC was "effective," having the ability to arouse curiosity and interest, which is mainly due to use of real pictures, animations, and graphics in the system, while 18.33% felt it was "very effective." None of the respondents felt it was "not effective."

Rafea et al. (1995) reported that integration of multimedia tools such as graphics, images, animations, video clips, and sound backup are essential components for the development of expert systems on disease diagnosis.

Perceived Utility

SIRC was developed with the intention of providing information on various management aspects of livestock such as housing and feeding management, and animal diseases and reproductive management of all livestock species such as cattle, buffalo, sheep, goats, pigs, rabbits, and poultry. Apart from that, the development programs of state and central government were included in SIRC with respect to subsidy, eligibility of beneficiaries, and the block-wise contact number of related animal husbandry officers to avail the programs. To motivate the rural youth to take up entrepreneurship in the livestock sector, various success stories in this subject were included in the form of videos. After showing the system to the respondents, their opinions were asked about the overall utility of SIRC.

The result shows that 85% of respondents perceived SIRC as "very useful," and 15% reported it was "useful" to them for decision-making. No one felt it was useless ("not useful").

Raju and Rao (2006) reported that PES was perceived more useful in making poultry farming decisions, especially when experts are not available; resulting in saving of time, money, and effort.

Perceived Problems in Accessibility

Dissemination of knowledge through modern communication technologies demands availability of secondary inputs such as computers and electricity along with knowledge of handling of these electronic devices on the part of users. The respondents were asked their perception about these problems.

It was observed that 21.67% of respondents know how to operate a computer and 10% have a computer at their home. The computer is a new technology for the rural masses and to gain proficiency, formal training will be needed. However, 96.3% of respondents reported that they don't have any problem accessing the SIRC, which is mainly due to private milk processing units that provide computers at their milk collection centers in villages. Similarly, most of the villages' *Gram Panchayats* (village councils) and dairy cooperatives have computers in their offices, where farmers need to go frequently and can access the information with the help of trained

persons. Moreover, this situation helps overcome the problem of computer illiteracy as it is being operated by technical persons. This could be the reason that 96.3% of respondents reported they don't have any problem accessing SIRC.

A panchayat model of the *Gyandoot* ICT project in Madhya Pradesh Gram Panchayat provides the physical space, and pays for the hardware and other infrastructure and electricity costs. Czech (2006) and Singh (2006) emphasized there is a strong need to establish joint ventures with the private sector and NGOs to enrich ICT resources in terms of both hardware and software, and the relevant content creation.

Rural India faces electrical power interruptions and the situation needs to improve by ensuring an uninterrupted power supply to villages.

Cecchini and Raina (2002) reported that in rural India, illiteracy, a low level of infrastructure facilities, and lack of education are powerful obstacles to computer and other ICT tool use. Lack of local content and inadequate power supply caused problems in information kiosks. A report of a task force on information kiosks emphasized that assured power supply in the villages, "Right to Information," and enhancing the human capital of the stakeholders should be viewed as preconditions to ensure optimal usage of the information kiosks and knowledge centers in rural India (Swaminathan, 2004).

Conclusion

The study concluded that the conceptual model of SIRC was found effective in disseminating information. The demand-driven approach of developing information content in the form of a computer-based interactive Information System will be the most convenient, cheapest, and effective future mode of information dissemination. The multimedia tools of ICT possess high capabilities for presentation of information particularly on diseases in formats that are appropriate and meaningful to end users (farmers). However, the help of grassroots-level agencies such as Gram Panchayats and dairy cooperatives to ensure secondary inputs computers, power supply, and human resources will play a big role in the popularity of the cyber extension.

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CHAPTER 17

Agritourism

EMERGING LIVELIHOOD OPTION TO ENHANCE FARMERS' INCOME IN INDIA

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Abstract

This study was conducted using the case study research method and restricted to two agritourism centers. General tourism is at its peak so connecting agriculture to tourism can enhance the livelihoods of farmers. The first case is about the Palshi Agritourism Centre at Palshi village by the well-known Indian entrepreneur and agricultural tourism advocate, Pandurang Taware. The second case is on the interventions of the Andaman and Nicobar Islands Administration. To share the experiences of Pandurang Taware and to explore the opportunities in Andaman and Nicobar Islands, Pandurang Taware was invited to the Andamans by the Extension Education Institute in Hyderabad and motivated Extension officers of the Andamans to promote agritourism in the Andamans. The objective of this case study was to probe the motives of starting such a concept and to get firsthand information as to how agritourism contributes to strengthening farmers through a means for supplemental income. The Palshi Agritourism Centre is the first of its kind to act as a model for many farmers to venture into such activities for sustainable livelihoods. It was started by Pandurang Taware, an enterprising individual, under the aegis of the Agri Development Trust on 110 acres of cultivated land. This project was critically monitored by Taware during its 2004–2006 gestation period. This project consisted of unique irrigation methods considering the interests of tourists in the areas of horticulture, floriculture, sericulture, winery, cattle breeding, animal husbandry, jaggery processing, and dairy farming. Hutbay in the Andaman and Nicobar Islands was promoted by the Department of Agriculture and Tourism and the Neil agritourism centers were promoted under the Public Private Partnership (PPP) model.

Introduction

The concept of agritourism developed due to urbanization, as many people are not aware of rural background and the constraints in production of grain, fruits, and vegetables. The integration of agriculture and allied activities are not known by urban dwellers. When asked about how food grains are produced and how various products of dairy, poultry, and farm are produced, people give a variety of answers. Agritourism is mainly meant for making use of these situations by having farmers create experiential learning for people to stay, experience, and "own" the activities of the farm. The activities include staying in the natural environment in the farm itself, planting trees, milking cows, riding bullock carts, harvesting crops, threshing, and winnowing. These activities make the visitors feel happy and create a leisurely environment while enabling farmers to get extra income. Agritourism not only allows participants to stay in a village and enjoy the village-based foods but also have an opportunity to be close to where 75% of Indians live. One of the best things about staying on a farm is that guests can contribute to the place through their involvement in agricultural operations, all within a tourism experience.

The concept of agritourism was formally launched at the Agri-Tourism Development Corporation, Baramati, Maharashtra, on May 1, 2004. The concept envisages the involvement of the private sector and the farmers who are the agritourism service providers, based on the PPP. Agritourism service providers and guides need to create a congenial natural living atmosphere, which includes good hygiene and quality facilities at the center. They show visitors agricultural practices such as cultivating flowers, harvesting agricultural crops or fruits, bee keeping, dairying, and other agricultural operations. They introduce the village, the life of villagers, their culture, and their societal norms through various participatory practices. The tourists can enjoy the natural environment, fresh air, and atmosphere at the center. The tourists should be exposed to the local community, which means attending a panchyat meeting, hearing local traditional songs, attending traditionally celebrated festivals and dances, and exploring art and crafts.

Maharashtra stands third in India for population and area. It lies on the west coast of India with a 720 km long coastline along the green Konkan region. Western Ghats (also known as Sahyadri) mountain ranges have several hill stations and water bodies with semi-evergreen and deciduous forests. Several tourist centers in Maharashtra are the supporting natural environment for the agritourism centers in the state. Almost 43% of the population lives in urban areas in Maharashtra. Tourists also come from outside the state and other countries. The well-developed infrastructure such as connectivity to the roads, communication facilities, connectivity to the airports, and a well-spread network of trains attract potential tourists. The agritourism centers are an added advantage.

The Andaman and Nicobar Islands were established in 1956 with a total area of 8,250 sq km and a population density of 46 per sq km. Out of the 572 islands, 37 are inhabited. Andaman and Nicobar Islands have beautiful beaches, with many places to visit such as the Cellular Jail, a colonial prison of great historical recognition; a water sports complex; and museums. Keeping in view the importance of the development of tourism in the islands, the administrators and policymakers seriously thought of

developing agritourism by taking advantage of the tourist flow. They aimed at attracting the tourists to stay in the farms in the natural environment rather than in the closed hotels. This facilitated the Andaman and Nicobar Islands Administration to promote agritourism in the islands. There are many such efforts started from Neil Island to Hutbay, where they have created models to motivate farmers to venture in to these type of activities which will be helpful to the farmers for betterment of their livelihood.

Methodology

The researchers observed and analyzed the changes in the agricultural sector by agro-based tourism as case studies from the state of Maharashtra and the Andaman and Nicobar Islands. Other sources are also used by the investigators while collecting data. It was also defined by Robert K. Yin that case studies are based on empirical inquiry that's based on the factual information in real-time in which the boundaries between phenomenon and context are not clearly evident, and in which multiple sources of evidence are used (Yin, 1984). The investigators personally visited these two service providers, interviewed the agritourism service operators, and gathered primary data with in-depth discussions (Ahire et al., 2018).

The present investigation was conducted by using the case study research method during 2012–13 and 2018. Maharashtra State and the Union Territory (UT) of Andaman and Nicobar Islands were purposively selected as the concept of agritourism was initially started in the state of Maharashtra and the tourism spots of UT Andaman have great potential for developing agritourism. The investigators are familiar with the areas of both states. The Andaman and Nicobar Islands fall under Extension Education Institute jurisdiction. This helped in developing rapport with agritourism service providers and getting firsthand information for documentation with the help of government departments. The investigator has visited four agritourism centers each in Maharashtra and Andaman and Nicobar Islands, selected randomly to document as case studies.

