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Approaches of Integrated Watershed Management Project: Experiences of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)

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ABSTRACT *The process of innovation-development to scaling is varied and complex. Various actors are involved in every stage of the process. In scaling the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)-led integrated watershed management projects in India and South Asia, three drivers were identified—islanding approach, multi-layered partnership, and innovative means of knowledge sharing. Through a consortium mode of partnership, ICRISAT established 'islands' or models for showcasing soil and water conservation interventions and integrated these with other concerns of the farming system (crops and livestock) and socio-economic dimension (capacity building). Activities on the islands were planned and implemented by the locals and replicated in satellite watersheds. Partnerships forged through the consortium approach provided a dearth of resources such as social capital. Projects built on trust and good relationships can be sustained even when direct financial support ceases. Innovative means of knowledge sharing like the Virtual Academy for the Semi-Arid Tropics (VASAT)—ICRISAT's innovation in capacity building and information management—provided the link between rural farm households and researchers. Credible intermediaries and markets were linked to farmers by information communication technology channels and markets through an interface of information and open/distance learning methods. VASAT's multi-dimensional strategy has been an important resource for a south–south partnership.*

KEY WORDS: Scaling, Innovation, Integrated watershed management, Public–private partnership, Islanding approach, Knowledge sharing

Introduction

The process of scaling (up and out) of innovations, which denotes promotion and development of projects with an emphasis on capacity building, is a challenging task. The complex nature of an innovation demands innovative means of promotion to achieve significant impacts, which in turn means a change in perception, attitude, and practice.

Agri-related technological innovations find their generation and refinements on-station. Researchers conduct small-scale trials. Successes are extrapolated and

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passed on to intermediaries for wider adoption. Invaluable insights derived from this scheme are: that research and extension (R&E) do not happen in a linear fashion; that it is not compartmentalized; that promotion/adoption should be integrated right at the stage of technology generation, and most importantly, that farmers are not passive adopters and unintelligent (Röling and van de Fliert, 2000), irrational or mis-managers (Pretty, 2000). Hence, this led to the conduct of research in farmers' fields where pilot testing is done. Farmers actively participate by providing some of the needed resources, and more importantly, by performing tasks traditionally done by the researcher or extension worker. The partnerships that ensue between the R&E practitioners and the farmers build upon the tenets of 'seeing is believing.' The promotion and appreciation of the technologies through adaptation with respect to the socio-economic resources of the users are facilitated. Both on-station and on-farm lay the foundation for systems thinking where R&E is viewed from a holistic perspective. With this, comes the revolution in conceptualizing research, development, and extension (RDE) that shapes much of the scaling of innovations (Figure 1).

In the latter part of the 1990s, the need for an integrated approach and a focus on the protection, conservation, and enhancement of natural resources was recognized. Integrated Natural Resource Management (INRM) is regarded in the Consultative Group on International Agricultural Research (CGIAR) as the second pillar of Integrated Genetic and Natural Resource Management (IGNRM) in the efforts to support agricultural productivity. The integrated watershed management (IWM) project is the means to make this happen, and could be the focal point where new technology and innovations developed by International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and other programs are converged, tested and demonstrated on a field scale (Shambu Prasad et al., 2006). Specifically, the hydrology of the watershed becomes the starting point for integrating interventions

