# The Smallholder Irrigation Market Initiative Volume I: A Framework for Action



By International Development Enterprises and Winrock International



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# **VOLUME I**

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# **EXECUTIVE SUMMARY**

The Smallholder Irrigation Market Initiative is an effort by International Development Enterprises (IDE) and Winrock International (WI) to work with multilateral and bilateral donor agencies, industry, research, foundation and nongovernmental organization communities 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 purpose of the initiative is to achieve large-scale poverty reduction through water control at the smallholder level, accompanied by sustainable intensification of farming supported by market development and mobilization.

This report to the Ministry of Foreign Affairs, Government of the Netherlands is the result of its financial support for a ten-month effort to conclude the Business Plan for the Smallholder Irrigation Market Initiative and to prepare five key country level pilot programs specifying practical steps to ramp-up the markets for smallholder irrigation. The ambitious overall goal of the initiative is to mobilize the development community to help 30 million smallholder families (approximately 150 million people) into market economies and out of poverty by the year 2017. The approach is to focus on the critical factors of technology, capacity, capital/credit, and information across the value chain of input chains, smallholder as productive entity, and output markets.

The SIMI Business Plan is implemented along two separate but related thrusts. First, in order to coordinate global knowledge sharing and the implementation of specific field projects, an overall management structure for SIMI is described. Secondly, this plan outlines a mechanism for applying adaptive research results, implementing activities, and adapting them as projects for local conditions. The following business plan includes focus on an overall management system for the initiative and detailed regional implementation programs as fundable next steps for a field-based action program in five key agro-ecological zones: The Deccan Plateau; The Poor Hills of Asia; The Gangetic River Basin; Southwestern China; Sub-Saharan Africa; and Eastern India.

#### The SIMI Approach

The goal of the Smallholder Irrigation Market Initiative is to expand rapidly the commercialization of small-scale agriculture through the sustainable adoption of small-plot water control systems. This goal will be accomplished through the development and strengthening of a global commercial supply chain for small-scale irrigation technologies geared to smallholder farmers. The approach is based on over twenty years of field testing by IDE, WI and the international development community, verified through an extensive literature review<sup>1</sup> and an intensive field study of the potential and constraints for the dissemination of small-plot irrigation technologies in six regional zones in Asia and Africa. The methodology and results of this fieldwork are presented in this plan.

The SIMI team has identified at least 30 million households that could benefit from the adoption of low-cost and affordable water control systems in the context of market participation. Market participation described here includes commercial market supply chains for technology (agricultural inputs including water management devices) and for marketing the higher value

<sup>&</sup>lt;sup>1</sup> <u>Smallholder Irrigation Initiative; Study on the Dissemination Potential of Affordable Drip and Other</u> <u>Irrigation Systems and the Concrete Strategies for their Promotion</u>, Winrock International and International Development Enterprises, March 31, 2001.

agricultural goods the smallholders will produce through the use of these technologies. The studies have identified a set of constraints and opportunities for rapidly expanding the adoption of these technologies from the currently installed base to about to 30 million poor households over a period of approximately 15 years.

This SIMI business plan advocates a 15-year timeline for tangible, human development impact against poverty in 30 million households worldwide. This vision includes three main stages:

1). Knowledge capture, including both technological research and field implementation lessons, of past rural agricultural development and irrigation initiatives by the SIMI team and the development community as a whole,

2). A six-year, targeted "take off" phase of field research and extension activities in five designated agro-regions, implemented under the model of the SIMI field action methodology, organized into two 3-year phases, and

3). A 12-year process, continuing beyond the initial three "take-off" years, which aggregates the successes and lessons of this approach and applies them to a scaled-up effort to extend the SIMI initiative worldwide.

The following SIMI business plan is comprised of two principle components: 1) a global system for organizing and managing the initiative, and 2) a field program customized to meet the particular needs of the five regional zones that were analyzed as part of the plan. Each component is described below with both specific budget estimates for the three-year intermediate planning period. Both public sector financing as well as commercial financial requirements are described.

#### **INTRODUCTION**

The focus on affordable smallholder irrigation technology, which is a key part of this plan, has its roots in the life experience of several thousand small farmers in developing countries all over the world. Over the past 20 years, evidence has mounted and shown that creating access to affordable small-plot irrigation technology for small farmers increases both their productivity and income -- providing a powerful poverty alleviation strategy.<sup>2</sup> Over this period, almost a million and a half treadle pumps have been purchased and installed by smallholders in Bangladesh, facilitated by International Development Enterprises (IDE). Costing about \$25 each and purchased from local private-sector enterprises, the treadle pumps are helping farmers to generate \$130 million dollars a year in new net income. Since this original program in Bangladesh began 15 years ago, private-sector based programs have rapidly expanded to India, Nepal, Cambodia, and Zambia. Other programs have spread to Mali and Burkina Faso, with the help of the non-governmental organization (NGO) Enterprise Works Worldwide. Approtech, a Kenyan-based NGO, has achieved annual sales of more than 6,000 pumps in Kenya, demonstrating that volume sales are possible in Sub-Saharan Africa.

In the past five years, a second generation of affordable small-plot irrigation technologies has emerged in the form of low-cost sprinkler and drip irrigation systems. More than 25,000 low-cost drip systems have now been purchased and installed by small farmers in western India, the hills of Nepal, China, Sri Lanka, and Kenya by organizations such as IDE, Chapin Watermatics, The Yanshan Institute in China, and Netafim. The initial evidence indicates that smallholder return on investment for low-cost drip systems parallels or exceeds the return rates generated by treadle pumps.

Central to the success of these initial programs is the realization that a large majority of the farmers in developing countries cultivate less than five acres. Their increased income and productivity must be the central focus of practical solutions to rural poverty. Lessons learned from agricultural development over the last 20 years makes it clear that there are vast untapped opportunities for smallholder irrigation in rural communities. Micro-irrigation has the potential to be a significant catalyst for practical rural poverty alleviation initiatives. These previously untapped opportunities are the focus of the Smallholder Irrigation Market Initiative (SIMI) business plan, presented by IDE and Winrock International. The business plan described in the following pages, however, reaches beyond private sector dissemination of affordable smallholder irrigation technologies and into a comprehensive approach of creating smallholder market systems.

Detailed interviews with farmers in Bangladesh who had owned treadle pumps for several years gave us some surprising new information. Although farmers increased their annual net income by an average of \$100 a year, about one fifth of them increased their annual income by \$500 a year. When we questioned these farmers to learn about the difference between \$100 and \$500 farmers, the information they provided proved revealing:

• Five hundred dollar farmers had shifted from subsistence crops to high-value cash crops

<sup>&</sup>lt;sup>2</sup> Shah, Tushaar, Alam, M, Kumar, M. D,, Nagar, R. K., and Singh, M. Pedalling Out of Poverty: Social Impact of a Manual Irrigation Technology in South Asia. International Water Management Institute, Research Report 45, Colombo, Sri Lanka, 2000.

