MULTIPLE USE WATER SERVICE IMPLEMENTATION IN NEPAL AND INDIA

Experience and Lessons for Scale-up

MONIQUE MIKHAIL AND ROBERT YODER

This book explores the practical implementation of the multiple-use water services (MUS) concept in Nepal and India, focusing on community-level lessons and implications for scaling up the approach. Lessons are drawn from projects that attempted to move beyond the segregation of irrigation and domestic water systems to allow the poor to access water for their domestic needs as well as enable income-generating vegetable production. Water service implementers and researchers will gain knowledge from two unique MUS models: direct NGO implementation of gravity-fed community system design in the middle hills of Nepal, and access through a large-scale government domestic water project in India. The MUS work in both countries included application of the learning alliance approach, allowing idea sharing at various levels (national/state, district, and local). These community, NGO, and government partner efforts to integrate water resource use will inspire professionals to look at village water use and service delivery in new ways.

This book is jointly published by International Development Enterprises (IDE), the Challenge Program on Water and Food (CPWF), and the International Water Management Institute (IWMI).

IDE

CGIAR Challenge Program on WATER & FOOD

IWMI International Water Management Institute

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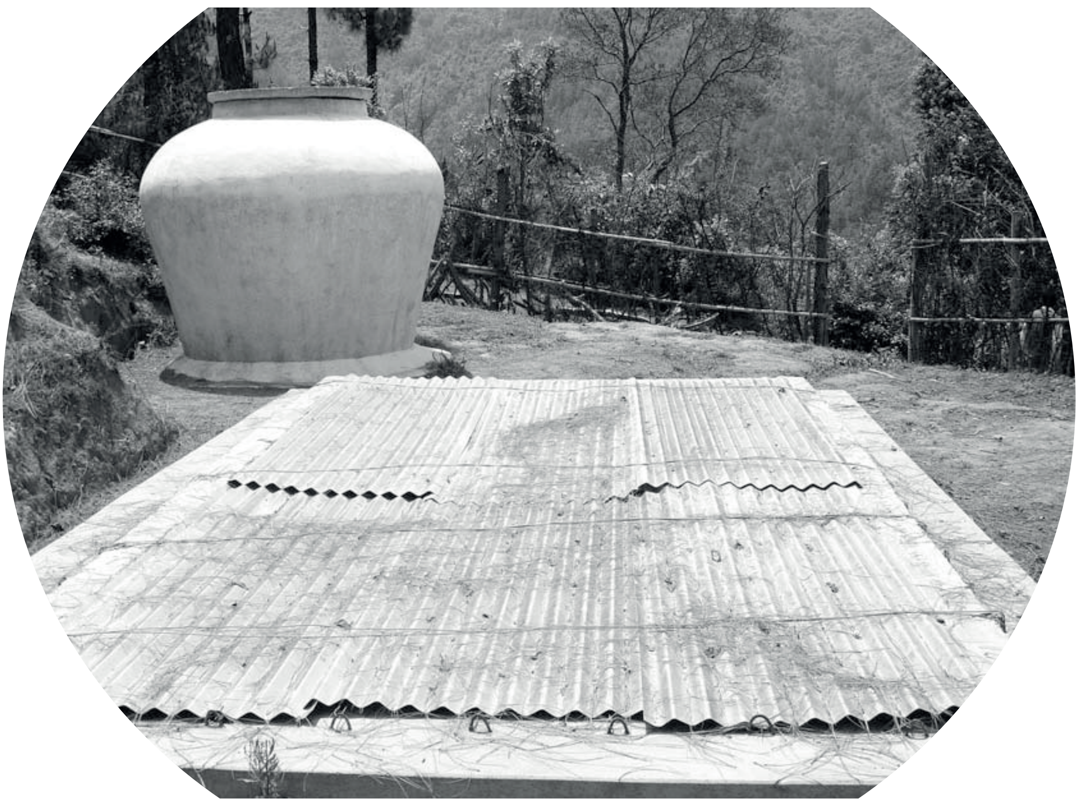

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List of Abbreviations

PART 1 NEPAL

ADB Asian Development Bank

ADO Agriculture Development Officer

AT Agriculture Technician

CBWSSP Community Based Water Supply and Sanitation Project affiliated with DWSS

CBO Community-Based Organization

CEAPRED Center for Environmental and Agricultural Policy Research, Extension and Development

DADO District Agriculture Development Office

DDC District Development Committee

DM District Manager

DoA Department of Agriculture

DoI Department of Irrigation

DoLIDAR Department of Local Infrastructure Development and Agricultural Roads housed within the Ministry of Local Development

DWSS Department of Water Supply & Sewerage

Fund Board Rural Water Supply and Sanitation Fund Development Board affiliated with DWSS

INGO International Non-government Organization

IT Irrigation Technician

LA Learning Alliance

MS Marketing Supervisor

MUS multiple use water systems in a general sense, as well as the Multiple Use Services project funded by the Challenge Program on Food and Water with the International Water Management Institute as the lead and implemented by International Development Enterprises (IDE-Nepal) in Nepal

NEWAH Nepal Water for Health

NFIWUAN National Federation of Irrigation Water Users Association, Nepal

NGO Non-governmental Organization

NITP Nonconventional Irrigation Technology Project, housed within the DoI

SAPPROS Support Activities for Poor Producers of Nepal

SIMI Smallholder Irrigation Marketing Initiative

SM/CM Social Mobilizer and Community Mobilizer

VDC Village Development Committee

WUC Water User Committee

PART 2 MAHARASHTRA, INDIA

BDO Block Development Officer
CBC Capacity Building Consortium
GP Gram Panchayat
LA Learning Alliance
SAC Social Audit Committee
SHG Self-Help Group
SO Support Organization
TSP Technical Service Provider
VWSC Village Water and Sanitation Committee
WEC Women Empowerment Committee

MULTIPLE-USE WATER SERVICE IMPLEMENTATION IN NEPAL AND INDIA

Experience and Lessons for Scale-Up

PART 1 THE NEPAL EXPERIENCE

INTRODUCTION

Multiple-use water services (MUS) describe a participatory, integrated, and poverty-reduction focused approach that takes a community's diverse water needs as the starting point for providing services. Multiple-use water services move beyond the conventional sectoral barriers of the domestic and productive sectors and provide for all water needs in a community. The CGIAR Challenge Program-Multiple-Use Water Systems (CP-MUS) project was funded by a grant from the Challenge Program on Water and Food with the International Water Management Institute as the lead organization.[1] The project was focused on developing guidelines for multiple-use water services delivery as an effective way to use water for poverty alleviation and gender equity.

Implementation of the CP-MUS project in Nepal occurred largely through the Smallholder Irrigation and Market Initiative (SIMI), which is a USAID-funded project being implemented by Winrock International as the lead organization with International Development Enterprises (IDE) and other local partners, including: the Center for Environmental and Agricultural Policy Research, Extension and Development (CEAPRED), Support Activities for the Rural Poor (SAPPROS) and the Agricultural Enterprise Center (AEC).

However, as success on MUS implementation became evident, it was integrated into other projects that IDE-Nepal and Winrock have partnered on: Ujyalo, Business Development Services—Marketing and Production Services (BDS-MaPS), and BDS-MaPS PRIME.[2] The tables below show the breakdown of the number of MUS projects implemented by the various IDE/Winrock Nepal programs.

Breakdown of MUS projects by year and program

Year	Program	District	Number of Projects	Total
2003–04	IDE-Dutch grant	Palpa	2	2
	SIMI	Syangja	4	12
		Palpa	5	
		Surkhet	3	
2004–05	SIMI	Syangja	2	9
		Palpa	2	
		Surkhet	3	
		Kaski	2	

2005–06	SIMI	Syangja	3	11
		Palpa	3	
		Surkhet	3	
		Kaski	2	
	BDS MaPS	Lalitpur	1	1
	Ujyalo	Gulmi	3	17
		Arghakhanchi	2	
		Lamjung	4	
		Salyan	2	
		Pyuthan	2	
		Doti	2	
		Dadeldhura	2	
2006–07	SIMI	Syangja	2	8
		Palpa	2	
		Surkhet	2	
		Kaski	2	
	BDS MaPS	Lalitpur	1	2
		Syangja	1	
	LEMI	Dhading	2	6
		Makwanpur	1	
		Kavre	2	
		Udaypur	1	
2007–08	SIMI	Syangja	1	8
		Palpa	2	
		Surkhet	1	
		Kaski	2	
		Lalitpur	1	
		Dadeldhura	1	
	RPI	Palpa	2	5
		Kaski	3	

Total Number of MUS Systems Built by Each Program from 2003–2008

IDE-Dutch	2
SIMI	48
Ujyalo	17
BDS MaPS	3
LEMI	6
RPI	5
Total	81

Total Number of MUS systems built in each district from 2003–2008

Palpa	18
Syangja	13
Surkhet	12
Kaski	11
Lamjung	4
Gulmi	3
Lalitpur	3
Arghakhanchi	2
Salyan	2
Pyuthan	2
Doti	2
Dadeldhura	3
Udaypur	1
Kavre	2
Makwanpur	1
Dhading	2

There are three distinct regions within Nepal—the high mountains region, middle hills, and Terai, the flat fertile area in the south of the country, bordering India. All of the multiple-use services projects implemented in Nepal were in the middle-hills region (see Plate 1).

STRUCTURE OF PART 1

Chapter 1 gives an overview of the Nepal setting in which MUS projects[3] were built along with a brief history of the country and relevant issues of poverty and development for smallholders in the middle hills. It also describes the basic structure of government departments concerned with water resource development.Chapter 2 describes the major stakeholders in the MUS project in Nepal, the project approach, major components, and process overview. Chapter 3 presents the case study of Chhatiwan, a single-tank, one-line distribution system with abundant water supply. Chapter 4 describes the case of Senapuk village, a double-tank, two-line distribution system with moderate water supply. Krishnapur case study comprises chapter 5, a water-scarce village with homestead storage and an "all but drinking water" MUS. Chapter 6 draws lessons and conclusions from the three case studies and is augmented with additional information about the role of SIMI staff and other Nepal MUS projects. Chapter 7, the final chapter on Nepal, covers the Learning Alliance process undertaken to expand the concept of MUS and an analysis of the scope for scaling up MUS work in the country.

