Smallholder Irrigation Market Initiative

Study on the Dissemination Potential of Affordable Drip and Other Irrigation Systems and the Concrete Strategies for their Promotion

Submitted to

The World Bank Group

by

Winrock International

Putting Ideas to Work

International Development Enterprises

Financial Support for the Study
Provided by

The Japanese Institute for Irrigation and Drainage

March 31, 2001
Creating New Markets via Smallholder Irrigation

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Creating New Markets via Smallholder Irrigation

Executive Summary

For the first quarter century of the new millenium, we are faced with an exponential escalation of two mutually reinforcing world problems: water scarcity and rural poverty. Despite the impressive gains in global food production over the last half century, an estimated 790 million people remain hungry. Meeting the crop demands projected for 2025, when the population is expected to reach 8 billion, will require an additional 192 cubic miles of water. 60% of current fresh water diverted for human use now goes to irrigation, and in many developing countries, irrigation’s share is as high as 90%.

The crop per drop produced by irrigation must clearly increase. But improving irrigation productivity on large farms alone will not solve the continuing problems of rural poverty, which are getting worse instead of better in sub Saharan Africa and other parts of the world. Increasing the agricultural productivity and income of the majority of farmers in developing countries who cultivate less than two hectares is a relatively untapped opportunity for finding practical solutions to rural poverty. Opening smallholder access to affordable small plot irrigation is a critical first step to wealth creation for the rural poor. New affordable irrigation technologies like low cost drip systems not only open the door to a path out of poverty: they are also a path to saving water, and doubling irrigation productivity on small farms.

Smallholder Irrigation Market Initiative

Objective of Poverty Alleviation through:
• High value sustainably produced crops
• Expanding markets for smallholder production
• Job creation
Enabled by:
• Smallholder irrigation

Smallholder Irrigation

Smallholder irrigation is an effective means for creating avenues for poor farmers to work their way out of poverty. About 600 million rural people are poor by country definitions. This study estimates that up to 30% of these rural poor could increase their incomes significantly through well designed and implemented country-specific smallholder irrigation programs. These farmers and their families are the targets of the Global Initiative for Smallholder Irrigation, an international effort to accelerate the commercial introduction of drip and other low cost irrigation technologies with the objective to bring 1 million hectares under cultivation each year for the next fifteen years. This in turn will provide an opportunity for 2 million poor rural families each year to take a major step on the path out of poverty.

1 The Global Initiative for Smallholder Irrigation is sponsored by the World Bank, Winrock International, International Development Enterprises and other organizations. This study is a component of the initiative and is supported by funding from the Japanese Institute for Irrigation and Drainage.
Scope of the Study

The scope of this study is to (a) determine under which conditions smallholder irrigation technologies can be successfully applied, (b) review case studies of smallholder irrigation programs including at least one case study from each of the six World Bank geographic regions, (c) evaluate prospective markets for the implementation of smallholder irrigation programs and (d) determine anticipated social and economic benefits. The World Bank commissioned Winrock International and International Development Enterprises to undertake this work, entitled “Study on the dissemination potential of affordable drip and other irrigation systems and the concrete strategies for their promotion” with financial support of the Japanese Institute for Irrigation and Drainage.

The World’s Forgotten Farmers

A key factor in the disappointing performance of many poverty alleviation initiatives is their failure to address the fact that most of the farms in developing countries are less than two hectares in size. For example, more than 75% of the farms in Bangladesh and in Bihar, India are less than two hectares. The key to tripling the global harvest through modern seeds and inputs has been irrigation, but until recently commercial irrigation devices have been too large and too expensive for small farmers. This has left them on the outside, looking in on many of the accomplishments of modern agriculture. Yet because small farmers are themselves poor, and are disproportionately concentrated in food deficit rural areas, increased productivity and income is central to practical approaches to poverty alleviation. For most small farmers in developing countries, affordable small plot irrigation may be the first step to wealth creation.

New Markets that Serve Poor Rural Customers

A key first step in finding practical solutions to both the issues of water scarcity and poverty in developing countries is opening smallholder access to affordable small plot irrigation, followed by a shift from subsistence to wealth-creating high value market driven crops. This shift is made possible by improving smallholder access to fertilizer, high quality seeds, and integrated pest management, and opening access to smallholder-oriented microcredit.
A common approach has been to assume that smallholders deserve high quality equipment. When conventional high quality irrigation equipment turns out to be too expensive to be affordable to smallholders, the problem has been “solved” by donor and government subsidies in large government-led projects. The Global Initiative provides an alternative to this approach, focusing instead on creating new markets for commercially available low-cost systems that serve poor rural customers.

**Opening Access to Affordable Small Plot Irrigation**

The first step in creating new markets that serve smallholder customers is the design of irrigation devices inexpensive enough for small farmers, and small enough to fit their plots. This approach uses the private sector instead of the government as the key instrument for the marketing and distribution of irrigation equipment, and utilizes an initial subsidy not on the price of the equipment, but on the promotion and marketing effort required to build sales volume to the point that it becomes attractive for private sector investment. The private sector also becomes the key player in opening smallholder access to inputs, credit, and markets for crops.

**Case Studies of the Market Creation Approach**

This report summarizes the experience of nine different cases in which the principles of market creation, affordable small plot irrigation, rural mass marketing, and wealth creation for smallholders were applied across a remarkable variety of ecosystems, agricultural strategies, and smallholder conditions. Most of these cases represent many years of village level experience. For example, in the Gangetic Delta areas of Bangladesh, India, and Nepal, 1.5 million treadle pumps were installed over a fifteen-year period, increasing the income of 7.5 million poor rural people by more than $150 million (US) per year. Newer technology like low cost drip systems in Kenya, the Deccan plateau of India, and the Hill areas of Asia produced and marketed through the private sector show even greater potential.

Experience with smallholder irrigation over the past twenty years suggests that we have only begun to tap the potential of these technologies. The treadle pump, a simple manual pump developed in the 1980s and marketed for $25/set in Bangladesh, has generated over $100 per family in incremental income for 1.3 million farm families. This experience has now been documented by independent evaluation studies; development professionals worldwide acknowledge its value. New micro-irrigation technologies are starting to show the same types of impacts and could potentially reach millions more farmers than the treadle pump.

This study presents a model for smallholder irrigation based on the experience in Bangladesh as well as that in more than ten countries around the world where farmers have adopted new irrigation technologies and are working their way out of poverty.

The case studies document experience gained in smallholder irrigation in various regions around the world. These studies demonstrate the applicability of the model and highlight
lessons that have been learned in various experiences with smallholder irrigation. The case studies also point to and assist in estimating potential demand for smallholder irrigation technologies. The approach was to identify experience with smallholder irrigation in various ecosystems in various regions around the world and then to extrapolate to the larger ecosystem to attempt to develop estimates of potential demand.