- They practiced diversified farming, rarely growing less than six high value cash crops
- They were more market savvy than \$100 farmers. For example, they were careful to produce cabbages three weeks before the glut hit, when prices were twice as high
- They used advanced agronomic techniques, including timely and appropriate fertilizer and pest management strategies
- They often had good access to credit
- They had good market information, and good access to markets where they could get the best prices

IDE and Winrock have incorporated what we learned from the \$500 farmers into the basic strategy of the SIMI business plan. The plan focuses, first and foremost, on facilitating a smallhold farmer's access to affordable irrigation in five key regions of the world. Access to irrigation water is the key starting point for a shift from subsistence to marketable cash crops, but opening smallholder access to markets, agronomic inputs, information, and credit are also critical components for poverty alleviation. All of these activities, triggered by smallholder use of affordable small-plot irrigation, form the central focus of this business plan.

The subsequent business plan for the Smallholder Irrigation Market Initiative (SIMI) includes three volumes: the first, directly following, includes a discussion on the rationale of the SIMI approach for rural poverty alleviation, a framework for action, a description of the specific steps that the SIMI field teams recommend to move forward with the plan, specific investment opportunities for donors, and an introduction to Volumes II and III of this business plan in the form of a synthesis of the main points. Volume II includes five chapters, each a discussion of the field research and analytical recommendations for the five ecological regions studied by the SIMI field team. Each chapter includes a discussion on immediate investment opportunities for that region, with proposed budgets attached. Volume III is a specific study which lays the groundwork for SIMI smallholder credit and supply chain financing strategies.

# I. POVERTY REDUCTION THROUGH THE CREATION OF SMALLHOLDER MARKETS

This business plan for the Smallholder Irrigation Market Initiative (SIMI) lays out the actions and investments required to lift some 30 million poor rural households out of poverty through the creation of *smallholder market systems*. An overarching principle of this plan is that the rural poor must participate in commercial markets if they are to break the bonds of poverty. The necessity of this principle has been well documented through the work of IDE, Winrock, and SIMI partner organizations and also represents an emerging consensus of development practitioners, institutions, and scholars.

Fieldwork by the authors of this business plan, International Development Enterprises (IDE) and Winrock International (WI), has demonstrated that the productive use of water through affordable, small-plot irrigation systems is a powerful entry point for enabling smallholder participation in markets. A key objective of this plan is to accelerate the massive adoption of small-plot irrigation technologies through commercial markets.

Drawing on over twenty years of field experience by IDE and WI, this document presents a plan for immediate action, as well as a long-term vision for poverty reduction through the development of markets that serve smallholders. Data from desk studies that document the potential of micro-irrigation for smallholders were further supported by the results of intensive field studies in five regional zones in South Asia, China, and Africa that were conducted to inform this Plan and which are presented in Part II.

#### **Rural Poverty and the Agricultural Sector**

Today, more than 1.2 billion people—some three times the total population of North America live in "extreme consumption poverty<sup>3</sup>," which the international community defines as the equivalent of living on less than one dollar per day. Seventy –five percent of these people reside in rural areas, have very small land holdings, and depend directly on agriculture for their livelihood.<sup>4</sup> Despite this fact, small farmers have not been a primary priority of international aid, and its focus has been drifting away from the agricultural sector for the past 15 years.

It is becoming clear that existing approaches to poverty alleviation are falling short of global development goals. It is also recognized that the locus of poverty is in rural areas and will likely remain there for the foreseeable future; projections suggest that over 60 percent of the "dollar poor" will continue to live in rural areas in 2025.<sup>5</sup> Furthermore, there is a growing realization that economic growth in non-farm sectors depends in large part on a vibrant and prosperous agricultural sector. All of these factors argue strongly for a renewed concentration of international aid in rural areas and in the agricultural sector.

More specifically, the emphasis must be on access to and productive use of the limited resources available to the rural poor (land, water, information, skills, technology, and capital), to enable them to become full-fledged market participants—both as consumers of agricultural inputs and producers of goods for expanding markets. A farmers' engagement with commercial markets

<sup>&</sup>lt;sup>3</sup> <u>Rural Poverty Report 2001</u>, International Fund for Agricultural Development, Oxford University Press Inc., New York, NY, 2001.

<sup>&</sup>lt;sup>4</sup> Reaching the Rural Poor: A Strategy for Rural Development. World Bank 2001.

<sup>&</sup>lt;sup>5</sup> Rural Poverty Report 2001, International Fund for Agricultural Development, Oxford University Press, Inc., New York, NY 2001.

must, in turn, provide sufficient income to enable each household to reinvest in their rural enterprises and in turn, to propel themselves to relative prosperity.

# The Basic Tenets of Smallholder Market Creation

The Smallholder Irrigation Market Initiative (SIMI) is predicated on several underlying premises as summarized below.

# 1. Focus on the smallholder

Effective solutions to poverty must deal directly with smallholders for the simple reason that they constitute the majority of the world's poor. This plan defines smallholders as farmers cultivating between 20 square meters and two hectares of land, though in some cases, such as in dry areas, larger farms may be a prerequisite for sustainability. The term "smallholder" denotes a rural household operating in the context of at least rudimentary market systems, with highly restricted access to land, water and capital, and whose family labor is its principle asset. The goal of SIMI is to target the portion of the rural poor who depend directly on agriculture and that can gain access to land and water resources. In the desk-study phase of this business plan, the SIMI team identified approximately 30 million rural households in Asia and Africa that meet the above criteria.

# 2. Market participation and asset creation

A primary cause of the persistent poverty faced by the rural poor is that they have limited interaction with commercial markets. With less than one dollar per person per day, they



cannot afford to purchase agricultural inputs or invest in production technologies, resulting in low land and labor productivity that does not rise much above subsistence levels. Consequently, they have little or no surplus production to sell to the market. Limited to a subsistence economy, the majority of smallholders have no opportunity to break the cycle of poverty and improve their lives.

Market participation is the key to asset

creation, which is in turn a means for increased market participation. The challenge is to start a process of progressively increasing market participation, enabling the smallholder to carefully accumulate assets and make the transition from subsistence farming to commercial farming. Smallholders must gain access to purchased inputs (irrigation equipment, seeds, fertilizers, farm implements) to enhance their existing production assets (land, water, family labor, traditional knowledge), which result in increased agricultural production, which may be further increased in value by on-farm storage and/or processing, and which can be sold to expanding markets. The farmers can then reinvest the profits from the market and sales into the production system.

#### 3. Water as the key to market participation

There is a remarkable correlation between rural poverty and a lack of control over water for irrigation. "Roughly half of the world's poorest people live on marginal lands- arid areas, steep slopes, and the like, that are prone to degradation."<sup>6</sup> In many of these areas, groundwater tables are falling and surface water resources are under increasing competition from industrial and municipal users. In many areas, water scarcity may also be exacerbated by climate change.

Without access to water and control over it, smallholders do not have a basis for commercial agricultural production. The risk of losing their crop due to erratic rainfall or inadequate irrigation water deters the smallholder from investing in high-value crop production. The ability to control water at critical stages of crop production is the single most important factor for enabling smallholders to enter commercial agricultural production.

#### 4. Comparative advantage of smallholders in high-value crops.

Smallholders have an important advantage over larger farmers in that their family labor can be applied to their small landholding with little or no cost for supervision.<sup>7</sup> The smallholder can capitalize on this characteristic to develop a comparative advantage in labor-intensive farming systems where the factors of production must be closely managed. Comparative advantage is most readily developed in the production of certain high-value crops such as fruits, vegetables, nuts, spices, mushrooms, flowers and other specialty crops.

