CHAPTER 6

COMMUNITY-LEVEL LESSONS

Photograph by Monique Mikhail.

The organization of this chapter is based on the 14 principles outlined in the CP-MUS Action Research Framework that are required at the community, intermediate, and national levels to implement and scale up multiple use water systems. (See Van Koppen et al. 2006 for more information on the MUS principles.) Information from IDE/Winrock MUS projects in Nepal, other than the three case studies, is used to augment the lessons from the three case studies in chapters 3–5. The information is based largely on personal and group interviews that occurred during February–May, 2007, group meetings, and questionnaires.

Interviews with IDE staff at the national level included the following:

- Deputy Team Leader, SIMI
- previous head of Engineering, IDE-Nepal; now Team Leader, Technical Assistance Microirrigation Project, Nonconventional Irrigation Technology Project of the Department of Irrigation
- SIMI Engineer

Interviews at the local level included:

- group interviews with communities in Kaski, Syangja, and Lalitpur districts; personal interviews with a few leader farmers and local staff in these districts
- individual interview with the Social Mobilizer for BDS-MaPS project in Lalitpur District
- individual interview with the Social Mobilizer for SIMI project in Palpa District
- focus-group meeting with Social Mobilizer/Community Mobilizer staff during the annual area-level SIMI staff meeting (March 22, 2007)
- focus-group meeting with agricultural technicians, irrigation technicians, agricultural-marketing supervisors, and district managers during the annual area-level SIMI staff meeting (March 21, 2007)

At the focus-group meetings during the annual area-level SIMI staff meeting in Tansen, a questionnaire about the process was handed out and answers collected. It focused on SIMI staff experience with the process, views about it, and suggestions for improvement.

Interviews with partner organizations included:

- district partners—LISP-Helvetas, World Vision, District Agriculture Development Office
- partner NGOs—SAPPROS and CEAPRED
- local implementing NGO in Kaski—SORUP Nepal

Field visits by IDE international staff included:

- Patnari and Odare villages in Kaski District
- Lele and Salyan villages in Lalitpur District
- Rangethati village in Syangja District
- Maredanda village in Palpa District

Information from SIMI staff experience in the following communities was also used:

- Maseri Tole in Birendranagar municipality of Surkhet District
- Bame Khola village in Lati Koili VDC of Surkhet District
- Kavre village in Lele VDC of Lalitpur District
- Bhirmuni Jodhane village in Dhikur Pokhari VDC in Kaski District
- Katuja village in Pelakot VDC of Syangja District

LIVELIHOODS-BASED SERVICES

COMMUNITY UNDERSTANDING

What became clear through all of the MUS projects in Nepal was that the concept of multiple-use services is not new to the hill communities. They automatically think of integrating multiple uses of water resources, ensuring that domestic needs take first priority. The Nepal cases illustrate that communities are far ahead of "development" and government agencies in planning and implementing water resource development for multiple use and are very adept at using their own resources and devices as well as combining single-purpose development "projects" to meet their needs.

The Krishnapur (water-scarce) example in Nepal perhaps best illustrates this. As part of a larger stream-diversion, farmer-managed irrigation scheme, the cluster advocated for the DoI to line their canal to increase water availability. But instead of just using the increased water for their khet land, they worked with SIMI to create greater control over the water with a community storage tank and offtakes for microirrigation of their bari land. When they realized that by adding homestead storage they could create an "all but drinking water " MUS, they shouldered the extra cost for the flexibility it would provide them. And when the water remained insufficient in this MUS during the dry season, they encouraged SIMI to help them tap a small nearby spring and add that additional water to the storage tank. Furthermore, a few of the households modified the system to also include drinking water . Two of the 16 households opted not to connect their homestead storage to the MUS "all but drinking" water supply and instead filled the storage from the preexisting Mul Pani drinking water System. These households use the MUS water only for irrigation by filling their drip-system header tanks by hose directly

from the offtake. They then supplement, when necessary, from their homestead storage containing water from the Mul Pani drinking water System. This mobilization of various resources and "add ons" to existing systems was an effective way to make the most of their scarce supply.

Something similar occurred in Chhatiwan, albeit on a smaller scale. The community originally organized around irrigation access but recognized their need for increased water for domestic use as well. Before working with SIMI, the farmers' group negotiated with neighboring communities to use some water from the regional traditional source structure and then lobbied their local VDC council to provide them with a half-inch pipe from the source to the cluster. When SIMI MUS activities began, they incorporated this pipe into their MUS system.