This study has identified the following steps necessary for the design and successful implementation of smallholder irrigation programs:

?? Carry out a feasibility study to identify opportunities and test potential technologies.
?? Adapt and develop the technology to the needs of the target customers.
?? Build the supply chain and rural mass marketing programs.
?? Develop a system of business development services that provides training and information to the target customers to enable them to take advantage of the new technologies.
?? Measure impact and feedback information to refine the program.

The Future Potential of the Smallholder Irrigation and Wealth Creation Approach

The goal of the global initiative is to place one million hectares a year under affordable small plot irrigation for smallholders over the next fifteen years, and to contribute to at least two million poor rural people moving out of poverty each year. Remarkably, the projections from the nine cases alone indicate potential for 4 million hectares of newly irrigated smallholder cultivation and a potential to alleviate poverty for 30 million poor rural families. If this potential can be realized, the new information gained from it can be applied much more widely to address rural water scarcity and poverty problems.

Key Barriers and Constraints

The study has determined key barriers and constraints to the promotion of commercial markets for smallholder irrigation systems. These constraints may be grouped as follows:

Development Community:

?? The resource-poor farmer has not been viewed as a potential entrepreneur, and therefore development investments have not been aimed at smallhold farmers in their role as customers of input markets, and suppliers of agricultural products;
?? Market forces have only partially been taken into consideration in smallholder development in general, and the dissemination of microirrigation specifically.
Smallholder Context:

- Limited access to credit, communication, transportation, inputs, information;
- In many cases, poorly developed markets for high-value agricultural outputs, and lack of linkages of the smallhold farmer to these markets.

Private Sector:

- Rural markets, and particularly low-income customers, are relatively unattractive to the private sector.
- Commercial availability of user-friendly kits is generally limited.

Social and Economic Benefits of Smallholder Irrigation Systems

The case studies reveal the principal advantages of smallholder irrigation systems as technologies that enable the production of high value crops:

- Scalable, divisible technologies with low capital investment requirements;
- Potential for poverty alleviation via wealth creation;
- Reduced water consumption compared to traditional methodologies, especially when coupled with greenhouses;
- Higher yields and quality;
- Up to 50% less labor than that required for hand watering;
- Potential benefits of tapping shallow aquifers and not mining deep water;
- Low operation and maintenance costs.

Potential for Bank Group Involvement

As the result of this study and interviews with Bank staff, we have identified four priority avenues of exploration:

1. Follow up on specific Task Manager interest in integration of smallholder irrigation in Bank projects in the pipeline;
2. Lay the groundwork with the Bank and with donors for the establishment of a Smallholder Irrigation Focal Point that advises on policy and priorities in smallholder development, coordinates activities and investments, and serves as a clearinghouse and catalyst for smallholder irrigation initiatives;
3. Investigate with IFC the creation of a specialized Smallholder Irrigation Investment Fund coupling technical assistance with business development services and finance to invest in small enterprises along the supply chain for micro-irrigation, along the lines of the Solar Development Group model; and
4. Engage relevant Bank staff in donor funded RD&D activities and pilot programs in key countries.
Next Steps

The following are priorities for follow-on activities to this initial study:

- Conclude the Market Potential Study
- Secure funding for and finalize Global Initiative Planning
- Convene global network of donors and implementers (May 2001)
- Explore mechanisms for Bank Group and donor support
- Commercial ramp-up in key countries
Creating New Markets via Smallholder Irrigation

I. Introduction. Over the next quarter century, water shortages will increasingly pose a fundamental obstacle to the further growth of productive agriculture. Water shortages are particularly acute in countries with large populations of rural poor reliant on smallholder agriculture. Although the problems involved in water management are complex, it appears that part of the solution may be to promote the introduction of new, small-scale, low-cost irrigation technologies and market access approaches where smallholders can improve yields of high value crops which can dramatically reduce water demand while improving their quality of life. (Polak, 1996, Postel, Polak, Gonzalez and Keller, 2001)

A growing body of literature documents the success of smallholder irrigation technologies (Barnes, Orr, and Islam, 1991; Downing and Polak, 2000; Hurdec, 2000; Mehta, 2000; Polak, Nanes, and Adhikari, 1997 and 1998; Polak, Morgan, and Saussier, 1999). The most widely known is the study by the International Water Management Institute (IWMI) (Shah, 2000), although other publications by independent evaluators provide a useful basis for comparing approaches to smallholder irrigation technology development and developing applicable models. They are referenced in various locations throughout the accompanying case studies.

The problem addressed by this study is the low income level and (to date) limited investment opportunities for smallholder farmers throughout the developing world. These farmers have often exploited their limited resources to the best of their abilities. Small plot size and limited access to water are major constraints for these farmers. They need technologies that can (a) assist them to best use their limited resources, (b) are affordable and (c) can substantially improve their incomes. Such micro-technologies now exist and are starting to have macro impacts.

The United Nations medium growth projections indicate that global population will expand from the present 6 billion to nearly 8 billion in 2025. More than 80% of these people will live in developing countries. Presently there are 1.1 billion farmers in the world of whom 1.05 billion are in developing countries (World Water Forum, 2000). Of these an estimated 600 million are classified as poor by country definitions. These farmers and their families are the targets of this Global Initiative, to which this study contributes.

Smallholder irrigation technologies are the basis for a significant change in the approach to irrigation development in developing countries around the world (Heierli and Polak, 2000).
Through modest investments in irrigation equipment specifically designed for their conditions and proven to have the capacity to use their available water resources efficiently, smallholder farmers are working their way out of poverty (Postel, 2001; Polak and Sivinnappan, 1998).

Even when enabled with irrigation technologies, smallholders face barriers to wealth creation. Smallholders need access to inputs, markets and credit. In addition to access to technology, farmers need the skills that will enable them to successfully utilize that technology. Beyond that they need assistance to assure that markets for their produce expand in line with their increased production. Global markets for products ranging from asparagus to zucchini exist, though access to markets requires better transportation and communication infrastructure, better sources of credit, and better marketing facilities. This study describes the process of understanding the barriers, developing pilot approaches and gearing up to assure that smallholders have improved access to markets. Smallholder irrigation is a key entry point by which farmers can access avenues to wealth creation.

In this study we define smallholders as those primarily poor farmers, some of who are landless. Many of these farmers have some access to land, although they often do not have a land title or deed, necessary to easily obtain credit. In Latin America the definition of a smallholder may be different from that in Africa or in Asia. In general, though, we consider smallholders to be those poor farmers whose production is currently at or below the subsistence level. In most countries these farmers operate with less than two hectares (or five acres) of land.