There is plenty of scope and potential in agritourism centers not only in Maharashtra, but also in several other states that promote various rural culture-based tourism. Agriculture Tourism Development Corporation (ATDC, Pune) is the main organization in the Pune District that supports promoting this activity for achieving income, employment, and economic stability in rural areas. Based on these special features and wide network of agritourism centers in Pune and nearby areas, the Pune District was selected by the investigator to document the first case of agritourism.

The Hutbay agritourism center in the Andaman and Nicobar Islands was promoted by the Department of Agriculture and Tourism, and the Neil agritourism centers were promoted under the PPP model.

Results & Discussion

Agri & Rural Tourism Training, Research & Development Centre

Pandurang Taware, who hails from Sangavi, Taluka Baramati, District Pune, completed his B. Sc. in computer science, and holds 6 acres of irrigated land with sugarcane cultivation, looked after by his parents. After his education, Taware observed farming over a period of 8 to 10 years and the cultivation practices followed by his parents and fellow farmers from other villages and their harsh life. He observed that agriculture is a continuous business, a full-time activity for farmers throughout the year. Erratic rainfall and price fluctuation in markets for agricultural commodities are the major factors to gain profit from agriculture, but they rarely happen in favor of farmers. This has forced Taware to develop a concept of agritourism as a subsidiary business for the farmers.

The Agri and Rural Tourism Training, Research, and Development Centre was established in 2004 at Baramati, Pune (Maharashtra). It is a totally dry land belt with rocky soils and very low rainfall. Taware began the center under the aegis of Agri Development Trust on 110 acres of cultivated land. Taware critically monitored the project during 2004–2006. It included unique irrigation methods and considered the interests of tourists in the area of horticulture, floriculture, sericulture, winery, cattle breeding, animal husbandry, jaggery processing, and dairy farming.

Taware developed this business model as a viable unit based on the premise that urban population is leaning toward nature and has a strong desire for family-oriented recreational activities in a rural setup. This project was carefully carved and considered the requirement of the urban population and the boost in the tourist sector. It has been running successfully since 2006 and currently is thriving in providing an inexpensive getaway to a large majority. This project is now very feasible and spread over its popularity among the large number of tourists.

Currently, Taware is operating as a president and managing director of Pune-based ATDC Private Ltd and fully involved in sales and marketing of agritourism. He has set up his own office in Pune with a mission to promote agritourism for achieving income, employment, and economic stability in rural communities in India; and to help develop and promote a range of activities, services, and amenities provided by farmers and rural people to attract urban tourists to their area, thus providing opportunity for urban people. He has started his own agritourism activities by acquiring the 30 acres of land in the small village of Palshi, Taluka Baramati, District Pune.

The researcher visited Agri and Rural Tourism Training, Research, and Development Centre in Palshi village and observed that Taware has planted 4,000 tree species such as Siris, Acacia, *Mellingtonia hortensis*, *Azadirachta indica* (neem), Rain tree, *Alstonia regia*, *Peltophorum ferrugineum*, Golden bamboo, Teak, and several other tree saplings. The fruit plants include mango, sapota, guava, and coconut. Several ornamental and flowering plants growing such as hibiscus, periwinkle, and jasmine are mostly hardy and suitable for dry land cultivation. These plants are irrigated with a drip irrigation system, and water is lifted from the watershed pond.

Figure 17-1. Tree plantation at Palshi.

Figure 17-2. Teak plantation at Palshi.

Figure 17-3. Coconut plantation at Palshi.

Figure 17-4. Huge infrastructure at Palshi Village, Baramuti.

Taware has taken a loan of Rs. 2.5 crore from Janta Sahkari Bank Pune for infrastructure development such as 10 rooms with attached western toilets and bathrooms, 10 rooms of Indian style with attached toilets and bathrooms, two dormitories for 25 people each, a conference hall with seating capacity for 100 people, and a dining hall with seating capacity for 200 people. The center also has a huge watershed pond with a size of 55 mts by 55 mts of 2 crore liters of water storage capacity. An open well has little water as the area is rocky and it is difficult to get water from the ground.

This specific project of agritourism generates an annual revenue of about Rs. 65 lakhs (2012–13). This stems from various primary sources as day and night camp, secondary sources as summer camp for three-days duration, and other sources as training for farmers for seven-days duration. The charges for day and night camp are around Rs. 600–700 per person, summer camp for three-days duration is around Rs. 2500–4000 per person and Rs. 10,000 per person for farmers training for seven days. Taware is also paying Rs. 2.75 lakhs per month on a loan installment. He is satisfied with the present level of his business. During the financial year 2012–13, around 10,000 tourists visited including some from 14 countries.

This project is implemented with the involvement of farmers from the nearby villages. Therefore, the farmers are also involved in sharing the revenue generated. This keeps the farmers motivated and attached to the project. The farmers also directly benefit as they can market their products to the tourists. Women's self-help groups get ready customers for their handicrafts, leaving high profit margins. Tourists comprise education groups such as school children, college students, business management colleges, corporates, families, and foreign tourists. Similar results were reported by Gopal et al. (2008).

As a part of the other sources of revenue generation, the center has trained 1,500 farmers since 2007, and 370 farmers have started their own agritourism centers.

The World Travel and Tourism Council (WTTC) has recognized Taware's efforts and applauded his work. He is also a recipient of several awards such as the National Tourism Award for 2008–09 from the vice president of India; finalist of the Global Tourism for Tomorrow Award 2011 by the WTTC, London; winner of Global Responsible Tourism Award 2011 by Responsible Travel, London; and winner of Responsible Tourism Award 2012 by Wild Asia, Malaysia, for his innovative concept of agritourism and successful business model for sustainable agri-rural tourists.

Figure 17-5. Overhead tank for water supply at Palshi.

Figure 17-6. Stay facility at Palshi.

Figure 17-7. Inside view of the rooms.

Figure 17-8. Huge watershed pond at Palshi.

Figure 17-9. Common practice followed by a woman for drying grains.

Figure 17-10. Pandurang Taware with school students at his center.

While developing the infrastructure at Palshi for tourists, Taware has engaged local people such as masons and laborers and used all the natural resources readily available at his farm at Palshi. The material such as natural boulders and gravels are used for construction, which helped him to reduce costs. Sixteen workers handle the day-to-day tourism activities on payment of Rs. 5000–7000 per month per person, which means that 16 families have food security.

During tourists' visits, the local artisans, pot makers, and farmers are informed by the center to bring their handicrafts and agricultural produce so that the tourists can buy directly from the producers. This concept opted by Taware made him more popular among the local villagers. Whenever the vegetables and other grocery items are required, a simple phone call works for Taware and he will get the things at his centers from the local farmers and vendors. Farmers and vendors are also happy as they are getting the maximum benefit from their products. Otherwise, farmers must travel 30 kms away to visit Baramati Market or 100 kms to visit Pune Market to sell their produce.

Being of a farming background and experienced in running the agritourism center and involved in developing resorts in the country, Taware is also encouraging other fellow farmers to come out into small ventures of agritourism models, which will support their livelihood and improve their lifestyle.

Figure 17-11. Foreign tourists at Palshi Village practicing yoga.

Figure 17-12. Foreign tourists in traditional dress at Palshi.

Figure 17-13. Foreign tourists in a traditional Maharashtrian.

Figure 17-14. Foreign children with goats at Palshi.

Agritourism: Andaman & Nicobar Islands Experiences

To explore the opportunities in the Andaman and Nicobar Islands and to give importance to the need to promote agritourism to enhance the livelihoods of farmers of the islands, Extension Education Institute Hyderabad has organized a week-long training program on agritourism by inviting Pandurang Taware from Pune, Maharashtra. The objective of conducting this training program is to orient the Extension officers on agritourism and to share the experiences of practicing farmer Taware.

Figure 17-15. Hutbay agritourism center.

Figure 17-16. Investigators on the way to tourism center.

Figure 17-17. Extension trainee officers visiting tourism center.

Agritourism Model: Neil Island

This model is a multisector integration model, touching on tourism, agriculture, and disaster management. Neil Island (now known as Shaheed Dweep), one of the Andaman Islands, has a presence on the tourism map of India for its vast and beautiful beaches with white, fine sand, and coral reefs. Neil is also known as the Vegetable Bowl of Andaman due to its hardworking and progressive farmer population, mostly of Bengali origin.

With the development of beach tourism, the farmers who had lands adjoining the sea were the major beneficiaries. But Neil also has about 41.6 ha of hilly land. The farmers with hilly land were being left behind in the race to adopt tourism. The Department of Agriculture has four farms on Neil Island, which includes a hilly land plantation of 0.4 ha. That particular hilly land was mentioned in the book of tourism interest called *Lonely Planet*, widely referred to by tourists.

The 2004 tsunami wreaked havoc on the islands, causing the islanders to prepare for any future events. Special relief measures were developed in which relief materials for such situations were stored on all the islands for use during such calamities. In Neil, those relief items were stored at Neil Kendra village, which is close to the sea, and in case of a tsunami or similar events, it will be washed away first. Moreover, being a tourist hot spot, if a tsunami alert comes, most of the people, being new to the place, may not find the road to the nearest highest point to save their lives.

Due to the increase in tourism, the land value increased. Poor farmers were always eager to sell their land as the rates were considered to be very high. In many cases, it sold for several crores of Indian rupees, which the farmers could not earn from the land in their entire lives with traditional agriculture. However, it was also observed that those farmers who took up agritourism were better off than ones who sold their lands.

Keeping in mind all of these issues, a model agritourism project was conceptualized on the 0.4 ha hilly land in the departmental farm. The idea behind the project is to use the departmental farm in a more profitable way, in which usually the income is generated mostly through collection and sale of coconuts. As the view from the top of the hill was beautiful and was already mentioned in *Lonely Planet*, it could be developed into a major tourist attraction.

