A Model for Pro-Poor Wealth Creation through Small-Plot Irrigation and Integrated Service Provision

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Presenter: Michael Roberts

Authors: John Magistro, Michael Roberts, Steve Haggblade, Fritz Kramer, Paul Polak, Elizabeth Weight, Robert Yoder

Abstract

This paper relates the field experience of an international NGO in strengthening linkages between irrigation development and poverty alleviation. Poverty Reduction through Irrigation and Smallholder Markets (PRISM) is introduced as a methodology for combining small-plot irrigation technology and Integrated Service Provision (ISP) to enhance small farmers’ ability to participate effectively in markets for high-value agricultural commodities. Data from field projects in Nepal and India suggest that the PRISM approach can lead to significant additional income for small farmers and other micro and small enterprises in agricultural value chains.

Keywords: irrigation, integrated service provision, poverty reduction, smallholder market development, Subsector Analysis, Business Development Services, agricultural/horticultural value chain development, India, Nepal.

Acknowledgements: The authors wish to express their gratitude to the farm families and BDS market participants interviewed in India and Nepal, to the IDE field staff who are implementing PRISM projects in both countries, and to the USAID IGP-BDS grants program for funding development of the PRISM model in India and Nepal.
I. Introduction

A majority of poor people in the developing world work in agriculture. Most are small farmers or landless laborers. Therefore, raising the productivity and incomes of small farms will prove central to meeting the UN-mandated Millennium Development Goal of halving poverty by 2015. Even the urban poor, who spend as much as half their income on staple foods, depend critically on increased agricultural productivity to moderate food prices on which their real incomes depend. Thus the battle against both rural and urban poverty will turn, in large part, on our collective ability to stimulate productivity gains in smallholder agriculture.

Yet small farms in the developing world face serious challenges. Most poor farmers do not control the water supply so crucial for enabling productivity-enhancing fertilizer and input use. Many small farmers operate in fractured input supply systems with minimal or nonexistent credit following the demise of heavy state input subsidies and market control, beginning in the late 1980’s. The increasing concentration of global agribusiness supply chains means that small farmers must find ways to link up commercially with much larger players or risk being squeezed out of the fastest growing domestic and export markets which are increasingly controlled by supermarkets and agribusiness firms (Reardon, Timmer, Barrett and Berdegue, 2002). In order for their incomes to grow significantly, smallholders must overcome three key constraints: 1) water access and control, 2) reliable high-productivity input supplies, and 3) access to the increasingly concentrated supply chains that now serve the most rapidly growing output markets. New intervention models that address these constraints at the farm level by means of shared public-private investment are providing encouraging indications of success in boosting smallholder farm income and reducing levels of rural poverty. Bundling of products and services to the small-scale farmer in a vertically integrated fashion may prove to be a key strategy in catalyzing the participation of ever growing numbers of poor rural producers in emerging high value agricultural commodity markets.

It is also widely recognized that improving management and production efficiencies in the use of physical resources—especially land and water—is a critical factor in the mission to eradicate global poverty. Irrigated agriculture, which is the centerpiece of this workshop, provides a tangible course of action to enhance resource management to this end.
This paper provides a “report from the field” that highlights the important role that small-scale irrigation development and ISP can play in poverty reduction efforts. The paper describes the experience of International Development Enterprises (IDE), an international NGO with a primary focus on rural market development and promotion of pro-poor water technologies. Recent IDE projects in Asia and Africa have adopted a systematic approach to strengthen the linkages between irrigation development and poverty alleviation by helping smallholders become more effective market participants. The approach is called Poverty Reduction through Irrigation and Smallholder Markets or PRISM. Early results from PRISM projects suggest that small-plot irrigation technologies combined with ISP in the context of vertically integrated value chains can open up market opportunities for smallholders, leveraging their comparative advantage to make the most of their limited assets and resource endowments.

The following sections begin with a description of the conceptual framework behind PRISM, which shapes and directs ongoing field projects, and a description of the small-plot irrigation typically promoted by IDE. This is followed by a presentation of two case studies from IDE projects in Nepal and India that are using the PRISM approach to link small farmers to market opportunities with the end result of providing sustainable economic returns to the smallholder.

II. PRISM: A Conceptual Framework for On-Farm Wealth Creation and Smallholder Poverty Alleviation

A central working principle of IDE is that demand for high-value agricultural commodities and the formation of pro-poor market environments can act as driving forces for boosting small farm income on a broad scale. Improved supply of critical factor inputs (land, labor, capital), and attendant products and services (seed, fertilizer, training, information, technology, finance/credit) will remain essential. However, it is demand for market commodities that will, in the end, stimulate production and boost crop productivity levels. In order to achieve sustainable and pro-poor wealth creation, however, the principle of market demand must be aligned with affordability, scalability, and private sector investment. This pro-poor, demand-side development orientation is captured in Hussain and Perera’s (2004) summary analysis below (Table 1) of a steady paradigm shift toward demand-side, private sector market forces as the vehicle for future rural poverty alleviation.

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1 International Development Enterprises (www.ide-international.org) is a non-profit development organization based in the U.S., Canada, the UK, and India. IDE employs some 500 professional and support staff in nine country programs in Asia and Africa.
### Table 1. Past and Emerging Approaches to Productivity Enhancements in Asia.