SELECTION OF CASE STUDIES

While every MUS scheme in Nepal provides unique insights for the approach globally, three cases from different districts (marked on Plate 1) and with different water supplies and technology development were selected as an efficient way to cover most of the lessons learned from the MUS project in Nepal. Chhatiwan Tole cluster (in Palpa District), as the water-abundant case with a single continuous-distribution system, was also the first MUS project to be built in Nepal. Senapuk village (in Syangja District), the second MUS system built in Nepal, has moderate water supply and was the first double-tank, two-distribution-line design. Krishnapur (in Surkhet District), a cluster within a water scarce village, built on-site water storage to allow flexibility of use with limited water supply. Most important, the three cases tease out important insights for further MUS implementation in Nepal and elsewhere around the world. The knowledge shared here is based primarily on site visits, informal interviews, focus groups, and interviews with staff responsible for implementation, key personnel, and leaders/elders in the villages/clusters. This study is not an impact assessment with systematic water-use and water-productivity measurement (which is now needed), but an analysis of the process of MUS implementation and concept dissemination. It lends insight for scaleup and anecdotal evidence of the potential impact MUS may have on rural smallholder's lives.

CHAPTER 1

THE NEPAL SETTING

Photograph by Monique Mikhail.

RECENT HISTORY OF NEPAL

The history of Nepal has been fraught with conflict. In order to understand the situation in which the MUS project implementation occurred, it is important to know Nepal's most recent history of civil war and dysfunctional government. In February 1996 one of the Maoist parties in the country started the "People's War" to establish a new democratic republic, beginning a decade-long civil war. The Maoists created their own government structure at the district level in around 70 percent of Nepal. In June 2001 Crown Prince Dipendra killed eleven members of the royal family, including King Birendra and Queen Aishwarya, and then himself, exacerbating the Maoist conflict and leaving his uncle Gyanendra the new king. In October 2002 Gyanendra temporarily dissolved the government only to reappoint another government one week later. Gyanendra again dismissed the government in February 2005 and took absolute control, supposedly in order to suppress the Maoist insurgency.

Communication, including freedom of the press, was largely stifled, and politicians were put on house arrest. Elections held in February 2006 were boycotted by the major political parties, and some candidates were even forced by the army to flee. Mass street protests and strikes in April 2006 forced into power a new seven-party coalition government (called the Seven Party Alliance), removed most of the king's power, and led Maoists to declare a cease-fire. The Seven Party Alliance began peace talks with the Maoist insurgents, leading to a comprehensive peace agreement in November 2006 and ending the civil war. An interim Parliament including Maoist representatives was instated in January 2007. In April the eight ruling parties formed an interim Council of Ministers including Maoist ministers. In September the Maoists decided to leave the interim government, demanding the monarchy be abolished and forcing the November constituent assembly elections to be postponed. In December, in order to reach a peace agreement with the Maoists and bring them back into the government, Parliament approved the abolition of the monarchy. In April 2008 elections for the new constituent assembly were held, and the Maoists won the largest block of seats. In May Nepal was declared a republic, and in July Ram Baran Yadav became president (U.S. Department of State).

NATIONAL TRENDS

It is among this political turmoil and uncertainity that the Nepal MUS project took place. In addition, other important national trends set the backdrop for MUS implementation and Learning Alliance work.

POPULATION PRESSURE

The population of Nepal is over 23 million and growing at 2.27% per year (Government of Nepal [1]). This population growth places pressure on the already scarce land and water resources of the region and underpins the need for careful planning and consideration of projected growth in project design.

POVERTY REDUCTION

According to the 2006 World Bank report "Resilience Amidst Conflict: An Assessment of Poverty in Nepal, 1995–96 and 2003–04," the incidence in overall poverty fell from 42% to 31% in the past decade. However, much more significant poverty reduction occurred in urban areas (22% to 9%) than in rural areas (43% to 35%). And the prevalence of poverty among rural households with less than one ha of land remains high (40%). Smallholder farmers participating in MUS projects in Nepal all fall into this category, largely because average landholding size has decreased in the past forty years by 28% from 1.11 to 0.8ha (Government of Nepal [2]) due to the partitioning of land to multiple sons in each generation. Furthermore, because they are more likely to have access to irrigation and better situated farms, the land productivity of nonpoor households is nearly two times higher than that of poor households (Sharma 1999).

Lack of access to irrigation is a major factor linked with rural poverty. According to the latest "Nepal Living Standards Survey" (Government of Nepal [3]), the risk of poverty is more pronounced among farm households that do not have access to irrigation. And as access to irrigation and the share of irrigated area increases, the poverty gap between farm households with and without irrigation grows. For these reasons, irrigation was identified as one of the key drivers for agricultural development in the 1995 Agriculture Perspective Plan along with fertilizer, power, technology, and agricultural roads. The Plan emphasizes the development of year-round irrigation, particularly through expanding shallow tube wells in the Terai and improving the existing Farmer Managed Irrigation Systems (Government of Nepal [4]). Matching the interest in expanding irrigation capacity, funding for irrigation has steadily increased since 1976 (Pradhan 2005). To help more effectively reach the rural poor who most need irrigation access, the World Bank is supporting irrigation projects that are demand-driven and managed by local water-user groups (World Bank [1]). However, the landholdings of a large percentage of smallholders in the hill area are high above the streams and rivers and are inaccessible to the quantities of water necessary for traditional cereal-crop production.

Another critical connection between poverty and the aforementioned Maoist insurgency and decade-long civil war is the impetus for unrest. A positive correlation has been drawn between poverty levels of certain areas at the onset of the civil war and the strength of the civil conflict there (Do and Iyer 2007). In addition, the perception of intracommunity inequality of access to resources within communities influenced the insurgency (Macours 2006).

Remittances, Migration, and Income Inequality

The aforementioned civil war encouraged many to seek work overseas, which dramatically increased remittances, accounting for one-third to one-half of the overall poverty-rate reduction over the last decade. In fact, in 2003–2004 remittances accounted for 12 percent of the nation's GDP. By 2003–2004, over one million Nepalese were working outside the country, mostly in India, but increasingly in the Persian Gulf and East Asia. Families also receive pensions from family members working in the British or Indian armies. Urbanization also factored into poverty reduction, accounting for roughly one-fifth of the overall decrease.

However, as families migrated and shifted to working abroad, the gap between the rich and poor widened. This problem was much more extreme in rural areas, particularly in the Midwest and Far West regions of Nepal (see Plate 1). Caste negatively influences the poverty status of Dalits and Janjatis (lower castes) in the middle hills. While these groups have experienced some poverty alleviation over the past decade, the rate of decline in poverty was much less than that of the Upper Castes and Newars in the same areas (Macours 2006).

As might be expected, the shift of the male population to working abroad is affecting women. Wives of migrant workers take on more responsibility than their counterparts, and poverty in female-headed households tends to be lower than the average, due to remittances. While this has empowered some women, migration is not always a positive influence. If the woman continues to live with her husband's extended family after he leaves the country, money is often sent directly to his parents, leaving her subservient to them (Macours 2006).

HEALTH AND DOMESTIC WATER SERVICES

A countrywide push toward increased health-facility coverage and road expansion has generated some positive health outcomes in the last decade. Child mortality dropped 5 percent each year, largely due to immunization and increased disease prevention and treatment (World Bank [2] 2006). Access[1] to domestic water services has also improved, although it remains a significant health concern. According to the UNICEF/WHO midterm assessment of Millenium Development Goals, 82% of rural Nepalis have improved access to drinking water, although only 8% have household taps, and only 20% of rural residents have access to sanitation facilities. The percentage of households with access to a tap or pipe (not necessarily a household connection) in the three case-study districts is fairly high (see Table 1.1). Despite these positive changes, it is recognized that more must be done to provide domestic water access. The World Bank is giving loans for projects that reduce water collection time (World Bank [1]). More specifically, they have initiated a Rural Water Supply and Sanitation Project that seeks to further institutionalize the "Fund Board" approach and support community-based user groups, pledging $41.5 million to this effect (World Bank [3]).

Table 1.1: Access to different types of water sources in the three case-study districts

District	Total Households	Tap/ Pipe	Well	Tube Well	Spout Water	Rivers/ Stream	Others	Not Stated
National	4,174,457	52.9%	9.0%	28.4%	6.4%	1.5%	0.9%	0.9%
Palpa	49,942	84.7%	6.8%	0.3%	6.0%	1.0%	0.1%	1.2%
Syangja	64,746	81.4%	11.8%	0.0%	5.2%	1.0%	0.0%	0.6%
Surkhet	50,691	69.1%	11.3%	0.0%	11.3%	4.9%	0.8%	0.8%

Source: (Geeta 2006)

CONSUMPTION PATTERNS, MARKET DEMAND, AND ACCESS

Food insecurity is a real problem for many households in Nepal, and child malnutrition in the country still ranks among the highest globally (World Bank [2]). The agrarian Nepal culture emphasizes that a farmer should grow all the food necessary for household consumption, with the need to purchase only salt, sugar, and cooking oil. Therefore, diets have historically consisted largely of cereals and tubers. For example, from 1996 to 1998 the people of Nepal obtained 80 percent of their diet from cereals and tubers alone (FAO 2001). Vegetable consumption primarily comprised a few rain-fed vegetables scattered near the homestead (cauliflower, radish, cabbage, or mustard) and *gundruk*, which is made by fermenting and then drying the leaves of these plants, eaten during the winter months. Expenditures on vegetables have generally been low: in 1996 they spent only 14.6 percent of their total food expenditure on fruits and vegetables (Seale et al. 2004).