The World Bank has always considered small-scale irrigation a promising option for developing countries. However, the Bank's past activities in smallholder irrigation have been minimal, and generally the Bank has focused on larger scale systems for larger plots. In addition, market-based technology diffusion via the private sector presents serious difficulties for governments as well as large international financial institutions, for neither are well-equipped to start, finance, and support very small enterprises.

The World Bank and other national and international bodies are now giving smallholder irrigation increased attention for five main reasons:

- Technological advances, particularly in the area of developing affordable, small-scale water lifting devices and drip irrigation systems;
- Shifts in the policy environment favoring private sector initiatives and increased smallholder participation;
- Heightened environmental concerns--in particular, concern for increasingly severe water shortages and food security;
- Increased focus on poverty alleviation, achievable by increasing smallholder productivity through affordable small plot irrigation;
- The emergence of viable market creation approaches for smallholder development.

The objective of this study is to clarify the site-specific dissemination potential and promotion strategies of low cost smallholder irrigation technologies in developing countries.
The study will attempt to determine and classify site-specific requirements for smallholder irrigation development versus those factors, which are applicable across broad geographical regions.

**Scope of this Study**

The scope of this study (provided as Annex 10) is to conduct studies and limited field work to (a) determine under which conditions smallholder irrigation technologies can be successfully applied, (b) review at least six case studies of smallholder irrigation programs including at least one case study from each of the six World Bank geographic regions, and (c) evaluate prospective markets for the implementation of smallholder irrigation programs and determine anticipated social and economic benefits. A series of meetings is to be conducted with Bank staff and presentations during the course of the study. The draft study is due March 31, 2001.

**II. Background**

**The Smallholder Irrigation Market Initiative**

The Smallholder Irrigation Market Initiative is a new effort by the World Bank to work with its member countries and the industry, research, foundation and NGO communities to provide financing and technical assistance for a global program to hasten the commercialization of low cost drip irrigation and other small scale irrigation technologies, and to expand their applications significantly in developing countries.

The initiative has four main thrusts:

- Preparation and finance of commercial and near-commercial applications with a goal of 1 million new hectares under irrigation per year
- Facilitation of international research, development, and demonstration (RD&D) and business development projects for expansion of commercial smallholder irrigation markets
Stimulation of high-volume global demand for smallholder irrigation technologies that, in turn, will stimulate agricultural intensification and ensure long-term participation of the private sector.

Organization of interested stakeholders in smallholder irrigation as a thematic group (community of practitioners) to facilitate knowledge sharing.

The objective of this initiative is to accelerate the introduction of cost-effective new technologies by promoting dialogue, conducting pilot activities, and providing assistance and financing to support small enterprises and larger private sector elements in countries and regions where the technologies can make an important contribution. The end result is self-sustaining enterprises that, once formed, will continue to sell and maintain equipment in the future.

Relation to Global Initiative for the Promotion of Smallholder Irrigation

This study is part of a broader international effort to promote poverty alleviation via the acceleration of commercial markets for smallholder irrigation. A business plan for the global initiative for the promotion of smallholder irrigation is under development. The business plan will analyze market development requirements, the role of the World Bank Group, required support to the Bank's regional units for smallholder irrigation project identification and preparation, options for a coordinating, strategic, and catalytic role in removing barriers that impede the introduction of low cost irrigation technologies in developing countries, and all relevant issues pertaining to the establishment and operation of the Smallholder Irrigation Market Initiative. The plan will also define strategies for effective collaboration between the World Bank's initiative, and initiatives implemented by other organizations in the public, private, donor, and NGO communities.

The business plan will clearly identify opportunities and constraints for investment, whether by the Bank or other investors. This study is the first output of that process and the results will be incorporated in the detailed Business Plan. Subject to availability of funding, the entire business plan is expected to be completed by May 2001.

Experience Suggests Potential

The experience with smallholder irrigation over the past twenty years suggests that we have only begun to tap the potential of these technologies. The treadle pump, a simple manual pump developed in the 1980s and marketed for $25 per unit in Bangladesh, has generated over $100 per family in incremental income for 1.3 million farm families (Polak, 2000). This experience has been documented in several studies, including a major study by

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<th>Experience Suggests Potential</th>
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<td>• Commercial smallholder market is emerging</td>
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<td>• IWMI treadle pump evaluation</td>
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<td>• Keller/Shah micro-irrigation evaluation</td>
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<td>• Donor involvement: Swiss, Dutch, Japanese, Canada, DFID, etc.</td>
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an independent research organization (Shah, 2000). Over the past ten years, a range of low cost small plot drip irrigation systems have been developed and field tested by IDE (Polak, 2000) by Chapin Watermatics (Chapin, 1998, Adams and Chapin), and by the Yanshan Institute in Beijing. A team consisting of Jack Keller, a renowned irrigation expert, and Tushaar Shah of IWMI, is currently documenting experiences with micro-irrigation technologies in Kenya and Asia.

Markets for smallholder irrigation technologies are evolving rapidly. Large irrigation equipment firms, such as Netafim, which previously were not interested in the idea, are now seriously developing equipment specifically aimed at smallholders. Although the private sector is often understandably reluctant to target poor farmers, the efforts of the private sector can contribute to the solution. Finally, donors have increased their support for smallholder irrigation. Examples include bilateral donors in Switzerland, the Netherlands, the United States, Japan, Canada, and the United Kingdom and private foundations such as the Kellogg Foundation.

### III. A Business Model for Smallholder Irrigation Development

#### Historical Approaches

Smallholder irrigation has a long history and includes a variety of approaches. During the 1970s and 1980s appropriate technology garnered a great deal of attention, led by proponents such as E. F. Schumacher (1974) and others. Although some equipment designed during this era such as fuel-efficient stoves succeeded to varying degrees, other equipment was never adopted other than by a pilot stage audience. Shelves are filled with the designs for such equipment. Numerous water harvesting technologies, for example, were developed to conserve water for smallholders, but the intended beneficiaries never adopted most of them. The promotion of many of these technologies lacked a business approach, which we assert is essential for programs aimed at convincing farmers to change their practices, even when the technologies are affordable and have demonstrable benefits.

The treadle pump, developed in the early 1980s in Bangladesh by Gunnar Barnes, a Norwegian development worker, and a number of others is an excellent example of a technology that could promote social equity but had little impact until it was marketed nationally. The pump is designed to lift water from shallow depths to the surface. Bangladesh is perfectly situated for this technology in that shallow groundwater is widespread and recharges annually. The treadle pump allows for growing a third dry season

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<td><strong>Investments and Returns</strong></td>
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<td>Donor Investment</td>
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<td>Farmer Investment</td>
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<td>Number of Farm Families</td>
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<td>Annual Increment Income/Family</td>
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crop, usually a high value vegetable crop, thus essentially increasing family income by more than one third. A major evaluation (Shah et al., 2000) has now confirmed the estimates that the pump has generated an average of over $100 of annual income for each of the 1.5 million purchasers.