With concentrated, labor-intensive production systems, it is possible for smallholders to achieve higher yields per unit area and better quality produce than farmers that cultivate larger areas with capital-intensive farming systems. Larger farmers, on the other hand, are usually better suited to the production of staple crops, which require less intensive management and are more adaptable to mechanization than most high-value crops. The smallholders' aptitude for high-value crops and the large farmers aptitude for staple crops results in a comparative advantage for smallholders in the production of high-value crops.

This comparative advantage of smallholders can be further enhanced through the provision of products and services that are suited to their unique characteristics and that will enhance their ability to grow and sell crops efficiently.

# 5. Creation of market systems for the rural poor

The integration of smallholders into agricultural markets is a gradual process and does not normally happen without outside intervention due to specific market biases.

• Suppliers of agricultural inputs tend to neglect smallholders as a potential market due to smallholders' modest purchasing power and the high transaction costs

<sup>&</sup>lt;sup>6</sup> <u>Human Development Report 1998.</u> "Changing Today's Consumption Patterns for Tomorrow's Human Development." UNDP 1998.

<sup>&</sup>lt;sup>7</sup> Costly supervision is required to monitor the work of non-family agricultural labor (Stiglitz, 1974). The costs of monitoring labor for non-mechanized, labor-intensive agricultural production are particularly high (Eswaran and Kotwal 1985).

associated with a disorganized, fragmented population segment that prefers to purchase in small quantities and frequently requires credit.

- Smallholders' access to output markets is often restricted by long distances and poor infrastructure. Commercial buyers may neglect smallholders due to high transaction costs, variations in quality, and discontinuous delivery schedules.
- There is also a marked absence of smallholder-appropriate products and services available through private market channels. Larger, more powerful landowners are better able to influence markets and agricultural research institutes to serve their interests (by developing and distributing labor-replacing technologies instead of labor-using technologies, for instance).<sup>8</sup>

Despite these biases against smallholders, the experience of IDE and WI is that smallholders can in fact participate effectively in agricultural markets when appropriate support is provided for the smallholders and for the private enterprises in the input and output markets. Developing smallholder market systems provides this support.

Sustainable supply chains must be developed to deliver the products and services that smallholders require to engage the market on economically rewarding terms. Numerous examples exist that demonstrate the feasibility of providing such products and services through private-sector channels, among which is IDE's experience in disseminating some 2 million micro-irrigation systems over the past 20 years.<sup>9</sup>

Smallholder market systems must be also be demand-driven. By identifying agricultural opportunities that have large and expanding markets (and for which smallholders have a comparative advantage) the demand acts as a magnet pulling together the necessary resources and drawing them through the system.

#### 5. External investment in Smallholder Market Systems

When a smallholder market system reaches maturity, it will be populated primarily by micro-, small-, and medium-enterprises (including the smallholders themselves, who are considered to be micro-enterprises) with minimum levels of subsidization from external

sources. During the market development phase, however, significant external investment (from donors and governments) is required to "set the stage" for a dynamic and expanding market system.

"Setting the stage" includes specific interventions to identify and remove barriers that hinder the integration of the poor into markets. For instance, the following list



<sup>&</sup>lt;sup>8</sup> Richard Grabowski, "The Implications of an Induced Innovation Model," *Economic Development and Cultural Change 27*, July 1979, 723-34

<sup>&</sup>lt;sup>9</sup> Other examples of private-sector delivery models can be found in "Poverty Alleviation as a Business," Urs Heierli, SDC

summarizes barriers to the availability of irrigation-related, income-generating technologies for smallholders:

- Lack of information by all potential market participants on what the systems can do and how to operate them.
- For very small-scale systems, initial returns to private companies are too low to guarantee entry.
- Generic promotion costs to overcome information gaps and develop profitable volume of market sales cannot be recovered by supply chain in the initial stages of product introduction.
- For smallholders, there can be initial cost barriers, even for small-scale systems. This prevents market growth to levels where private sector profitability can occur.
- All elements in supply chain and the links between elements are not developed, so that market failures occur at one or more points along the chain.
- Producers lack knowledge about potential markets or specific market segments.
- Producers are unable to forecast demand, supply, and prices for new products at different points in time and space and for different product characteristics.

Well-planned external investments will unleash market forces to create smallholder market systems that are not only self-sustaining, but also self-expanding. Additional external investments in watershed conservation projects were also found to be necessary to increase water supplies to smallholders in the Deccan Plateau and Poor Hills of Asia.

#### **The SIMI Approach**

The goal of the Smallholder Irrigation Market Initiative (SIMI) is to rapidly expand the commercialization of small-scale agriculture through the creation of smallholder market systems, with small-plot water control systems as an entry point. The program approach is based on over twenty years of field experience by IDE, WI, and the international development community, verified through an extensive literature review<sup>10</sup> and an intensive field study of the potential and constraints for the dissemination of small-plot irrigation technologies in five regional zones in Asia and Africa. The methodology and results of this fieldwork are presented in Part II of this plan.

The SIMI team has identified at least 30 million households that could benefit from the adoption of low-cost and affordable water control systems in the context of market participation. Market participation described here includes commercial market supply chains for technology (agricultural inputs including water management devices) and for marketing the higher value agricultural goods the smallholders will produce through the use of these technologies. The studies have identified a set of constraints and opportunities for rapidly expanding the adoption of these technologies from the currently installed base of about two million users to 30 million poor households over a period of approximately 15 years.

<sup>&</sup>lt;sup>10</sup> Smallholder Irrigation Initiative; Study on the Dissemination Potential of Affordable Drip and Other Irrigation Systems and the Concrete Strategies for their Promotion, Winrock International and International Development Enterprises, March 31, 2001.

An important aspect of the work that SIMI proposes is that of an emphasis on sustainable livelihoods for the participating farmers and members of the emerging private sector. In order for micro-irrigation technologies to succeed in reducing rural poverty, the initiatives must take into consideration how the recommended activities can be maintained and enhanced in the future. The resulting market-based livelihoods that SIMI seeks includes provisions for coping and recovering from stresses and shocks. Additionally, smallholder market creation must also include improved social and institutional livelihoods. While increased financial capital is the main objective for SIMI beneficiaries, human, social, natural and physical forms of capital must also be maintained or improved. This means, for example, that the important cultural threads that revolve around farming practices or certain crops are taken into consideration, as are gender and adult/youth roles in the family. A clear set of objectives and impact indicators for each aspect of the initiative will be included with the field action plan, and these will take into consideration the diverse aspects of human development that are necessary components to poverty reduction.

This SIMI business plan advocates a 15-year timeline for tangible, human development impact against poverty in 30 million households worldwide. This vision includes three main stages:

1). Knowledge capture, including both technological research and field implementation lessons, of past rural agricultural development and irrigation initiatives by the SIMI team and the development community as a whole.

2). A six-year, targeted "take off" phase of action research and model testing in five designated agro-ecological regions, organized into two, 3-year phases. Validating the proposed SIMI approach, This phase is called the Core Action Research and Development Program (CARDEP).