Likewise, in Senapuk, the households had a previously built domestic water system that was insufficient for even their domestic needs, so they worked with SIMI to supplement the system with a spring from a stream they had previously used to irrigate their khet land. The new MUS system incorporated the old domestic water system into its design and now provides water for both domestic use and irrigation.

Furthermore, in a MUS project in Lalitpur District, the community had already obtained partial funding for a productive-use system from the local DADO as well as the DoI. But once they learned of SIMI's MUS activities, they requested help in modifying the project to include domestic uses.

Perhaps most important, MUS systems were able to achieve more buy-in at the community level, including active participation and contribution of both men and women because the system was explicitly providing a service to both the domestic and productive realms of the household. Although single-use systems benefit all members of the household, in Nepal the productive sector is generally considered to be the male realm while the domestic sector is generally considered to be the female realm. While the lines are much less clear in reality and both men and women share in the productive/domestic responsibilities and benefits, single-use systems concentrate benefits on one realm or the other whereas MUS systems equally benefit both realms.

EXPANDING PRODUCTIVE USE

Although it is generally true that farmers who have more of a financial buffer will take more risks on new innovations, due to the community nature of MUS and the link with microirrigation, most households that have even a small land area are simultaneously taking advantage of the new technologies. Despite this positive uptake of technology, larger farmers still have more land that could be cultivated with vegetables or other crops both on- and off-season. But there are a few limiting factors to this increased production. First, the MUS system can only provide a limited supply of water due to the small spring source(s) they are using. DADO-Palpa suggested the use of plastic ponds for

rainwater collection as an added potential component of MUS systems, particularly in cases where the source flow is low. Or the model of MUS in Nepal could be expanded to include the potential feasibility of expanding their water sources by piping water from streams. Second, sometimes factors other than water supply limit expansion of production. For example, in Senapuk there are so many men who working outside of the village that the households are constrained in how much they can cultivate. This is a major consideration for future upscaling of MUS. Unless income gains from productive uses can compete with income from sources outside the community, expansion of the productive component of MUS systems will be limited.

There are other productive-use possibilities in addition to expansion of irrigation and vegetable production that have yet to be explored in MUS systems in Nepal. Due to the way that IDE/SIMI MUS projects have been implemented, many of the other stakeholders in government and other NGOs, and even within the IDE/SIMI team itself, see MUS as basically a dual-function system—irrigation and domestic water.[1] But the idea is broader than this dual function, and the communities themselves are open to other productive uses. Several future possibilities to further raise household income include the following:

- Small-scale food processing to create value-added products. For example, a community cannery could be built to process the fruits and vegetables and sell them for higher prices in the markets.
- Cultivation of tree crops (fruit, nuts). Although the financial pay-back takes longer with these types of crops because it takes multiple years for them to start producing, they can provide greater sustainability and variety of products for sale. They also lend themselves better to small-scale processing options, such as cooking oil and fruit preserves.
- Growth of higher-nutrition fodder to raise a greater number of poultry and livestock. Household wastewater could be utilized to grow the fodder necessary to raise more livestock and poultry for the high-value products they offer.
- Microhydro projects
- Aquaculture

These suggestions were discussed during the community group interview in Senapuk. They recognized that microhydro projects were not a cost-effective option for them, given their water source, but they were definitely interested in fish ponds, fruit crops and their potential processing, and growth of fodder to sustain more livestock. They were less interested in tree crops because they felt that they would produce too much shade and reduce production of their vegetables.

HURDLES TO GREATER INCOME INCREASES

Increases in income from vegetable sales have been an important financial boost for households with MUS. The average household income from vegetable production over two seasons (after-consumption sales minus costs) was$330 in Chhatiwan and $199 in Senapuk. For Krishnapur, the average income increase for one season was $40.35. Even if this estimate is doubled to estimate what two seasons would produce, the income is much lower than the other two cases. There were several reasons for this result. The systems in Chhatiwan and Senapuk were built a year earlier than in Krishnapur. In IDE's experience, income obtained with vegetable production using microirrigation increases each year for the first four years as farmers become more adept at vegetable production with microirrigation, as the marketing committees improve their skills, and as the whole value chain strengthens. More specific problems in Krishnapur included heavy monsoon rains and effects of poultry raising led to significant crop damage. Additionally, surveys were done after only one cultivation season (the rainy season), so increased gains from off-season production had yet to be seen by Krishnapur farmers. Chhatiwan also faced environmental factors like hailstones and mice chewing drip lines, albeit to a lesser extent. In order to realize the highest income gains possible through MUS projects, SIMI and other implementing agencies should consider the major potential problems for farmers in obtaining high yields and seek to mitigate these problems prior to vegetable production. SIMI has begun this effort by testing the availability and performance of various hail-net sheds that could protect crops from hailstones.