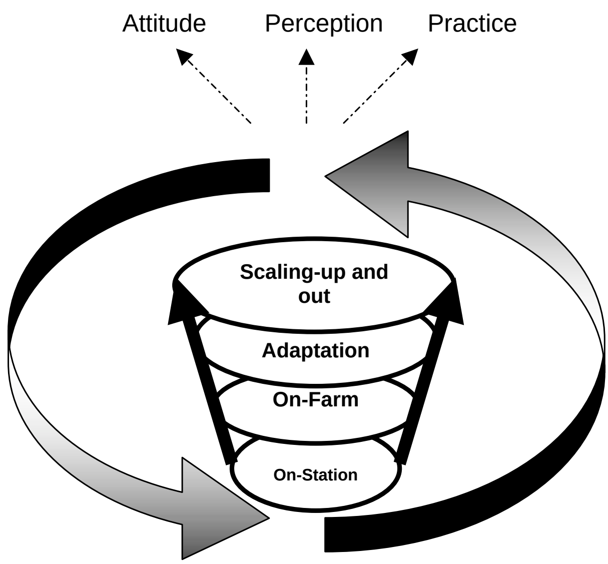

Figure 1. Process of scaling-up and out

in crops, livestock, and collective actions as well as various forms of stakeholders' participation. Since ICRISAT's inception in 1972, the focus of its on-station research was already at the watershed level where soil and water conservation technologies were developed taking into account soil health, cropping systems, livestock, etc. Research reports show the novelty of IWM as an approach to improve and sustain agricultural productivity in the semi-arid tropics (SAT). A case in point are the low-cost physical structures and equipment (i.e. broad bed furrows, contour bunds) and equipment(i.e. tropicultor) that are easy to manage, and which reduced soil loss by about 60–75%, rainwater loss by about 50–60%, and increase water recharge by about 40%. Most importantly, grain productivity per hectare went up to four tons from one to two tons per hectare. A review of the research reports of the Agroecosystems group and interviews with scientists, consortium members, farmers and other stakeholders involved in the ICRISAT-led watershed projects in India, Thailand and Vietnam provided the inputs for this paper.

ICRISAT's remarkable achievements are the results of an evolving approach to a problem situation. Starting its initiatives from a very specific focus (nutrient deficiency), the watershed evolved as a venue for holistic thinking. Watershed became the entry point for understanding the other elements of the farming system, which led to the improvement of rural livelihoods. Convergence of disciplines and institutions and meaningful participation of stakeholders was achieved, and the integrated mode of management in watersheds provided the venue for changing (perspective and practice), learning (new skills, technologies and approaches), and scaling (up and out through capacity development).

Drivers for Scaling

Promotion and adaptation of viable technologies do not happen without some form of drivers. The initiatives for watersheds in India and South Asia hinge on a system's perspective for doing RDE, where multi-layered partnerships, 'islanding approach', and innovative means of knowledge sharing contributed to widespread scaling.

'Islanding' Approach

The establishment of benchmark watersheds at regional levels facilitated scaling. Benchmark sites are strategically established in the different districts to serve as 'islands' or models for showcasing the different biophysical and later the social interventions. The minimum requirement of the benchmark is that through improved soil, water and nutrient management methods the medium–high water holding capacity soils can enhance and sustain their productivity. Specifically, the target ecoregion should have: an assured rainfall of approximately 800–900 mm annually, water-holding soils with a capacity of 150–200 mm available in the soil profile, and a growing period varying from 120 to 240 days (*ICRISAT Annual Reports 1998–2004*). By itself, the benchmark package has gained its appeal in India and South Asia because these areas have ecoregions of this nature and share similar problem situations.

In 1999, ICRISAT in partnership with other institutions of India launched the first IWM projects in five benchmark areas; namely Adarsha, Lalatora, Goverdhanpura, Kailaspura and Semli. The 'island–satellite' process of diffusion led to the establishment of watersheds in Vietnam, Thailand and China. In India, ICRISAT was able to craft more public–private partnerships, which led to an increased number of watershed sites (Table 1). At the time of writing, the ICRISAT-led consortium had supported 368 watersheds in India, demonstrating the highly important multiplier effect.

Through IWM, ICRISAT dispelled the fears of poor farmers about erratic rainfall and a gamut of other agricultural problems. The IWM approach uses the biophysical characterization of the watersheds as a springboard for other interventions. In India, this initial step revealed that the following: soils have poor drainage, are nutrient deficient, and have poor water management. The inferior productivity is exacerbated by lack of employment opportunities, inadequate agri-support services, and increasing population.