<table>
<thead>
<tr>
<th>Past Approaches</th>
<th>Emerging Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Development of large-scale systems, favored areas</td>
<td>• Small-scale systems, marginal areas</td>
</tr>
<tr>
<td>• Supply-side approaches</td>
<td>• Demand-side approaches</td>
</tr>
<tr>
<td>• Public sector management and financing of resources</td>
<td>• Public-community-private sector management and financing of resources</td>
</tr>
<tr>
<td>• Public sector supply of other services (credit, information dissemination)</td>
<td>• Public-private sector partnerships in supply of services</td>
</tr>
<tr>
<td>• Sectoral approaches to management</td>
<td>• Holistic approaches, IWRM</td>
</tr>
<tr>
<td>• Focus on increasing the size of the pie</td>
<td>• Increasing the size of the pie and its distribution</td>
</tr>
</tbody>
</table>


For more than two decades, IDE has pioneered a market-based approach to small farm income generation that builds on local capacity in the private sector. This method enables large numbers of poor farmers to increase their livelihoods through the purchase and use of affordable, income-generating technologies. In the area of small-plot irrigation, for instance, IDE has worked with local manufactures, providing technical assistance to enable them to produce foot-powered treadle pumps and drip-irrigation equipment that is appropriate to local water needs and affordable for smallholders. IDE established links between manufacturers and retail distributors and conducted promotional campaigns in rural areas to raise awareness and stimulate demand for small-plot irrigation equipment. In the end, self-financing supply chains for affordable irrigation systems were established, with all supply chain members receiving a reasonable profit and with the smallholder benefiting most of all.

Worldwide, this approach has lead to the distribution of over 2.5 million small-plot irrigation systems in Bangladesh, India, Nepal, Cambodia, Vietnam, Zambia, and Zimbabwe, each one generating an average additional income of more than $100 per year for smallholder households (Shah et al. 2000). Up to 20 percent of irrigators, however, have been able to make $500 or more per year in extra income. IDE field surveys indicate that the high-earning farmers are those who have been able to overcome the next level of market constraints after the water constraint. They have been able to participate more fully in the market by purchasing more inputs, shifting from subsistence crops to higher value crops, making effective use of technical knowledge and market information, and developing stable linkages to output markets.

**Lessons from the Field**
A number of lessons have come out of IDE’s field experience. First, small farmers have (or can develop) a comparative advantage in the production of certain high-value crops. Smallholder advantage derives from:

- **Proximity advantage.** Smallholders are more familiar with local preferences and can provide fresher supplies with lower transport costs to local markets.

- **Price advantage.** Lower opportunity costs for land, a willingness to accept lower remuneration for labor, and the use of family labor with little or no supervision costs, enable many smallholders to produce at lower cost than large-scale commercial growers.

- **Quality advantage.** Smallholders, as resident owner-managers, are in close contact with their production environment and have greater motivation than hired labor to provide the extra care needed to cultivate high-quality produce.

Second, for smallholders to participate effectively in markets and generate significant on-farm income, solving the water constraint is a necessary but insufficient condition. Irrigation and other production technologies and services are only useful for income generation in so far as they enable smallholders to take advantage of market opportunities, which are the true driving forces of on-farm wealth creation. Although the requirement for water control is not the only constraint that farmers face, it is usually a critical one. Irrigation intervention is therefore a strategic entry point from which a range of market constraints can be addressed in order to enhance the comparative advantage of smallholders in the production of high-value crops.

Third, the income-generating potential of irrigation is directly related to the degree to which smallholders are integrated with input and output markets. Impacts are greatest when small farmers are able to access a range of complementary goods and services for the production and marketing of high-value crops. Furthermore, when these goods and services are aligned along specific commodity value chains, a synergistic effect is created. Thus, irrigation interventions are most effective where pre-existing market linkages exist or where such linkages can be created. Under these conditions, smallholders are empowered to become more effective market participants—both as consumers of agricultural goods and services and as producers of saleable crops—with the end result being increased incomes and improved livelihoods.

A fourth lesson is that the goods and services required to alleviate smallholder constraints can be effectively delivered by micro and small enterprises (MSEs) at sustainable, unsubsidized, and yet
affordable prices. Smallholder-friendly markets, however, rarely arise spontaneously. Instead, the rural poor tend to be ill-served or bypassed as a market segment for a number of reasons: they are located in remote areas with poor infrastructure, they have low purchasing power, they make purchases and sell produce in small volumes, and the quality and quantity of their production is inconsistent. Public investment (by governments, donors, NGOs, etc.) in market facilitation is required to counteract these exclusionary forces and create market environments in which smallholder producers may thrive. Public intervention may take the form of technology research and development, establishing market linkages, awareness raising and demand creation activities, infrastructure development, and policy support, among others.

The PRISM Approach

These lessons have lead to the development of the PRISM approach for facilitating pro-poor market development; a methodology that is sufficiently flexible to have wide applicability across regions, but sufficiently specific to be useful in analysis and project design. The PRISM approach brings together and builds on the experience of IDE and other organizations that work in the area of micro-enterprise development, sub-sector analysis, Business Development Services (BDS), and small-scale irrigation development (Boomgard et al., 1992; Lusby and Panliburton, 2002).