The key to the success of the pump, as documented in the Bangladesh and other case studies, was the extensive promotion of the pump and its widespread availability through the private sector. This approach has now been successfully replicated elsewhere by other implementers and we feel confident we can now present a model of this approach.

**Description of the Model for Smallholder Irrigation Development**

What characterizes the present approach to smallholder irrigation development (as opposed to earlier approaches of appropriate technology) is the shift in emphasis from the technology development phase (although this phase is still important) to the phase of developing a private sector-led supply chain and rural mass marketing of the equipment (Edesess and Polak, 1997).

Based on the experience in a number of countries by a growing number of organizations, a framework that characterizes parameters for success can now be summarized. The overriding principle of all the successful approaches is that they treat farmers as entrepreneurs motivated by profit who make investment decisions based on information available to them. Successful technology transfer depends on finding farmers who fit this profile and using them as demonstrators who will influence their less entrepreneurial or more risk adverse neighbors.

**Components of the Model**

The model has six components: feasibility, technology development, supply chain development, rural mass marketing, agricultural integration, and impact measurement and feedback. Each of these components is critical but each can be carried out by different actors.
**Feasibility Study.** A feasibility study is the initial step in making a decision to proceed with a national or regional-level program. Its objective is to determine the potential market for particular smallholder irrigation technologies. During the feasibility stage a team examines current smallholder irrigation practices, assesses water resource availability, reviews the experience with past technologies, identifies potential local partners and determines capability of local manufacturers. The team will set up several demonstrations of potential technologies and convene focus groups of farmers to evaluate the technology. The feasibility phase is not restricted to the market of micro irrigation technologies. Rather, this phase also looks at crops as currently produced, current production practices, and especially, market opportunities in high-value crops for which the smallhold sector may have a comparative advantage.

**Business Model for Smallholder Irrigation Development**

**Develop the Technology:**
- Conduct Feasibility Study
- Field Testing, Farmer Feedback
- Technology Adaptation

**Technology Development.** Once a decision is made to proceed with a program, the technology package is finalized. Decisions need to be made on importation or local production, manufacturing methods and materials, the size of kit, etc. Demonstrations are conducted on a wider scale and discussions are held with private sector producers to determine their capability. Definition of the specific product, its market and how it will be manufactured are determined at this stage. Feedback from farmers is needed at all stages, as well as analysis of characteristics of the target farmers, including affordability of the product. Successful programs market a product that is affordable to farmers and that can pay for itself in a season or, at maximum, a year. Also during this phase, research and adaptation is carried out on production technologies that the smallhold farmer can use, together with the water-related technologies, in his or her efforts to become a cost-effective supplier of high-value crops and agricultural outputs.

**Keys to Technology Adaptation**
- Appropriate sized kits
- Affordable kits
- Maintained by farmers
- Kits and spares available nationwide
Supply Chain. Once a product is identified it must be manufactured. Locally manufactured products are preferable, as demonstrated by the Kenya case study, in order to avoid supply problems. Although drip tape is not produced in many developing countries, PVC pipe and other plastic products are produced in many countries. Micro-irrigation kits can easily be produced using micro-tubes, which can be manufactured with a minimal upgrade at a PVC pipe factory. The method of manufacture is linked to the selection of technology and these decisions must be made in tandem. Also it is critical to determine how and by whom the products will be distributed. It is desirable to have as wide a distribution network as possible, not just to one target area within the country. Local agricultural outlets, hardware stores, etc. are logical candidates for retailers. The structure and relationship of manufacturer, wholesaler and retailer needs to be determined for each program. Questions of quality control, guarantees and other issues need to be resolved. Various types of supply chains have been developed, and it is essential that all parties in the chain make a profit to ensure sustainability.

In the development of supply chains, provisions are made for private sector enterprises to supply the associated inputs (seeds, fertilizers, soil amendments, plant protection agents, etc.) that the smallholder farming community will need to take maximum advantage of the water-related technologies. In addition, provisions are made for the private sector and/or government agencies and NGOs to provide necessary farmer training.

As availability of credit is a major factor in the successful mass dissemination of productivity-enhancing technologies for the smallholder, special consideration is given to building into the supply chain mechanisms for credit for the smallholder.

Rural Mass Marketing. In order to convince farmers to buy new technology major efforts must be put into marketing. The marketing effort will take different forms depending on the country. The Bangladesh experience with marketing included demonstrations, performances, leaflets, posters, calendars, etc. The Kenya Approtec experience involved national newspaper advertising including contact information on each local supplier in the country. In Latin America and elsewhere, radio has effectively been used as a marketing tool. Links with NGOs working at the field level have been effectively used to demonstrate and promote micro-irrigation technologies.

Agricultural Production: Adding Value to Product, and Output Marketing. With micro-irrigation farmers may be producing high value crops with which they are unfamiliar. They
may need training on variety selection and management practices. Farmers may also need training in the use of postharvest practices and on-farm processing in order to add value to their products, and to gain access to profitable and stable markets. Promotion of high value crops may involve policy dialogue with the host government to facilitate relevant infrastructure development and the creation of new markets. Marketing may also involve improved storage and preserving (drying, pickling, cooling, freezing) of high value crops carried out on an industrial scale.

**Impact Measurement and Feedback.** In order for the program to work effectively, managers must be able to monitor impacts in order to continuously adapt the program to meet its objectives. Programs may need to adapt new technologies, tap new markets, or find new sources of donor funding. In order to respond to changing conditions, program staff members need to monitor sales, redefine the target smallholders and measure the impact that the technology is having on incomes, employment, and other factors. This data needs to be fed back to the program to enhance profitability, build sustainability, and ensure greater incomes for the target smallholders.

The process involves a number of actors with a variety of skills. For this reason the Global Initiative has placed high priority on the establishment of a network that would include a variety of organizations including donors, NGOs and other implementers, host governments and the private sector. There is a strong need for coordination of the program to assure that parties work together towards a common goal. A network secretariat would have a major objective of promoting coordination among all the actors involved in promoting smallholder irrigation.