With this, ICRISAT provided a package of intervention that abated the constraints of the biophysical situation while at the same time attended to socio-economic issues. New science tools and methods have contributed to predicting the performance of technologies under different climatic conditions. Building social capital through skill build-up was simultaneously done, which enhanced appreciation of initiatives, roles, commitment, and scaling. Improved productivity and income, the major milestones in benchmarking, are achieved because of the following technologies and support:

New Science Tools and Methods

- Improved soil and water conservation structures (percolation tanks, check dams, gully controls, contour bunds, etc.)
- Integrated pest management (IPM) and integrated nutrient management
- Crop diversification and intensification
- Improved cultivars

Capacity Building

- Improved access to inputs and other resources
- Infrastructures
- Effective institutions

A few of the specific interventions and their corresponding impacts under the two aforementioned categories are:

Increased Water Availability, Reduced Run-off and Soil Loss

- Watershed interventions implemented in India increased groundwater availability by 7.3 m in Lalatora, Madhya Pradesh; 5.7 m in Bundi, Rajasthan; 4.2 m in Kothapally, Andhra Pradesh with increased irrigated area from 207 to 343 ha.
- Water harvesting structures resulted in an additional groundwater recharge per year of approximately 427,800 m^3 in Thanh Ha Watershed, North Vietnam.

Table 1. Time line of watershed projects in India, South Asia, and Southeast Asia

Year	Benchmark	No. of satellites	Partners
1976	ICRISAT's initial works on integrated watershed management Approach: On-station Focus: Example: Soil and water conservation to address nutrient deficiency		
1999–2000	Ranga Reddy District, Andhra Pradesh, India		
	Adarsha Watershed	1	Central Research Institute for Dryland Agriculture (CRIDA) MV Foundation
	Vidisha District, Madhya Pradesh, India		
	Lalatora Watershed	1	Bharatiya Agro-Industries Foundation (BAIF)
	Bundi District, Rajasthan, India		
	Goverdhanpura Watershed	1	BAIF
	Guna District, Madhya Pradesh, India		
	Kailaspura Watershed		BAIF
	Dewas District, Madhya Pradesh, India		
	Semli Watershed		Samaj Pragati Sahayog
Late 2000	Kim Boi District, Hoa Binh Province, Hanoi, Vietnam		
	Thanh Ha Watershed	1	Vietnam Agricultural Science Institute (VASI)
		(Established Huoang Dao Watershed in 2003)	
	Khon Kaen Province, Thailand		
	Tad Fa Watershed	1 (Established Wang Chai Watershed in 2003)	Department of Agriculture-Office of the Agricultural Research and Development (OARD) Reg. 3 Department of Land Development (DLD)/ Khon Kaen University (KKU)
	Mahaboobngar, Nalgonda, Kurnool, Prakasam and Anantaphur Districts Andhra Pradesh, India		
	APRLP Watershed		Andhra Pradesh Rural Livelihood Program (APRLP), Government of Andhra Pradesh
	Guizhou Province and Yunnan Province, China		
2003	Lucheba Watershed		Guizhou Academy of Agricultural Sciences
	Xiaoxincun Watershed		Yunnan Academy of Agricultural Sciences
	Adilabad District, Andhra Pradesh, India		

Continued

Table 1 (*Continued*)

Year	Benchmark	No. of satellites	Partners
	Powerguda Watershed		Integrated Tribal Development Agency, Government of Andhra Pradesh
	Bulacan, Tarlac, Ilocos Sur and Bohol Provinces, Philippines		
2004–2005	Dona Remedios Trinidad Watershed		Bureau of Agricultural Research (BAR), Philippines Local Government Unit
	San Clemente Watershed		BAR Local Government Unit Tarlac State College of Agriculture
	Sta Maria Watershed		BAR Local Government Unit Ilocos Sur Polytechnic State College
	Sto Nino Watershed		BAR Local Government Unit
	Kola, Tumkur, Chitradurga, Charwad and Haveri Districts, Karnataka, India		
2005–2006	Sujala Watershed		Government of Karnataka
	Tirunelveli District, Tamil Nadu, India Tamil Nadu Watershed		

Collective pumping of well water and an efficient water distribution system enhanced farmers' incomes by four fold per hectare by growing watermelons, and reduced drudgery for women.