Yet, vegetable consumption is rising. From 1994 to 2003 vegetable consumption per capita rose by 34.7 percent.[2] And although 97 percent of vegetable production is domestic, imports are increasing, with a good quantity of the vegetables traded at local markets coming from Indian traders. These factors suggest two opportunities for Nepalese farmers: capturing the market supplied by Indian vendors and servicing the expanding new vegetable markets of Nepal. But, many Nepalese farmers do not have easy access to markets. In Nepal, only 36 percent of the rural population has access to all-weather roads (World Bank [4]). Currently the Nepali government spends about 1.8 percent of its GDP on transportation, but new World Bank funding for the Road Maintenance and Development Project (which is working to improve access to more remote areas in the country) and a grant to the Department of Local Infrastructure Development and Agricultural Roads (DoLIDAR) is assisting decentralized local agencies to develop and manage rural roads (World Bank [4]).

SITUATION OF THE MIDDLE HILLS

LAND CLASSIFICATION

Even considering pensions and remittances, agriculture remains the major economic activity in the middle hills of Nepal. Land is classified into three basic types, depending on the type of crops that can be grown on it: Since rice is the primary crop for the Nepalese, the most important land is *khet*, which is terraced with bunds for growing rice and is commonly the only land that is irrigated (often with Farmer Managed Irrigation Systems). *Bari* is sloping land that is sometimes terraced to reduce the slope and generally is not irrigated but is used to grow all types of rain-fed crops. The steep slopes and wasteland is called *kharbari* and is used for growing fodder and thatch.

Use of bari and khet is based on location in relationship to the homestead —bari close to the homestead can more easily be used for vegetables that require protection from predators and pilferage. Khet close to the homestead is more likely to be used for potatoes or other vegetables in the dry season if it is close enough for easy access since more labor is required than for traditional cereal crops. Bari is the most prevalent land type in the middle hills region. And despite a lack of access to canal irrigation, it has great potential for increased crop growth with microirrigation because the technology can be used on sloping land without danger of erosion. For this reason, the productive portion of the MUS projects in Nepal took the form of microirrigation of vegetables on bari land close to the homestead.

ACCESS TO WATER

In the middle hills, snow melt is largely inaccessible because rivers draining it have cut deeply into the valleys and are usable only with very long canals or by pumping, which is often prohibitively expensive. Because of this, spring water has become the preferred source of domestic water for all villages. In many cases the discharge from springs is seasonal, and where their water is captured for domestic use, these springs no longer feed into the streams. Domestic uses include drinking, cooking, utensil washing, bathing, house cleaning, toilet flushing, and livestock watering. Households also prefer to use tap water for clothes washing except when (as at festival times) there are too many loads of wash for the available water. At these times they go to the nearest spring or stream to wash clothes. If households have many animals, they may take the animals to the stream to drink also.

Most irrigation water in the middle hills comes from small rain-fed side streams. These have seasonally high discharge variability and may have no water in the premonsoon dry season. With sufficient irrigation water and short-season varieties, three crops of cereal can be grown in a year (one per season) at elevations below 6,000 feet and two crops per year at higher elevations. However, many households, and often entire village communities, have no access to irrigation and are primarily dependent on rainfall for their crops.

The highly variable seasonal rainfall patterns heavily influence both the availability of domestic water and the growing seasons of Nepal and are the major complicating factor for MUS project settings. The settings described in one season could change completely in another season as well as from one year to the next. However, the variability also makes irrigation in the premonsoon and postmonsoon seasons highly attractive to farmers, both for sustenance and because produce garners higher prices during the off-season.

The three recognized seasons in Nepal are based on the monsoon: premonsoon (or "dry season" from March to mid-June), monsoon (or "rainy sea-

Table 1.2: Rainfall and temperature pattern approximation for case studies

Season	Months	Average Temperature Range (° C)		Average Evapotranspiration (mm/day)		Percentage of Rainfall	
		Tansen (approx. for Chhatiwan & Senapuk)	Surkhet (approx. for Krishnapur	Tansen (approx. for Chhatiwan & Senapuk)	Surkhet (approx. for Krishnapur)	Tansen (approx. for Chhatiwan & Senapuk)	Surkhet (approx. for Krishnapur)
Premonsoon	March to mid-June	16–28	10–36	4.5	5.4	15%	15%
Monsoon	mid-June to Oct.	19–27	16–36	3.4	3.9	78%	81%
Postmonsoon	Nov. to Feb.	6–19	3–24	2.1	2.1	7%	4%

Source: FAO CROPWAT data for Tansen, located 20 km southwest of Senapuk and 10 km northwest of Chhatiwan, and Surkhet, located six km southwest of Krishnapur.

son" from mid-June to October), and postmonsoon (or "winter" from November to February) Rainfall and temperature data for the three case-study sites are good examples of the disproportionate distribution of rain in the three seasons (see Table 1.2 and Figure 1.1). The area around Tansen (representative of Chhatiwan and Senapuk) receives around 1800 mm (approximately 71 inches) of rainfall per year, while the area around Surkhet (representative of Krishnapur) receives around 2200 mm (approximately 86 inches) annually.

CROPPING PATTERNS

Figure 1.1 shows the rainfall patterns at the two climate stations nearest to the three case studies as well as the traditional cropping pattern on khet land in the middle hills of Nepal. From IDE staff experience, a khet field of 0.4 ha will yield about 2,000 kg of paddy (unhusked rice), 2,000 kg of maize, and 500 kg of wheat per year. Because of a decrease in wheat prices, farmers have shifted production from wheat to potatoes in the postmonsoon winter season.

Cropping During the Premonsoon Dry Season

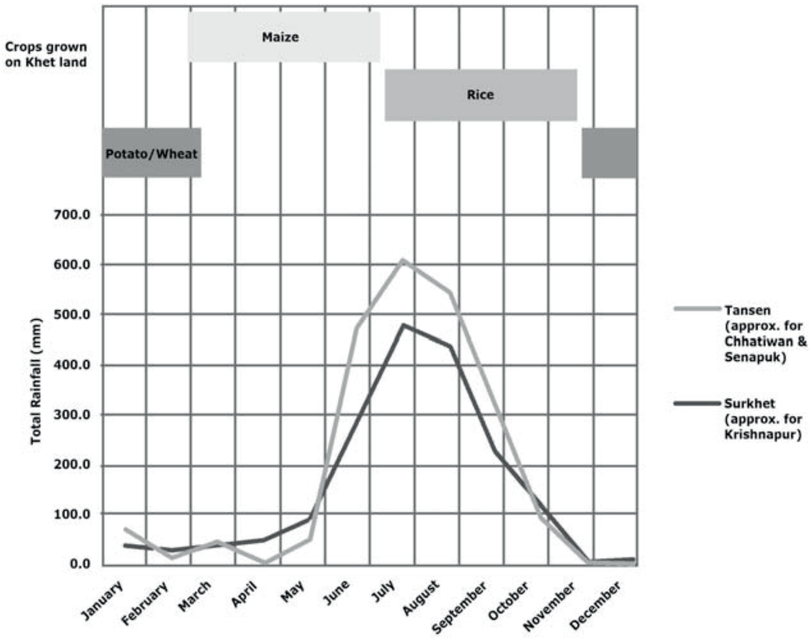
The hottest time of year with most solar radiation is the season prior to the monsoon (dry season). While around 15 percent of rainfall does occur in this period, it is in the form of unreliable thundershowers. If the nearby stream has sufficient water for irrigation, rice can be grown on khet land in the dry premonsoon season. However, this is often not the case, so traditionally there has been no attempt to grow irrigated paddy on khet land in the premonsoon season. Instead, a short-season maize is planted (increasingly using hybrid varieties), and if the distribution of rain showers is reasonably uniform, production is good. If it does not rain at the time of optimal maize planting (in March or early April), the fields are generally left fallow or lentils and other crops that require less water are planted. On bari land, a long-season maize is generally planted in March or April if there is a good soaking rain. This crop is harvested late in the rainy season. If irrigation is available for bari land, vegetable production becomes possible, extending the cropping intensity of bari land to three crops per year. Recently, garlic, onions, and chili peppers have been taken up as cash crops grown on bari.

Cropping During the Monsoon Rainy Season

Since most of the rainfall occurs in the monsoon season, it is the peak cropping period. Recently the trend has been to use small spring-fed streams as the major source of irrigation water. Where these are available, they are generally used to grow rice on khet land. The bari fields near the houses in the village are used to grow rain-fed maize intercropped with beans during the monsoon season.

Fruit and vegetable cultivation is traditionally subsistence, with a small percentage of farmers periodically selling a few vegetables in the market.

Figure 1.1 Rainfall and typical cropping patterns on *khet* land



Created using FAO CROPWAT data for Tansen, located 20 km southwest of Senapuk and 10 km northwest of Chhatiwan, and Surkhet, located 6 km southwest of Krishnapur.

Farmers generally do not irrigate vegetables but simply cast a few seeds near their households and let them grow with minimal cultivation effort.

Cropping During the Postmonsoon Winter Season

Even though only around 5 percent of rainfall occurs in the postmonsoon season, residual moisture from the monsoon period and low evapotranspiration due to mild temperatures allow farmers to cultivate some crops in this season. While the temperature is optimal for growing wheat, and residual moisture at sowing time is good, lack of rainfall limits the productivity of wheat cultivation. Wheat or mustard were traditionally planted on the bari, but potatoes or garlic/onion crops are gradually replacing wheat in the postmonsoon season.

LIVESTOCK

All households in the villages of the middle hills generally have livestock, including buffaloes, cows, and goats; some villages also raise poultry and pigs. Livestock contribute meat and milk to local families' diets, and sale of *ghee*[3] and meat contribute to their cash income. However, the quantity of cattle/bullocks is decreasing in Nepal for a few reasons: First, landholding size is decreasing, so there is less need for animals to aid in cultivation. Second, there has been an increased interest in high-yield animal breeds, requiring a fewer number of animals to produce the same amount of milk and meat. Third, a lack of available land for fodder has limited cattle/bullock production to some extent. However, poultry, goat, and hog production has increased, in part because of the government's encouragement as part of their poverty-reduction strategies.

In this area of Nepal two livestock-feeding systems are most often used: sedentary and stall-fed. In the sedentary system, livestock graze around the perimeter of the village during the day and returnto the village inthe evening. Livestock is also sometimes grazed away from the village; however, restrictions can limit this (Cooke 2000). Where all land is cultivated, animals are not allowed to graze. Goats are generally kept in the house or in a shed to keep them away from crops during cultivation. So grazing away from the village mainly applies to cattle, buffalo, and goats and includes foraging in the forest and on postharvest cultivated land and fallow land. The animals feed on crop residues from paddy, maize, millet, wheat, mustard, soybean, and vegetables; grasses; and tree fodder from both forest trees and those owned by the farmer (Pariyar).