Using agricultural commodity sub-sectors as the analytical entry point, The PRISM approach emphasizes market demand as the primary driver that will boost agricultural productivity and farm income. While supply side technology and related products and services remain a critical component of any strategy to boost crop output, it is the focus on commodity value chains that serves as the reference point for developing project strategies.

An array of integrated products and services (ISP) are arranged vertically along the value chain, which is composed of three levels, namely the input chains, on-farm production, and output chains (Figure 1). The irrigation technology supply chain is a key input to the vertically integrated commodity value chain and is highlighted because of its central and catalytic role in the PRISM approach as an entry point for addressing a broad range of market constraints.

Figure 1. Vertically Integrated Smallholder Value Chain
The key features of the PRISM approach involve identifying specific market opportunities (e.g., specific commodity sub-sectors such as coffee, mushrooms, fresh vegetables, etc.), analyzing smallholder constraints and opportunities within the sub-sector, and then facilitating MSEs in providing affordable products and services that will help smallholders to resolve critical constraints and/or take advantage of key opportunities. The basic steps in the PRISM approach are described below and illustrated in Figure 2:

- **Situation Assessment.** Conduct primary and secondary research to gather information about the environment in which smallholder markets are to be developed. This includes an examination of water needs, socio-cultural dimensions, environmental issues, and partnership possibilities.

- **Assessment of Market Opportunities.** Identify promising agricultural market opportunities that are expanding, that offer potential for significant income generation, and for which smallholders have (or can develop) a comparative advantage. Typically, market opportunities are found in specific commodity sub-sectors such as vegetables, fruits, herbs, coffee, etc. Assess the promising market opportunities using research tools.
such as Sub-sector Analysis (SA) and BDS market assessment to identify critical areas of constraints faced by smallholders and the MSEs in the value chain. The analytical focus is on the commodity value chains, which serve as the reference for developing project strategies.

- **Design Interventions.** Design interventions to address key constraints and opportunities identified above by strengthening MSE abilities to deliver necessary products and services to smallholders effectively, efficiently, and sustainably. This includes a strategy for delivering sustainable and affordable water control to smallholders as an entry point to enable smallholders to exploit the selected market opportunities.

- **Project Implementation.** Implement the interventions in coordination with partner agencies. This generally involves activities such as market linkage creation, technology development, demand creation, and capacity building.

- **Monitor, Evaluate, and Learn.** Monitor and evaluate outcomes as an information source for operations, as a means of documenting impacts, and as a tool for project learning. Revise the implementation plan in response to lessons learned and changing external or internal environmental conditions.
Figure 2. The PRISM Approach to Smallholder Market Development.

**Situation Assessment**
- Natural resource assessment
- Socio-economic assessment
- Smallholder asset assessment
- Partnership scoping
- Boundary definition

**Market Opportunities**
- Macro assessment of options
- Market opportunity selection
- Sub-sector analysis
- Current-practice gap analysis
- BDS market assessment

**Intervention Design**
- Value chain leverage points
- Business plans
- Definition of partner roles
- Exit strategy
- Monitoring framework
- Workplan and budgets

**Operating Principles**
- Poverty focus
- benefits reach the poorest people possible

**Gender/social**
- benefits reach disadvantaged groups

**Listening & learning**
- Participation of smallholders and other partners

**Environment**
- sustainable
- resource management

**Entrepreneurship**
- innovative
- market-based solutions

**Project Implementation**
Menu of Options (not exhaustive)
- Small-plot irrigation
- Pro-poor technology R&D
- Supply chain development
- Commercial & social marketing
- Enterprise strengthening
- Group formation
- Information linkages
- Credit linkages
- Output market linkages
- Policy influence

**Monitor, Evaluate, Learn**
- Knowledge management
- Risk management
- Impact documentation
- Project learning

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- Knowledge management
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III. Increasing “Income Per Drop”: the Case for Small-plot Irrigation Technology

The development of improved water management through irrigation made a major contribution to the achievements of the Green Revolution. Between 1970 and 1990, the total irrigated area in the developing world expanded by 42 percent from 123 million to 175 million hectares (FAOSTAT data). When combined with high-yielding seed varieties and fertilizers, increased irrigation resulted in impressive gains in world grain production. However, the vast majority of irrigation investment (both public and private) was directed toward relatively large and technologically sophisticated systems in more favorable agro-ecological regions populated by more well-endowed farmers. Poorer farmers with small plots of land in marginal areas were, by and large, left on the sidelines.

Prolonged neglect of small farmers by mainstream irrigation development policy and practice has resulted in a wide gap between existing irrigation technology and the irrigation needs of smallholders. Nevertheless, a number of innovations have emerged that do provide smallholders with appropriate and affordable options for irrigated agriculture. Among these are foot-powered treadle pumps, low-cost drip irrigation systems, and low-cost water storage options (Keller and Roberts, 2004).

This type of small-scale irrigation, which underlies the PRISM approach, is a distinct category of irrigation that we have termed small-plot irrigation. Small-plot irrigation can be defined generally as self-contained irrigation technologies for use on small plots of land (typically ranging from 20 to 20,000 m²) by small groups of people (typically a single household) without the need for collective infrastructure. These technologies are affordable to the rural poor (typically recouping investment costs within one growing season) and may be used as stand-alone tools or in combined technology packages to meet the specific water needs of individual users.