3). A twelve-year implementation phase, beginning in year three of the initial CARDEP period, which applies tested and validated methods in a scaled-up effort to extend the SIMI initiative worldwide.



Figure 1: SIMI Impact Timeline

The following Smallholder Irrigation Market Initiative business plan comprises two principle components: 1) a global system for organizing and managing the initiative, and 2) a field program customized to meet the particular needs of the five regional zones that were analyzed as part of the plan. Each component is described below with both specific budget estimates for the three-year intermediate planning period. Both public sector financing and commercial financial requirements are described.

# II. SETTING UP A FRAMEWORK FOR ACTION

The SIMI Business Plan is implemented along two separate but related thrusts. First, in order to coordinate global knowledge sharing and the implementation of specific field projects, an overall management structure for SIMI is described. Secondly, this plan outlines a mechanism for applying research plans, implementing activities, and adapting them as projects for local conditions. This field-based methodology is called the **Core Action Research and Development Program (CARDEP).** The SIMI management structure is described below, while the CARDEP methodology is described in the following section.

# **SIMI Management Structure**

At the global level, a mechanism is required to effectively organize the efforts of the international community to respond to the SIMI challenge. It will: 1) galvanize the international community around the SIMI approach, 2) publicize the opportunities created by SIMI, 3) focus the resources and attention of the donor community and the commercial private sector on the practical challenges presented by SIMI, and 4) correct market failures by helping to organize the commercial market for affordable, small-plot irrigation technology.

The management of SIMI comprises three functions and corresponding organizations: 1) the SIMI Governing Board to set policies and to coordinate the global SIMI program, 2) the Advisory Council to provide technical and implementation guidance and linkages among partners, and 3) a Secretariat, which functions as an administrative body for SIMI.

**SIMI Governing Board.** The primary managing partners of SIMI have agreed to create and support a Governing Board (GB) for SIMI, to facilitate a focused global approach. The Governing Board's principle function is to organize, monitor and set policy direction on the overall SIMI practice and approach, as well as to provide technical advising to the implementing partners.

The functions of the Governing Board can be grouped into four components:

- Communicate and promote the SIMI approach among the private sector, donor community, governments in LDCs and developed countries, NGO community, and the general public in donor countries and LDC countries.
- Identify opportunities and recommend priorities for the efficient and effective application of donor funding in support of the SIMI goal. This could include recommending international research priorities, identifying capitalization requirements for market development in specific regions, and identifying technical assistance needs.
- Coordinate research on the methodology and impact of market-creation projects worldwide in order to continually learn from field experience and refine strategies accordingly. Data from field projects will be monitored, evaluated, and synthesized resulting in a body of knowledge that will define general principles and best practices for smallholder market creation.
- Approve SIMI work plans, and oversee the Secretariat's activities, monitor progress and report to the stakeholders.

The authority and credibility of the Governing Board, and ultimately its effectiveness in influencing the flow of development funds toward smallholder markets, will derive from the fact that the membership will include individuals from the primary SIMI partner organizations, who

are reputed for their expertise in rural development. The Governing Board will consist of seven members, with standing representations, comprised of:

- NGO Representatives (2)
- World Bank Representative
- Irrigation Experts (2)
- Private Sector Supply Chain Representative
- Bilateral Donor Representative

**SIMI Advisory Council.** The Advisory Council (AC) will consist of all SIMI partners (donors and implementers) and stakeholders, and will be convened by the Governing Board, via the Secretariat, to discuss plans and activities, provide technical and policy advice, implementation links, and partner coordination. SIMI is an articulated approach to poverty alleviation, but also an action-oriented initiative to coordinate the numerous components of the approach. SIMI monitors and coordinates the geographically based projects as well as the sector-based projects that contribute to the SIMI goal. Therefore, the Advisory Council is a forum for the organizations working toward the SIMI goal to regularly review the SIMI program, assess progress, provide feedback to the SIMI Governing Board and Secretariat, and provide an opportunity for partners to exchange information.

The Advisory Council will advance SIMI goals by defining new entry-points and partners by:

- Identifying market opportunities for smallholders
- Identifying gaps in the products and services available to smallholders that limit their ability to exploit market opportunities. Products and services are defined broadly as the technology, training/knowledge, market information, and financing necessary for smallholders to produce and sell crops effectively, profitably, and sustainably.
- Identifying private-sector enterprises that can provide appropriate products and services to smallholders, providing agricultural inputs and linking them to market opportunities.
- Helping private-sector enterprises to access the capital needed to start or expand business activities that serve smallholders.
- Exchanging knowledge about research, field projects, lessons learned, and new opportunities among the community of SIMI partners.

**SIMI Secretariat.** The SIMI Secretariat will be the main implementing staff center for SIMI, carrying-out the daily activities necessary to move the SIMI field activities forward. The Secretariat is responsible for:

- Executing the program and generally providing staff support for SIMI.
- Acting as a clearinghouse for public knowledge and information related to the creation of smallholder market systems. This function will include maintaining a public-access knowledge base; coordinating the collection of relevant market data (global, regional, local); and organizing seminars and conferences.
- Creating a long-term strategic plan and annual work plans, as well as continually advancing the investment opportunities and funding needs of SIMI projects.
- Designing and implementing regular impact monitoring and assessments.

The Secretariat also supports the donor-internal SIMI departments or individual project officers by providing advice, backstopping and training to implementing agencies. The Secretariat will play a leadership role in providing and coordinating technical assistance activities for implementing organizations requesting consultation and assistance. As the initiative expands, partner organizations will become active Secretariat players.

The Secretariat will receive input from the Advisory Council, but will be directly guided by, and responsible to, the Governing Board. Winrock International and IDE, as the financially accountable managing partners, will house the Secretariat and are also directly responsible for the Secretariat.

**Managing Partners.** For the initial conceptual design of SIMI, the early management needs of SIMI, the implementation of the pilot field programs, and as well as for continued financial accountability, Winrock International and International Development Enterprises (IDE), has formed a partnership together, referred to as "WI-IDE." Both organizations have made significant direct financial contributions to the establishment of SIMI, as well as personal, humanitarian commitments. Additionally, both organizations have fully audited and proven inhouse capability and staff resources for the management of programmatic and financial responsibilities. This team of managing partners is also well represented with highly trained personnel in the locations where the field development programs are proposed. These organizations will serve as the initial pilot platforms on which the SIMI participants will work together.

#### **Examples of other SIMI Partners.**

Loan and Grant Making Agencies: Agencies that are willing to allocate part of their poverty reduction resources under the general umbrella of SIMI. They contract directly for investment opportunities that are identified by SIMI partners, and essentially fund individual components of the overall SIMI program. They use their standard project designimplementation-evaluation practices to finance discrete projects, so that funds flow directly from the agency to the projects but under the framework of SIMI goals and methodology. Within these agencies, there will be a designated department, or individual project officer, which will become members of the Advisory Council and liaise with the SIMI managing entities. These departments advise their respective agencies concerning SIMI priorities and standards, and thus influence the flow of project resources.

**Specialized Services to the SIMI Effort:** These are existing entities (e.g., CGIAR Centers, universities, commercial enterprises) that are contracted by selected donor agencies (but acting on the advice of SIMI) to provide specialized services such as research, technology adaptation, and market related information services.