The plantation already has various fruiting plants such as mango, sapota, guava, and coconut. With inclusion of a sale point to the hill, the visitors can be served farm fresh products. Ten ecofriendly huts were developed for staying. A restaurant was also developed on the hilltop.

As this hill is the nearest highest point, a road was developed from the main road to the hilltop with proper sign board at the main road showing information like “way to highest point” to be taken in case of tsunami alert. The tsunami relief materials will be stored on the top, so that people reaching for rescue can use the materials. Finance for the project has been arranged through National Agriculture Bank for Agriculture and Rural Development (NABARD), Disaster Management and Tourism.

The unit was to run through a PPPP model:

- Public (government departments such as Agriculture, Tourism, Forest, Disaster Management)
- Private (assets and infrastructure developed by administration and leased out to local unemployed youths)
- Panchayat (elective village council will be looking after the management)
- Partnership (all working together)

The agritourism model has the potential to improve the financial situation of farming while teaching the population to understand and value the important role of the farmer as well as the path that food takes to get to their tables.

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CHAPTER 18

Best Practices in Entrepreneur Development

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Note: This content was provided as an expansion to the presentation *Promoting Local Food Entrepreneurs for Nutrition and Economic Growth*, organized under the MSU–MANAGE international conference "Agricultural Extension and Advisory Services: Innovation to Impact," February 12–14, 2019, Hyderabad, India.

Introduction

Food and farm business in the United States are a critical part of the economy including 5% of the Gross Domestic Product, 10% of employment, and 10% of citizens' income. Sales from the food sector comprise $1.4 trillion, with $164 billion generated from value-added products. Innovation within the food system skyrocketed with food industry research spending doubling over recent years (Committee for Economic Development, 2017).

Michigan is one of the most diverse agricultural states in the United States (Michigan Department of Agriculture and Rural Development, 2019b).The Michigan Department of Agriculture and Rural Development estimates that more than four million hectares (10 million acres) of farmland spreads across nearly 48,000 farms throughout the state. Farms employ over 800,000 workers, making up 17% of the total employment for Michigan (2019a).

At Michigan State University (MSU) Extension, education and research focus beyond agriculture and include health, nutrition, personal finance, and youth. The MSU Extension team provides Michigan farmers and food enterprises with best-practice resources, training, and education specific to producing, processing, and managing the business including accounting, marketing, and finance. Supporting all aspects of the food and farm business is critical to farm sustainability.

Public Health Considerations

In the United States, major health and economic disparities exist across income classes. One in 10 citizens consume the recommended amounts of fruits and vegetables. Americans living below the poverty level consume fewer fruits and vegetables than those living with higher incomes (Centers for Disease Control and Prevention, 2018). Diet-related disease such as diabetes and cardiac disease are at an all-time high. In 2018, 11.1% of Americans experience food insecurity with over 7% of those being children;

whereas during this time in Michigan, 12.6% of its residents were food insecure (Coleman-Jensen et al., 2019). To help address this concern, the federal government delivers food assistance programs to provide additional food dollars to mothers, families, and other adults. These programs provide improved access to a wide variety of foods and offer special incentives for purchasing Michigan grown fruits and vegetables.

Over the past several decades, consumer food purchasing behaviors have changed due to the closing of neighborhood grocery stores. As food retail establishments closed in neighborhoods across the United States, residents have had limited access to healthy and affordable foods. The Centers for Disease Control and Prevention suggests that improving access to fruits and vegetables in food retailers can decrease the incidence of diet-related disease (2018). The change in food purchasing behavior has created inequity in access to healthy foods for individuals living in poverty and with limited transportation. The addition of farmers markets, small retail food businesses, and community-supported agriculture have provided improved access to healthy, locally sourced produce and products. Healthy Food Financing Initiatives have been created to support more neighborhood-based retailers (and other food-based businesses) to bring healthy food back into the cities (Myers & Caruso, 2016).

A statewide policy initiative was created to highlight opportunities for healthy food to benefit the state's economy and increase food and agriculture literacy, which also addresses these public health issues. This initiative, the Michigan Good Food Charter, seeks to re-envision the food system in ways that promote health, equity, sustainability, and thriving economies. The charter is coordinated by the MSU Center for Regional Food Systems with input from a statewide steering committee, composed of over 20 organizations with a vested interest in improving the state's food system. Through the efforts of the partners, positive change has occurred to improve access to healthy foods in schools and hospitals, create food hubs where produce and meat are aggregated for large institutional purchase, and develop training and technical assistance for food entrepreneurs (Kelly et al., 2018).

Entrepreneurship Programs

The MSU Product Center Food-Ag-Bio (Product Center) and the Michigan Good Food Fund provide food and farm businesses assistance such as planning businesses, creating value-added products from the farm, and selling products to food retailers. The Product Center is a center within the university that supports entrepreneurship throughout the value chain. The Michigan Good Food Fund is a public-private partnership with the university and nonprofit and for-profit organizations to help food businesses obtain business support and financing.

MSU Product Center

A part of MSU Extension, the Product Center provides food and farm businesses assistance in developing and launching new products into the food and agriculture markets. Businesses starting out or those already established work directly with a business coach called an *innovation counselor*, a field-based educator. Innovation counselors are geographically

dispersed throughout Michigan providing support such as business planning, product development, strategies to market products, and referrals to regulatory and other experts within the university and Extension.

The Product Center team includes dietitians, agricultural economists, food scientists, and packaging and processing professionals. Specialty Services, one of the services offered through the Product Center, provides business owners with access to a dietitian who assists in analyzing recipes and creating nutrition facts labeling for product packaging. Market research services assist the entrepreneur in considering real-time trends and market and consumer analysis often critical for business planning and expansion efforts. The team of food scientists at the university offer valuable services with testing for sensory and product formulation needed to increase product sales. The Product Center ensures that each entrepreneur receives customized service and counseling to manage a food or farm business.

Entrepreneurs working with the Product Center can participate in face-to-face and online educational trainings on topics such as, starting a home-based food business (https://bit.ly/37DneGK) or starting a commercial food business (https://bit.ly/35zXPuL). Each year, the Product Center team hosts a conference that combines educational sessions with a trade show titled Making It in Michigan. The event provides a half-day of educational sessions to help entrepreneurs manage, market, and grow their businesses. The event provides businesses the opportunity to showcase their food products to food retailers from around the state.

You can find more information on the MSU Product Center in Chapter 19: Entrepreneurship Through Market-Linked Extension: The Role of Institutional Innovations.

Michigan Good Food Fund

Programs to support access to healthy and affordable foods have been created to address these issues. Healthy Food Financing Initiatives were started throughout the United States to improve access to healthy foods, provide increased job opportunities, and develop healthier food options in communities. The Michigan Good Food Fund is one of many Healthy Food Financing Initiatives in the U.S. It supports food enterprises by providing technical assistance and financing options to healthy food enterprises.

The Michigan Good Food Fund aims to bring healthy and affordable, locally and sustainably grown and produced foods to communities where access to healthy and affordable foods is limited. A public-private partnership between the MSU Center for Regional Food Systems, the W.K. Kellogg Foundation, the Fair Food Network, and Capital Impact Partners, the program addresses this issue by supporting business along the value chain—from the farm to the processor to the restaurant and retailer.

The Michigan Good Food Fund is the key healthy food financing strategy in the Michigan Good Food Charter. The mission is to bring in more healthy and affordable foods to Michigan's communities by supporting businesses who use environmentally sustainable practices; create good, fair-wage jobs; and help to grow Michigan's economy. Part of the vision of the Michigan Good Food Charter, economic development and healthy foods for all Michigan residents, are the goals of the program.

Many food and farm enterprises lack the business acumen needed to manage the finance and marketing side of their businesses. Even more owners find that when financing is needed, they lack the ability to manage debt as well as the financial statements required by lending institutions. The Michigan Good Food Fund works to ensure that businesses, especially those often overlooked by traditional banks, are ready for debt financing by providing technical assistance around financial projections, product costing, and business planning.

Inequitable access to capital and lending is of concern for enterprises. In the United States, women and persons of color have had less ability to access financing (Henderson et al., 2015). The Michigan Good Food Fund aims to provide equitable access through flexible and patient financing terms. Directly assisting entrepreneurs with financial documentation and business support, the team connects enterprises with mentors and lenders. The team of specialists, working in partnership with the Product Center, provide technical assistance to help the businesses become ready for financing. Technical assistance can include business planning, financial review, e-commerce sites establishment, and marketing.

Working together with MSU Extension, the Center for Regional Food Systems, the Product Center, and the Michigan Good Food Fund team can help product makers source more locally grown food. Product makers searching for local ingredients can use the online tool MarketMaker to locate farmers near them while producers can find product makers searching to source specific ingredients including meat, produce, and honey (MarketMaker, 2019).

Food safety is important for the farm business. Compliance with local, state, and federal regulatory agencies is a must for a successful food and farm business. Producers selling to institutions such as schools and hospitals have specific food safety guidelines to follow. Programs such as Farm to School help to reduce barriers for the agricultural industry to sell directly to schools. These programs have increased access to healthy foods and increased long-term revenue for the farmers (National Farm to School Network, 2017). Farmers looking to process meat and poultry that they produce, can work with specialists within MSU Extension and the Product Center to ensure proper sanitation procedures are in place. MSU Extension also provides food safety certification options for food processors including Better Process Control School trainings as well as Hazard Analysis and Critical Control Point trainings to help support food and farm ventures in Michigan.