A significant commitment of research effort and resources is required to develop a wider range of irrigation technologies specifically suited to smallholders’ unique characteristics (e.g., small landholdings, low capital availability, low risk tolerance, and relatively low opportunity cost of family labor). In most cases, it is not sufficient to merely scale-down technologies that are appropriate for larger farms; solutions must be re-engineered from the smallholder’s point of
view. Technology features that are important to smallholders include low cost, suitability for small fragmented land parcels, rapid return on investment, simple and inexpensive maintenance, a manual power source, and divisibility. A smallholder-friendly technology will exhibit most or all of these features.

Small-plot irrigation technologies can significantly improve water productivity. Judicious use of nearby water sources at the individual household level limits water losses during storage and distribution and drip irrigation enables smallholders to approach world-standard levels of water application efficiency. There is however another form of efficiency to which small-plot irrigation can make a valuable contribution and that is in targeting economic benefits toward the rural poor. Small-plot irrigation has the potential to increase both “crop per drop” and “income per drop.”

- Small-plot irrigation systems provide an affordable entry into irrigated agriculture, giving smallholders an opportunity to increase their production and generate income by selling their surplus. There are few investments options in rural areas of developing countries that offer as much potential for as many people as irrigated agriculture (Shah, et al. 2000). By combining low entry cost, high return on investment, and short payback periods the technologies meet the needs of large numbers of small farmers.

- The economic benefits resulting from the small-plot irrigation technologies are biased toward the poor because the technologies themselves are self-targeting. Treadle pumps and low-cost drip, for instance, have high labor requirements relative to more expensive irrigation options such as engine pumps and state-of-the-art drip irrigation equipment. For this reason, the small-plot irrigation systems are primarily attractive to the rural poor, who have small landholdings and relatively abundant family labor, but are of little interest to more wealthy farmers with larger landholdings.

- Small-plot irrigation generates both on-farm and off-farm employment, which is extremely important to the rural poor, especially the land poor. On-farm employment is increased as a result of increased production and cropping intensity. Local enterprises are engaged in the production, distribution, and installation of the irrigation equipment, creating employment in the rural non-farm sector. The broader rural economy is stimulated by financially empowered smallholders purchasing agricultural and non-agricultural goods and services from rural markets.

- Small-plot irrigation also contributes to gender equity by reducing women's workloads, improving family nutrition, providing a source of independent income for women,
creating opportunities for women to learn new skills, and reducing the necessity for family members to migrate away from the home for seasonal wage labor.

In discussions of irrigation-poverty linkages we must avoid the mistake of equating “irrigation” with “canal irrigation.” While canal irrigation is tremendously important, especially in increasing the yields and productivity of staple crops that have anchored the successes of the Green Revolution, there is clear evidence that groundwater, and other water sources like rainwater harvesting, are playing an increasingly important role in irrigation as a whole, and especially so in poverty reduction related irrigation strategies.

In Bangladesh for instance, groundwater represents 69 percent of total water used in irrigation (FAO Aquastat). According to a 2002 BADC survey of irrigation in Bangladesh, there were a total of 865,213 shallow tubewells accounting for over 60 percent of total irrigated area whereas canal irrigation amounted to only about 25 percent of total irrigated area. Groundwater represents 53 percent of total irrigation water use in India, 34 percent in Pakistan, and 18 percent in China. But the potential impact of groundwater irrigation on the poor is much greater than its proportion of total irrigation water used. In IDE’s direct work with poor farmers, groundwater and locally-sourced surface water are much more important existing and potential future sources of pro-poor irrigation than canals.

- During the past two decades over 1.5 million treadle pumps have been distributed in Bangladesh with significant impacts on rural poverty. More recently, the rapid increase in smallholder adoption of $150 diesel pumps (when import duties were eliminated) has made a significant contribution to the creation of water markets, which to a large extent are replacing treadle pumps as an affordable source of irrigation water for Bangladeshi smallholders.

- In southern Africa, there are an estimated 7.5 million hectares of dambo wetlands—as much as the current total irrigated acreage in all of Africa. Many of these wetlands can provide year round access to small-plot irrigation water at a depth of two or three meters.

- In the Yellow River basin of China, where many of China’s rural poor are located, there are some three million “dry wells” used to capture and store rainy season runoff for use as drinking water and in some cases, for supplemental drip irrigation of wheat.
In light of the vast opportunities offered by non-traditional, non-canal irrigation, discussions about pro-poor irrigation strategies must take smallholder-level irrigation into consideration. Another factor to consider is the complementary relationships that may exist between canal irrigation and small-plot irrigation: the effect of canal leakage in recharging shallow aquifers used by downstream farmers, for instance, and the potential for combining small-plot irrigation technologies with canal systems to improve water use efficiency and to mitigate common canal tail-end problems of inadequate and irregular water supply.

IV. From Theory to Practice: IDE PRISM Case Studies from India and Nepal

Value Chain Development of the Horticultural Subsector in Rural Nepal

In Nepal, more than 85 percent of the population earns their income from agriculture. Most on-farm production is devoted almost solely to staple crop cultivation for home consumption. Farm households typically earn cash from seasonal employment either in the fields of more wealthy farmers or through migratory labor, primarily to India. Since 1993, IDE Nepal has been developing markets for agricultural inputs that support the production of vegetable crops to increase the cash income of small farm families. The development of input markets has focused on poor farmers with small landholdings and has included small-plot irrigation technologies such as the foot-powered treadle pump for lifting ground water in the terai (plains) region, and low-cost drip irrigation, micro-sprinkler and mini-water storage systems for upland farmers in the hills. The goal has been to transform farmers from subsistence to micro-enterprise market production orientation. IDE has worked with over 27,000 farmers who have increased their annual net income, on average, by more than $100. The majority of these farmers were not commercial growers prior to involvement in IDE programs.