Despite the hurdles farmers faced, vegetable production for two seasons through MUS averaged 15–27 percent of annual household income in the three detailed cases.[2] While this is a significant amount, particularly for such a recent project, much of their income still comes from pensions, remittances, and other employment (service and religious work). And although the added income is a good buffer, it is not yet significant enough for family members outside the village to return and work in agriculture. However, it is a notable economic opportunity for household members unable to travel outside the community for employment, and it is incredibly important for the poorest households whose vegetable sales comprise a larger portion of their income.

MARKETING CHALLENGES

Some aspects of marketing posed another hurdle for farmers. There is no set formula for marketing of the produce from the MUS systems. Although collection centers were attempted in all three cases, in Krishnapur the collection center is working well; in Chhatiwan it was completely stopped; and in Senapuk it still exists, but the community was not completely happy with it. One possible reason for this difference is that Chhatiwan and Senapuk were the first two MUS systems built, so SIMI was still in the nascent stage of devel-

oping them. Another possible reason is the presence of other marketing options. While Chhatiwan only had the options of selling to the marketing committee or individually selling in the market, Senapuk and Krishnapur had other marketing possibilities besides the marketing committee. Senapuk built a marketing center along the all-weather road and also went to Butwal to sell ghee and could sell vegetables there as well, and Krishnapur had the weekly bazaar in Birendranagar and sold to traders who came into the village on their way to the bazaar. Perhaps having multiple options allowed farmers to feel that they could participate in the marketing committee while still maintaining some level of control over marketing their produce. Some interviewed households did mention a preference for selling their produce in the market themselves because they could then do their purchasing at the same time. And Senapuk women felt greater independence if they sold independently.

Chhatiwan members also indicated that the lack of commodity price information was the reason they felt they were not receiving a fair price. Although the members of Senapuk did not specifically mention commodity price information as the reason, they, too, said they felt the prices they were receiving were lower than expected. This feeling of being "cheated" on price is a critical one for prolonged involvement in vegetable production and marketing. SIMI has already taken some corrective measures to mitigate this problem by ensuring that price information is broadcast over FM radio in the areas where it works. SIMI is also helping to set up district apex marketing committees to help the smaller district marketing committees access markets beyond their districts.

While the current local-market possibilities for hill communities in Nepal are high, they may not always remain so. At present Nepal imports significant quantities of vegetables from India, and Nepali producers could replace these imports. However, massive upscaling of MUS activities could create a marketing problem, especially in smaller communities, if saturation of vegetable markets causes prices to drop, resulting in a decreased financial benefit of MUS. Diversification of crops and water-related enterprises should be explored for effective MUS upscaling.

CHANGES IN SOCIOECONOMIC POWER DISPARITY

While the direct benefits of increased income are notable, the indirect benefits are also striking. In Senapuk, MUS is actually changing the power dynamic between rich and poor. Because of their improved financial situation, poorer households are no longer obligated to take as frequent or large loans from their wealthy counterparts in the village and are therefore less beholden to them. They can also now borrow from the community revolving fund. In Senapuk as well as other villages with MUS the wealthy are actually not cultivating vegetables but are purchasing vegetables from the poor in the village. This creates a local market for the poor.

On the downside, SIMI staff mentioned that in one MUS project the richest people are demanding more water for bathing and clothes washing because they feel entitled to a larger portion of water than the poorer households. Despite the fact that all households contributed the same amount in labor, cash, and fees to the MUS system, because the richer people have higher positions in the community, their requests for extra bathing water are "accepted" by the rest. This type of class-based prioritization is common in the hills. However, according to SIMI field staff, out of all the communities that have built MUS systems, only one still displays this behavior.

HEALTH IMPACTS

When interviewing the households of communities with MUS systems, it became evident that the health improvements they felt were as equally important as the direct and indirect financial benefits. The additional domestic water has been critical for many of the households, and improved hygiene ranked high among benefits of the system. Communities also reported that increased vegetable consumption has increased their feeling of well-being.