- Improved watershed technologies reduced seasonal run-off volume to less than half (194 mm/ha) and soil loss to less than 1/7th in Tad Fa Watershed, Thailand, as compared to the conventional system (473 mm run-off and soil loss 31.2 t/ha).
- Similar impacts on run-off, peak run-off rate, and soil loss were recorded at nucleus watersheds in India, China and Vietnam (Sreedevi et al., 2006; Wani et al., 2006a; Wani et al., 2006b).

Increased Productivity and Incomes

- Watershed interventions in 66 community watersheds in India increased crop yield by three to four times. In Rajasamadhiyala, Gujarat two downstream villages benefited by increases in crop productivity of 20–30% and income by 84% (from US$857 to US$1,578). In Kothapally, household agricultural incomes doubled in three years with total household income of US$795 in 2001 compared to US$622 in the untreated village. Droughts did not reduce share of agricultural income in watersheds. In the non-watershed village, the share reduced by one-half. Household average incomes in a tribal village, Powerguda, Andhra Pradesh increased by 77% in three years due to watershed interventions (US$618.22 versus US$348.44 per year).

- In Tad Fa and Wang Chai Watersheds in Thailand, farm incomes increased by 45% within three years.
- Lucheba Watershed in Guizhou, China, transformed its economy through crop–livestock integration with buckwheat as an alley crop that controlled soil erosion, provided fodder and increased per capita income from $200 to $325 in two years (Sreedevi, 2006; Sreedevi et al., 2006; Wani et al., 2004; Wani et al., 2006a; Wani et al., 2006b).

Increased Carbon Sequestration

- Increased carbon sequestration of 3.7 t/ha in 24 years under improved management with a pigeonpea-based system was observed in Vertisols at Patancheru, India. In Powerguda, a women's self-help group pioneered the sale of carbon credits (147 t CO_2–C) to the World Bank from their *Pongamia* plantations. Long-term simulation analysis showed that soybean–pigeonpea intercropping retained more organic carbon in the soil profile (about 4 t/ha) as compared to soybean–chickpea system.
- Improved management in Kothapally Watershed with pigeonpea-based system showed substantially higher C stocks in long-term simulation (10,000 t) than with farmers' management (Bhattacharya et al., 2006; Singh et al., 2007; Sreedevi, 2006; Srivastava, 2006; Wani et al., 2003a; Wani et al., 2003b).

Decreased Migration in India

- A case study of the Rajsamdhiyala Watershed, Gujarat revealed that increased employment opportunities through the introduction of watershed activities reduced migration of 8.2%, of which 64% were skilled people (Sreedevi et al., 2006).
- New agricultural technologies and community empowerment in Powerguda provided sufficient employment and income opportunities, which led to complete reduction in seasonal migration (D' Silva et al., 2004).
- Watershed interventions in Shekta, Ahmednagar district, Maharashtra reduced seasonal migration by 15% in skilled labors and 60% in non-skilled labors. The result of meta-analysis of watershed program in India revealed that about 175 and 132 person-days/ha/year of employment can be generated in low and high income regions, respectively (D' Silva et al., 2004; Joshi et al., 2005; Sreedevi et al., 2006).

Benchmark watersheds serve as platforms for the integration of proven and evolving interventions, negotiation between and among stakeholders, cooperative participation, and capacity building. ICRISAT-led IWM started with a few benchmark sites and satellites where simultaneous activities took place to influence others. In time, satellites were weaned to become islands. Some of the impacts mentioned earlier show that IWM can make a difference to resource-poor farm households.