**IV. The Case Studies**

**The Approach**

Review of Installed Systems: Case studies have been employed in this paper in several ways. The first is a straightforward approach to document experience that has been gained in smallholder irrigation in various regions around the world. Second, we use these studies to demonstrate the applicability of the model and to highlight lessons that have been learned in various experiences with smallholder irrigation. Third, and perhaps most significantly for this study, we make use of existing experience to point to and assist in estimating potential demand for smallholder irrigation technologies. Our approach was to identify experience with smallholder irrigation in various ecosystems in various regions.
around the world. These experiences range from mature programs, such as the treadle pump program in Bangladesh, to the fledgling experience in China. From each of these we have extrapolated to the larger ecosystem to attempt to develop estimates of potential demand. We intend to use these cases as the basis for future programs and will expand upon these further in the next phase of the Business Plan. Annex 1 includes case studies of smallholder irrigation in various places around the world. The following sections on lessons learned and crosscutting issues serve to synthesize the information provided in the case studies.

Assessment of Past Approaches: Lessons Learned from the Case Studies

The case studies provide important information regarding model validation as well as insights into the design of future programs. The following is a summary of lessons learned based on the case studies.

**Need for Micro - Credit in the Supply Chain.** In virtually all case studies, access to credit for the purchase of irrigation equipment and agricultural inputs was identified as the greatest single remaining constraint to smallholder adoption of improved irrigation and agricultural intensification; the poorer the farmer the greater the credit constraint. Netafim reported that access to credit would remove the greatest existing constraint to increased sales of their Netafim family drip systems in China, and treadle pump dealers in Bangladesh and India consistently predict a doubling of sales if credit were available.

Although existing microfinance organizations and equipment manufacturers occasionally make credit available, these cases are a distinct minority. Since smaller loans have relatively high transaction costs, loans for irrigation equipment in the range of $25-$75 are still very hard to come by in poor rural areas not well served by microfinance institutions. Even then, many existing microfinance organizations prefer not to specialize in agricultural equipment; others prefer densely populated areas where threshold loan volumes can more easily be reached, and still others prefer loan portfolios with larger average loan sizes. Since this affordable irrigation technology has repeatedly demonstrated the capacity of generating net cash returns of 300% on its purchase price in the first growing season, increasing the probability of 6-month payback, the absence of microfinance support is particularly unfortunate.

The business plan for the global initiative will include the development and field testing of economically sustainable models for increasing smallholder access to microfinance to

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**Case Studies**

- Africa
  - Kenya
  - Zambia
- Asia
  - Bangladesh
  - Maharastra
  - Nepal, Himalchal Pradesh
- Eastern Asia
  - China
- Latin America
  - Mexico
  - NE Brazil
  - Nicaragua
- Near East/North Africa

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purchase irrigation equipment and inputs. A collaborative effort with existing experienced microfinance organizations to develop and field test models of microfinance delivery through the private sector supply chain will be an important first step in this effort. This thrust should take advantage of the experiences of private sector companies like Singer that finance small household machinery and appliances.

**Local Production and National Distribution.** The Kenya case study of the Chapin bucket kits distributed by the Kenya Agricultural Research Institute (KARI) provides two important insights into problems associated with production and distribution. The bucket kit is manufactured in the U.S. and shipped to Kenya in container-lot quantities. Although the shipping costs per kit are relatively low, delays hinder the availability of kits. An entire container is expensive, so the program must depend on a large influx of funding to import the kits. This means that the program is not run as a sustainable business. Second, the kits have been distributed only at the national headquarters of KARI and several other outlets. They are not available through the private sector at local outlets. Although the program has conducted a good demonstration program both at the national headquarters and at local agricultural field days, it lacks a consistent advertising campaign. Only sporadic advertisements and newspaper articles have announced the availability of the kits. This has resulted in uncertainty and reliance on distribution through NGOs, which buy a number of kits for their target farmers. Finally, spare parts are not readily available as there is no national supply chain of kit retailers.

**Existing Irrigators are a Natural Target.** The case study from China examines a potential program to promote smallholder irrigation in China, targeting poor farmers in Guizhou. Although it is not yet clear which technologies would be most beneficial to these farmers in terms of increasing incomes, farmers have shown keen interest in micro-irrigation and other technologies which save labor, increase yields and increase quality of produce. In comparison to some experiences in Africa where farmers are being introduced to irrigation for the first time, in the China case, the transition is much easier because farmers are already producing high value irrigated crops. Wealth generation, however, may come as much from efforts to expand their opportunities to enter export markets as from the introduction of new irrigation technologies.

**Market Linkages.** The Zambia Dambo development case study provides a number of interesting lessons learned. First, the program emphasized local production of treadle pumps, which lowered costs from $200 to between $60 and $70 per pump. IDE has operated the project in 4 areas of Zambia with 18 retailers, with emphasis on demonstrations to reach farmers. Farmers have been linked to micro-credit. The dispersed nature of the population and poor transportation and other infrastructure has hindered adoption. The most significant lesson is from the socio-economic study, which shows that those farmers who are linked to established horticulture markets realize the highest incomes. Generally, limited access to markets has prevented many farmers from full adoption of the technology. Zambian farmers

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2 *Dambo* is a term locally used in Eastern and Southern Africa referring to seasonal wetlands which are usually located in the headwater areas of river plateaus and are typically grass-covered flood plains or valley bottoms.
tend to be dispersed, and although access to land and water in dambo areas is good, farmers are generally located far from markets, and are constrained by poor road infrastructure.

**The Poor as Target Customers.** The experience in Nepal reported in the Poor Hill Agriculture Case Study illustrates the techniques used when extremely poor farmers, including women, are targeted as major potential users of micro-irrigation technologies. This experience is repeated in Kenya and elsewhere where poor women are not only producers of household gardens, but can also be involved in commercial agriculture. More emphasis on training is needed for farmers who lack experience producing high value crops. On the other hand, IDE found that hill areas often had climates suitable for off-season crop production with possibilities for good returns for crops produced during certain seasons.

**Quality vs. Affordability.** The Bangladesh case is classic in its approach to mass marketing: the program used a variety of methods, including demonstrations, plays, a movie, leaflets, and songs to reach the target audience. As the Bangladesh market for treadle pumps matured, growing competition developed among treadle pump manufacturers, some of whom produced inferior quality pumps. IDE educated customers to differentiate between high and low quality products and to make informed decisions. IDE produced three levels of pump quality and advertised the expected life of each pump, finding that customers preferred the lower cost pumps. The main lesson is that suppliers need to be ready to face competition in a maturing market. Other lessons from this case include the importance of endorsement from key decision makers in the country. Also, in one interesting micro-credit example, a bank has taken the lead in promoting and selling treadle pumps as part of a credit package.