The stall-fed system is more often used when there is limited community land for grazing and when the area is too steep. It is rare for households to utilize any of their small land area for fodder production, so stall feeding is often practiced in areas of intensive cultivation with three crops per year where there are generally enough by-products to feed the livestock. If there are not enough crop by-products, families cut grass, leaves from trees (including the species Ficus semicordata, Garuga pinnata, and Erythrina arborescens), and any other fodder they can collect from the nearby forests. They also sometimes make a cooked gruel of oilseed cake, straw, and water, called *kundo*.

Livestock watering in Nepal is considered part of domestic water allocation; if the domestic water supply is sufficient and nearby, a family will collect water from it to water their livestock. However, the domestic supply is often inadequate for all domestic needs. If such is the case but an irrigation supply is nearby, households will bring water from the irrigation canal for the animals. If the irrigation supply is further away, families will take their animals to drink from the irrigation canal. If there is no water supply infrastructure, but a stream is available, households will take the livestock to the stream once or twice per day to water. If there is water scarcity and none of the above options are available, households will move the animals to a separate location. In this instance a small group of families will jointly build a corral for their livestock and have a few boys from the families stay there to take care of the animals.

GOVERNMENT STRUCTURE

Although multiple-use services projects in Nepal were implemented by the communities and NGO partners, various government organizations provided both financial and in-kind contributions and technical training. In order to understand the role that the government played in the MUS project in Nepal, it is necessary to understand the government structure and present water resource development situation.

LOCAL GOVERNMENT

In Nepal the smallest political division is the ward. Nine wards make up a Village Development Committee (VDC), which is an administrative-political structure but can also refer to an area of political designation. It is the most local governing body in Nepal, and membership is based on the population density of the area. The formal governing body of a VDC has traditionally been a 13-person Village Development Council headed by a chairman, vice-chair, and secretary. However, with the recent political upheaval, the current VDC leader is the VDC secretary, who is appointed by the Ministry of Local Development.

DISTRICT AND REGIONAL GOVERNMENT

The District Development Committee (DDC) is the next tier up from the VDCs. Each DDC oversees all VDCs in a district and is headed by the chief district officer, who is responsible for maintaining law and order and coordinating the work of field agencies of the various government ministries. After the enactment of the Decentralization Act in 1982, the DDC became responsible for all district development activities including irrigation and small-scale water supply and sanitation (where the population was under 1,000). This decentralization of government services such as education, primary health care, and rural road maintenance has transferred some power to the district level (World Bank [2]).

DDCs receive technical support from the District Technical Office (DTO), which is overseen by the Department of Local Infrastructure Development and Agricultural Roads (DoLIDAR) under the Ministry of Local Development at the national level. DoLIDAR is meant to coordinate directly with other line agencies such as the Department of Irrigation (DoI) and the Department of Water Supply and Sewerage (DWSS). The Department of Irrigation also has district-level offices that coordinate with the DDCs.

There are several governmental organizations involved in assisting farmers with agricultural services. These include:

- District Agriculture Development Office (DADO)
- District Livestock Services Office (DLSO)
- Agriculture Service Center (ASC)
- Livestock Service Center (LSC)

DADO and DLSO are both district departments within the Ministry of Agriculture and Cooperatives. They have offices in each district headquarters. ASC and LSC are like extension agencies, each servicing around four or five VDCs. They are responsible for disseminating information to farmers through demonstrations and other knowledge sharing. However, on a day-to-day basis DADO, DLSO, ASC and LSC provide little support for farmers, although they occasionally provide some technical assistance.

There are a total of 75 districts in Nepal which make up 14 administrative "zones" that are grouped into five development regions—Far Western, Mid-western, Western, Central, and Eastern (see Plate 1). These zones are more of a regional demarcation than political boundaries.

NATIONAL GOVERNMENT

The major national-level ministries with involvement in multiple-use services projects are the Ministry of Water Resources, the Local Development Ministry, the Ministry of Physical Planning and Works, and the Ministry of Agriculture and Cooperatives. The DoI falls within the Ministry of Water Resources while the DWSS is housed within the Ministry of Physical Planning and Works. The Department of Agriculture is under the Ministry of Agriculture and Cooperatives (see Figure 1.2).

The DWSS is largely concerned with urban water and sanitation development but operates in conjunction with the Rural Water Supply and Sanitation Fund Development Board (called the Fund Board) on rural water supply and sanitation services. The Fund Board was created in 1996 to promote sustainable and cost-effective demand-led services in order to reverse the trend of lagging services. It operates predominantly through NGOs and community-based organizations (CBOs) at the local level to emphasize community ownership.[4] The NGOs/CBOs act as contractors with terms and conditions established formally at the national level. Therefore, partnership cannot be built at the district level if it is not explicit in the national-level contract.

The Fund Board, funded by the World Bank and the UK Department for International Development,is supervised and managed by seven board members comprising joint secretaries, one each from the Ministry of Physical Planning and Works and the Ministry of Local Development; one from the Association of District Development Committees of Nepal and one from the Association of Village Development Committees in Nepal; two professionals representing the nongovernment sector; and one professional representing the private sector. All of these board members are nominated by the central government for three-year terms. The chairperson of the Fund Board is elected by the members for a three-year term. While the Fund Board is largely focused on domestic water, there has been recent interest in microirrigation and MUS systems. (This interest is described in chapter 7—Applying the Learning Alliance Approach.) See Figure 1.2 for a general layout of the government organizations involved either directly or indirectly with domestic and productive water policy and implementation in Nepal.

GOVERNMENT WATER-DEVELOPMENT SITUATION

The Water Resources Strategy of 2002 guides all water resource projects in Nepal. Two of the ten goals the Strategy recommended are:

- Adequate supply of and access to potable water and sanitation and hygiene awareness provided
- Appropriate and efficient irrigation available to support optimal, sustainable use of irrigable land

Working toward achieving these goals is the responsibility of multiple government agencies.

RESPONSIBLE AGENCIES

Guided by the Strategy, the overarching agency that controls water resource projects in Nepal is the Ministry of Water Resources. Implementation is through the National Water Plan, run by an interministerial coordinating committee comprised of the National Water Resources Development Council, Water and Energy Commission, and National Coordination Secretariat. The National Water Resources Development Council and Water and Energy Commission Secretariat set policy and coordinate nationally with DoLIDAR, the Fund Board, and DoI, the agencies that are largely responsible for project implementation. They also operate through regional and district water and sanitation subcommittees, which interface with the DDCs, VDCs, NGOs and local community groups including Water User Associations (WUAs). With a mandate from the irrigation component of the National Water Plan, the DoI started a program in 2003 to promote the development of nonconventional irrigation technology schemes including microirrigation.

WATER RIGHTS

Water rights in Nepal are administered under customary rights and statutory laws. Customary rights adhere to land ownership of the abutting stream or river; if the source is on public land and is being used by a group, particularly for drinking water, the source is considered to be community property. If the source is on private land, it is considered to be private property. The practice of protecting a source from encroachment by erecting a statue or temple near the source still exists, and if a source is in forested land, the forest is protected, with penalties for anyone who attempts to damage the source quantity or quality (Gautam 2006).

On the other hand, the Water Resources Act of 1992 established the government as the owner of all water resources of the country and contained three separate regulations: drinking water supply, irrigation, and ground water. Within the Water Resources Act, priority is given to domestic water with irrigation having secondary status followed by other uses (Gautam 2006).

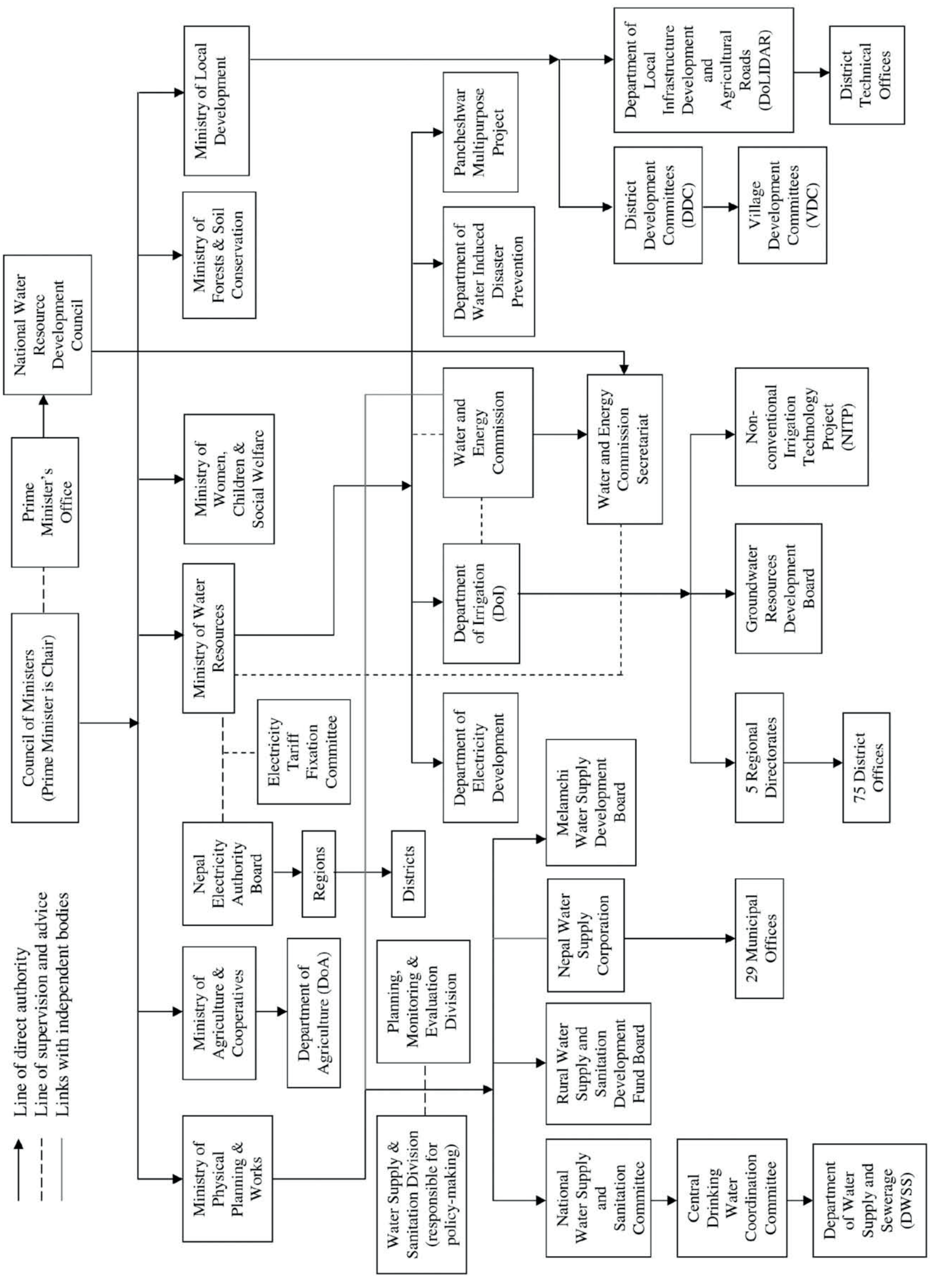
It is the tension between the statutory laws and customary rights that leads to confusion about source registration and use rights. The Water Resources Act gives power to the district level over user licensing and resolution of water disputes. The registration of water rights for irrigation, drinking water, hydropower, and other commercial uses is the authority of the District Water Resources Committee (DWRC) chaired by the Chief District Officer with the Local Development Officer and all office chiefs dealing with water resources development comprising the rest of the committee. The DWRC is required to use prevailing local norms to guide their licensing and dispute-resolution actions including (Gautam 2006):