Under a USAID-funded project (Developing BDS Markets for Small Commercial Horticulturists in Rural Areas of Nepal) initiated in 2001, IDE Nepal has been linking small-scale rural farmers to high-value horticultural markets by facilitating private sector provision of a range of products and services through the horticulture value chain. A key technology input has been the marketing

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2 The case studies presented and the data derived in this section are the result of two Business Development Services (BDS) projects funded under the Innovative Grants Program (IGP) within the Office of Microenterprise Development at USAID. Each program commenced in October, 2001, with a three year funding horizon, soon to be completed.
of small-plot irrigation technologies (treadle pumps, drip irrigation) to allow smallholders to increase their number of cropping cycles into the dry season. IDE Nepal project activities under the USAID project cover the rural areas of three terai districts (Rupandehi, Kaplivastu and Nawalparasi) and two hill districts (Palpa and Kaski of western Nepal).

Production of vegetable crops has the following highly desirable characteristics for the small farm unit: high labor requirement, fast turnover of investment (2 to 4 months), high profitability, and high value per unit land. This makes this enterprise uniquely suited to the land and cash-poor, labor abundant family farm environment. Demand for vegetables is estimated to increase by 5 percent per year nationwide, thus creating a demand for more than 6,000 additional tons of vegetable production in the six IDE project target districts each year. This is equivalent to roughly 13,000 smallholder production units.

Using the PRISM methodologies of subsector analysis and BDS market assessment, IDE identified major constraints to high value horticultural production, including access to a reliable supply of quality inputs, especially irrigation technologies, and access to downstream markets to sell market produce. IDE is facilitating the establishment of a network of private sector entrepreneurs who are providing these services to the farmers (i.e. reliable access to quality micro irrigation technologies and agricultural inputs), and sustained access to downstream markets for their products. The cost of providing this access is covered by commercial mark-ups paid for in full by the farmer.

IDE is working with existing Farmers Groups which fill a key role as service providers to neighboring farmers in fulfilling the following two functions: 1) channeling technical and marketing information from government and other sources to small commercial horticulturists, and 2) provision of linkages to private-sector merchants for inputs purchases and produce sales. Three sets of key actors provide a range of integrated services to the rural smallholder (Table 2): 1) agri-input dealers, 2) vegetable traders, and 3) lead farmers, who have been selected from the Farmer Groups and intensively trained to act as local repositories of horticulture knowledge. In addition to the services provided by these three sets of actors, treadle pumps and drip irrigation

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3 Farmers are also diversifying their horticultural production significantly, growing cauliflower, rayo (mustard), carrots, radishes, beans, peas, cabbage, tomatoes, and potatoes in the winter season. Cauliflower, cucumber, cabbage, lauka (gourd), pumpkin, ghiraula, radishes, tomatoes, brinjal, chilis, and lady finger are grown in the spring and summer seasons.
hardware is supplied through a private-sector network of manufacturers, distributors, assemblers, retailers, and on-site installers.

Table 2. Integrated Service Provision Actors in the Horticultural Value Chain – Nepal

<table>
<thead>
<tr>
<th>ISP Provider</th>
<th>Products</th>
<th>Services</th>
<th>Client</th>
<th>Payment Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agri-input Dealer</td>
<td>Irrigation equipment, seeds, fertilizer, pest control</td>
<td>Information about proper selection and use of products</td>
<td>Small farmer</td>
<td>Embedded in the price of the product</td>
</tr>
<tr>
<td>Vegetable Trader</td>
<td>Fresh vegetables</td>
<td>Produce aggregation, Access to major markets</td>
<td>Small farmer</td>
<td>Embedded in the price of the product</td>
</tr>
<tr>
<td>Lead Farmers</td>
<td>Fresh vegetables</td>
<td>Agricultural training, Access to dealers and traders, Information about technology</td>
<td>Small farmer</td>
<td>Embedded in the price of products to farmers.</td>
</tr>
</tbody>
</table>

The project focuses on three major activities in order to equip smallholders to become viable commercial horticultural producers: 1) capacity building of private sector BDS providers through intensive training in vegetable production and marketing; 2) promotion of increased vegetable production (through use of increased inputs and appropriate management practices) by promotional activities carried out through the farmers groups; and 3) creation of linkages from private entrepreneurs (on the input and output side) to horticulture farmers and Farmers Groups through meetings, workshops, and personal contacts.

Service provision by input suppliers, micro irrigation assemblers, and Farmers Groups are having three major impacts at the farm level: 1) the transformation of small, poor farmers, including women, into micro-entrepreneurs through high-value commercial vegetable production; 2) a significant increase in horticultural productivity and on-farm net income; and 3) improved access by small farm units to input/output markets on a sustainable basis.