**Working with NGOs.** The case study on the Deccan Plateau in India illustrates several principles in line with the model just presented. This is a case where micro-irrigation technologies have been introduced and are now rapidly being adopted by smallholders due in large part to promotion by over 200 NGOs working at the grassroots level. This demonstrates an important lesson: working with NGOs can provide important benefits. In this case the partner organizations handle the whole task of demonstration and promotion. Also, in working with the NGOs, new business opportunities have opened up for crop input packages and the opportunity to facilitate the marketing of pre-packaged seed, pesticide and fertilizer as well as seedlings and saplings. Another important lesson that is clear in this case is the scalability of the micro-irrigation technology. IDE is marketing four levels of kits to the target farmers, each one providing an annual profit potential which allows moving up to the next larger kit with an increased wealth building potential. This program is still at an
early stage, with IDE serving a supplier. Sustainable businesses need to be developed which can provide desired products to NGOs as well as to private customers.

**Crosscutting Issues**
A number of crosscutting themes have been identified during the course of the study. Some of these are discussed in more detail in the case studies.

**Role of Women.** Irrigation schemes have often been developed with scant attention to the important role played by women in agriculture and commerce. Particularly in Africa, women play the predominant role in choice and use of such technologies as low-head drip irrigation. Equipment design must carefully consider women's concerns, such as the need to be close to home, the need to devote time to multiple activities such as child care and the role women play in economic decisions in the household.

**Hybrid Approach.** In the hills of Nepal, limited access to irrigation water was identified as a key constraint to the expansion of smallholder irrigation using low cost drip systems. Water from village drinking water systems was commonly available, but in limited quantities. Householders in Kenya often used extra water from their drinking water source for the 50-70 liters of water a day required by a bucket kit. Hybrid drinking water/irrigation systems at the village level make it possible for village drinking water systems to turn a profit, and at the same time expand access to irrigation water for smallholders. The marginal cost of building a three-inch pipe to a spring instead of a two-inch pipe is slight, but the irrigation water it brings to village drip systems can generate enough income to pay for two thirds of the total cost. Six households with access to credit can pay off the loan to build a shared tubewell with the income from six-bucket kits installed along with it. The design of hybrid drinking water/irrigation systems can be incorporated as a planned element of community water supply schemes. Making drinking water profitable through hybrid systems can significantly leverage the impact of the finite resources available for drinking water programs, as well as making a large contribution to opening smallholder access to irrigation water.

**Peri-Urban Irrigation.** Although not often regarded as significant by irrigation officials, peri-urban irrigation plays an important role in contributing to income generation among lower income groups in most developing countries. Peri-urban irrigation can enhance the nutrition of urban dwellers, although health concerns are often raised about irrigating with polluted water. Recent studies of peri-urban irrigation in Africa (Cornish and Aidoo, 2000; Hide and Kimai, 2000) identify opportunities and constraints of peri-urban irrigation in two cities in sub-Saharan Africa: Kumasi in Ghana and Nairobi in Kenya. Lack of land tenure and the uncertain nature of the enterprises limit the scope of working with these entrepreneurs. Smallholder irrigation technologies in peri-urban areas have high potential, particularly where vegetable producers irrigate with sprinkler cans and immediately see savings in labor. Other benefits include water conservation; improved quality of produce; portability and low investment cost and are well suited to peri-urban irrigators.

**Commercial Irrigation.** Commercial farmers generally have higher incomes, better access to credit and other resources and better access to markets in comparison to smallholders. Although we hesitate to draw a fine line between "smallholders" and "commercial" farmers we generally consider commercial farmers to have sufficient income earning opportunities, distinguishing them from our target farmers. In the case of China, for example, private sector
companies should work with greenhouse producers to improve production methods since in most cases those farmers are not considered poor by Chinese standards. Elsewhere, however, partners of the Global Initiative will reach the rural poor, who will pay for irrigation equipment but not necessarily the full cost of delivering that equipment at the early stages of market development. Commercial irrigation can benefit smallholders in that drip irrigation products tend to be readily available where there is a substantial market for commercial irrigation. On the other hand, larger commercial irrigators may dominate the local market, as is the case in South Africa, making it difficult for smallholders to gain access to markets to sell their products.

**Irrigation by Landless.** Even landless farmers may have some access to land, perhaps through illegal occupation or by paying rent. These landless farmers may benefit from micro-irrigation technologies, which are affordable, portable, and water efficient.

**Water Resource Issues.** From the individual farmer's perspective smallholder irrigation technologies make sense if they can improve family income. From a national water management perspective, though, do these technologies make as much sense? The question is whether drip irrigation results in water savings in comparison to other irrigation methods. (Seckler, 1996; Keller, Keller and Seckler, 1996; Postel, 1999; Suryawanshi, 1995). As discussed by Gleick (2000), drip irrigation can reduce water consumption by up to 60% in comparison to furrow irrigation. This results from decreased on-farm losses since water is delivered directly to the root zone of the beneficial crops. Drip irrigation reduces non-beneficial water consumption such as through transpiration by weeds and evaporation from bare soil, resulting in "real" water savings – more water available for other uses. Many developing countries in Africa, for example, have only developed a fraction of their irrigation potential according to published figures (IMPIM, 2001), yet are still facing at least localized water shortages. Under this scenario, micro-irrigation technologies make sense to increase food production while having minimal impact on already scarce water resources. Gleick (2000) also includes tables that quantify increased yields (up to 50%) for various crops and decreased labor requirements (up to 90% savings) in comparison to various other irrigation methods. Thus drip irrigation has many advantages in addition to its water saving characteristics.

**Environmental Concerns.** Smallholder irrigation technologies generally have relatively minor impacts on the environment in comparison to other irrigation methods. Farmers using treadle pumps in Bangladesh and elsewhere use shallow groundwater, which is recharged annually. Drip irrigation systems require less water than other irrigation methods; hence less water is pumped from aquifers in comparison to other irrigation methods. One concern about micro-irrigation is the discarded plastic waste from abandoned drip tape and tubing. In India,

### Advantages of Micro-Irrigation

- Reduces water consumption up to 60%
- Higher yields and higher quality produce
- Good water uniformity
- Up to 50% less labor compared to hand watering
an industry has emerged to recycle drip tape, obviating this problem. Generally when farmers convert from surface to drip irrigation or add a small area of irrigation to their dryland farms there are few concerns. However, greater concerns arise where individual or groups of farmers initiate irrigation on new land adjacent to water sources, such as is the case with the dambos of southern Africa. In this case there may be concerns for preservation of ecosystems and endangered species. Countries should have regulations for allocating these types of lands and may need to restrict such development.