As SIMI progressed through MUS implementation, SIMI staff received feedback that a stronger sanitation component was required. According to SIMI staff, increase in availability of domestic water coupled with SIMI's encouragement of sanitation has also boosted the construction of latrines in MUS villages as well as the overall use of water for sanitation and hygiene. This in turn increases community members' pride in their village because it is cleaner. But even though some individual households took it upon themselves to construct their own toilets after project implementation, there was no comprehensive plan for sanitation within the MUS project. Therefore, BDS-MaPS hosted a one-day orientation on sanitation in December 2006 which was led by both SIMI engineers and an engineer from the Nonconventional Irrigation Technology Project (NITP) of the Department of Irrigation. Additionally, at the beginning of 2007 an all-MUS demonstration of Ecosan toilets was initiated. In each SIMI MUS site, staff request that one household volunteer to purchase and install an Ecosan toilet with SIMI's assistance in order to demonstrate its use and applicability to the community. This has begun to raise awareness about sanitation and the use of composted human waste as fertilizer for crops. If incorporated into these communities further, it could minimize water use for sanitation, increase agricultural yields, and minimize disease transfer through open defecation.

SCHOOL-ENROLLMENT INCREASE

Field staff and communities interviewed all reported that due to health improvements for children, one major benefit of MUS systems has been increased school enrollment. In addition, children, especially young girls, no longer need to spend hours carrying water, so they have more time for school.

In one Kaski MUS community called Patnari, most of the people are landless and previously could not afford to send their children to school. With vegetable production and sales, they can now afford school fees and materials, so enrollment has increased. In Lele village of Lalitpur District, all 28 households worked in the stone mines, and the children of 15 of the households worked in the mines with their parents for extra income. Due to the increased income from MUS, ten households have completely shifted to vegetable production and stopped working the mines, and although the remaining 18 families still work in the mines, all 28 families can now afford to send their children to school regularly.

INCREASED CAPACITY TO ACCESS AVAILABLE RESOURCES

The construction of MUS systems is creating intercommunity connection and facilitating interaction with other NGOs and government agencies. At the beginning of a MUS project, SIMI will facilitate a farmer-to-farmer exchange visit with another village that has implemented a MUS system so that the community can see firsthand what the system looks like and hear stories of its impact from other farmers like themselves. Often these visits are the most compelling support for working toward a MUS system in their own village.

But even without these farmer visits, neighboring villages regularly share information. It is this information sharing that is leading more and more communities to search for ways to implement MUS in their own villages. This is a powerful mechanism for dissemination of information about MUS and the most compelling encouragement for upscaling. According to IDE/SIMI field staff, partner NGOs, local-government agency staff, and MUS villages that have been interviewed, villages surrounding those with MUS schemes are all requesting MUS systems from local government officials, local NGOs, national NGOs, and IDE/SIMI. The facilitation of farmer-to-farmer communication is needed to further expand knowledge of and interest in MUS. For example, monthly farmer forums in Kaski bring together local government officials, NGOs, and farmers to discuss local agricultural problems; this could be a great way to disseminate information about MUS.

One of the major benefits of MUS systems is that it allows for both community and individual action for improved living conditions. The Social Mobilize from Lele village in Lalitpur indicated in her interview that she realized that the process of implementing MUS had strengthened the cohesiveness of the community. Through the development of an active WUC, extensive training activities, and regular interaction with government officials, NGOs (local, national, and international), and outside visitors, the community learns the most valuable tool of all—how to work together to advocate on their own behalf for community-led use of their water resources. Yet within the community parameters, there is also flexibility to take initiative on a house-

hold basis to use more of their land for agriculture, thereby increasing their livelihood security, food security, and, for women specifically, increased financial autonomy.

However, there could be greater encouragement of women for vegetable production with MUS. One IDE/Winrock program in Nepal, BDS-MaPS PRIME focuses only on women and disadvantaged groups and could lend lessons to the other programs through which MUS is implemented. Social mobilizers play a key role in motivation of women for vegetable cultivation. Gender-awareness training for the community in addition to trainings on vegetable production and marketing geared specifically for women could help raise support for women in vegetable production. And building the capacity of women to access resources, such as linkages with input and output traders, could help increase women's empowerment.

IMPROVED COMMUNITY PROFILE

All of the MUS communities have also found that MUS raises their pride in their villages. Since MUS communities have become model communities for other hill villages to visit, the scheme raises their esteem with neighboring communities. MUS communities also have frequent outside visitors from government agencies and NGOs (local, national, and international). Due to this showcasing, communities feel they have something to be proud of, which not only boosts their self-image, but encourages upkeep of the system because they know others are aware of their activities.