Results of the project to date have been encouraging, although slowed somewhat by a Maoist insurgency movement that has impeded project implementation recently in the countryside. Approaching three years, the project has reached 7,097 smallholders and built an ISP value chain of 839 BDS providers. The value chain providers trained and supported by the project thus far are listed in Table 3.
Table 3. ISP Horticultural Value Chain Development – Nepal

<table>
<thead>
<tr>
<th>ISP Value Chain Providers</th>
<th>Number of Providers</th>
<th>Average Annual Sales $</th>
<th>Average Net Annual Income $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leader Farmers</td>
<td>333</td>
<td>$479</td>
<td>$386</td>
</tr>
<tr>
<td>Agro-Vets</td>
<td>91</td>
<td>$10,653</td>
<td>$1,024</td>
</tr>
<tr>
<td>Vegetables Traders</td>
<td>163</td>
<td>$8,592</td>
<td>$918</td>
</tr>
<tr>
<td>Installers/Masons</td>
<td>224</td>
<td>$146</td>
<td>$146</td>
</tr>
<tr>
<td>TP Manufacturers, Drip Assemblers</td>
<td>2</td>
<td>$23,275</td>
<td>$4,057</td>
</tr>
<tr>
<td>Treadle Pump/Drip Dealers</td>
<td>25</td>
<td>$13,300</td>
<td>$998</td>
</tr>
<tr>
<td><strong>Total and weighted averages</strong></td>
<td><strong>839</strong></td>
<td><strong>$3,510</strong></td>
<td><strong>$522</strong></td>
</tr>
</tbody>
</table>

Source: Adapted from IDE Nepal Field Report, March 2004.

Average annual sales volume was highest for pump manufacturers and drip irrigation assemblers at US$23,275, and lowest for the leader farmers at US$479. Based on these figures, a total volume of nearly three million dollars moves through the horticultural value chain each year stimulating the local economy in the five project site areas. These ISP value chain enterprises also have achieved promising gains in annual income as well, with manufacturers netting over $4,000, while installers and masons (known as mistries) netted substantially less, at $146. Perhaps most promising were the average gains per leader farmer, at $386, a substantial economic impact in a country where GNI per capita in 2003 was $240⁴.

Figures from Table 4 illustrate the impact of the project at the smallholder farm enterprise level. The sample farmers were interviewed at project start-up (baseline) and after two years of participation in the horticultural value chain. Total crop sales quantity and volume have increased among this group by well over 100 percent. Net average income among farmers in their second year rose 250 percent from $77 to $269. Crop productivity has risen, in part, due to a change in cropping intensity and cropping practices. Farmers have begun to grow high value vegetables throughout the entire year, from winter to spring and summer seasons.

In Nepal, women are integral, active producers in rural farming systems. They comprise approximately 45 percent of the project beneficiaries and have observed positive changes in their quality of life since project participation. Household vegetable consumption and market sales have risen, thus improving the nutrition of family members while also boosting disposable income. Some women have noted additional family income now available for improved schooling of their children and investment in household assets including livestock. Most

importantly, some women have noted an increased sense of self-confidence and social status due to their increasing economic independence from marketing high value crops.

Table 4. MSE Smallholder Annual Sales and Income.

<table>
<thead>
<tr>
<th>Smallholder Sales and Income</th>
<th>Baseline</th>
<th>2 Years Post Intervention</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmers (N)</td>
<td>72</td>
<td>72</td>
<td>0</td>
</tr>
<tr>
<td>Total Sales Quantity (Kg)</td>
<td>58,389</td>
<td>130,941</td>
<td>+124%</td>
</tr>
<tr>
<td>Total Sales Volume ($)</td>
<td>$8,782</td>
<td>$24,289</td>
<td>+177%</td>
</tr>
<tr>
<td>Total Cost of Material($)</td>
<td>$1,358</td>
<td>$2,382</td>
<td>+75%</td>
</tr>
<tr>
<td>Total Cost of Labor ($)</td>
<td>$1,933</td>
<td>$3,074</td>
<td>+59%</td>
</tr>
<tr>
<td>Total Net Income ($)</td>
<td>$5,492</td>
<td>$18,833</td>
<td>+243%</td>
</tr>
<tr>
<td>Average Net Income/Farmer</td>
<td>$76</td>
<td>$262</td>
<td>345</td>
</tr>
</tbody>
</table>

Source: Adapted from HURDEC, 2004.

Pro-Poor Market Development in Western India

A USAID funded project (Creating New Markets For The Poor With Micro Irrigation Technologies In Maharashtra, India)\(^5\) initiated in 2001 has built upon and expanded IDE’s earlier work, moving from a technology supply chain focus, to a broader value chain market development emphasis in building high-value horticultural niche markets. The project has three objectives:

- To further develop the market for drip micro irrigation technology, building on past product and market testing results (for tailoring products to customers), and on relationships and linkages developed with and among market service providers;
- To develop the market for a package of horticultural products and services designed to meet the needs of small farmers. The horticulture package includes access to saplings or seedlings, affordable fertilizer and pesticides, and appropriate agronomic advice.
- To facilitate ISP among both public and private sector actors to provide demand-driven market products and services through the entire horticultural commodity chain, from input provision of irrigation hardware, to on-farm market data access and downstream linkage to expanding new high value markets.

The India program began project start up by first conducting market research to identify promising horticultural subsector commodities and demand- and supply-side constraints.