Aggregation of farm products is often necessary to meet the demand of large institutional buyers. In Michigan, 12 food hubs work to increase market opportunities for farmers to sell products to large institutions such as schools and hospitals. These businesses sell to two to 800 institutional customers and have increased the sales of locally grown and processed foods throughout the state. The food hub serves as an aggregation point for produce, meat, poultry, and egg producers to connect to large procurement buyers such as hospitals, universities, and schools who require large quantities for sourcing. Farmers and processors can sell their products to the food hub, which then sells directly to individuals, institutional buyers, or distributors. A statewide network, Michigan Food Hub Network, facilitated by the MSU Center for Regional Food Systems, exists to engage and support

these businesses on topics of aggregation, storage, processing, and distribution (MSU Center for Regional Food Systems, 2019).

Case Studies

Food and farm businesses in Michigan range across the value chain from traditional farming to processing to retail outlets. Unique business opportunities have been created to help address the public health issue of limited access to affordable and healthy foods. Included here are several examples of businesses who started to fulfill a need.

Community Supported Agriculture (CSA) is a strategy that allows community members to purchase shares of a farmer's crop or land to allow for access to farm fresh produce and sometimes dairy, eggs, and meat. The business model connects the grower directly to the consumer and reduces risk to the farm business as members pay for shares prior to the start of the season. The CSA or often referred to as "veggie boxes" are filled with farm fresh items and picked up or delivered straight to the customer/member. Individuals or groups of employees at corporations may buy a share allowing them to receive farm fresh products delivered to their work sites. Farmers who participate can benefit by having access to working capital in advance of the season (through member payment at the start of the season) and increased profits (U.S. Department of Agriculture Alternative Farming Systems Information Center, 2019).

Figure 18-1. An urban farm with a hoophouse for season extension. (Photo by Takidia Jenkins-Smith)

One example of a CSA farmer is a young woman from Grand Rapids, a city in Michigan with the second largest population in the state. A mother of three, she started growing her own food out of financial need. She and her children, along with the neighbors, maintained urban farms in their neighborhood. To supplement her family's income, she sold the produce she grew as CSA shares to the neighbors and at the local farmers market. By growing her own food, she was able to supply her family and her neighbors with healthy and affordable food choices. She attended a business training conducted by the Michigan Good Food Fund team where she spent three days learning about profit and loss statements, value proposition, and building a business model canvas. She received assistance from the MSU Extension community food systems educator in her area to better manage her business.

Figure 18-2. Owners of Zilke Farms check the health of their plants. (Photo by Vicki Zilke)

Figure 18-3. The Zilke Farm Kitchen serves meals made from farm fresh produce and meats. (Photo by Vicki Zilke)

Another farmer who expanded her farm business for additional revenue opened a farm kitchen. After growing produce on a 5-acre farm for many years and hearing stories from her customers that they no longer had time to prepare meals at home, she opened a small retail location with a commercial kitchen. In the kitchen, her team prepares ready-to-heat meals with food that is fresh from the farm including her produce and another local farmer's chicken. Selling pre-cooked food allows individuals the opportunity to purchase healthy and affordable meals. With the support of the Michigan Good Food Fund and the Product Center team, this farmer was able to open an online store where customers can preorder meals. She also received support with writing grants to help fund expansion of the store. This technical assistance was provided to the client both pre- and post-financing.

One other example of an agribusiness supported by the services of the Product Center and the Michigan Good Food Fund is a farmer raising chickens on pasture. Producing smaller quantities of product than the typical chicken farmer, this young farmer received assistance from MSU Extension and the Michigan Good Food Fund. MSU Extension services supported him with establishing a CSA as well as licensing and regulations needed for selling to restaurants. Requiring financing for expansion, he worked with the Michigan Good Food Fund lender to complete all necessary loan documents and obtain funding for equipment purchases.

Figure 18-4. Old World Farm owner Eric Shevchenko Alegria produces pasture-raised chickens for local restaurants. (Photo courtesy Eric Shevchenko Alegria)

Conclusion

Services like those offered by the MSU Product Center and the Michigan Good Food Fund partners provide the necessary assistance to grow food and farm businesses. Aligning these programs within MSU Extension provides extended technical assistance and support of the enterprises.

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CHAPTER 19

Entrepreneurship Through Market-Linked Extension

THE ROLE OF INSTITUTIONAL INNOVATIONS

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Introduction

Indian agriculture has seen tremendous growth since its independence in 1947, although producing sufficient food to feed the growing population is always a challenge. Agricultural extension has played a key role in enhancing production through various services to disseminate knowledge, skills, and technologies to farmers and other stakeholders. Public and private institutions contributed immensely through innovative approaches. Their continuous support and contributions through various services to the farmers and entrepreneurs helped farmers' products compete for better prices. On the other hand, increased expenditure capacities of individuals with food purchasing power, economic growth, and increased income will further expand demands. The various challenges agriculture faces must be addressed to achieve further agricultural success.

Innovations have the potential to offer solutions as per the local needs and capacities of farming communities (Gatzweiler & von Braun, 2016). Institutions can play an important role in producing innovation-oriented, yet practical, solutions to local agricultural challenges (Payumo et al., 2017). The role of institutions and partnership has also been identified by Ganguly,

Gulati, and von Braun (2017) in their working paper on innovations spearheading the next transformations in Indian agriculture. Technological innovations can no longer be pursued separately from organizational and institutional innovations as each depends on the other. Institutional innovations are not only necessary to ensure the access and use of technological innovations but also to create an enabling environment that rewards grassroots innovators for being creative and sharing their knowledge (Gatzweiler & von Braun, 2016).

Taking into consideration the importance of institutional innovations in not only helping establish an innovator as an entrepreneur but also in enhancing the access of technology and service to a large number of end users, this chapter is an attempt to compile some of the institutional innovations to enhance the reach of technology and services. This will supplement the extension efforts of various departments. The compilation is based on the information shared and discussion held during the Joint International Conference organized by Michigan State University (MSU) Extension and National Institute of Agriculture Extension Management (MANAGE) on "Agricultural Extension and Advisory Services: Innovation to Impact" that took place February 12–14, 2019, at MANAGE, Hyderabad. India.

MSU Product Center

The MSU Product Center Food-Ag-Bio (Product Center) was established in 2003 and served its first client entrepreneurs in 2004. It is an outreach center, housed in MSU Extension, the mission of which is to support entrepreneurship in the food, agriculture, and natural resource sectors of the Michigan economy. The Product Center addresses the skill requirements of aspiring entrepreneurs by providing them with training, coaching, and technical assistance as per their needs at various stages of their own and their business' development.

The Product Center strives to build and maintain an ecosystem of support for its client entrepreneurs. At the field level, appropriately trained, certified *innovation counselors* work with the entrepreneurs. These are MSU Extension educators, who dedicate a percentage of their time to the work of the Product Center. Approximately ten innovation counselors are geographically dispersed across Michigan. Each innovation counselor works with entrepreneurs located in the Extension district they serve, but they also help entrepreneurs anywhere in the state who need their particular expertise virtually via technology. These entrepreneurs tend to be in the early stages of developing their businesses, mostly pre-venture or Stage 1. They help these clients to understand all that is involved in launching a new business, review business plans, and assist them in connecting to local and state entrepreneurship support organizations that can provide additional aid.

When the innovation counselors are unable to help a client with technical challenges, they refer the entrepreneurs to the Product Center's campus staff. This group includes individuals with expertise in nutrition, food safety, marketing, and various types of economic analysis. When the clients' needs go beyond the capability of the campus staff, they are referred to other experts available at MSU, including the many experts throughout the MSU Extension system.

The Product Center facilitates clients in having access to university resources such as specialists in the Department of Food Science and Human Nutrition; the School of Packaging; the Department of Agricultural, Food and Resource Economics; the Eli Broad College of Business; the College of Communication Arts and Sciences; the College of Law; and the Center for Regional Food Systems, among others. The Product Center and its partners have expertise on a wide range of subjects enabling it to extend support to clients all along the process of business development (see Table 19-1).

Table 19-1. Expertise and support available from the Michigan State University Product Center.

Expertise Available	Type of Support Offered
▪ Agricultural economics ▪ Market research ▪ Policy analysis ▪ Food science/food safety ▪ Nutrition ▪ Food processing ▪ Packaging ▪ Agri-food supply chain ▪ Entrepreneur/business development ▪ Economic development	▪ Business concept development ▪ Business planning ▪ Entrepreneur coaching ▪ Marketing and market research ▪ New product development and testing ▪ Packaging ▪ Labeling (nutrition facts and package design) ▪ Food safety ▪ Making connections with retailers and distributors ▪ Feasibility assessments ▪ Cooperative development services ▪ Impact assessment

An important service of the Product Center is helping food and natural resource product entrepreneurs gain access to retailers and distributors. For this purpose, the Product Center established an annual conference and marketplace tradeshow called Making It in Michigan. This one-day event offers a morning educational conference for entrepreneurs and an afternoon trade show, where they can vend their products. Retailers and distributors attend anonymously, sampling the items offered and, ultimately, entering into agreements to buy some of these to sell on grocery store shelves. The show typically attracts 150 to 200 vendors and many other entrepreneurs, prospective entrepreneurs, and members of the public.

The Product Center has also developed a facility, called the Food Processing and Innovation Center (FPIC), with equipment, infrastructure, and food safety licenses to help entrepreneurs develop and validate products and obtain consumers' feedback before making business decisions and investments. The FPIC is intended for Stage 2 and Stage 3 entrepreneurs; the former are just starting to grow via the development of new product lines, while the latter are larger companies seeking a place to work on potential products that have been stuck in the queue at their research and development facilities.