IMPORTANCE OF CHAMPIONS

The importance of a champion for the projects cannot be understated. Dal Bahadur Disa in Chhatiwan (chapter 3) is a perfect example. Often the leader farmers become the leadership of the WUC. For example, in Lele there was one farmer (Chandra Bahadur Sundas) who realized that food scarcity could become a real issue for his community if they did not take some initiative. Many in the community were forced to be day laborers in the stone industry in addition to farming to ensure enough food for their families. But day-labor job availability depends on the contractor, decreasing villagers' job security and food security. Due to MUS they have shifted to vegetable production, and many no longer work as day laborers. Chandra Bahadur Sundas became the chair of the WUC. Like Dal Bahadur Disa and Chandra Bahadur Sundas, in many MUS projects the champion was a leader farmer but also sometimes the VDC Secretary or the DADO of the district.

SUSTAINABLE WATER USE

INCREMENTALLY IMPROVING KNOWLEDGE/RAISING AWARENESS

Training

In all MUS projects, staff led numerous training sessions including water tank safety, management of water, pipe assembling and maintenance, and water distribution. Training programs lasted anywhere from two hours to seven days, depending on the subject matter. (A full list of trainings is given in chapter 1.) Trainee selection was done through user-group discussions, with emphasis on training key farmers who then became trainers of others in the group. Although some class-based theoretical learning was conducted, most training focused on practical demonstrations.

Water Quality

Where water quality is definitely an issue, as in Krishnapur, the community has demonstrated their ability to keep sources with different water qualities separated. Household-level storage is key to making this separation possible. Therefore, improving low-cost options for on-site storage is a priority.

Yet, despite the water safety education provided as part of the MUS projects, a lack of prioritization for source protection is still a problem in some communities. Most of the Nepal MUS projects built covered tanks right at the intake from the spring to protect the source. Since this is standard practice for drinking water systems in Nepal, MUS projects have taken drinking water standards as a guide However, in Senapuk the intake remains uncovered despite pressure from SIMI to complete the cover. Perhaps the community does not perceive that the cost of the cover is worth the source protection it will provide. Or maybe they feel that the water is clean enough regardless. Similarly, in the Lele MUS system in Lalitpur District,[3] children break into the intake to play and remove the rocks that are intended to block soil and leaves from entering the system. While the community has chided them for this behavior, they have not placed a fence or other protective barrier around the source. And although the WUC in Lele had planned to at least include a filter at the intake, they have not yet put this in place. Although new MUS systems are being designed with sand filtration at the inlet to increase protection, these examples point to a lack of priority for source protection at the community level.

And unlike the single-tank, one-line distribution systems, those with a two-tank, two-line system must be careful about the use of the water from the productive-use tank. The larger ferro-cement lined tanks do not have a cement cover, but simply a corrugated iron sheet. Therefore, although the water in the

productive tank is simply overflow from the domestic tank, once it is in the tank, it is not as protected. Even though water in the productive-use tank is not meant for domestic use, some families whose houses are closer to their offtake than their hybrid domestic tapstand are using the water from the offtake for domestic purposes. These households should be made aware of the water-quality difference in the two tanks during the trainings provided by SIMI.

Another potential for concern is a lack of testing of the water source quality prior to system construction. It is assumed that spring-water quality is good, and often the source used is the only one available to the community. The springs used have the same water quality as other sources used for domestic water development in the hills of Nepal, and their quality is usually better than the surface water available. And simply having more water available to households for domestic use is known to improve health.

Water Quantity

MUS systems have been useful to raise awareness of water conservation in hill villages. Even in areas with scarce-to-moderate water supply, domestic taps are often left running even if they have a mechanism to shut them off. Many MUS systems are designed to capture and use this overflow water. Additionally, with the double-tank, two-line distribution design, it is beneficial for the community to shut off their domestic taps when not in use because it increases the amount of domestic water and the overflow collects in the productive-use tank. In Senapuk, the desire to expand the hours of access to water resulted in successfully promoting the closing of community taps immediately after drawing water.

Additionally, the use of microirrigation is a tangible way for people to see how even a small amount of water can be productive. Many of those interviewed, in the villages as well as in partner NGOs and government agencies, mentioned that they were skeptical that such a small amount of water could actually result in plant growth, particularly in the dry season when evapotranspiration rates are high. Yet farmers with microirrigation systems are growing successful crops with much less water. This concept of more efficient water use for crop production is influencing not just the farmers in the villages but individuals working in the DoI and DoA as well, and the promotion of microirrigation technology through government programs is expanding rapidly.