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\(^5\) The USAID project is operating in 12 districts of Maharashtra including Solapur, Osmanabad, Latur, Amrawati, Buldana, Yavatmal, Jalgaon, Nasik, Nandurbar, Ahmednagar, Aurangabad, and Jalna.
Promising crops identified and now marketed in the project include oranges, mangos, papaya, mung beans, sapota, pomegranate, lemons, sweet limes, amala, bananas, custard apples, and vegetables (tomatoes, cucumbers, eggplants).

The first constraint to agricultural productivity among the small farmers in the project areas is inadequate water access. Typically, poorer farmers – which include landless tribal farmers and laborers – have access to a shallow open well, normally shared among a number of extended families. These wells have a low quantity of water, which is inadequate for growing vegetables using traditional irrigation methods. With drip irrigation, however, the limited water supply can be used to practice small-scale commercial horticulture.

On the demand side, the project has (1) developed products and service packages tailored to the needs of identified market segments; (2) engaged in promotional/demand creation activities; (3) developed linkages with a network of NGOs interested in demonstrating and disseminating information on the benefits of drip irrigation technology and horticultural production using improved inputs and practices; (4) developed a profitable and penetrative private sector supply chain (made up of manufacturers, distributors, agro-input dealers, and market agents) to produce, distribute and sell the technology and affordable service packages; and (5) promoted business linkages among industry firms, and among firms and relevant micro-finance NGOs, universities, and government agencies. Among the range of ISP actors now participating in the horticultural value chain, public sector institutions such as universities and research centers collaborate with a network of NGOs, private sector agro enterprises, and farmer self-help groups (Table 5).

Table 5. Integrated Service Provision Actors in the Horticultural Value Chain – India

<table>
<thead>
<tr>
<th>ISP Provider</th>
<th>Product</th>
<th>Service</th>
<th>Client</th>
<th>Payment Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>NGO</td>
<td>Technical assistance</td>
<td>Promotion/demonstration, training and info services</td>
<td>Small farmer</td>
<td>Free public good</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>AMIT drip components, water storage bags</td>
<td>Credit</td>
<td>Assembler</td>
<td>Bundled in the price of the product</td>
</tr>
<tr>
<td>Assembler</td>
<td>AMIT drip kits</td>
<td>Installation &amp; maintenance guide</td>
<td>Small farmer</td>
<td></td>
</tr>
<tr>
<td>Farming system booklets</td>
<td>Crop demonstration</td>
<td></td>
<td>Small farmer</td>
<td></td>
</tr>
<tr>
<td>Agro-Input Dealer</td>
<td>Micro sachets of fertilizer and pesticide, vermi-wash micronutrient</td>
<td>Application &amp; dosage guide</td>
<td>Small farmer</td>
<td>Bundled in the price of the product</td>
</tr>
<tr>
<td>Research Institutions, Laboratories</td>
<td>Technical assistance</td>
<td>Soil testing IPM</td>
<td>Small farmer</td>
<td>Fee for service</td>
</tr>
<tr>
<td>IT Kiosks</td>
<td>Market Information, Transport</td>
<td>Commodity Pricing, Crop Grading, Bulking, Buyer Linkages, Transport</td>
<td>Small farmer</td>
<td>Fee for service</td>
</tr>
</tbody>
</table>
IDE has organized training programs at the village level for NGOs, BDS providers and farmers. Training involves a range of topics including drip technology system design and installation, best practices in crop production, pest disease control, organic farming, and optimal groundwater use. Technical training is often by IDE field staff along with drip irrigation assemblers. Training on horticulture farming best practices is done by local experts such as retired government extension officers, university professors, and progressive farmers. IDE has particularly focused on linking these experts to regional training centers, such as Krishi Vigyan Kendras (KVK) set up under the Indian Council of Agricultural Research (ICAR), to conduct live demonstrations and training sessions on agronomic practice, including soil fertility maintenance, IPM, composting techniques, etc. IDE has also organized exposure visits for new farmers to successful project areas and has arranged training sessions with progressive farmers.

IDE has also facilitated effective promotion tools such as marketing campaigns in the rural areas. IDE staff, along with local ISP providers, move from village to village in a jeep/rickshaw to promote AMIT drip farming. In addition, IDE has developed an effective outreach mobile video film using Indian film stars for viewing by local villagers. Most of IDE’s demand creation advertising activities are undertaken along with the ISP providers who are progressively assuming a greater role in assuming the full cost of such promotional strategies.

On the output side of the commodity chain, IDE is facilitating value added processing by linking women to training services to learn proper sorting and grading of fruits and vegetables. Some local NGOs such as Gramin Arogya Prakalp, have started providing training to women in such post harvest activities. Women are also being trained in the preparation of spinach and coriander powders under the project.

One of the most innovative features of the India IGP-BDS project has been the creation of private sector rural-based IT kiosks where farmers can readily access market pricing information and an expanding range of services. These centers are now linking up with a private commodity market pricing service that provides farmers with instant access to pricing data for all regional and national markets. Information also includes strength of demand in various markets, consumer
preferences in graded produce, and crop varieties preferred. These centers also include services in produce bulking for members, transportation, and negotiating better prices for the farmers.

Results of the project as it approaches completion have been very encouraging. After nearly three years, the program has now marketed micro irrigation technology and related farm services through a value chain of 728 BDS providers, including three main groups of drip irrigation retailers and assemblers, agro-input dealers, and nursery growers. Average net annual income was highest for the drip dealers and assemblers at $884, and lowest for the agro-input dealers at $177 (Table 6). GNI per capita in India in 2003 was $540\(^6\).