- Priority of drinking water over other uses;
- Prior appropriation;
- Upstream users must not adversely impact preexisting downstream users;
- Mutual contracts or agreements to share a water source can be made among groups of users;
- An agreement can be made between two groups of users such that one group can permit a second group to use its water allotment with receipt-of-labor contribution, O&M fund contribution, or other mode of payment;
- Water-rights dispute resolution must be attempted by the user groups themselves prior to involvement of the DWRC.

The Water Resource Act also established a status for Water Users Associations (WUAs) as autonomous corporate bodies having perpetual succession. The WUC can own a project while the district government remains the owner of the water source itself. The WUC has legal authority to collect annual fees as established by the district and can stop services for default on payment (Gautam 2006). The DWSS proposed the idea of registering the right to a source through Water Users Associations based upon each separate use, and some groups do this. However, registration with the DWRC is more legally binding.

Furthermore, registration of a group is different from registration of a water source, although they can also be combined. For registration of both together, users need to first develop a constitution to create a formal Water User Association and then get a recommendation from the VDC. The VDC recommends to the DWRC that the registration of the source belong to the WUA. The DWRC contacts the District Irrigation Office or drinking water and Sanitation Office for their recommendation of use. Based on their recommendation, the WUC is registered with the source for only one purpose—drinking water or irrigation.

Figure 1.2 Organizational structure of government bodies dealing directly or indirectly with domestic and productive water in Nepal



On the other hand, a group of farmers that organizes as a production group, not as a Water User Association, can register a source under its group name with the DDC but will not be considered a formal registered Water User Association. Most of the MUS projects in Nepal were registered in this way by using the name of the production group they had previously formed. Some groups that registered with the DADO as formal agriculture groups were required to additionally register the source through the DDC to obtain formal rights for its use. To make matters even more complicated, if the DoI contributes over NPR 500,000 ($7,143) for a particular scheme, then the user group must also be registered with the DoI.[5] Although registering as a legal entity allows the group to have a bank account and more assured use of the source in the future, this confusing setup and involvement of multiple government entities is a formidable challenge for smallholder farmers who do not have the time or the experience to effectively deal with these types of legal procedures.

Compounding convoluted registration practices, the Maoist insurgency removed the existing government oversight and support structure during the civil war and replaced it with Maoist mandates. Natural-resource user groups including Water User Associations remained some of the only functioning democratic institutions during the conflict and provided a crucial function for rural communities. NGO projects adjusted to enable continued work with these groups, and the groups themselves adapted by holding fewer meetings and restricting their management activities (Schweithelm et al. 2006).

CHAPTER 2

PROJECT OVERVIEW

Photograph by Bimela Colavito.

PRIMARY PROJECT STAKEHOLDERS

Communities were the focal point of MUS project work, but involvement of other organizations was critical. Some organizations contributed financially, with in-kind donations, or technical assistance and were also influenced by project involvement. Others provided essential information about communities when SIMI was searching for communities to work with. For a more in-depth look at project partners and the evolution of their involvement in MUS, see Chapter 7.

COMMUNITY MEMBERS — CLUSTER OR VILLAGE

During implementation of MUS projects in Nepal, SIMI worked with both whole villages and clusters within villages. A cluster can be either a grouping of households that are physically separated from other groupings of households within the village or an ethnic/caste grouping of households within a village. Both Chhatiwan and Krishnapur are examples of clusters that are physically separated from other groups of households within their village. While Chhatiwan is separated by hilly terrain, Krishnapur is separated by the fact that they all use the same branch of the village's canal irrigation system. Senapuk, on the other hand, is an example of a whole village (36 households) that SIMI worked with to construct a MUS scheme. Throughout this document "community" is used as a general term to signify a group of people and could apply to a cluster or village.

WATER USER COMMITTEE (WUC)

When SIMI begins working with a community, the community is required by the agreement to register use of the source (registration is explained in the "Water rights" section chapter 1 above) and be recognized as a formal entity. Once it is registered, the community can set up a bank account in the user group's name and receive loans and/or material assistance from agencies such as DoI and DoA for its MUS system. Many of the communities that SIMI works with in Nepal have already organized themselves into production groups and often register under their groups' names. Sometimes these groups simply transition into the construction committees, and they sometimes hold new elections. Subcommittees of the construction committees are created for various tasks—site selection, water resources capacity measurement, selection of pipe route, and selection of sites for constructing hybrid tapstands, offtakes, and tanks. Upon completion of project construction, the committees either transition directly into Water User Committees (WUCs) or reelections are held. The WUCs are responsible for operation and maintenance, setting allocation rules, and mitigating any disputes over use that may arise. SIMI recommends a gender composition of at least one-third female for the committees, but not all groups necessarily follow this recommendation.

LOCAL ORGANIZATIONS

Local NGOs and community-based organizations are also involved in MUS projects. SIMI staff will often approach local NGOs working in a new area to determine which communities would be best to work with and to make inroads with these communities. And in districts where SIMI is applying the NGO model function (explained below) these NGOs may actually become partners in direct MUS implementation. In other cases, local NGOs or community-based organizations (e.g. Community Forestry Groups, community clubs, and cooperatives) will contribute funding for a project. And in some cases local schools financially support MUS systems in order to obtain drinking water for students and sanitation facilities.

INTERNATIONAL ORGANIZATIONS

IDE and Winrock partner on all the programs through which multiple-use services were implemented in Nepal including the programs of SIMI, BDS-MaPS, and Ujyalo. IDE/Winrock also partner with other international NGOs on MUS projects including World Vision Nepal, Helvetas, and CARE. Through these partnerships the international NGOs support MUS projects financially and with materials, whereas IDE handles technical assistance with the help of local NGOs and community-based organizations.

GOVERNMENT

Among the local and national government agencies, it is mainly the VDC that provides a supportive role in MUS project implementation. At the inception of each project within an area, SIMI calls a meeting and invites the leaders of five or six area VDCs. They explain the project to the VDC leaders who then discuss it in their respective villages. Those who are interested come back to SIMI with affirmation that they wish to implement a project in their villages.

However, the DDC is becoming increasingly involved in MUS projects, particularly considering the decentralization effort to shift control of development work to the district level (see chapter 7—Applying the Learning Alliance Approach for a more detailed discussion of this). District offices of various line agencies have contributed both materials and money to support MUS projects, leaving the planning and implementation up to SIMI staff, VDCs, and construction committees. They also provide technical assistance and training support for some schemes. The DADOs are the most active district-level line agency contributors to date.

At the national level, the Department of Irrigation through the NITP is the most substantial contributor to MUS schemes. Although government bodies in charge of rural drinking water infrastructure (largely DoLIDAR) are not yet involved in MUS projects, SIMI staff is working on obtaining their involvement for future projects.

MUS APPROACH

IDE takes a value chain approach to improving smallholder livelihoods, and MUS projects are no exception. IDE connects smallholder farmers to input suppliers, including manufacturers of microirrigation technologies, works with manufacturers to train them on microirrigation technology production and encourages retailers to supply the equipment in regional hubs where smallholders can access them. The farmers are then trained on production of high-value crops and connected to markets for crop sale. It was within this approach that the conceptual evolution of MUS in Nepal began.

BEGINNINGS OF IDE/SIMI INVOLVEMENT WITH MULTIPLE-USE SERVICES

Prior to the initiation of SIMI, IDE had worked on connecting farmers with inputs including the provision of microirrigation technologies, capacity building on high-value crop production, and connection to markets for sale of the products. However, IDE had not previously been involved in developing water sources for farmers. Roughly three quarters of the farmers who purchased microirrigation kits used water from their existing drinking water systems for irrigation of kitchen gardens near the water taps. However, this was limiting because the drinking water systems were not designed to provide enough water for irrigation. And the difficulty of carrying sufficient water from the public tapstands led to underirrigation of crops and lower yields than desired. In some cases the farmers augmented the supply of water for irrigation by using household wastewater. But IDE engineers realized that they needed to incorporate irrigation need into the design and match water resource development with irrigation needs.