> *"MUS is small and small is beautiful."*
> —Chief of DoA M&E Section

However, despite these positive changes, communities are largely using the microirrigation systems only in the dry season. In the monsoon and postmonsoon seasons they use the microirrigation kits for a set land area but then hand-water with a hose or bucket on a larger area of land. Despite the

benefits of microirrigation and the ability to use less water for higher yields on the same land area, farmers still do not perceive that the benefits outweigh the cost of purchasing additional kits for expanded microirrigation. Ultimately, the use of microirrigation makes more sense to them when water is scarce, but conservation is less important during times when there is more water. Perhaps as the populations of these communities grow and competition increases for the water supply, the use of microirrigation in the monsoon and postmonsoon seasons to conserve water will become more prevalent.

EXPANSION OF WATER SOURCES FOR MUS

In conjunction with the education about efficiency of water use and the positive attributes of microirrigation, the construction of MUS has led to the realization that there are many small water sources in the hills of Nepal that are critical for future water resource development. Prior to MUS, stakeholders generally argued that most of the economically feasible water sources were already exploited in Nepal and that there was little likelihood of finding additional sources in the hills. Yet there are tens of thousands of small sources (springs and streams) that have not yet been utilized or are underutilized. And, through MUS, IDE/SIMI is demonstrating the possibilities of use for these small sources.

However, the challenges to using them must be overcome. While stream flow is largely dependent on snow melt from the Himalayas, spring discharge is dependent on the monsoon rains. Therefore, flow variability exists not only from one spring to the next, but also between seasons for the same spring. Some springs stop altogether in the dry season. And due to the sheer volume of these small sources, they have not all been mapped or measured, nor is there a central registry where use claims on them are catalogued. Moreover, the opportunities are not uniform throughout Nepal. Some locations have abundant water, whereas others have scarcity for part of the year like in Krishnapur. It is only by going to a community site and talking to the local residents that detailed information can be determined on the location of water sources, who owns the legal or customary rights to their use, and which (if any) government office rights owners have accessed to support their claims. Most important, tapping these smaller sources will require negotiation with communities or individuals over the right to use the sources. And if MUS are to be scaled up, the government will need to streamline its formal rights-registration process.

Despite these hurdles, the potential for expansion of small water sources for MUS is substantial. Those that have yet to be tapped can be used to build new MUS systems. And even when rural domestic water systems that have already been built, local people can easily identify which springs are not yet fully utilized, thus allowing those water sources to be captured for productive use.

As a note of caution, while the use of these springs has great potential, if all of these small sources are fully captured, it will decrease the flow levels in streams and rivers, some of which are essential to the populations in the Terai and other neighboring countries. The importance of ensuring adequate flow levels to uphold ecosystem health as well as provide water for downstream communities must not be overlooked. The danger is an uncoordinated effort to build MUS by many NGOs and government agencies with no consideration of how the water resources interact with one another. It is essential that if MUS is to be scaled up, the government must take the critical role of coordinating the construction of these schemes and safeguarding downstream water flows.

Although water-system design for multiple uses, utilizing canal water or other surface water, has largely not been planned in the past, surface sources could, in many cases, be better utilized for every purpose except drinking water. Even though most MUS systems constructed in Nepal to date have used spring water as their source, other sources hold potential as well. Krishnapur is an exception and can be a model for expanding MUS sourcing to include canals and other surface water. If springs are not available nearby, surface-water sources can be utilized for all productive and nondrinking domestic purposes. And if treated, such water could be used for drinking as well. In certain areas, rainwater harvesting is also a promising option to augment small-spring or surface-water sources, particularly as a complementary source to an existing spring that may be at low flow. Rainwater harvesting can be a collective system or done on an individual basis, depending on the community.

It is also not necessary for all schemes to be gravity-fed pipe systems. In one Palpa scheme, half of the community is above the water source and could be served by pumping water up to them. However, pumping and extra storage both add significantly to system costs. These additional source options should be included in the menu of options considered by communities in conjunction with project teams and various combinations of sourcing and storage considerations based on usage needs, source availability, and financial resources.

WATER-USE NEGOTIATIONS

As more sources are sought for additional MUS schemes in Nepal, negotiations for rights to use the water will become even more important. Without the legal rights to use the water, a host of complications arise. Nearby communities can claim ownership through customary use and disrupt the use of the source. Or as populations grow, the domestic-use priority rule could force communities with MUS systems to give up their productive-use allocation for the domestic purpose of neighboring communities. This potential for conflict over source allocation is precisely why SIMI requires the community WUC to undergo negotiations for legal access to water-use rights, even though those negotiations are often long, involved, and difficult.