Table 6. ISP Horticultural Value Chain Development – India

<table>
<thead>
<tr>
<th>ISP Value Chain Providers</th>
<th>Number of Providers</th>
<th>Average Annual Sales $</th>
<th>Average Net Annual Income $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drip Dealers/Assemblers</td>
<td>256</td>
<td>$8,836</td>
<td>$884</td>
</tr>
<tr>
<td>Agro-Input Dealers</td>
<td>401</td>
<td>$3,541</td>
<td>$177</td>
</tr>
<tr>
<td>Nursery Growers</td>
<td>71</td>
<td>$2,561</td>
<td>$256</td>
</tr>
<tr>
<td><strong>Total and weighted averages</strong></td>
<td><strong>728</strong></td>
<td><strong>$5,307</strong></td>
<td><strong>$433</strong></td>
</tr>
</tbody>
</table>

Source: Adapted from IDE India Field Reports, 2002-2004.

In this project, drip irrigation technology reached 21,266 smallholders over a thirty month period. Table 7 indicates the distribution of sales for the various size-price combinations available.

Table 7. MSE Smallholder Market Participation.

<table>
<thead>
<tr>
<th>AMIT Systems</th>
<th>Number sold</th>
<th>% of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bucket kit (20 m², $2)</td>
<td>2,036</td>
<td>10</td>
</tr>
<tr>
<td>Drum (120 m², $25)</td>
<td>210</td>
<td>1</td>
</tr>
<tr>
<td>Customized (150 m² to 2,000 m²)</td>
<td>13,896</td>
<td>65</td>
</tr>
<tr>
<td>KB Eazydrip</td>
<td>5,124</td>
<td>24</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>21,266</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: Adapted from IDE India Field Reports, 2002-2004.

In the first year of the program, farmers’ net additional income averaged $285. In the second year, net profitability of these farm families rose markedly to $811. Among those farmers entering the program in Year 2, net additional income was $322 in their first year. These data suggest that as farmers master the use of drip irrigation technology, their productivity, and thus their income, rises sharply. In many instances, farmers increase their plot size, expanding their drip irrigation system by adding pipe lengths.

While women are involved significantly in most agricultural work including irrigation, typically the marketing (both purchase of inputs, technologies, etc, and sale of outputs) is handled by the men. More specifically, the drip irrigation systems, though operated by both men and women, are purchased in the name of the man unless it is a woman-headed household. The smaller bucket and drum kit systems are almost always operated by women. It is estimated that roughly 10 percent of the larger systems are managed by women. Overall, women constitute approximately 19 percent of total market participants in the program.

V. Conclusion

As time passes, the immense challenge of reaching the Millennium Development Goals by 2015 looms large. While a plethora of conceptual models exist to boost farm income and remedy smallholder poverty, few are actually time tested and grounded in sustained empirical evidence. Models of irrigation that advocate for conventional large and medium-scale canal furrow systems that: 1) improve water resource access (by means of lifting, conveyance, and storage), and 2) facilitate integrated service provision (ISP) for non-land and water inputs through public-private sector partnerships, have been proposed by Hussain and Perera (2004) as a viable solution to smallholder poverty.

IDE has incorporated the core elements of Hussain and Perera’s framework into their evolving work under an action research smallholder wealth creation model, termed PRISM. IDE’s approach embraces a comprehensive bundling of products and services across all segments of the horticultural subsector value chain – at input, on-farm, and output levels. The unique variation in IDE’s approach is on irrigation technology that is affordable, scalable, and simple in design. Confirming Hussain and Perera’s observation that “…access to agricultural water alone is a necessary but not a sufficient condition to enhance productivity and alleviate poverty,” IDE places primacy in the configuration of pro-poor markets as the key driver needed to generate on-farm wealth and move the rural poor out of poverty. Smallholders must be in a position to respond to demand for high-value agricultural commodities. This can be achieved by identifying appropriate high value market opportunities, critical market constraints or bottlenecks, and putting into place the necessary market infrastructure to allow for smallholder incentive to produce in a more efficient and profitable manner, while also minimizing risk. Crop
Diversification is a critical feature of such a production portfolio, balancing subsistence with new, promising niche crops that will assure a high return to the farmer.

IDE, through its market-driven approach to smallholder wealth creation with efficient access to and use of water as a key production variable, has put into practice the core set of principles outlined by Molden, Sakthivadivel, and Zaigham (2001) needed to boost crop productivity and farm income: 1) use of improved crop varieties, 2) promotion of high value crops, 3) reallocation of water from lower to higher value uses, 4) promotion of crop diversification, 5) improved water management (via more efficient water lifting, conveyance, and storage), 6) promotion of small-scale affordable technologies, and 7) optimizing non-water inputs in seed, fertilizer, soil management, and improved pest management practices.

Case study results from two USAID-funded programs in IDE programs in Nepal and India demonstrate application of the principles above using a PRISM approach, and are showing promising early results as a viable strategy to significantly increase farm income and achieve the ambitious vision of the new millennium to move large numbers of the world’s rural poor out of poverty.

References


Agriculture, Australian Centre for International Agricultural Research (ACIAR)
Proceedings No. 116.