A meeting with the entire IDE technical team was held in July 2003 to discuss the best way to develop water resources for irrigation. They decided to borrow ideas from gravity-flow domestic water systems in the hills and, using the WATSAN drinking water design program, designed a similar irrigation system. Some technical staff realized that if they built a hybrid domestic water irrigation system, not only would it provide much-needed domestic water, but it would also enable the expansion of microirrigation technology use and save precious water collection time that could be used for vegetable cultivation. As a comparison trial, they designed two systems in neighboring villages—one just for microirrigation (Gaptung) and one hybrid domestic water/irrigation scheme (Chhatiwan), both using a single-tank, one-line distribution system. Although both villages had positive results, the response from Chhatiwan was better. SIMI chose another village (Tori Danda) in a neighboring district to try building another MUS system, but conflicts arose over the source, so implementation was halted. Next they chose the village of Senapuk and started construction there, ultimately coming up with the first double-tank, two-line distribution system. After construction in Senapuk began, the conflict in Tori Danda was resolved, and SIMI chose to build their system in a similar fashion to the one in Senapuk. After successful implementation in these two villages, IDE staff was so pleased with the results that the hybrid concept was adopted for all SIMI districts. This was the beginning of MUS system design and construction in Nepal by IDE and partners. A few other organizations, such as NEWAH, had previously designed rural drinking water systems that included livestock needs and a small percentage of extra water for "other uses," which villagers were using for kitchen gardens. However, their systems were predominantly designed for domestic purposes, and productive use was considered an acceptable "extra." NEWAH systems are by design "domestic plus" whereas the new hybrid systems were designed specifically for domestic and productive purpose, making them the first "MUS by design" systems in Nepal.

Once MUS began, IDE-Nepal used their existing programs to expand, improve, and test new methods for both MUS implementation and scaleup. These included Ujyalo, BDS-MaPS, and BDS-MaPS PRIME as mentioned in the Introduction above. By the end of 2008, 81 MUS systems had been designed and built in the middle hills of Nepal, servicing anywhere from 10 to 200 households. Due to the lack of sufficient project funds, it was very difficult to construct schemes of more than 200 households, restricting the size of MUS and the communities IDE was able to work with. Out of these systems, about half are single-tank, one-line distribution systems, and half are double-tank, two-line distribution systems. Krishnapur (chapter 4) is the one system that uses homestead storage in addition to their single-tank, one-line distribution system.

It was in this way that water source development became one component of the SIMI project in Nepal. The other components remain microirrigation, rainwater harvesting, and water storage for irrigation. Although these other components are sometimes combined with MUS, in villages where MUS is not being implemented, either harvested rainwater or surplus water from preexisting drinking water schemes is collected in tanks and used for microirrigation. In some projects solely microirrigation is promoted, and it is left up to the community to determine how they access water for this purpose; these communities largely have sufficient domestic water available. Rainwater is used mainly as supplementary water since collection during the monsoon season is not enough to supply year-round needs. The first option for MUS schemes is always the rehabilitation of the existing domestic water scheme that is either no longer in operation or has insufficient supply. If there is no system already available, MUS schemes construct entirely new infrastructure by tapping a previously untapped water source and piping it to the village for multiple uses. In one case (Krishnapur, chapter 5), water from a branch canal of a farmer-managed irrigation system was combined with a spring source.

SIMI uses two different models of operation for MUS:

- SIMI direct implementation—this is being done in seven districts (all three of the case-study schemes were built through this model).
- The NGO model—a contract is signed between SIMI and a local NGO to do implementation.

MUS TEAM STRUCTURE AND OPERATION

SIMI operations are headed up by a national team comprised of staff from both IDE and Winrock International and guided by the Advisory Board. The SIMI Advisory Board is officially recognized by the government and has representation from the Ministry of Agriculture and Cooperatives, Ministry of Finance, Ministry of Women, Children & Social Welfare, Ministry of Local Development (within which DoLIDAR is housed), Department of Agriculture, Department of Irrigation—Nonconventional Irrigation Technology Project (NITP), National Agriculture Research Council, Agro Enterprise Centre, SAPPROS, CEAPRED, IDE/Nepal and Winrock International.

However, it is at the district level that most of the implementation occurs. The district teams are comprised of the following positions:

- District Manager—responsible for overseeing and coordinating all district-level SIMI activities.
- Agricultural Technician—responsible for providing technical support on production techniques to community members.
- Irrigation Technician—responsible for conducting the feasibility study and survey for MUS as well as providing technical support for microirrigation technology promotion including installation, operation, maintenance training, construction supervision, and supply-chain development.
- Marketing Supervisor—responsible for organizing local marketing committees and ensuring market connectivity of smallholder farmers.
- Social Mobilizer—responsible for mobilizing community participation; SMs are usually from the district they work in.
- Community Mobilizer—responsible for mobilizing community participation; CMs are usually from the community they work in.

In the districts where the direct-implementation model is used, SIMI has one District Manager and one Irrigation Technician for the whole district. Each pocket within the district has an Agriculture Technician and Marketing Supervisor.[1] And each VDC has a Social Mobilizer/Community Mobilizer. Social Mobilizers and Community Mobilizers assist the Water User Committee with all project activities at the group level. This includes facilitation of monthly meetings, provision of information on service providers, education on seasonal agricultural activities, selection of households for demonstrations, and encouraging uptake in new technologies. The Social Mobilizer/Community

Mobilizer also responds to any small problems or conflicts the community has during the process. For example, if there is a problem with obtaining seeds or spare microirrigation technology parts, they will work with the community to manage solutions. If a larger problem arises, the community will approach the Social Mobilizer/Community Mobilizer and together they will access the respective district team member for assistance. For example, for an agriculture issue they will meet with the Agricultural Technician; if the problem is with marketing, they will talk to the Marketing Supervisor; and if the problem is something technical with the MUS system or microirrigation equipment, they will meet with the Irrigation Technician.

Each Social Mobilizer/Community Mobilizer works with around 17 user groups, visiting older groups less and newer groups more frequently. During preconstruction and construction phases, the Social Mobilizer/Community Mobilizer visits the community every other day or more frequently if requested. After completion of the scheme, they visit once a week in the first two months and then less frequently.

Direct-Implementation Model Function

In order to launch MUS activities, the central SIMI office organized an orientation for Irrigation Technicians about the MUS concept, how it could be implemented in the field, and why SIMI had chosen to incorporate MUS into its program. After this orientation meeting each Irrigation Technician explained the MUS approach to all the other staff on their district teams. Then the Social Mobilizers/Community Mobilizers shared the MUS concept with the community groups they were working with.

For each project, the Irrigation Technician is primarily responsible for all aspects of design and construction (site selection, surveying, and construction) while the Social Mobilizer/Community Mobilizer staff liase between the communities and the remainder of the district teams.

The staff meetings held at the various levels are:

- The Social Mobilizer/Community Mobilizer staff meet once a week with the Agricultural Technician and Marketing Supervisor and twice a month with the Irrigation Technician.
- In the district all district-level staff including Social Mobilizer/Community Mobilizer participate in a monthly meeting and discuss the progress and problems that have arisen. The progress and problems are communicated with the SIMI Area Office. When possible, the Area Coordinator participates directly in this district-level meeting.
- An all-area-level staff meeting is held annually with all district teams in a designated area along with the central-level staff. All comments and issues are collected and discussed and solutions sought.

- The central-level staff meet bimonthly with all Area Coordinators. Again, issues and concerns are raised and solutions discussed. Any issues that remain unsolved from the district and area-level meetings are raised at the central-level meeting as well. The Area Coordinators share the output of these meetings with district-level staff.

NGO Model Function

In the direct-implementation model through SIMI, Social Mobilizer/Community Mobilizer staff are directly employed by SIMI, whereas in the NGO model they are employed by the local partner organization and work in concert with the remaining SIMI team. In Ujyalo, the whole district team is employed by the local partner organization. At the beginning of the project, IDE/ Nepal's technical team trained the NGO technical staff on MUS, and now the local NGOs implement MUS projects.

In the NGO model all of the Social Mobilizer/Community Mobilizer staff meet in their pockets to gather ideas for the next phase of implementation. They then sit with SIMI staff to determine a set implementation plan. The local NGOs are largely responsible for performing needs assessments and identifying potential communities, social mobilization, assessment of available water resources, and helping the community find local financial resources. In Ujyalo, the whole process is handled by the local NGO staff.

Comparison of Two Implementation Models

See *MUS Team Structure and Operation* in earlier this chapter for a review of the beginnings of MUS, SIMI team structure, and two different models used for project implementation—the direct-implementation model and the NGO model. Although they are quite similar, there are a few functional differences between the two models. While the social-mobilization component is similar between the two, the training and follow-up provided may be different. In the direct-implementation model, SIMI staff directly trains the community, giving more clarity to what and how the technical knowledge is shared. However, in the NGO model, SIMI first trains the NGO, and then the NGO trains the community. Or if the NGO has significant prior experience, SIMI may not give the NGO all the training. Although there is less clarity in exactly what and how the information is being shared through the local NGOs, it is definitely increasing their technical capacity, as stated by SORUP.[2]

Therefore, although there is less direct control by SIMI, the NGO model may in essence be more sustainable because the local NGO is much more likely to remain working in the local area, and creation of a relationship with the community allows them to depend more on the local NGO for follow-up after project construction. In the direct-implementation model, contact with the community will last only as long as SIMI does.

However, in the NGO model, much depends on the quality of the local NGO staff. If the needs of the community require innovation and extrapolation of technical knowledge, there can be problems both ways. If the NGO is unable to innovate, the solution given may not effectively solve the problem at hand, and they will need to seek technical support from SIMI. In this case the results will only be as good as the communication between SIMI and the NGO. However, if the NGO is too radical in its innovation, there is a danger that standards will not be followed. Therefore, SIMI must walk a fine line to keep the projects on track without being overly prescriptive and allowing growth within the local NGOs. Fortunately, the local NGOs SIMI has worked with to date have been very effective and have shown great ingenuity in their work.