**Implementing Organizations:** Implementing organizations are those who commit to carry out the field-based programs within the SIMI ideology, and as part of the planned CARDEP methodology. The implementing organizations receive funding from the above-described loan and grant making agencies, as well as the private sector, when available. Winrock International and IDE are currently the two main implementing organizations for the initial phases of SIMI.

#### A Multi-Organizational Approach

The CARDEP phase within SIMI calls for a multi-dimensional strategy to help overcome the numerous constraints at the input, farm, and output levels that prevent smallholders from participating fully in commercial markets.

Given the large scope and broad range of activities required to create smallholder market systems, it is clear that successful implementation of CARDEP will rely on the coordinated efforts of many actors, which, depending on the location, may include government, research institutes, NGOs, community-based organizations, and private-sector companies.

The managing partners of IDE and WI, will be the primary implementing agencies during the initial stages. The areas of direct CARDEP implementation by IDE and WI will vary depending on the background and experience of the local program staff and the capacity of other organizations in the region.

Working in cooperation and coordination with others, IDE and WI will take the initial lead role in:

- Designing the market system to be created, which includes gathering baseline data, identifying water strategies, cash crops, constraints, and intervention strategies, as described in the 6-step process,
- Promoting the SIMI approach and CARDEP model internationally and within each agroregional location, in order to engage the participation of other key organizations,
- Creating a "platform" on which IDE, WI, and other actors can converge to jointly contribute to the goals of SIMI, and the implementation of the three-year CARDEP plans, and
- Coordinating the CARDEP-related activities of all participating organizations.

# III. FIELD ACTION PROGRAM

While the conceptual and methodological framework of the SIMI approach is grounded in many years of experience, as well as recent targeted field-based feasibility studies, its application on a large scale merits further testing and development. This is the purpose of the CARDEP phase of SIMI. In addition to CARDEP in each region, there will be significant opportunities for expanded projects to begin in the same regions.

CARDEP will use an action-oriented, applied research approach to further develop and fine-tune the intervention methodology, which will lead to the creation of agricultural markets for the rural poor. Specifically, a standard methodology is needed for the systematic integration of the lessons learned from field experience, to ensure quality, impact-oriented strategies, and to translate this experience into an approach that can be used in varied contexts and with millions of smallholders.

CARDEP will be undertaken in five key poverty-afflicted regions of the world

- The Gangetic River Delta, represented by Bangladesh and West Bengal, India,
- South-western China, represented by the "Natural Greenhouse" valleys in Guizhou Province,
- The Deccan Plateau of India, represented by the Maharashtra State,
- The Hill Areas of Asia, represented by Nepal, and
- Sub-Saharan Africa, represented by Zambia.

The field programs proposed in each of these locations are described in Volume II, and summarized in Table 1below. WI-IDE has existing programs and strong teams in all five areas where the field programs are to be implemented.



The five areas represent a wide cross-section of differing conditions that have an important bearing on market creation for the poor (e.g., water availability, population density, market access). This will allow WI-IDE to test and further develop the CARDEP model under conditions that, together, are representative of most of the areas in the world where the model is to be applied on a large scale in the future.

In each region, an intervention strategy will be executed that is tailored to the local situation and

aimed at creating a sustainable market system. The results of the fieldwork in each region will be collected, analyzed, and synthesized to develop a replicable intervention strategy for the creation of smallholder market systems in diverse situations worldwide.

	Bangladesh	Southwestern	India- Mahamathua	Nepal	Zambia
	representing Gangetic Plains	representing The Natural Greenhouse	representing Deccan Plateau	representing Poor Hills of Asia	representing Shallow Water in Sub-Saharan Africa
Marketshed	Gaibandha, Kurigram and Bandarban	"Natural Greenhouse" river valleys	12 Districts on the Deccan plateau	7 districts of Central and Eastern Nepal	7 population centers in 5 provinces
Water resource	Rivers and shallow aquifers	Rivers, streams	Rivers, groundwater	Streams and springs	Dambo wetlands and river valleys
Water strategy	Expansion of water markets, low-cost diesel pumpsets	Water storage bags, drip irrigation	Low-cost rope and washer pump and treadle pressure pump; Low-cost drip/sprinkler system; low-cost water storage	Piped water, low- cost drip and sprinkler systems, low-cost water storage	drip irrigation, micro-sprinklers
Cash crops	Cauliflowers, onions, chilies, and potatoes; Turmeric, ginger, and spices	Persimmon, castor-oil plant, papaya, teak	Pomegranate, papaya, mango, ginger, tumeric, citrus, gooseberry	Tomato, cauliflower, onion, pea, eggplant.	Paprika, coffee, fruits, and vegetables
Population density (people/km²)	198	134	336 (All India)	164	13
Marketshed pop. (households)	396,281	10,000	2,000,000	705,000	158,000
Beneficiaries (after 3-years)*	9,500	5,500	10,000	12,000	4,500
Extra net income (after 3 years)**	\$200	\$272	\$450	\$181	\$300

**Table 1: Immediate Investment Opportunities** 

\* Total beneficiaries for all locations after three years is 47,500. Total beneficiaries after six years is 160,000 \*\* For households that were reached in year 1. Average net additional income for all locations in year 3 is \$272. Average in year 6 is \$496. \*\*\*These are supporting activities, with details given in the respective chapters in Volume Two (Sections 4).

In each of the initial CARDEP locations, a six-step process will be used as outlined below to design intervention strategies aimed at the creation of sustainable smallholder market systems within six years. CARDEP will work interactively with local smallholders, enterprises, and organizations to implement the field programs. The specific design for each of the five locations is summarized in the respective chapters in Part II.

#### Figure 2: The Six-Step CARDEP Methodology

- 1. Define the **target marketshed**<sup>11</sup> in terms of its physical, social, economic, and agricultural characteristics.
- 2. Identify the **target population** of smallholders within the target marketshed for which a smallholder market system will be developed.
- 3. Identify the underlying **water strategy** for providing smallholders with access to and control over water resources.
- 4. Identify a preliminary set of **high value agricultural products** that have the potential to provide significant income for smallholders in the marketshed. Select products based on the size and stability of potential markets, comparative advantage of smallholders relative to larger farmers, opportunities for off-season cultivation, and suitability to local growing conditions.
- 5. Identify and prioritize the **market constraints** that prevent smallholders from realizing optimal production levels and participating fully in the market. The analysis begins at the small farm level since the smallholders' constraints will determine what is required from input and output markets. Identify constraints that prevent the input and output markets from meeting the smallholders' needs. For example, if smallholders lack good quality seed, a constraint at the input level may be a lack of capacity to produce, package, and deliver high-quality seed.
- 6. Develop an **intervention strategy** to address the constraints identified above in order of priority. Continuing with the example from above, an intervention strategy to ensure the availability of high-quality seed may include developing a commercial seed production methodology, training a small business to produce the seeds, and/or training farmers in methods to produce their own seed stock.