Water rights and related management issues and the way the implementing organization and community deal with them are critically important in the success of MUS projects. While examples occurred in a small minority of projects, conflicts have actually stopped MUS construction and caused problems for communities after project completion. In the Maseri Tole MUS scheme in Birendra Nagar municipality of Surkhet District there are two interrelated problems. The pipes are getting clogged with lime, so they must be cleaned out every 15 days. This requires the community to keep the pipes above ground instead of burying them, even in the forest where other communities collect firewood and grass for cattle. People from these other communities have been cutting the mainline pipe that delivers water through the MUS scheme to the Maseri Tole. It is unclear what their motivation is, and it could potentially just be mischief-making. But according to SIMI staff, they may also dislike the Maseri Tole because they are a Dalit[4] community, and the mischief-makers may believe that the community does not deserve water. Or they may just be jealous that another community is receiving assistance. In order to solve the pipe-cutting problem, the community decided to increase supervision around the pipeline and pay an operator to walk from the source to the tank several times per day. This has stopped the pipe cutting.

As this management issue shows, where common property is channeled to one community, other communities have no incentive to respect the user. Solutions require either policing as is now practiced or finding a way to bring all stakeholders to the common property use on board. The second option is both complex and time consuming and is not something SIMI is currently well positioned to undertake. However, in situations such as this, the right partner NGO could help SIMI and MUS communities resolve these management issues.

Another example is Kavre village in Lele VDC of Lalitpur District where project progress is indefinitely stopped due to a conflict between the community that MUS was being built for and the upstream community that has rights to the water source. The original agreement was that the neighboring community would receive two drinking water taps for allowing the Kavre village to use some of the source water for MUS. However, after the detailed engineering survey, they increased their demand to six drinking water taps and coverage of 47 households instead of the original 33. The two communities are now unable to come to an agreement, in part due to caste differences. The upstream users are Dalit and other lower castes, whereas the downstream community is a mix of upper and lower castes. IDE attempted to help them reach an agreement by holding a group meeting between both communities, but the upstream group refused to participate. The project cannot continue unless an agreement is reached. And since most of the funding is coming from the NITP of the DoI for the project, if it is not constructed within this fiscal year, the money will have to be allocated to another community.

Sometimes communities simply will not come to an agreement, and

there is nothing SIMI can do to prevent that. Much depends on the skill of local leaders and facilitators. The first example indicates that IDE's follow-up system with communities that already have MUS projects may not be strong enough and that perhaps the WUC's capacity to deal with these sorts of issues is not being fully developed. Both the lime problem and the pipe-cutting issue did not come to light until an impromptu visit was made to the community by national-level IDE staff. Well-designed follow-up has two functions: to ensure that problems are dealt with and that feedback into the process helps avoid similar problems in the future. Without proper follow-up built into the program, these cannot occur and conflicts like the one in Maseri Tole are likely to spring up. However, this is again an issue of resources—the implementing organization(s) must incorporate follow-up into the process so that time and money are allocated for it.

The second example shows the necessity of coming to an agreement with other source users prior to project construction. Another community that had conflict during construction that was ultimately resolved through the process is Bhirmuni Jodhane village in Dhikur Pokhari VDC in Kaski District. The problem in Bhirmuni Jodhane occurred between two clusters within the same community, one upper caste and one Dalit. The MUS system was planned and constructed for the whole community, but the upper-caste households hesitated to use water from the same pipeline as the Dalit community because cultural norms dictate that water Dalits use is "polluted." In Nepali culture, when an upper caste is using a source, Dalits are not allowed to use the same source. During planning, the Dalit community said that they would not contribute labor or materials to the scheme if they were not allowed to use the same source as the upper-caste cluster. The upper-caste cluster agreed to the use of the same source but not the same pipeline, so the Dalit cluster started rioting in protest.

SIMI facilitated a community group discussion where all castes were required to sit together to come to an agreement or construction would halt. The VDC Secretary also participated in the negotiation meeting to motivate both sides to come to an agreement. The two sides finally agreed to have two separate outlets from the tank, one for each cluster, with an increase in labor contribution for both clusters. They only excavated one trench and laid the two pipes in it from the tank but built separate water tapstands for each cluster.

Another conflict that was resolved during the process was Katuja village scheme in Pelakot VDC of Syangja District. The problem occurred during the arrangement of an agreement for use of the source because it was owned by one landowner outside the community who was not part of the MUS scheme but had longstanding customary rights to the source for irrigating his khet because the source was on his land. At the beginning he was unwilling to share the water, so the community, the VDC Secretary, and SIMI all met with him repeatedly for a week to come to a resolution. The community offered to provide him with a drinking water tap next to his home. Although he had already been using the source for drinking, it was not yet piped to his house.