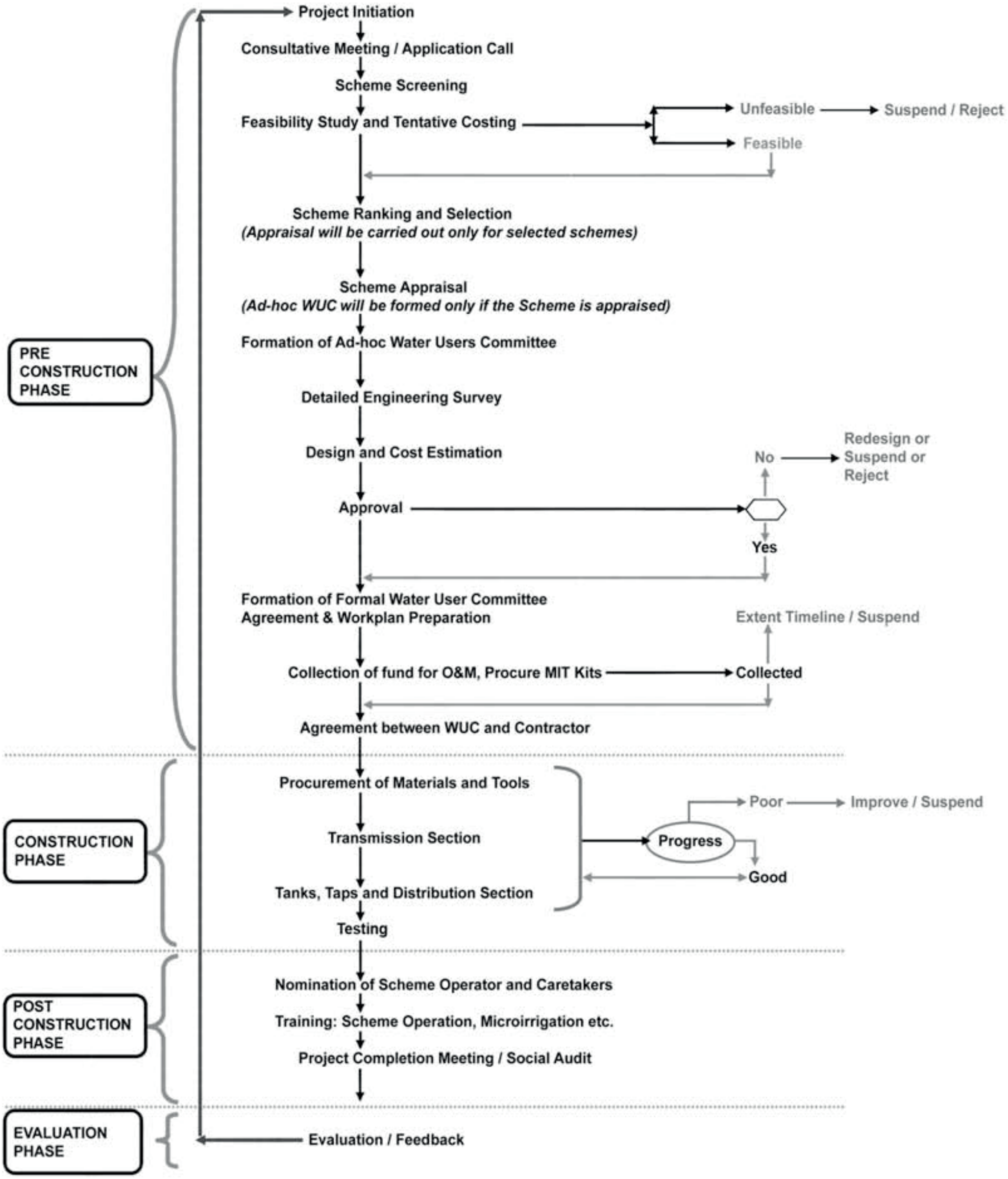
PROJECT IMPLEMENTATION

The overall procedure for project implementation can be seen in Figure 2.1. At the onset of the SIMI project, staff divided every district where it worked into three regions called "pockets" for project selection. Annually a target number of MUS projects are planned for each pocket within every district. The district teams then obtain information from the DDC and VDC in the district and local NGOs on these three pocket areas, requesting information on which areas have the highest priority need for water supply and which VDCs and communities are interested in a project. The team then reviews village-level data to select those with access to a market, an available water source, and evident poverty.

Once the villages that best fit the criteria are selected, initial consultative meetings between SIMI and the communities are held. Although SIMI selects and approaches each community in a slightly different way, its project agreement is based on a standard set of requirements. These requirements, clarified at the initial meeting with each community, are as follows:

- SIMI provides planning, design, and construction support limited to materials and expertise required from outside the village, such as a trained mason.
- SIMI provides various trainings (explained in the "Trainings" section below).
- The village provides all local materials and unskilled labor for construction.
- The village is responsible for operating and maintaining the completed scheme.
- The villagers are required to establish a Water User Committee and register the group with the district government as owners and managers of the scheme. Finally, at least 75 percent of the villagers must indicate interest in purchasing microirrigation kits to use for vegetable production (see Table 2.1, appendices 1 and 2). Cost for the kits is not included in overall project costs; households purchase them independently at full cost.

Figure 2.1 MUS project implementation procedure



Courtesy of Deepak Adhikari.

SYSTEM PARAMETERS

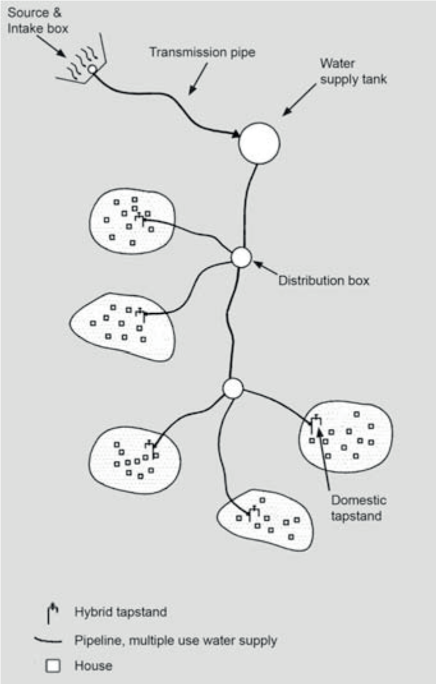
Once the initial meeting is held and the project agreement is made, the water demand is calculated using a set of parameters. Domestic demand is calculated by assuming a need of 45 liters/capita/day[3] for the projected 10-year population of the village or cluster. For irrigation demand, SIMI engineers use a range of 400–800 liters/household/day. This productive-use design requirement is based on the evapotranspiration rate in the hill region of Nepal. Taking the case sites as an example, Table 1.2 shows the premonsoon dry season evapotranspiration rate to be 4.5 mm/day for Chhatiwan and Senapuk and 5.4 mm/day for Krishnapur. The rate is 2.1 mm/day for all three case-study areas during the postmonsoon season. Experience by SIMI field staff in the Nepal hill environment demonstrated that as little as 2 mm/day/m^2 water-application rate will provide a good crop of vegetables in the winter and spring seasons. The premonsoon dry season flow rate of the source for each system was measured against the combined domestic and productive needs to ensure enough year-round base flow for system design.

SYSTEM COMPONENTS

After the demand is calculated and a sufficient source chosen, the system is designed. The main system components are largely the same for all MUS schemes in Nepal. Some slight variations occurred as IDE adjusted and incorporated alternate models it had been testing for storage and new designs for intake water filtration. Systems begin with source protection at the intake of the spring, and then water is conveyed by gravity through plastic pipe to one or two water collection tanks near the village. IDE tanks include the Modified Thai Jar (see appendix 3) with capacities of 1,000, 1,500, and 3,000 liters and the soil-cement-lined tank (see appendix 4) with capacities of 6,000 and 10,000 liters. The Modified Thai Jars are made with ferro cement (a mixture of sand and cement which is applied as a thick plaster) and wire netting for reinforcement. The soil-cement-lined tanks are pits dug in the ground with a soil-cement plaster lining. These designs were developed with emphasis on effectiveness and low cost. The size of tanks used for MUS systems is based on the flow rate of the spring and the planned need of the projected future population of the village or cluster.

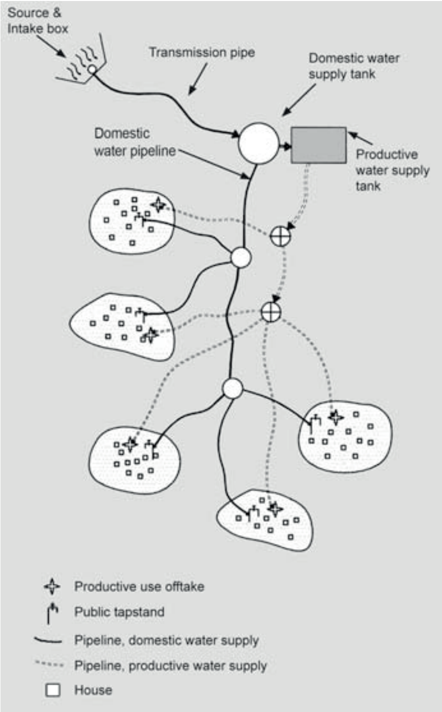
The water is then distributed to two different types of outlet delivery structures—“hybrid tapstands” and “offtakes.” Hybrid tapstands have two different types of taps on them: one is a domestic tap under which a jug or other water-storage container can rest as it fills, and the other is an irrigation tap designed to directly attach a hose to fill up the drip irrigation “header” tank or operate a sprinkler. Offtakes are single-use taps that are low to the ground and designed with two taps to attach hoses for filling the drip irrigation “header” tanks or attach directly to the sprinkle system.

Figure 2.2a Single- tank, one- line distribution system



Courtesy of Deepak Adhikari.

Figure 2.2b Double- tank, two- line distribution system



Courtesy of Deepak Adhikari.