Through this process, a comprehensive system has evolved with provisions for integrating information and knowledge available from various departments and organizations and for serving entrepreneurs at all stages of the business life cycle, thereby making the entire initiative work for both emerging and growing companies. In this way, the Product Center offers a complete end-to-end solution to help new ideas to develop into full-fledged commercially sustainable enterprises.

MSU Extension's Role With Private Sector Business Incubators & Accelerators

MSU Extension, as a long-standing partner with local governments, has developed a relationship with the agriculture business incubator ACRE AgTech, an organization founded on the idea that it would develop local, marketable innovations, find investors, and ultimately, create thriving businesses. The incubator was established with funding from a local government with the intent to drive job creation while functioning as a private entity. Since the incubator's inception, MSU Extension has worked with it as an established partner, representing higher education and research-based programming. The partnership model emphasized a two-pronged approach. The first step is to conduct outreach to the agricultural community. When a local innovation is identified, MSU Extension would refer clients to ACRE AgTech. MSU Extension is uniquely poised to play this role due to the historical relationship and reputation that Extension educators have with the agriculture community. The second prong in this process is to vet the agriculture products that come into the incubator as a third party, nonbiased entity with zero vested interest in the product or innovation itself.

Successes & Challenges of the Incubator Model

The incubator model helped in identification, validation, and commercial multiplication of the technologies. The most successful aspect of the incubator model is increased visibility by the business community and county governments. The process, however, met many challenges along the way such as scarcity of local innovations, difficulty in bringing different organizations and agencies together, inconsequential differentiations of small innovations, and inconsistent funding.

For example, in Ottawa County, Michigan, a local farmer designed a small anaerobic digester. The patentable idea was digestion of any organic material in three to four days as opposed to the average 21 days. The challenge of this particular innovation was that there were no data to verify the farmer's claim of digestion in a shortened time period. The MSU Extension educator developed a lab procedure to test the project and sought $8,000 to $10,000 to duplicate the process in the lab. ACRE AgTech was not able to find an investor that was willing to pay for the lab work to be done, and therefore, the project could not move forward.

Moving to an Accelerator Model

At the end of 2018, ACRE AgTech, having learned from their challenges, shifted directions from their incubator model to an accelerator model. The basic idea of the accelerator model is to maintain a database of challenges and "wishes" that have been identified by commodity groups, processors, and farmers or growers. ACRE AgTech would then publicize those needs to the innovator community to seek potential solutions. Applicants would then

be reviewed by the business sector partners and then accepted into the accelerator program.

With the change in business model, the role of MSU Extension has also changed. An MSU Extension educator is taking on an educational role in helping ACRE AgTech clients understand Michigan agriculture. Included in this role is scheduling tours of farms and agribusinesses, providing educational programming, and providing feedback on how Michigan agriculture and ACRE AgTech clientele can work together. In August 2019, they launched their first cohort of entrepreneurs. MSU Extension plays a coaching role in ACRE AgTech's business cohort meetings. ACRE AgTech goals for this cohort are to help enrolled companies develop lasting business relationships that can lead to customer access in Michigan, position them to secure investment capital, and support the Michigan agricultural community (www.acreagtech.com/).

In summary, due to its long-standing relationship with the agriculture community in Michigan, as well as its history of delivering and supporting reputable research in support of agriculture, MSU Extension is a vital partner to include for business development and entrepreneurial support in serving this community. The relationship with ACRE AgTech is still under development and consistently changing and adapting based on new needs and lessons learned; however, it's clear moving forward that MSU Extension's voice in the business model is essential to the process.

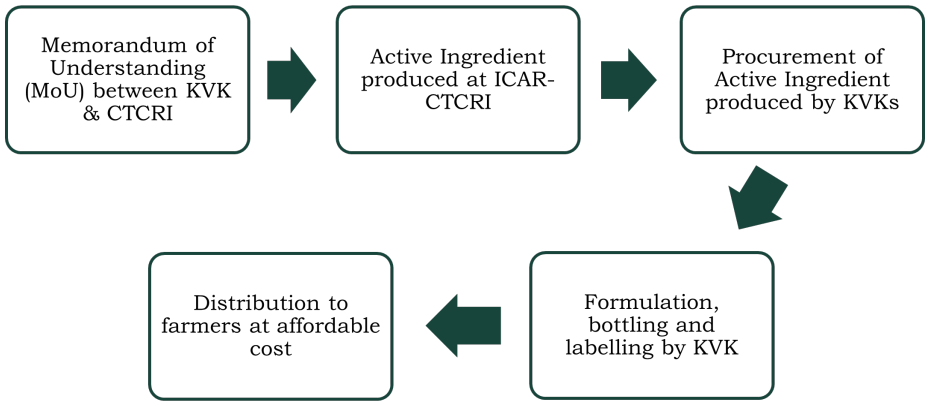
ICAR–Central Tuber Crops Research Institute

The Indian Council of Agricultural Research (ICAR) Central Tuber Crops Research Institute (CTCRI) (or ICAR–CTCRI) has adopted different institutional arrangements for the commercialization of technology in agriculture. The models are being implemented by the Intellectual Property and Technology Management Unit of CTCRI. The unit's committee, the Intellectual Property and Technology Management Committee, is responsible for making decisions related to intellectual property management as well as transfer and commercialization of technology. The first model adopted by the CTCRI addresses the challenge of developing cost-effective production and distribution networks of technology. Under the initiatives, Krishi Vigyan Kendra (KVK), an extension agency operating at the district level, is being used for manufacturing and distributing bio-inputs to farmers. Research and training are the responsibility of ICAR–CTCRI, while its multiplication and distribution at affordable prices is the responsibility of KVK (see Figure 19-1).

Some of the basic conditions for the association between ICAR–CTCRI (responsible for research and product development) and KVK (responsible for production and distribution) are:

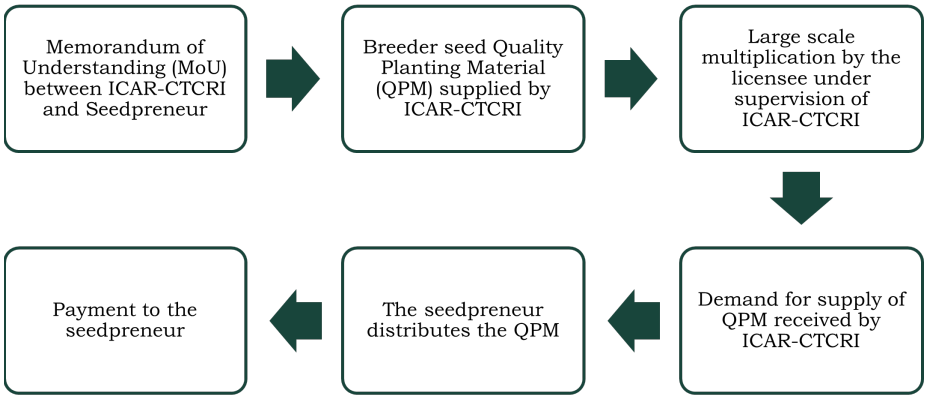
- License fee: Rs 25000 (USD $354)
- Period: five years
- Technology know-how: formulation of active ingredient

Figure 19-1. Taking biopesticides to farmers through KVK's contract manufacturing system.



Another model involves developing entrepreneurs for multiplication and distribution of the already developed and tested technology by the research institute. Most of the time, the research institutes are set up with a focus primarily on research and have a weak link for commercialization of technology. ICAR–CTCRI has successfully experimented with this model for developing a *seedpreneur* for multiplication and distribution of quality planting material developed by the research institute (see Figure 19-2).

Figure 19-2. Creating sustainable seedpreneurship for production and distribution of quality planting material through Public Private Partnership (PPP) Mode.



The terms and conditions laid down for such association are defined as under:

- License fee: Rs 25000 (USD $354)
- Period: three years
- Supply of seed materials by ICAR–CTCRI at current prices
- Field supervision arranged by seedpreneur (Based on Seed Certification Standards)
- Royalty: 1%

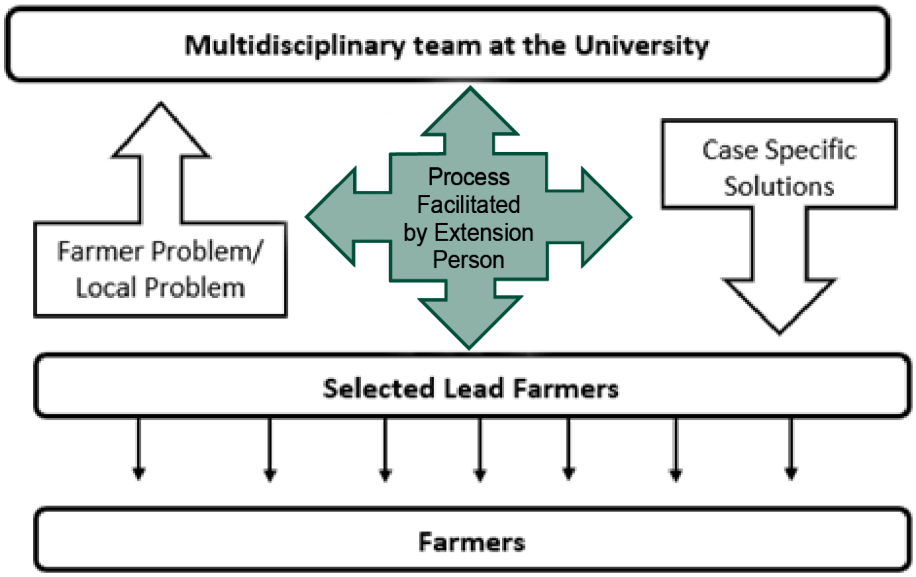
Technology Incubation Centre (TIC) is another model adopted by CTCRI with a focus on providing training and infrastructure support. The TIC provides equipment for rent for the development and testing of technologies and products before their commercialization. Village Incubation Centre, another model, offers solutions with locally available resources. The Village Incubation Centre provides local need-based training to help participants develop solutions for their local problems and optimally use the available

resources. The Multi-Institutional Collaborative Village Incubation Centre created at Riha, Manipur, India, in 2015 has 150 users from two villages, generating a revenue of Rs 25000 per year (at an average) since its inception. This center is managed by KVK, Ukhrul, Manipur. However, there was a need for scaling up with strong market linkages to make technologies profitable. The multi-level engagement with stakeholders has improved technology development and its transfer process. Such models are suitable to meet demands before a full business model is worked out.