V. Constraints and Opportunities: The Market for Smallholder Irrigation Technologies

Prospective Markets: Approaches to Estimating Market Potential

There are a number of factors that must be considered when estimating the market for smallholder irrigation technologies. Among these are factors related to land and water resources, socio-economic factors related to numbers of potential poor farmers likely to adopt the technology, and, finally (but important), factors related to markets for irrigated crops. This section will briefly describe these factors. This analysis is similar to a linear programming model in which we attempt to maximize sales subject to constraints represented by functions of various variables. This study reviewed experience to estimate the limits imposed by each set of variables.

Land and water play a critical role in estimating potential markets for smallholder irrigation technologies. The FAO and others have published estimates of existing and potential irrigable land by country. A recent compilation for Africa (IPTRID, 2001) includes a list of countries by their rate of irrigation development. These statistics can serve as a good first sort on countries where irrigation is important and where the potential for additional irrigation is high. Zambia is a case with a high potential for irrigation development (3.5 million hectares) but a very low percentage of developed irrigation. Whether it has a high potential for smallholder irrigation technologies needs to be determined by examining other factors as well. In the case of treadle pumps it would be most important to know about the availability of shallow groundwater and irrigable land adjacent to surface water. Unfortunately most countries do not publish statistics on shallow groundwater, and only general conclusions can be drawn from the existence of broad alluvial valleys and plains, or dambos in the case of Zambia. A detailed review of groundwater data would be important once a country is selected for investigation.

The second set of constraints deal with socio-economic aspects of smallholder agriculture. Our assumption here is that a certain percentage of smallholders will adopt a particular technology in any given country and that number may or may not be related to the amount of irrigable area. Experience in other countries may be a guide for estimating the percentage of adopters. Thus the number of potential adopters of drip technology in Country X may be estimated based on the number of adopters in Country Y, which has had a longer history with drip irrigation but similar conditions otherwise. Estimates for potential treadle pumps sales in India are thus based on previous experience with treadle pumps in Bangladesh. This method is limited by the assumption that experience in one country is applicable and transferable to that in another. An important factor is the entrepreneurial spirit of
smallholders versus their conservative nature. Smallholder farmers, particularly poor subsistence farmers who are concerned about meeting their basic food requirements, are conservative. The entrepreneurial aspect of farmers needs to be developed in order to speed adoption. Through the use of demonstrations and growing farmer awareness based on personal observation of the technology used by their neighbors, the potential number of adopters will grow over time. Since micro-irrigation technologies are aimed at poor farmers, we can expect that as farmers gain more wealth they graduate from our target group and become more commercial farmers.

The third set of constraints is based on consumers' demand for crops commonly grown by smallholder irrigators. There have been many examples of glutted local markets for crops that are typically irrigated such as tomatoes, cabbage etc. We need to be able to forecast these markets and make sure that smallholders do not flood the market, thus lowering prices and reducing returns. Farmers need to be aware of the limited absorptive capacity of local markets, and be prepared to grow alternative crops and time the market for windows of opportunity when supply is low and demand high. Part of the agriculture integration program is to expand markets for irrigated crops through measures such as processing, expanding use, and promoting exports. When farmers can meet quality and other demands of export markets there is less concern about market oversupply. Although we generally assume that farmers using smallholder irrigation technologies will irrigate high value horticulture crops, in some countries farmers have obtained satisfactory returns from what are generally considered lower value crops, including maize, sugarcane, and wheat. A further point is that estimates of per capita consumption for high value crops may vary tremendously from country to country and these values are likely to increase as incomes increase. For example, in China vegetable production is quoted as 350 kg per capita per year whereas Africans would be shocked to see this quantity of vegetables on their plates.

Although resource and socio-economic constraints are important, market constraints are likely to be most important in terms of hindering the sales of smallholder irrigation technologies. Work to expand crop markets is necessary if significant numbers of farmers are to be brought out of poverty.

In this study we have used our best estimates and estimates of colleagues around the world to assist in the projection process. For example the Indian National Committee on Irrigation and Drainage has estimated the potential for drip irrigation in India to be 10.5 million ha (INCHED, 1994) based on adoption of drip irrigation technologies to that date. The committee suggests as a target for India to convert at least 1% of the irrigable land to drip irrigation over the next 8 to 10 years. We have used these and other data as the basis for our estimates of potential acreage and numbers of potential target farmers.

**Evaluation of Potential: Extrapolating from the Case Studies**

Each of the case studies gives an indication of the potential for smallholder irrigation within the larger ecosystem. These results are summarized in the table below. Although the results are not complete, they indicate that over 40 million poor farmers are potential customers for irrigation technologies that will bring them out of poverty. With an average family size of
five, this represents a potential population of 200 million, or over 30% of the world's rural poor. The projection represents almost 7 million hectares of newly irrigated land, which could be productively and efficiently used for producing high value vegetables and other crops.

Table 1. Potential areas and numbers of farmers adopting smallholder irrigation technologies by ecological areas

<table>
<thead>
<tr>
<th>Ecosystem</th>
<th>Case Study Country/ Region</th>
<th>Current Area (ha)</th>
<th>Current Number of Farm Families</th>
<th>Projected Area (ha)</th>
<th>Projected Number of Farm Families</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Scarce Tropics SSA</td>
<td>Kenya</td>
<td>32</td>
<td>5,000</td>
<td>300,000</td>
<td>3 million</td>
</tr>
<tr>
<td>Dambo area of SSA</td>
<td>Zambia</td>
<td>1,000</td>
<td>2,000</td>
<td>400,000</td>
<td>1 million</td>
</tr>
<tr>
<td>Gangetic Delta</td>
<td>Bangladesh, Eastern India, Nepal Terai</td>
<td>300,000</td>
<td>1.5 million</td>
<td>1.5 million</td>
<td>8 million</td>
</tr>
<tr>
<td>Deccan Plateau, India</td>
<td>Maharastra and Gujarat</td>
<td>150</td>
<td>10,000</td>
<td>500,000</td>
<td>7 million</td>
</tr>
<tr>
<td>Hill Areas of Asia</td>
<td>Nepal Hills, Himachal Pradesh India</td>
<td>500</td>
<td>7,000</td>
<td>500,000</td>
<td>7 million</td>
</tr>
<tr>
<td>Semi-arid areas of Latin America</td>
<td>Mexico</td>
<td>Field test stage</td>
<td></td>
<td>300,000</td>
<td>600,000</td>
</tr>
<tr>
<td>Winter Vegetables in China</td>
<td>Greenhouses in North China, Natural Greenhouses in South China</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural Greenhouse River Valleys</td>
<td>a. Guizhou Province</td>
<td>13,000</td>
<td>100,000</td>
<td>80,000</td>
<td>600,000</td>
</tr>
<tr>
<td>Natural Greenhouse River Valleys</td>
<td>b. Guizhou, Yunnan, and Guanxi Autonomous Region</td>
<td>40,000</td>
<td>300,000</td>
<td>250,000</td>
<td>2 million</td>
</tr>
<tr>
<td>Greenhouses</td>
<td>c. Northern China</td>
<td>15,000</td>
<td>200,000</td>
<td>150,000</td>
<td>2 million</td>
</tr>
<tr>
<td>Total</td>
<td>Totals</td>
<td>369,682</td>
<td>2,124,000 families (10.5 million individuals)</td>
<td>4 million</td>
<td>31.2 million families (200 million individuals)</td>
</tr>
</tbody>
</table>