In the different watersheds (islands or satellites), proven best bets are shared among the sites. ICRISAT successfully provided the avenue for sharing and learning through dynamic capacity building, which facilitated scaling. Taking the case of scaling the benefits of microdozing (boron, zinc, and sulfur application), the benchmark–satellite approach was used to disseminate and influence farmers. Rapport among farmers is facilitated through baseline soil characterization. Farmers from the benchmark watersheds along with the technical experts were involved in soil sampling, analysis, tabulation, and interpretation using the local language. In turn, farmers themselves used such knowledge in satellite watersheds. Other examples of innovations drawn from the different benchmarks and satellites and adopted by other IWM sites are:

- Vermicomposting from the Adarsha Watershed, India.
- In Guna district of India, vermicomposting became a major activity in the year 2004–2005 and 44 vermicompost pits were established.
- The environmental clubs trace their conceptualization from the Bundi Watershed, India, and rely on the experiences of other watersheds to organize self-help groups (SHGs) on village seed banks as part of Bundi's income generation.
- The use of *Glyricidia* as green manure and 'live fence' is a technology of India that has found a niche in Thanh Ha Watershed, Vietnam.

In the benchmarks, there is excellent exchange of learning and honing the potentials of research development. For instance, in the establishment of seed banks at the village level in Lalatora Watershed, Vidisha District, India, the SHG Laxmi initially started as a thrift group. Then, the group moved on to get into the seed business by starting with 300 kg of chickpea seeds and gradually increasing until the SHG was adept with enterprise operations. Likewise, it has considered the procurement of breeder's seeds, not only of chickpea, but also of soybean, sorghum and coriander.

The 'islanding' approach proves beneficial in promoting advocacy not only to farmers within the islands but also to satellites and neighboring villages. The strong links developed between the island and the satellites improved farmers' confidence and trust.

This paradigm was successfully applied in the Andhra Pradesh Rural Livelihoods Project (APRLP)–ICRISAT and Tata–Indian Council for Agricultural Research (ICAR) consortium projects.

A key feature of the scheme is the sense of ownership inculcated among the locals. The strong sense of inclusion in mainstreaming the development of their own communities, taking collective actions against their problems and constraints, and enjoining only a certain degree of guidance from 'outsiders' propelled the watershed projects to include other concerns. In India, literacy and SHG formation were regarded as added impacts directly linked with the IWM. In South Asia, IWM was a good case for consciousness-raising on the importance of an integrated approach to soil and water conservation under different agro-ecosystems.

Likewise, the capacity resource development in IWM takes a unique twist. A critical mass that includes representation from farmers, non-Government organizations (NGOs), agricultural officials and researchers undergoes training and in turn undertakes similar skill-building in satellite watersheds. This effectively accelerated

Box 1. Information flow on seed village concept

> In the seed village concept of the APRLP, training a critical mass of farmers and technical staff together initiated the formation of village seed banks. The training objective was to inculcate the importance of maintaining quality seeds. The strategy involved training two to three potential farmer leaders in each of the three 'islands' (benchmark sites: Kurnool, Nalgonda and Mahabubnagar) plus one or two representations from the project implementing agency, watershed development team, and the ICRISAT field staff. Four satellites of the three islands had two to three representatives. Farmer-leaders who participated in the training served as the key resource persons in succeeding trainings of the islands and satellites.
>
> In this scheme, about 15–20 farmers were trained at each site, covering a total of 200 farmers in over eight days. Likewise, ICRISAT made sure that women farmers are part of the training. This is one of the most significant impacts since women have taken on the responsibility of their village seed banks (i.e. SHG in Lalatora Watershed).
>
> Technical backstopping was from ICRISAT and the implementing agency during and after the trainings. The essentials of the seed system were successfully instilled among the farmers. Building the capacity of the locals with sufficient and effective means like hands-on training, minimum external support (technical knowledge), co-farmers as trainers, and participation of various interest groups like women were the impetus for scaling the seed village concept in India. Locals achieved self-reliance in producing their own quality seeds while generating some income.
>
> From this example, the importance of scaling to induce change in perception, attitude, and practice of individuals is seen. The utilitarian function of a technology is not sufficient to create change. Along with technology should be some deliberate efforts to create awareness, adaptation, and impact.

the adoption of very specific technologies like those in IPM (trainers' training) and seed village concept (Box 1).