Scientist-Farmer-Interface Programme

Kerala Agricultural University has experimented with the Scientist-Farmer-Interface Programme. The program, facilitated by the extension workers, helps in establishing an interface between scientists and selected prominent farmers to work out solutions for local problems. Under the program, the university organizes discussions to offer case-to-case solutions. There are prominent lead farmers selected from different Gram Panchayats (a village level body) under the program. These selected farmers use the platform developed for sharing information under the Scientist-Farmer-Interface for bringing their problems as well as the local problems for discussion. The multi-disciplinary team of scientists will discuss the problems shared by the lead farmers and suggest case-specific solutions. The solution emerging from the discussion is taken by these prominent lead farmers to the rest of the farmers in the locality. The model is depicted in Figure 19-3. The emphasis is on the need for using rural institutions for planning and implementation of development projects at the grassroots level. There is also a need to map the skill requirements of extension professionals in the context of grassroots-level planning and making appropriate arrangements for their training and certification.

Figure 19-3. Depiction of the Scientist-Farmer-Interface Programme.



Need for Research-Extension-Farmer Linkages

It is important to establish sound research-extension-farmer linkages in a country like India with immense potential for improvement in both quality and quantity of agricultural produce. Many farmers have not been properly reached by agricultural extension services, and the problem of poor-quality food production has been attributed to the weak linkages existing between research, extension, and farmers. Though in terms of quantity, food grains production is increasing, farmers lack in quality consciousness. Though high-yielding varieties of crops are being cultivated in India, farmers and other related stakeholders follow poor hygiene practices. This hampers the crop export potential in the international market. Further, the other limitation is the dominance of small, subsistence, and resource-poor farmers whose farm production is below the production output achieved in experimental stations and farm trials. This is due to low levels of education, inefficient farming practices, and insufficient linkages to technologies between research and production. The weak market linkages of farmers have contributed negatively to the development of demand-driven technology that could be adopted easily to actual farm situations.

In general, the agricultural research and extension system is characterized by a large number of actors in a fragmented and underdeveloped innovation system, resulting in low national and regional innovation capacities. Farmers are generally viewed as passive recipients of technology. As a result, research outputs do not reach farmers and remain shelved in research centers. Instead, research and extension need to take place within interlinked, overlapping, and interactive processes. This led to the evolution of concepts such as research-extension-farmers linkages and Market-Linked Extension in the country. Some important recommendations follow:

- The participatory technology generation approach should be used to enhance the participation of farmers in research. Feedback of the farmers regarding the new technology during the testing stage at research stations, KVKs, or at the sites where trials have been conducted should be taken in different districts.
- Participatory conduct, monitoring, and evaluation should be made mandatory for Adaptive Research Trials and extension programs to avoid wasting resources and manpower.
- A research-extension-farmer interface should be organized at block level by the KVKs twice a year with adequate representation of all sections of the farmers including small and marginal, medium, and large.
- More concentrated efforts are required in the adopted villages of the KVKs so that they become model villages. All the technologies recommended by State Agricultural Universities (SAUs), Department of Agriculture, and others should be displayed in those villages. An exposure visit of the farmers from other parts of the district should then be organized to inspire them to follow the same.
- Focus of the organizations like SAUs and the State Department of Agriculture should be shifted from production to marketing, post-harvest management, value addition, and farm-level processing. There is a pressing need to professionalize the Department of Agricultural Marketing in each state.
- Farmers should be facilitated through KVKs in gaining computer literacy and use of information and communication technology tools.

Conclusion

Globally, the governments are trying to create a conducive environment by encouraging linkages of agriculture with commercial principles, creating sufficient infrastructure to support processing and post-harvest management, and developing partnership between various players and agencies all along the value chains as per their capabilities and strengths. However, institutional innovations will play an important role in the identification and validation of technology with the potential to provide localized solutions and to take the same to end users. However, it is challenging to have an arrangement with the ability to influence the entire process of development and distribution of potential technology. The various models discussed in the previous sectors also have their own area of focus.

The MSU Product Center and models like Business Incubators and Accelerators have their focus on innovator and innovation. The strength of innovation-based models such as the MSU Product Center lies in having backward and forward linkages with appropriate institutes. The ground-level linkages established under the models in the form of innovation counselor and extension educator help in identifying the innovator and innovations, and integrate the same with the rest of the process covering development, validation, multiplication, and distribution of innovations. Although the responsibility of taking the technology to the end user lies primarily with the innovator, there are provisions to provide linkages with retailers and distributors. This helps in making the innovations available to the masses, and entrepreneurs are also able to make profits for their innovation and efforts.

In contrast, institutional arrangements made by ICAR–CTCRI focus mainly on taking the technology to the end users in partnership with an agency having ground-level-presence. The model adopted by CTCRI is about identifying the appropriate partner and sharing technology for multiplication and distribution. The model allows CTCRI to focus on its strength (research) and outsource the component of production and distribution. Under this arrangement, two agencies with their interests and strengths are coming together to efficiently deliver the technology to the end users (see Table 19-2).

Innovator-based models focus mainly on the development of innovations, while multiplication and distribution are a relatively weak link. ICAR models focus on multiplication and distribution of already developed technology to the end users. Institutional arrangements can also help farmers collaborate and learn from each other as suggested by the Scientist-Farmer-Interface of Kerala Agricultural University, which uses farmers to take the solutions to other farmers.

Recommendations

Institutional arrangements are important in identifying and developing innovations and taking developed technology or services to the end user as a solution. Some of the recommendations based on the learnings from models discussed in the previous section follow:

- Innovators need continuous handholding through the various stages of the business cycle to help them develop ideas into sustainable businesses.

Linkages with extension personnel working in the field like the innovation counselors in the case of the MSU Product Center along with forward linkages with knowledge centers may help an institute to offer an end-to-end solution to the innovators.

- Innovators will need different sets of skills at different levels of business development. The support institute needs to have a mechanism to provide appropriate training-based solutions to the innovators as required by them at different stages of business development.
- There is a need for different kinds of models for developing ideas coming from a wide range of innovators with potential to offer solutions to different target groups.
- The Extension system is required to be roped in effectively in both kind of models. In innovation-based models, extension personnel available in the field may help in identifying innovations with the potential to offer solutions to local issues. The extension system will equally be useful and effective in taking the already developed technology through multiplication and distribution.

Table 19-2. A component-wise analysis of different institutional models.

Component	MSU Product Center	Business Incubator & Accelerator	ICAR KVK	ICAR Entrepreneur
Focus	Innovator	Innovator	Technology distribution	Technology distribution
Process will revolve around	Technology, product or service development and its testing	Technology, product or service development and its testing	Identification of extension agency (KVK) and sharing technology for production and distribution	Identification of entrepreneur and sharing technology for production and distribution
Tools for achieving desired results	Training Product development Testing and validation	Identification Validation Multiplication	Agency identification MoU Multiplication and distribution	Entrepreneur identification MoU Multiplication and distribution
Structure	Three tier	Multi-agency	Partnership for endpoint access	Partnership for endpoint access
Infrastructure	Provide	Link to source	Technology only	Technology only
Ground-level link	Certified counselor	Extension educator	None	None

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CHAPTER 20

Professional Development for Extension Staff

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Introduction

Training and onboarding programs must strategically align with best practices in adult learning and be regularly monitored and assessed. Extension is an educational organization that offers educational programming to adults in communities. Therefore, Extension must commit to offering excellent training to their own employees if those employees are expected to design and deliver high-quality educational programs within communities they serve.

A strong onboarding experience leads to higher job satisfaction and organizational commitment, lower turnover, higher performance levels, career effectiveness, and less stress on new employees (Bauer, 2011). Excellent training contributes to productive, thriving employees. Thriving employees are happier in their work, more committed to their organization, and higher performers. Research investigating factors that contribute to individual and organizational excellence has found employees who thrived were characterized by two components: (1) a sense of vitality and (2) constant learning (Spreitzer & Porath, 2012). While training needs to span all employees at all career stages, extension organizations need to pay special attention to onboarding new staff, since this sets the tone for employee satisfaction and workplace culture.

Onboarding Overview

Onboarding is not a single event. It is a strategic plan of varied activities that are meant to integrate new hires into the organization, with the goal of providing them with the skills, knowledge, and cultural understanding needed to productively fulfill their job responsibilities. This can include traditional training, self-study and self-access materials, group orientations, mentoring programs, and even job aids and documents relating to policy and procedures.