#### The Synthesis of Field Experience

At its heart, CARDEP is an applied research methodology aimed at developing an intervention model for creating sustainable market systems that will draw smallholders out of subsistence agriculture and into the market economy and increased prosperity. The purpose of the CARDEP field programs, therefore, is to test the intervention model and develop it further to the point

<sup>&</sup>lt;sup>11</sup> The geographical extent of the CARDEP field programs is delineated by *marketsheds*. The concept of a marketshed is based on an analogy with the concept of a watershed in hydrology. A watershed is a hydrologic unit comprising the area that contributes rainfall runoff to a receiving water body. Similarly, a marketshed is an economic unit encompassing the population that interacts with a central marketplace.

where it can be applied on a large-scale basis. The intervention model developed through each CARDEP must be thorough, but also adaptable, so that it may be applied to other geographic locations to replicate the market creation process.

While the development of the intervention model will require a total of six years to complete, it is anticipated that the lessons learned from the testing phase can immediately be applied in other, large-scale contexts. Therefore, it should be possible to design and implement new intervention programs as early as one year after the start of the model testing program. As new evaluation information becomes available, it can be built into these new programs on a continuing basis.

#### IV. FINANCING SIMI

Both public and private investment is required to implement SIMI. Public investment will organize and manage SIMI, while commercial financing is required to invest in the supply chain technology end users. For the initial three-year "take-off" period, \$3.0 million of donor funding is required for the overall SIMI management system while approximately \$28 million will support the initial CARDEP fieldwork needed in the five regional zones. Commercial and private financing required to support supply chain and smallholder participants is estimated to be significant, specifically in the CARDEP marketsheds.

#### **Investment Opportunities**

A. **SIMI Management Structure.** The SIMI Secretariat will be the main administrative body of the initiative, and will require core funding to coordinate its knowledge sharing activities, as well as enable the Governing Board and Advisory Council to promote SIMI opportunities. *The cost of the administrative and coordinating functions of the management structure are estimated at \$1 million per year for the first three years.* 

#### B. Immediate Investment Opportunities: A Three-year Plan

- a. **The CARDEP Methodology.** This methodology is designed to test and further develop the SIMI intervention model in five specific locations. While its scope and corresponding financing is meant to be highly flexible, the five geographical CARDEP plans described in Part II of this plan are the "platform" projects for the first three-years of SIMI. Each CARDEP can be financed in full by a donor, or in targeted components. *The minimum amount of resources required for the execution of the five described CARDEPs for the next three-year phase is \$7.8 million.*
- b. *Geographic Expansion Projects.* Simultaneous with the development of intervention strategies to be applied throughout the respective regions, a series of satellite projects will be implemented with the objective of adapting the regional strategy to the specific conditions of the sub-regions. This will be done through intensive interaction with farmers and development agencies in the sub-region. The intention is to gradually expand the approach being applied in the three-year program throughout the region.

The satellite projects will involve the following activities:

- 1. Do a basic survey of water, agriculture, and socio-economic conditions in each area. This would involve an analysis of the high-value crop sub-sector, including identification of opportunities and constraints specific to that sub-region.
- 2. Based on the outcome of this survey, develop a specific water and small farmer productivity/income generation strategy.
- 3. Form a consortium of agencies (both government and non-government), interested and capable of participating in the proposed set of interventions. Begin the process of orienting and training these agencies in the approaches and technologies of SIMI.
- 4. Conduct field-testing of the selected set of interventions and technologies. Based on these field tests, the interventions and technologies will be adapted to local conditions in preparation for later scaling up operations.

These satellite projects will be conducted within a three-year time frame, serving as a "primer," for which the SIMI team can benefit and then move forward with a scaled up SIMI intervention in the sub-region over a period of 12 years.

The total cost of the satellite projects as proposed under the respective three-year programs of the different regions in Part II of this Plan is \$20.5 million.

- C. Extended 12-year Scale-Up Projects. Based on the lessons learned from the CARDEP and expansion programs in the highlighted regions, the intervention methodologies coming out of CARDEP can immediately be applied to additional areas that can benefit from market creation efforts, as part of a rapid scaling-up process. CARDEP then becomes a generic model that can be applied in relevant regions, and customized according to the interests of the donor. WI-IDE is set up such that it can design specific project proposals based on the CARDEP approach, as well as assume the coordination/implementation role of any CARDEP-type project.<sup>12</sup> It is expected that these scaled-up projects will provide a more cost-effective, wide-spread expansion of SIMI approaches, following the first three-year "take-off" phase. As part of the "ramping up" strategy for SIMI, they will continue minimally for 12 additional years.
- **D. Internal Donor SIMI Projects.** It is expected that the bi- and multilateral donor community will want to carry out a multitude of SIMI-inspired development projects aimed at the rural poor in the years following the first three-year phase of SIMI. The managing partners of SIMI, Winrock International and IDE, as well as the staff of the SIMI Secretariat, will provide technical assistance to funding agencies, in order to inform their request for proposal process of the successes of SIMI.

#### **Options for Financing Sources**

**Public Funding.** The public funding for the initial three-year CARDEP in five agro-regions will be obtained through traditional development funding channels, such as through bilateral and multilateral donors who are interested in supporting field projects under the SIMI ideology. Funding for the management system will be derived from a combination of direct support for the Secretariat, as well as small portions of CARDEP fieldwork funding. Each attached country feasibility study includes an action plan and budget for the CARDEP process in that region, specified by country. Each action plan includes the detailed activities needed to carry out the 6-step CARDEP plan, as well as the potential impacts and additional resources needed for the subsequent 12-year phase. Donors may be interested in funding an entire region CARDEP plan, or components of a specific plan, which can be leveraged with complementary funding from other donors in the same region.

<sup>&</sup>lt;sup>12</sup> Generic budgets for implementing projects based on the CARDEP model are provided in the respective chapters of Volume II. Present indications are that the public investment cost for smallholder marketshed development with 10,000 participating smallhold families is on the order of \$200 per family over a six-year period (i.e., \$2,000,000). Corresponding commercial and private investments required (i.e., investments by farmers, supply chain enterprises, and output market enterprises) – and as expressed on a per-family basis—is expected to be on the order of \$500.

Region/Activity	<b>Total Amount</b>	
	\$ million USD	
SIMI Management Support	3.00	
Gangetic Plains		
CARDEP	1.80	
Geographic Expansion	5.70	
South-western China		
CARDEP	1.45	
Geographic Expansion	2.25	
Deccan Plateau		
CARDEP	1.35	
Geographic Expansion	3.60	
Poor Hills of Asia		
CARDEP	1.65	
Geographic Expansion	4.00	
Sub-Saharan Africa		
CARDEP	1.55	
Geographic Expansion	4.95	
Total	31.30	

 Table 2. Public investment funding required for the first three-year phase of SIMI implementation

**Private Funding**. The SIMI team anticipates that public funding alone cannot finance the activities needed to implement the SIMI plan in its entirety, including the long-term vision of poverty reduction for 30 million households. The sustainability of an effort like SIMI also requires that it does not completely depend on donated funds or loans, but that the private sector becomes an active participant in rural development as well. We expect that capital investments will come from the private sector, including commercial businesses and national/regional finance organizations.