Women's groups actively participated in income generating activities like vermicomposting, Nuclear Polyhedrosis Virus (NPV) production, seed production and storage, and nursery management (Box 2). Instilling the concept of environmental protection and conservation among the young is a 'best bet' for sustaining the products of current hard work in R&D.

Box 2. Mainstreaming women's contribution to sustainable development

The tenacity of women in householding and their propensity to meet challenges are remarkable.

- Laxmi is a woman leader who is actively involved in various activities like savings, vermicomposting, nursery management, and preparation of the mid-day meals of school children. On top of this, she is also a trainer, providing skills and insights on coping with life's difficulties, to neighboring villages. In the scaling process, Laxmi's case shows her social networks assuming the functions of disseminating information and generating advice to problems, giving access to tree saplings of *Pongamia*, *Jatropha,* and *Glyricidia*, and providing emotional support.
- Subhadrabai from Powerguda pioneered the biodiesel enterprise with *Pongamia*. With this, her group sold carbon credits to the World Bank and gained accolades worldwide.
- Sa-ngad Lhuangkham in Wang Chai Watershed, Thailand organized cooperative groups to make fish sauce, soap, shampoo, and fish feed.
- In Addakal mandal, India, 5000 women from 17 villages are federated. They operate a bank, run a training center and a knowledge hub. They are connected worldwide through information technology and facilitated empowerment of other women most especially of their immediate district.

Contrary to claims of non-access to resources like land in some societies (Diarra and Monimart, 2006), integrated watersheds have brought opportunities for women's inclusion in the production system. As seen from these cases, women have found niches for generating income and determining their own development. The cases prove that women in certain situations and relationships can yield power and possibilities for maneuvering to achieve better livelihoods (Vijfhuizen, 1998). It encourages creativity and innovations without jeopardizing social norms. Likewise, among resource-poor households, member(s), specifically women, try to engage in a combination of activities in the subsistence and market economies (Mula, 1999).

Multi-Layered Partnerships

Partnerships help realize the potentials of watershed projects in contributing to poverty reduction among resource-poor households. Different types of partnerships can be crafted depending on what works best. These are two important points emerging from the analysis of reports of ICRISAT-led watershed activities. The consortium mode of partnership is efficient and effective in managing and scaling the model watersheds. The complex issues in the watersheds, like declining productivity, are effectively addressed by the joint efforts of ICRISAT with the national agricultural research and extension system (NARES), international donors, state institutions and various interest groups like private entities, community-based organizations, farmers' group and NGOs (who at one point are critical about the work done by government organizations and line departments). NGOs point of view used to be that government departments are of no use to the community. In addition, the government line departments feel that most of the NGOs are good at criticizing yet are involved in shady financial deals. ICRISAT brought these two factions together to work for the benefit of the community. NGOs used to think that research organizations work in isolation and are not aware of the ground realities and the problems faced by the farmers. Similarly, researchers noted that most of the NGOs did not have technical support and consequently could not harness their social strength for the benefit of the community. ICRISAT's consortium approach has brought together all such actors for the benefit of the rural poor.

Participatory approach as a means and an end in IWM made significant impacts because of improved or new links. The positive evidences or outcomes of the ICRISAT and NARES partnership in the benchmark watersheds model in India paved the way for new partnerships and broadened project objectives (see Table 1).

Partnerships in India. In 2002, APRLP with funding support from the Department for International Development (DFID) geared its efforts toward livelihood development. A total of 50 watersheds (10 nucleus and 40 satellites) were established in three districts. That same year, ICRISAT forged a partnership with the Sir Dorabji Tata Trust, which opened avenues for private partnership. Public–private partnership was a new mode of interaction and experience for both ICRISAT and the Tata Trust (CRISP, n.d.). To date, the Tata Trust continuously provides support to ICRISAT on watershed initiatives.