The Four C's model of onboarding (Bauer, 2011) is a useful framework for creating robust onboarding and support systems, and one which Michigan State University (MSU) Extension has used to guide a comprehensive onboarding structure. The four components include Compliance, Clarification, Culture, and Connection.

Compliance focuses on institutional policy, rules, and regulations. This dimension is common in even the most basic of employee onboarding models, appearing in employee handbooks and other written policy. While compliance may appear to be black or white, new employees need help in contextualizing policy and rules; onboarding should not stop at simply asking an employee to read an organizational handbook. An example of how MSU Extension has done this would be using learning scenarios to illustrate what choices one should make when traveling or expense reporting to abide by travel policy and rules. The use of scenarios in adult learning capitalizes on the problem-solving orientation of adults, which is a key tenant in *andragogy* (Knowles et al., 2010), or adult learning theory.

The second component, **Clarification**, focuses on the understanding of one's role, responsibilities, and expectations. A 2014 study by Bamboo HR revealed that one in six new hires leave in the first three months, and of these, 23 reported that "receiving clear guidelines to what my responsibilities were" (Maurer, 2015, First Impressions Matter section) would have increased the likelihood of staying. Clarification requires messaging tailored for each position by supervisors, as it may differ from position to position. This need to personalize the content is extremely relevant at MSU Extension; educators specialize in specific content areas and serve defined geographic regions as small as a county and as broad as statewide. Thus, their work realities vary hugely despite a shared title. This requires training supervisors on the topic. Employee managers and leaders must realize the importance of clearly setting expectations and defining roles, and regularly circle back to these discussions as priorities and responsibilities evolve over time.

Culture focuses on understanding formal and informal organizational norms. The formal aspect of this dimension includes understanding an organization's mission, goals, values, and history. These elements are often well-documented, and thus easier to include. Equally important within this dimension, though, would be informal and undocumented aspects of organizational culture and expectations, which can vary from unit to unit. This may address norms for scheduling meetings, expectations regarding responsiveness to emails, preferred modes of communication, and the preferred way to get things done in accordance to common but undocumented ways of working. Due to their fluidity, such informal aspects are best achieved through building relationships and peer support. Mentoring programs effectively address this dimension.

The dimension of **Connection** focuses on relationships to help new staff adapt and flourish. Employees lacking engagement, whether they are high or low performers, quit more often; and performance does not predict engagement (Wigert, 2018). Forming connections gives new employees access to valuable insider perspective on informal work culture and contributes to a sense of belonging and engagement. This can be achieved by inclusion on projects and meetings, mentoring, and team-building events.

Michigan State University Extension Onboarding

All new staff, from secretaries to educators to district directors, engage in an onboarding process that is led by the learning and talent development specialist and the human resources team.

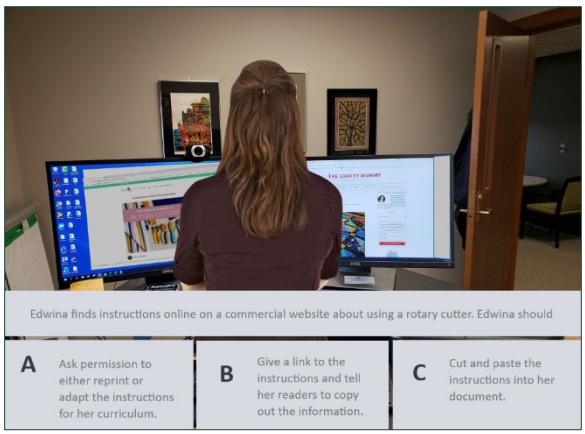
Onboarding begins as soon as the new employee signs the offer letter. Supervisors receive a new hire checklist of tasks to complete to ensure the employee has the information and resources required to start the new job. This reduces anxiety of new staff, sets the tone for a warm welcome, and provides opportunities for new staff to make connections and begin to gain knowledge in the area of compliance. Supervisors receive a modifiable agenda template for their first expectations-setting meeting with the new staff as well as a modifiable training plan that includes required and optional training activities for their first year. These supervisor tools ensure that all new employees are clear about their roles, responsibilities, and expectations.

New staff complete two self-paced online onboarding courses. The first course addresses formal organizational culture such as the history, mission, and structure. It also introduces an array of resources with links so new staff can dive back into topics and learn more when ready. The second course contains a collection of modules on topics that are relevant across job positions, such as civil rights expectations and administrative skills of expense reporting and time management.

The online, self-paced, asynchronous format of these courses aligns well to both the logistical needs of Extension employees, who are geographically spread across Michigan, and to best practices in adult learning. Adult learners need to feel self-directed and be seen by others as such. They want to take responsibility for their own learning and feel like it is a choice (Knowles et al., 2010). The self-paced format of these courses allows for this and provides learners with readily accessible documentation on various areas that they can easily circle back to for review or reference.

Online learning modules make use of Extension-specific scenarios (see Figure 20-1). Adults typically become ready to learn when they experience a need to cope with a real-life situation or perform a task (Knowles et al., 2010). These scenarios help learners to contextualize theoretical information into their own professional world of Extension, and can easily be incorporated into both face-to-face and online learning modules, such as the excerpt from an online module shown in Figure 20-1. The grounding of the materials in Extension-specific scenarios also motivates learners, as the link between their reality and the content is obvious.

Figure 20-1. Example scenario from the MSU Extension online training course "Preparing to Submit Your Educational Project to an Editor."



The format and length of these onboarding course materials were informed by a 2017 needs analysis (n = 220) that revealed the preferred length of training to be 20 to 45 minutes. Thus, course material was chunked into thematic modules ranging in length from 20 to 30 minutes. Online course badges for individual modules and a certificate of completion for each course provides motivation and allows for accountability as certificates can be requested by supervisors to document completion of the materials.

Whereas these online resources focus on compliance, formal work culture, and the providing of connections to online and other resources, a face-to-face element is necessary to help new staff to build relationships and learn how their individual roles fit into the larger mission of the organization. To achieve that, a two-day, face-to-face orientation is required of all new employees. These orientations take place four times a year on the MSU campus and require overnight travel for most attendees.

The orientation focuses on understanding the organization, building relationships, and making connections. Attendees meet with members of leadership and key support staff and learn about the mission, vision, values, and history of the organization along with diverse types of programming provided. All employees attend the same orientation, from administrative support staff to educators to directors, so it does not cover the specifics of how to perform one's job. While the orientation does have elements stressing organizational identity, MSU Extension tries to balance this content with content that celebrates the new employees' strengths. The organization takes this approach because when onboarding focuses on individual identity instead of on organizational enculturation and identity, there is less turnover and higher levels of engagement and job satisfaction (Cable et al., 2013). Thus, MSU Extension incorporates activities that have participants identify their strengths and passions at work and recognize how their unique skillset can contribute to the success of the unit. Staff attend a session on diversity training, and the message that diversity results in strength is reinforced.

Mentoring

Mentoring helps the new employee strategize in work-life balance, manage stress, understand organizational values, and identify as an important part of the organization (Payne & Huffman, 2005). Having a mentor helps employees form supportive relationships and keeps employees from feeling that their work lacks meaning (Bailey & Madden, 2016). In the context of Extension, mentoring can result in increased job satisfaction (Bowen et al., 1994) and result in improved program planning and implementation (Kutilek & Earnest, 2001). At MSU Extension, each institute has a mentor coordinator who makes and monitors mentoring matches. Mentors are selected from employees who are positive, well-connected, experienced, and willing and able to invest an appropriate amount of time. Mentoring is a choice, not a requirement. Both mentors and mentees complete information forms so that appropriate matches can be made based on shared areas of interest, preferred communication modes, geographic location, and personality. The learning and talent development specialist oversees the program. She works with the coordinators, maintains a mentoring handbook, and provides training and guidance for new mentors. Surveys to both mentors and mentees at 2, 6, and 12 months into the mentoring relationship serve to keep coordinators informed on the progress of the mentorship. Survey responses reveal when a relationship may not be working, if additional support or resources are needed, and what perceived benefits are resulting from the relationship.

Frameworks for Professional Development: Core Competencies & the T-Shaped Professional

In Extension contexts, the term *competency* has been broadly defined to include "the application of knowledge, technical skills and personal characteristics leading to outstanding performance" (Boltes & Bieber, 1997, p. 35), or the "knowledge, skills of abilities required of a job" (Cooper & Graham, 2001, p. 39). Given the broadness of these definitions, one can imagine the difficulty of using competencies as a framework for professional development that spans positions. Thus, MSU Extension has focused on core competencies, which is defined more specifically to be broad and inclusive skills, which span positions and provide a scaffolding for how employees can succeed at work. Core competencies are not position specific. "They relate to our organizational values and create a link between what we believe and how we behave" (Baker, n.d.).

At MSU Extension, our core competencies span disciplines and positions to provide a structure for goal-setting, professional development, and performance management. These competences, revised in 2019, are listed in Table 20-1.

Table 20-1. MSU Extension Core Competencies.