VI. Findings/Conclusions/Next Steps

The conditions for successful smallholder irrigation relate to implementation of the model set out above. Clearly poor smallholder farmers all over the world could benefit from these technologies, which they currently lack access to. The conditions under which they will
Smallholder Irrigation Market Initiative

adopt these technologies need to be carefully studied and developed. Lessons learned from Bangladesh and a growing list of other countries have assisted us in defining a model for delivering appropriate technologies to smallholders and developing their understanding and willingness to adopt the technologies. Adoption rates are dependent on many factors. The model attempts to systematize these and serves as the basis for developing effective programs worldwide.

Specifically, the conditions for successful implementation of smallholder irrigation programs include:

?? Carrying out a feasibility study that identifies opportunities and tests potential technologies
?? Developing the technology
?? Building the supply chain and rural mass marketing
?? Integrating agriculture and work to expand the market for agricultural produce
?? Measuring impact and feeding back information to redesign programs

The case studies have served to verify the model and provide insights into new methods of implementation.

Estimating the market potential for smallholder irrigation technologies is an inexact science. Three important factors have been identified (resource constraints, socio-economic constraints and output market constraints). Experience has shown that smallholder irrigation technologies will expand to a certain percentage of the overall irrigated acreage. Marketing constraints, while often cited as a major limitation, have proven less important than initially thought since farmers can produce a wide variety of crops with micro-irrigation.

Overall we see a huge untapped potential for smallholder irrigation technologies. This demand is well beyond that which can be satisfied by a single donor or single implementing agency. The experience of the treadle pump in Bangladesh, which has enabled over 1.3 million farm families to move out of poverty, provides the model for future programs, with the private sector playing an important role once the initial market is established. Start-up programs need to emphasize technology, rural mass marketing and other factors. The demand for smallholder irrigation technologies needs to be addressed on a global scale, with intensive country level programs by a number of implementers and coordination at a central level. The Global Initiative on Smallholder Irrigation has tackled an ambitious goal and should move quickly toward the next step of preparing a detailed business plan to target at least one million poor farmers per year.

Potential Mechanisms for Bank Group Support

The World Bank considers small-scale irrigation to have great potential for enabling commercial markets for high value, sustainably produced crops, thereby creating wealth and expanding jobs. The Global Initiative for Smallholder Irrigation reflects this vision. However, defining approaches to aggregating these small, distributed technologies into technical assistance and financing packages suitable for development bank action is difficult.
The increasing focus of the Bank on poverty alleviation, coupled with Bank policy to work more closely with NGOs and the private sector and looming water shortages has encouraged more innovative approaches to including small-scale irrigation activities in financing and technical assistance packages\(^3\).

Traditionally, the major development banks\(^4\) faced several obstacles in packaging small-scale irrigation activities into a loan package:

- Minimum loan size to justify the bank’s investment in the entire project cycle is often too large for the needs of a national small-scale irrigation initiative.\(^5\)
- Small-scale irrigation is essentially a dispersed, local activity where bank funding tends to support centralized, large-scale investments or investments targeted at large institutions (e.g. national research and extension systems) capable of absorbing large tranches of funds.
- Traditionally, small-scale irrigation has depended on NGOs or Community Based Organizations to jumpstart the process with training, demonstrations, loans, and mass communication campaigns. Banks have traditionally focused on public sector institutions.

However, recent innovations in funding and country agreements have reduced significantly these barriers to funding small-scale irrigation initiatives.

- Governments, as the borrowing agencies, have been more amenable to passing on responsibilities and funding to NGOs or other local organizations to plan and implement activities.
- Targeted microfinance projects have been able to provide a package (training, funds, marketing assistance, etc.) to promote small-scale irrigation.
- Small-scale irrigation, where feasible, can be part of a larger loan package such as a larger water development or rural development project. Such projects often include investments to support other parts of the small-scale irrigation project business model such as rural roads and marketing infrastructure.

The Niger Private Irrigation Project, currently in the World Bank project cycle for 2001, represents many of these innovations in practice. The Government has decentralized management of water resources to local communities and encouraged greater private sector participation. The project combines tube wells with manual pumps, thus increasing project size, and includes funds for training, technical assistance and finance. An umbrella NGO will implement the project. Advice will include study tours, workshops, demonstrations, field trials, field days, and techniques to improve crop yield and quality. This work will be

\(^3\) A good example is the proposed Niger-Private Irrigation Promotion project proposed for 2001 funding. This is discussed below.

\(^4\) The section refers to development banks in general, including the World Bank, Asian Development Bank, Interamerican Development Bank and African Development Bank. These are collectively referred to as banks or development banks.

\(^5\) The projections provided in the paper for India illustrate this point. The potential for drip irrigation was stated as 10.5 million ha and if 1/10 of that could be converted to drip irrigation per year using low-cost small scale irrigation technology, and assuming this would require development bank funding for only a small proportion of total funding, then the amount required would probably be about the minimum loan size.
contracted out to the Niger Association for Private Irrigation Promotion ANPIP). The program will also create savings associations; provide land-titling assistance for project beneficiaries; and assist local irrigation service providers. Total project cost is programmed at $33 million.

As the result of this study and interviews with Bank staff, we have identified four priority avenues of exploration:

1. Follow-up on specific Task Manager interest in integration of smallholder irrigation in Bank projects in the pipeline;
2. Explore with the Bank and with donors placement of a Smallholder Irrigation Specialist in the Rural Development Group of the Bank dedicated to preparing subproject components in Bank projects;
3. Investigate with IFC the creation of a specialized Smallholder Irrigation Investment Fund coupling technical assistance with business development services and finance to invest in small enterprises along the supply chain for micro-irrigation, along the lines of the Solar Development Group model;
4. Engage relevant Bank staff in donor funded RD&D activities and pilot programs in key countries.

Next Steps

The following are priorities for follow-on activities to this initial study:

?? Conclude the Market Potential Study
?? Secure funding for and finalize Global Initiative Planning
?? Convene global network of donors and implementers (May 2001)
?? Explore mechanisms for Bank Group and donor support
?? Commercial ramp-up in key countries
VII. References


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