There were others that followed such as:

- The Bundi Watershed, Rajasthan was established and implemented by the NGO, Bharatiya Agro-Industries Foundation (BAIF).
- The Guna and Dewas Watersheds, Madhya Pradesh, with Tata Trust funding, were implemented by BAIF. The primary objectives of these watersheds are to combat land degradation and enhance productivity.
- Another milestone in ICRISAT's watershed project is the positive outcome of an alliance initiated in 2003 with the community-based institution at Powerguda. With some complementary investments in their watershed approach that made way for energy generation through the plantation of *Pongamia* trees, the indigenous people of the village increased their incomes and raised their self-esteem.
- In Karnataka, where the state government provided the active conduit, the primary concern for the joint collaboration was to build on the capacities of the institution in a holistic manner.
- The Tamil Nadu initiative is a partnership in the offing where the focus of support is to enable hands-on training on water management for the students.

ICRISAT's consortium approach, which allows for shared responsibility, pooling of resources, and a stronger voice for lobbying, facilitated the teamwork required to address issues in IWM projects. Moreover, one cannot dispense with the contributions of other International Agricultural Research Centers (IARCs) like the International Water Management Institute (IWMI), International Livestock Research Institute (ILRI) and World Wide Fund for Nature (WWF), who are allies because of common problems. It must be reckoned that while centers have their own mandates, a holistic perspective is needed where different forms of collaborative work may happen for better results. This not only maximizes the use of resources such as technical expertise and findings/breakthroughs. More often, the problem situation in the watersheds allows for an integrated approach requiring the alliance of institutions and stakeholders. Similarly, the various networks like the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) and Cereals and Legumes Asia Network (CLAN) have provided an added venue for exchange and collaboration.

Most importantly, ICRISAT's experience in building alliances puts across two very important lessons:

- That trust will stand as a measure for creating relationships and how well these relationships are able to yield the support they need (Mula, 1999). Initial reluctance to participate could be remedied by an intensive awareness-raising campaign.
- That projects, which do not aim to benefit the implementing body (rather, are people-centered or people-oriented) will not languish when direct financial support ceases.

Relationships are built on trust and on believing in other individuals. When this happens and when people are made aware that initiatives are not self-serving, partnership and learning are likely to emerge.

Knowledge Sharing Through Benchmark–Satellite Scheme and Innovative Use of Technology

Knowledge sharing is an indispensable component of cooperation for development. Exchanges can open opportunities for partnerships and cooperation. ICRISAT's innovation in knowledge sharing follows a multi-dimensional strategy to channel the spillover from the south for the benefit of the south. Through the Virtual Academy for the Semi-Arid Tropics (VASAT), the problem of drought mitigation faced by resource poor farm households of the SAT (i.e. India, South Asia and West and Central Africa) is addressed through demand-driven and need-based content type of information, communication and capacity building (www.vasat.org). VASAT creates information education and communications materials that are readily accessed, understood and applied by rural households. It also caters to national and international interest groups. Institutional members of the VASAT coalition, through a peer-mediated review process, develop learning resources. This makes the contents relevant to users.

Learning and insights drawn from the experiences of the watershed projects are packaged in such a way that modern technology (Internet) and conventional means like the telephone system are put together to reach out to the masses through a hub-spokes concept. Volunteers at the rural access points receive location-specific information and deliver it to rural households through blackboards, public speakers, etc. VASAT is an innovative and cost-effective medium to educate and support a critical mass of rural women and men (Dilip et al., 2005).

The main hub in India was established in 2004 at Addakal, Andhra Pradesh. The operation is in partnership with the Adarsha Mahila Samaikhya (AMS)—Adarsha Women's Welfare Organization. The villages of Jaanampeta, Vemula and Kommireddypalli located within a 5 km radius from the central hub are the access points.