Competency	Description
Physical and fiscal resources	Mindful of individual and shared workspaces and resources. Exhibits good stewardship of physical and financial resources (e.g., storage, supplies, budgets, financial records, and reporting).
Teamwork and leadership	Thoughtfully engages in working with others throughout the organization to plan and accomplish the organizational mission and promote shared values. Positively influences groups and individuals. Establishes and supports teams such as advisory boards, committees, councils, etc. (e.g., coaching, mentoring, creating a vision, implementing action plans).
Partnerships and collaborations	Is aware of issues and variables vital to the community being served, and understands how these variables impact program prioritization, planning, and delivery. Continuously seeks opportunities and builds strategic partnerships to leverage and build support for programming to reach organizational goals and serve communities according to their needs (e.g., communicates with media, communicates Extension's value to partners, awareness of community).
Program development, evaluation, and reporting	Supports the development and delivery of programs including the collection of appropriate data to measure impacts. Understands the need to communicate programming outcomes to stakeholders and continuously improve programming content and marketing through evaluation (e.g., needs assessment, marketing, program evaluation).
Educational delivery and technology adoption	Delivers content in formal and informal educational contexts using appropriate strategies and methods based on the target audience. Stays current with innovations in educational technology and adopts these technologies as appropriate, using modern theories in teaching and learning (e.g., being an early adopter or tester of innovative tools).
Diversity, equity, and inclusion	Leads and supports efforts to advance a diverse, equitable, and inclusive community and workplace consistent with Extension's core values. Builds awareness (of self and others across differences) and prioritizes diverse relationships, networks, and collaborations to build and include all Michigan's population across program planning, delivery, and evaluation. Open to understanding historical and current barriers that impact constituents and colleagues lives at the personal, interpersonal, institutional, and cultural levels. Consistently upholds the highest standards of equity and inclusion in programs.
Interpersonal and organizational professionalism	Displays positive interpersonal skills and has self-awareness in being accountable, responsible. Recognizes areas for self-improvement and pursues professional development for continuous learning. Aligns actions to the mission and goals of Extension (e.g., professional in communications, follows through on initiatives and meets deadlines, puts thought into appropriate professional development, makes an effort to keep skills updated).

Having a shared set of understandings and skills spanning disciplines and positions enables staff from various programmatic areas or disciplines to function well as teammates and colleagues. It cannot be denied, however, that each position also demands job-specific skills and knowledge beyond these competencies. These content-based skills and knowledge are also sometimes referred to as "technical" competencies. Thus, we have wed the concept of core and technical competencies with the T-shaped model of professional development.

The T-shaped model of professional development encompasses both core competencies that span disciplines and disciplinary-specific skills and competencies.

> The T-professional, often illustrated as a large block T, integrates depth, defined in terms of disciplinary knowledge and the ability to understand how individuals with that knowledge function and interact to accomplish a desired outcome within or across a system(s), and breadth, defined as the professional abilities that allow someone with profound disciplinary knowledge to interact meaningfully with others who possess different disciplinary knowledge in order to affect an outcome that might not otherwise be possible. (Gardner & Estry, 2017, p. 1)

This concept of a T-shaped professional model emerged from industry in the 1990s as a way to conceptualize the type of talent companies were looking for in their employees. MSU recognized the value of the model as a useful framework to articulate a planned way of graduating students trained in the liberal arts who would possess both the expertise in their own discipline and the skills needed to work across disciplines. From there, the university also adopted the model to frame university employees' professional development.

The core competencies that cut across multiple positions within an organization are crucial in developing employees who are able to work across disciplinary boundaries to contribute to projects and solutions, and see challenges and issues faced in different disciplines and systems. A review of essential competencies needed by extension professionals by Argabright et al. (2019) shows that the competencies most frequently deemed as crucial in extension have historically been "program development and evaluation, research expertise, and a fundamental knowledge of Extension." However, they argue, we must go beyond these traditional topics in developing Extension professionals to face increasingly complex challenges. Skills needed to face these challenges include many "soft" skills such as effective teamwork and relationship building, which allow individuals with various talents to come together and form diverse teams capable of solving these problems. In addition, Extension needs to develop leaders who excel in communication and other soft skills so that new talent is retained and supported (Seger & Hill, 2016). This is not a new idea; a 2010 Delphi panel of national experts in Extension resulted in two main groupings of competencies, one relating to the program development process and the larger grouping composed of core interpersonal skills (Harder et al., 2010) that could all fit onto the "top" of the T (see Figure 20-2) and easily apply to professionals in many disciplines.

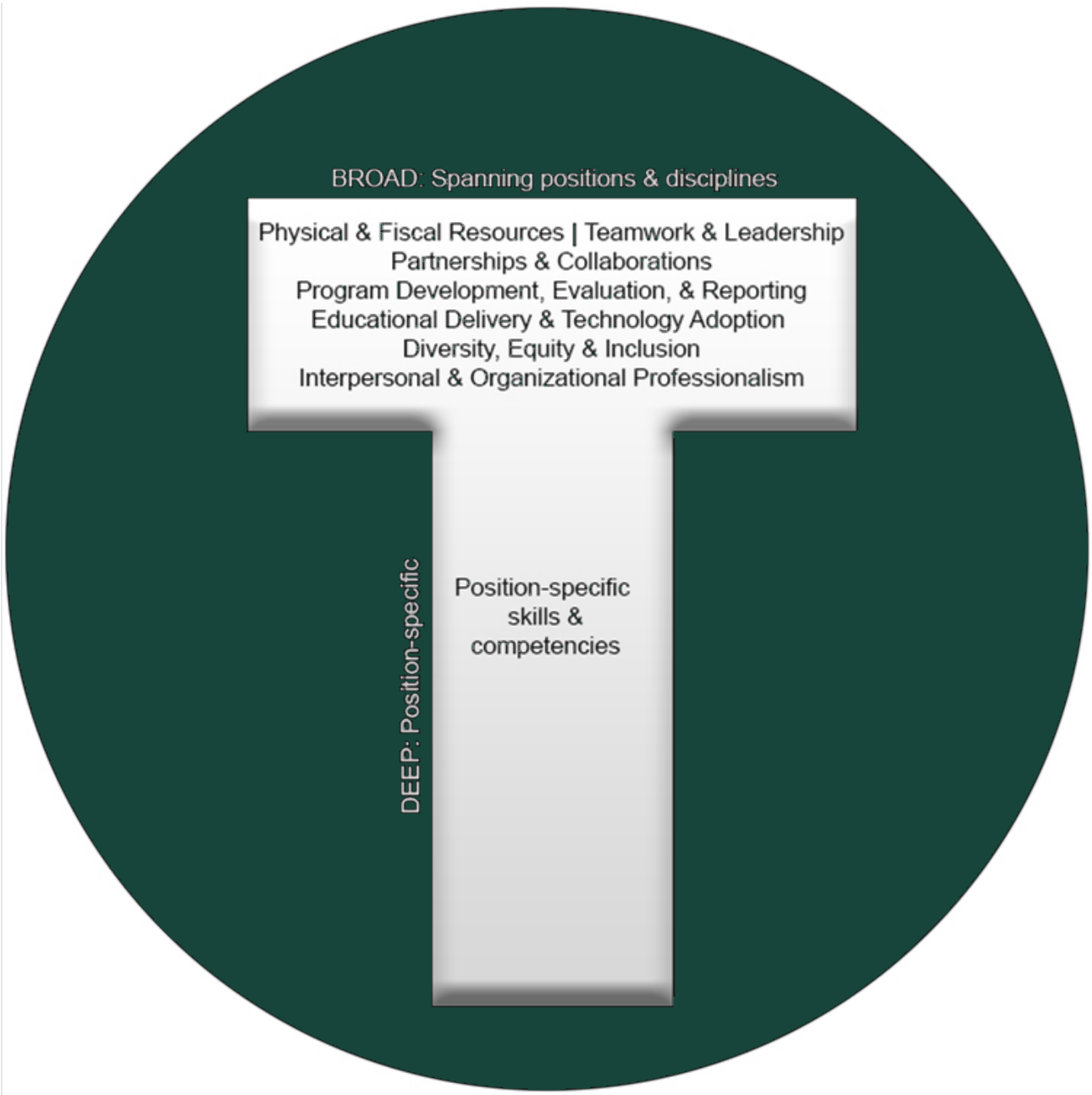
The seven MSU Extension core competencies focus on the top bar of the "T" in the T-shaped professional model (see Figure 20-2). Some of these

competencies reflect the nature of our organization; we exist to serve communities through evidence-informed educational programming. For this reason, the following competencies are included in the top bar of the T:

- Partnerships and Collaborations
- Program Development, Evaluation, and Reporting
- Educational Delivery and Technology Adoption

For example, not all positions at MSU Extension directly develop programs. Yet all extension employees must have a broad understanding of what happens in program development, evaluation, and reporting, as it is the crux of what we do.

Figure 20-2. T-shaped learning model used to frame core competency and position-specific competencies for MSU Extension employees.



If we wish our employees to take their responsibilities to educate and inform communities through evidence-based programming seriously, we must be deliberate in our approach to onboarding, training, and development. Aligning your training delivery to best practices and developing a framework for determining content are the first steps in this process.

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INNOVATIONS IN AGRICULTURAL EXTENSION

In February 2019, a group of extension programming staff, specialists, and directors as well as leaders in the field of agriculture collaborated at the International Conference on Agricultural Extension: Innovation to Impact, jointly organized by the National Institute of Agricultural Extension Management (MANAGE), and Michigan State University (MSU) Extension, East Lansing, Michigan, U.S.A, at MANAGE, Hyderabad, India. This book, *Innovations in Agricultural Extension*, was imagined at the conference. Authors from Kyrgyzstan, Tajikistan, India, Mozambique, Nepal, Nigeria, and the United States of America contributed to the book, eventually co-published in 2021 by MANAGE and MSU Extension. Its 20 chapters cover a wide range of topics such as an overview of agricultural extension, community outreach and advisory services, case studies of agricultural programs and initiatives, community and government engagement, information and communication technology, agritourism, entrepreneurship, and professional development, among others. This book showcases best practices in extension with the goal that extension professionals are inspired by and learn from programming examples across the globe.

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