The use of these two types of outlets is based on both the type of system (single-tank, one-line distribution or double-tank, two-line distribution—see Figures 2.2a and b) and the location of the bari land that the households will be farming. In single-tank, one-line distribution systems, if the bari land is isolated from the house, then an offtake will be located in the bari area for those households to use for irrigation, and a hybrid tapstand will be located near the homes for domestic purpose. If the bari land is near the homes, then hybrid taps will be built for those households to use for both domestic and irrigation purposes. On the other hand, with a double-tank, two-line distribution system, in order to keep the use of domestic water separate from the use of irrigation water (to ensure sufficient quantity of domestic water even in the dry season in water-scarce areas) hybrid tapstands are designated for domestic use and located near the homes while offtakes are designated for irrigation use and are located near the bari land. All tanks, hybrid tapstands, and offtakes are constructed on-site by a trained mason (someone either hired from outside the village or trained as a mason in the village by SIMI staff) with labor contribution from all households in the community. As the first single-tank, one-line distribution system, the Chhatiwan case study in chapter 3 gives more background on the genesis and uses of this system. The Senapuk case study in chapter 4 shows the development of the first double-tank, two-line distribution system.

The hose that connects to the offtake or irrigation tap on the hybrid tapstand to fill up their microirrigation "header" tanks is not included in the cost estimation or design of the MUS system unless there is a special request from the community to do so. If the cost estimation is included in the system design, the community can choose to seek outside funds to cover that portion of the design, or they can contribute it themselves. Otherwise, the cost of the hoses is borne by each household, based on the length of hose needed to reach its field from the hybrid tapstand or offtake.

In order to enable equal distribution to each hybrid tapstand and offtake on uneven terrain, equal flow must be distributed to each outlet on a timed basis. To ensure that equal delivery time actually supplies equal volume, pressure regulators are used to adjust the discharge rate at each outlet. These pressure regulators are commonly used in domestic water systems in the hills where there are large elevation differences between taps.

MATCHING FUNDS

A concurrent process to creating the system design is the search for matching funds from project partners. Before a project can actually be fully approved, communities are required to secure the necessary funds. First, the SIMI district team determines a basic budget projection including how much is required from other partners. This budget is described to the community, and discussion is held to assist the community in identifying potential funding partners. The community (with Social Mobilizer/Community Mobilizer assistance) goes to local organizations—clubs, other NGOs, GOs[4], local government,[5] etc.—to seek funding. The SIMI team concurrently seeks funding from district- and national-level GOs and NGOs. Once verbal interest is received from various partners, a detailed cost analysis is completed as part of the engineering survey. The actual financial requests of these potential partners are then made. The success rate of actually acquiring funds is greatest at the community level, then the district level, and finally the central level. Once the required budget is secured through various project partners, the implementation is finalized. Only after this does the central-level SIMI staff send the full documents to all project partners and the district office for signature.

MICROIRRIGATION

The other major technical components of the Nepal MUS systems are the microirrigation kits that the farmers are encouraged to purchase for efficient irrigation of their high-value crops. Farmers are offered a variety of microirrigation kit choices as shown in Table 2.1. Appendices 1 and 2 explain the specifications of the drip and sprinkle systems. Irrigation kits can be expanded for an additional cost, giving the farmers the potential to increase their irrigated area over time with their production earnings.

Table 2.1: Available microirrigation kits

Irrigation Type	Kit Size	Area Irrigated (m^2)	$ Cost
Drip	Very small	80	13.60
Drip	Small	125	17.50
Drip	Medium	250	28.70
Drip	Large	500	54.90
Drip	Very large	1,000	106.20
Sprinkle	Medium	250	11.30
Sprinkle	Large	500	21.30

Source: SIMI data

There are a host of benefits farmers receive through use of microirrigation. Due to a 50 percent water savings compared to flood or furrow irrigation, the use of drip or sprinkler systems enables the irrigation of a larger area. The frequent application of small amounts of water also limits deep infiltration losses and reduces the chance of water stress on plants, resulting in increased production. Additionally, it improves the quality of the produce because it reduces the incidence of disease and damage. Farmers can reduce their labor costs by reducing irrigation and weeding time. Since drip irrigation applies water near the plant and minimizes water application away from the plant, weed growth is retarded in the area away from the plants. And, less fertilizer is required due to accurate fertilizer application through the drip system. The major problem with microirrigation is blockage of the emitters due to use of water with high particulate matter. Since most of the MUS projects developed spring sources for use with the microirrigation kits, and the particulate matter in spring water is low, this problem is mitigated. A more in-depth discussion of the technologies used in the Nepal MUS systems, the reasoning by which they were chosen, and the implications of their use can be found in Yoder et al., 2008.

ON/OFF-SEASON PRODUCTION

The major goal of incorporating microirrigation into the MUS systems in Nepal was the ability of farmers to grow high-value vegetable crops both on- and off-season. The designation of on- and off-season varies according to the vegetable produced. The on-season is the traditional season when a vegetable is grown in Nepal. For example, cucumbers are normally cultivated during the monsoon season (mid-June to August). Farmers receive a lower price when they sell cucumbers in this season because there is a glut in the market at this time. However, if farmers can grow and sell cucumbers in the premonsoon season, there is less supply in the market, and they can receive up to 100 percent higher prices in this off-season.

Cultivating vegetables in the off-season does require sufficient irrigation water, greater financial outlay, and technical knowledge. If farmers can access the requisite funds at the beginning of the season, the returns are high enough to cover the initial financial burden and provide a higher profit. As part of the MUS projects in Nepal, SIMI helps farmers access water for productive use, microirrigation equipment for efficient application of the water, technical knowledge to grow the crops, and assistance in marketing. The Water User Committees set up in villages through MUS projects also establish a loan fund to help those who need assistance at the onset of vegetable production. The four vegetables cultivated by MUS farmers that receive the highest off-season return are cucumber, capsicum, bitter gourd, and tomato.

TRAINING

A key component in the success of the Nepal MUS projects is the training that SIMI provides. Training helps to increase knowledge, disseminate technologies, build capacity, increase market acceptability of produce, and raise awareness of different ways to increase farm income.

Before training sessions are conducted, skills within the community are assessed. If there is a mason or plumber available within the community, he will be ultimately responsible for heading up the construction tasks. However, for any construction he is unfamiliar with, SIMI provides a trainer to help during the construction process. This builds the knowledge of the mason or plumber as well as the rest of the community. If there is no plumber or mason within the community, one from outside the community is hired with oversight from the construction committee and SIMI team.

Training sessions conducted for every MUS project and their timing include:

- Plumbing/Masonry—after the detailed design and estimate are completed, but before construction begins
- Scheme Management training
  - ~ Assembly—during construction phase as on-the-job training
  - ~ Repair and maintenance—just after completion of MUS and refresher training when problems are encountered
  - ~ Users orientation training about operation of the scheme—Just before completion of MUS construction
- Water resource training—just before the completion of system construction
  - ~ Safeguarding of water tanks, management of water, and water distri bution. Among other topics, these trainings included information on water purification (filtration, boiling, etc.), cleaning of drinking water containers, and the importance of using each type of tap for its designed purpose (tapstands for domestic and offtakes for irrigation) to ensure sufficient domestic supply.
- Farmer-to-farmer training tour program to other vegetable production area to see existing schemes—just before or just after the completion of system construction
- Microirrigation technology
  - ~ Pre-use training—just before drip installation and crop transplanting time
  - ~ Post-use training—sometime during the crop season, just before harvesting, or just before the drip system is stored
  - ~ Repair and maintenance—during cultivation once the drip lines are installed for use
  - ~ Agriculture production techniques—just before the specific season for each crop; postharvest training is conducted just before the harvesting of crops; the other trainings are less time-sensitive and depend on the situation.
  - ~ Off-season vegetable production, nursery preparation and management, Integrated Pest Management (IPM), Integrated Plant Nutrient System (IPNS),[6] soil solarization, compost making, post-harvesting practices, plastic tunnel development, seasonal-crop planning, plastic-house construction, crop-sowing methods and timing, and crop health
- Income-generation techniques
- Trainings specifically for women—at the same time as the agriculture-production technique training
- Production cycles, postharvest handling, agroprocessing techniques, developing sustainable rural institutions

In order to select the trainees for each session, the WUC calls a meeting and selects the trainees depending on who has time and who is able to share what they learn with those who are unable to attend. Many of the trainings are conducted by SIMI staff, but some are done by other local organizations or line agency staff. Key people in the village are also trained by SIMI staff to become trainers themselves. These individuals are then responsible for conducting some of the later trainings. Most of the trainings are practical in nature and include field demonstrations and exposure visits.

Training programs lasted anywhere from two hours to seven days, depending on the subject matter. More intensive training periods were held at the beginning of the project, and the time involvement tapered as the project progressed.

MARKETING

In order for farmers to see the highest returns on their investment in microirrigation technologies and the productive component of the MUS systems constructed, they must be connected to markets. Since most MUS farmers have not sold vegetables as cash crops before, a marketing component is a major part of the MUS project. As part of the wider SIMI project, production groups have been established in many villages. SIMI starts marketing groups based around key regional markets by linking production groups in multiple VDCs. These marketing groups share the same collection center for sale of vegetables and elect a collection committee to run the operation. The committee is responsible for collecting and weighing the vegetables and taking them to the nearby market for sale. A fee (usually NPR 1/kg of produce) is collected by the committee to cover the cost of operating the collection center and transportation to the market.

There are now 70 marketing committees and 60 collection centers,15 of which have become cooperatives. Two districts have also created apex marketing committees that represent the committees in their district and help them market outside of the district.

COSTS OF MUS PROJECTS

Due to different designs and village/cluster sizes, distance from the source, and other factors, the cost of each MUS system varies. However, when looking at the whole range of MUS projects in Nepal, the average project cost per household of a MUS system is shown in Table 2.2. This cost estimate spans the project implementation period of 2003–2008 and includes the cost of agricultural interventions.[7]

Table 2.2: Average system project cost 2003–2008

Average direct MUS costs	NPR	$
Cash costs	142,500	2,262
Noncash costs	95,500	1,516
Total	**238,000**	**3,778**
Average staff costs	30,000	476
Staff fringe (50 percent)	15,000	238
Overhead, other indirect (21 percent)	3,000	48
Total direct/indirect costs per MUS	**286,000**	**4,540**
Average households per MUS system = 36		
MUS cost per household	7,944	126
Average cost per household for agricultural interventions	4,400–6,300	70–100
Overall cost per household of MUS (including agricultural interventions)	**12,344–14,244**	**196–226**

Source: IDE MUS project data