Information on soil and water conservation techniques, weather data and crop and livestock advisory are generated from the IWM projects. These are synthesized and passed by the AMS to the village-volunteer within 24 hours of receiving the request through the fastest and most accessible way.

User-sensitive information and education communication materials are indispensable components of VASAT. These are designed to enhance the hands-on training of stakeholders or information obtained from other sources. An example is the 'Education through CDs'. The Azim Premji Foundation provided interactive multimedia CDs to all the volunteers and information centers as the means to educate children on basic competencies.

ICRISAT's mandate for knowledge sharing requires qualified people to lead in the development and dissemination of technologies. Recognizing this, ICRISAT made RDE in a concerted manner where scientists are doing research together with the farmers in their own fields and adhering to their own circumstances. VASAT has also the 'Technology Induction Program' to transfer ICRISAT's experimental results to the farmers by conducting demonstrations in selected farmer's field. They invite all the village community members to participate in these experiments. This has encouraged better appreciation and understanding, as people are involved from inception to implementation. The question of maintenance and sustainability is also addressed.

Several strategies contributed to widespread scaling of the IWM project. The watershed's encompassing nature ensures that concern is not limited to just an issue (most often increasing crop productivity) but with objectives of wider magnitude.

Social networks in various forms and scale are the pipelines for creating the much-needed impact in watershed projects. These allow access to technologies and information, which leads to empowerment. Social networks can be a form of capital. Through connectedness, trustworthiness, and social support, ICRISAT is able to avail of new opportunities for collective action and prospects for new interventions for the SAT in India and South Asia.

South–South Partnership. Simultaneously with the benchmark watersheds set up in India in 1999, ICRISAT extended the demonstration of the model in Thailand (Tad Fa Watershed) and Vietnam (Thanh Ha Watershed) and a year after, to China (Lucheba Watershed). One satellite watershed was established in each of these benchmark watersheds: Wang Chai in Thailand, Huoang Dao in Vietnam, and Xiaoxincun in China (see Table 1). These areas are characterized by serious land degradation, which is critical to agricultural productivity. In each of these countries, two watersheds are supported and closely monitored. In Thailand, the partnership is through the Department of Agriculture, Department of Land Development, and

Khon Kaen University. In Vietnam, this is through the Vietnam Agricultural Research Institute (VASI), a research center. The China connection is implemented with an academy having three-pronged functions of education, research, and extension.

The Philippines became a partner in late 2005. Appropriate innovations and insights from ongoing initiatives are being implemented in four benchmark sites. The work is in collaboration with the Bureau of Agricultural Research (BAR) mandated to coordinate the research activities of the country.

The role of VASAT in scaling the achievements of IWM in South Asia and Southeast Asia (Philippines) cannot be left unnoticed. Its website is updated regularly with inputs from national (Central Research Institute for Dryland Agriculture and Indian Institute of Technology) and international partners (ILRI, IWM, Desert Margins Program). Its telecommunication facilities provide the potential for reaching across borders.

The success in expanding watersheds at a higher scale and magnitude is not only because of technological advances. Success likewise depends on effectively addressing issues relating to local economies and organizations. Having proven that IWM is the means to sustain agricultural productivity and endowments of the natural resources, succeeding efforts must heed on the merits of the aforementioned drivers.

Conclusion

Lessons learnt from the benchmarks and in the ongoing IWM projects of India and Asia alliance show that scaling does not have hard and fast rules. ICRISAT's experience in scaling generated international public goods. These include:

- Multi-institutional coordination where partnerships and alliances at different levels happen because watersheds have 'soft' boundaries. Public–public, private–public partnerships, and multi-country collaboration facilitate the scaling process.
- Scaling process builds institutions like SHGs. With institutions built, a multiplier effect is guaranteed and sustainability assured because of local commitment.
- Lessons from the scaling process indicate generation of valuable inputs for decision making. Even if lessons are site-specific, these can provide an understanding about how the system works. ICRISAT's experience shows that the decision to have NGOs or NARES as partners depends on the local structure and resources.

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