#### V. SUMMARY OF FINDINGS OF THE FIVE REGIONAL FIELD STUDIES

The SIMI Business Plan was informed by 1) desk studies of the global experience in small-scale irrigation development, 2) expert consultation, and 3) intensive field studies in five geographic regions in Asia and Africa that were carried out in late 2001 and 2002 by IDE and WI staff. The five areas were defined according to similar water access characteristics for agricultural purposes and grouped in the general geographic zones. This grouping is useful for analyzing, comparing and contrasting the constraints and potential for the introduction of irrigation technologies to smallholders around what the SIMI business plan describes as "marketsheds." Field study methodology included; 1) collection of secondary data available from a variety of sources in the regions, 2) key informant interviews, and 3) a variation of participatory Rural Appraisal (PRA) methods of structured interviews with farmers, market supply chain participants and intermediaries in the irrigation and smallholder development sector.

Part II contains the detailed analysis and results of each of the field study regions, divided into 5 chapters. These field studies have verified the SIMI hypothesis that small-plot irrigation technologies are a powerful instrument for addressing rural poverty. The data and information derived from the field work have informed the SIMI approach as put forth in this business plan. The sections below contain a synthesis of common constraints and opportunities discovered through this intensive fieldwork.

#### A. Increasing Smallholder Access to Affordable Small Plot Irrigation

In the four of the five regions surveyed, the principle water source for smallholder irrigation was shallow groundwater, or surface water in streams, rivers, and reservoirs.

**Streams and Rivers: Progression from Buckets to Low-Lift Water Devices.** In Sub-Saharan Africa, millions of small farmers, particularly those within reach of city and town markets, lift water from streams, rivers and shallow dug wells by bucket, and carry it to water plants. The main water source in the winter season natural greenhouse of Guizhou province in China comes from rivers, and as in Africa, is carried by bucket directly from the river to the fields. In China, smallholders use a more efficient shoulder bar for carrying two buckets of water. For smallholders lifting and carrying water in buckets, pressure treadle pumps offer an immediate opportunity to expand irrigated land area by a factor of five with the same labor input, where land is available. Therefore, substantial smallholder productivity increases are immediately possible using treadlepumps in Zambia and Kenya.

Areas of Water Scarcity: Progression from Flood Irrigation to Drip Systems. In water scarce areas, groundwater sources are deeper, and often beyond the lifting range of treadle pumps. The Deccan plateau provided a good example of this, and here it is necessary for small farmers to make a major investment in a hand dug well, typically 65 feet deep and 15 feet in diameter. There are a million hand dug wells like this in Maharastra state alone, and SIMI incorporates an initiative to link smallholder irrigation to smallholders with hand dug wells. The water in these wells that is available for irrigation is limited to what accumulates in the well overnight, since it may take 24 hours for the well to recharge. Low-cost water lifting technologies like the rope and washer pump or the Bangladesh deep pump set may make a significant contribution here. Since water scarcity is a critical issue, the introduction of low cost drip irrigation could make significant improvement in crop per drop compared with the inefficient surface irrigation methods currently practiced. In the Deccan plateau, watershed development initiatives are rapidly expanding access to irrigation water for small farmers, but when the newly

recharged wells are tapped for irrigation, water is often distributed to plants with wasteful surface methods. A thrust to link and integrate SIMI strategies with existing watershed development programs forms a significant part of the SIMI business plan in the Deccan Plateau, as well as in the Poor Hills of Asia and the hilly areas of the Natural Greenhouse area of China.

#### Shallow Groundwater Regions: Progression from Treadle Pumps to Low-Cost Diesel

**Pumps to Water Markets.** Shallow groundwater regions are exemplified in the Gangetic Basin, where water is broadly available in the suction range during the winter dry season, when agricultural productivity is low. Smallholder access to shallow groundwater irrigation is remarkably different in the Gangetic basin regions of Bangladesh, India, and the Nepal Terai. The most advanced of these areas is Bangladesh, where the revolution has been in full swing for

15 years and has been based on the widespread sale of treadle pumps.

In Bangladesh, the market for mechanized irrigation pumps in the past five years has been dominated by the imported low-cost Chinese diesel pump sets. With The removal of import duties on diesel pumps, the price dropping from \$500 to \$150 for the cheapest diesel pump, and increased smallholder income for large numbers of owners. This consequently stimulates the purchase of hundreds of thousands of three to five horsepower Chinese diesel pump



sets. Since these pumps produce more water than the average small farm needs, diesel pump owners sell excess water to their neighbors, and this has stimulated the emergence of water markets, which are rapidly replacing treadlepumps as a source of affordable irrigation water for smallholders.

The SIMI strategy in these areas is to facilitate the emergence of water markets in addition to the adoption of low-cost water lifting technologies. The progression from treadle pumps to low cost diesel pumps is also taking place in parts of India<sup>13</sup> and in Africa. In Eastern India, the concentration of treadle pumps is lower than in Bangladesh, and there is still a large market opportunity for treadle pump marketing, as well as for low-cost, locally-made and imported small mechanized pump sets. The least advanced water lifting region is the Terai area of Nepal. In this region, SIMI will focus on header pumps initially, and then facilitate low-cost diesel pumps and water market development progressively. The expansion of water markets has also generated interest by private entrepreneurs in purchasing state-owned and operated deep tube wells, in order to sell water into these markets.

The progression from buckets, treadle pumps, and low-cost mechanized pumps like Chinese diesels, to the emergence of water markets offers a practical model for small-scale surface and shallow groundwater development for small farmers all over the world.

Hill Area Water Sources: Progression from Canal Irrigation to Low-cost Drip, Sprinkler, and Water Storage Systems. Existing irrigation in the valleys of the hill areas of Nepal has been devoted almost exclusively to canal irrigation for grain crops produced by larger farmers.

<sup>&</sup>lt;sup>13</sup> Shah, Tushaar and Ballabh, Vishwa. Groundwater markets in North Bihar. Economic and Political Weekly, no 32 (52, pp A 183-190.

Water available in small streams and excess water from piped village drinking water systems has been seen as insufficient for use in conventional surface systems requiring substantial water supply. Affordable and water-efficient piped irrigation systems like low cost drip and low cost sprinkler systems in hill areas now makes it possible to tap excess water in village drinking water systems for the production of high value horticultural crops. The same widely known existing techniques for constructing village piped drinking water systems from streams, can also build large numbers of micro gravity piped water systems that delivers water to hundreds of smallholder low cost drip and sprinkler irrigation systems. The field study conducted by IDE/Winrock found that a \$2000 piped water system in Nepal can serve 40 farmers. SIMI anticipates the development and field-testing of new hybrid systems for drinking water and micro-irrigation for hill villages and low-cost water storage systems linked to micro-irrigation technologies. Low-cost on-farm storage and collection devices are also relevant in this strategy.

# B. Exploiting the Smallholders' Comparative Advantage for Farming: The Shift from Subsistence to High-Value Cash Crops

In all five regions, small farmers are finding it increasingly difficult to survive on subsistence crops, particularly if they have limited or no access to irrigation and rely on producing rainfed subsistence crops. Even when smallholders have access to irrigation, farm sizes are steadily decreasing in densely populated Asian countries, such as Bangladesh and India. This decrease in farm size is a result of population pressure, and it is increasingly difficult to produce enough rice, maize, wheat, or other coarse grains to keep the family fed throughout the year on these smaller irrigated plots. In sparsely populated countries like Zambia, recent drought and diminishing government fertilizer subsidies are making it increasingly difficult for farmers to earn a livelihood on the rain-fed maize production that is encouraged by the government. Finally, as trade barriers are removed in other countries, smallholders find it increasingly difficult to compete in the world marketplace because of rice or corn imported from large mechanized farms in developed countries.

**Progression From Subsistence to Labor Intensive, High-Value Crops.** Smallholder participation in markets is a central SIMI theme and is demonstrated as a powerful force for increasing income. Like the progression from treadle pumps to diesel pumps to water markets, the progression from subsistence to cash crop farming is gradual, as described to us by small farmers with several years' experience using treadle pumps. Many risk-averse farmers use irrigation water to first increase their rice harvest, adding vegetables when they know they can produce enough rice for the table. As their experience producing and marketing vegetables



grows, and their cash crops become more diversified (reducing the risk), they become more confident that the income they can reliably generate from diversified vegetable production will buy more rice than the same irrigated land could directly produce.

Maize and millet farmers in the Nepal hills at first believed that it was impossible to grow offseason cauliflower and cucumbers during the winter with drip irrigation, but then rapidly increased winter cash crop production to the limits of their existing water source. Farmers producing rain-fed maize in Zambia rapidly expanded their 500 square meter rotation of bucket irrigated tomatoes, green maize, and rape greens to one acre after acquiring a treadle pump, and then shifted gradually to higher value cash crops like red paprika and coffee trees, with several purchasing petrol pumps in the second and third year.

**Progression from Mono-Cropping to Diversified Cash Crops.** Small farmers with several years experience growing market-oriented cash crops after adopting affordable irrigation consistently told us that it was difficult to impossible to predict future market prices for their production. To lower the risk, they gradually diversify crop production, typically growing at least 4-6 high-value crops, increasing the likelihood that at least one or two would command a high market price. Capitalizing on this experience, the first step to implementing the SIMI strategy is to identify 4-6 high value crops that fit with specific agro climatic conditions in each region, but also fit smallholders' family labor situation.

Farmers in the Deccan Plateau, for example, were able to use their limited water from dug wells to shift from small areas of winter coarse grain crops to high-value fruit or vegetable crops, using drip irrigation.

Avoiding Market Gluts. A secondary issue emerges with irrigation and crop diversification, centered on a need for smallholders to become more sophisticated market participants. Experience with commercializing smallholder production has underscored market risks. Smallholder experience with market flooding varied widely from one region to another and from one crop to another. A total of 1.3 million farmers growing vegetables with treadle pumps during the main winter season in densely populated Bangladesh are still finding markets for their crops, although gluts develop for specific vegetable crops in some years, for which the risks are best covered with diversified production practices. Trader systems and transport systems are relatively well developed in Bangladesh and large, well-developed, relatively accessible markets are also the rule for most smallholders in the Gangetic delta and Deccan plateau areas of India. In each of these areas, the SIMI team identified high-value crops for which a significant volume of unmet demand remains, like the large unmet local and export market for pomegranates that can be grown in the Deccan plateau.

But this is not the case in the natural greenhouse regions in Guizhou Province in China, where serious gluts have already developed for key winter season crops like tomatoes, chili peppers and melons. Market constraints, such as poor transportation facilities and undeveloped trading networks are severe in this region. By contrast, hill areas close to the road system in Nepal rarely experience gluts, especially when they are producing high demand off-season vegetables, but local gluts are common in sparsely populated hill areas more than a day's walk from the nearest road. In sparsely populated African countries like Zambia, market gluts are common in areas beyond the periphery of large population centers, and here contract farming and access to regional export markets appear to be promising strategies.

**Progression from Main Season to Off-Season Crops.** In each region, the identification of opportunities for smallholders to grow crops outside the main growing season, when prices are the highest, are the first opportunities for high value smallholder crops are examined by SIMI teams in each agro-climatic zone. In the hills of Nepal around Pokhara, the climate and soil conditions allow smallholders to grow drip irrigated cauliflower and cucumbers at a time that they cannot be produced in the Tarai or India, bringing prices twice as high as in the main season.

The natural greenhouse area in Guizhou province allows the production of winter vegetables without constructing greenhouses, although price differentials for winter vegetables are rapidly decreasing in China. The cool climate in high altitude plateaus in the same hill areas in China allow summer vegetables to be produced without the major pest problems experienced during the

rainy season in the main vegetable producing regions in south China. Likewise, the monsoon season in countries like Bangladesh and India create difficult growing conditions, which puts a premium price on crops like tomatoes. Field tests for a variety of new techniques in Bangladesh have allowed small farmers to produce monsoon tomatoes, generating a remarkable net return of \$60 per decimal (40 square meters). Monsoon pineapples have also been successfully field tested in the same region, and provide the potential to extend the main market by 3-4 months, at double the normal price.

# C. Strengthening Smallholder Supply Chains

The regional surveys as reported in this plan confirm the lack of specialized supply chains for inputs required by the smallholder community. It is clear that if the smallholder is to have access to water control implements and other purchased inputs that help them maximize their ability to take advantage of their productive assets, supply chains will need to be established and developed that can produce and distribute the inputs as required by the smallhold customer.

# D. Improving Agronomic Practices

Most of the small farmers interviewed by the mission teams had very low crop yields and were operating at a low level of agronomic practice. The SIMI field team analyzed use of soilbed preparation, seedbed preparation, composting, seed variety, quality and uniformity, fertilization, weeding, irrigating, and plant spacing. Exceptions include smallholders in India and Bangladesh, who had many years of experience with irrigated horticulture, or those exposed to intensive training by agronomists in the program implemented by IDE in the Nepal hill areas. These farmers are successfully using more productive systems. A consistent finding in the study of informal irrigation practiced by bucket farmers growing vegetables for city markets within a 40 km radius of Kumasi, Ghana, and a 20 km radius of Nairobi, Kenya, was the low level of agronomic practice<sup>14</sup>.

# E. Opening Access to Markets

Small farmers with treadle pumps in Zambia routinely paid out at least 25% of the price they received for their vegetable crops for transporting them to market. This high transport cost was many times higher than that paid by bucket farmers one or two hours drive from the capital, but with access to a high quality paved roads and a relatively efficient truck transport system. Smallholder access to markets varied widely from region to region, with major transport constraints in African countries like Zambia and Mozambique, and in Guizhou Province in China contrasting with excellent transport systems available to regions like the horticulture producing areas in Himachal Pradesh selling to the Delhi market five hours or more away by truck and rail, and the good transport access available in many other densely populated regions in India and Bangladesh.

# F. Smallholder and Supply Chain Access to Credit

Constraints in smallholder access to credit to finance the purchase of affordable irrigation technology and inputs was reported almost as a universal constraint by stallholders in all five regions studied. The groundwork for SIMI smallholder credit and supply chain financing strategies is presented in Volume III of this report.

<sup>&</sup>lt;sup>14</sup> Cornish, GA and Lawrence, P. Informal Irrigation in Peri Urban Areas. Report OD 144, HR Wallingford, Wallingford, UK, November 2001.