He agreed to this arrangement, and a party was organized in celebration. Conflict has not arisen since project completion.

Both Bhirmuni Jodhane and Katuja show the power of involving the VDC Secretary in conflict mitigation. The Secretary's presence was important because the communities are aware of the power of the Secretary's position. Although the Secretary did not explicitly mentioned it in the meetings, he can pull funding from the project if it looks like problems will not reach resolution, and communities do not want to lose their project. The Secretary's presence also creates a more binding agreement than if it were brokered only in the presence of the two communities.

In Senapuk (chapter 4), it also took a great deal of effort for the community to negotiate use of the water source from the previous owner. They ultimately agreed to give ten bags of cement to improve the diversion and canal for the existing irrigation scheme to the owner's fields and restrict the size of the pipe at the intake of their MUS scheme. And in Bame Khola MUS scheme in Lati Koili VDC of Surkhet District there were conflicts between two clusters sharing the source within the village. The first cluster that had previously been using the source had used a temporary mud canal to divert it. The cluster was originally uninterested in sharing the water because they thought the source had less water than it actually did due to the seepage loss through the mud canal. The second cluster worked around this by requesting a UK Department for International Development funded project to make a permanent canal so they could utilize the seepage water. After this, an agreement was reached between the two clusters.

The importance of resolving these problems as part of the initial planning phase of the project cannot be understated. And although in practice SIMI requires the community to have written proof of their legal right to use the source prior to scheme construction, perhaps an even more rigorous requirement is necessary. Perhaps probing communities as to other upstream or downstream users, their castes, political or cultural tensions that exist, water uses already existing, etc. needs to be undertaken as part of the MUS process in order to mitigate potential rights problems before they arise.

APPROPRIATE TECHNOLOGY

USE OF EXISTING TECHNOLOGY COMPONENTS

When working with new communities on MUS projects, SIMI first encourages communities to utilize existing infrastructure and then build upon it. Many domestic systems (some in varying states of disrepair) and farmer-managed irrigation systems exist in the hills, but overflow from these systems often that can be captured and utilized more efficiently. As can be seen in all three of the case studies, SIMI worked with communities to build the MUS concept into existing infrastructure. In Chhatiwan they used a portion of

water from the existing source and incorporated the half-inch pipe that the community had previously obtained from the VDC into the MUS-system design. In Senapuk, they incorporated the previous drinking water system into the design for the new MUS system. In Krishnapur they utilized water from a branch of the existing farmer-managed and recently lined surface-irrigation system to create their MUS system. Adding on to existing infrastructure helps communities utilize their available resources more efficiently, reduces conflict over water resource capture, and minimizes system cost.

SITING FACTORS

Siting the locations of the community storage tank(s), hybrid tapstands, and offtakes is one of the most challenging tasks of the WUC and SIMI team when designing MUS projects. In fact, when discussing the construction process with the SIMI district teams, it was highlighted as the most contentious issue within the community because all households want to have the tapstand or offtake placed as near to their homes as possible. Resolving the problem becomes a balancing act between equitable access, convenience of hybrid-tapstand use, the relative location of bari land for each household, cost considerations, community politics, and who is willing to provide land upon which to build the system components.

The SIMI team begins by recommending a design to the community, but ultimately it is the community that must come to agreement on the locations chosen, and it is often the Social Mobilizer/Community Mobilizer[5] who is responsible for mitigating any arguments. The SIMI team first seeks government land for construction of the tanks, but if it is not available, community members are requested to give their land, and sometimes the landowner will negotiate to have an extra tap or storage in exchange for his land. If the household is unwilling to give its land, another site is chosen, and the system design is changed accordingly.

In order to maximize equity and ease of access, the SIMI team attempts to place tapstands such that each house is roughly the same distance from the nearest one. SIMI also seeks to place offtakes close enough to the bari land that it is possible to easily use microirrigation kits. However, as mentioned in chapter 1, households often have bari close to the homestead and more of it further away. While the bari close to the homesteads has been utilized for vegetable production in the MUS systems built to date, for some households the bari is too far away to be covered by MUS, so they cannot use the water for irrigation unless they carry it to the fields, reducing their usage of the MUS system for irrigation. If the further bari is at higher elevation than the MUS storage tank(s), then it is unlikely that the system can be used to irrigate it. However, if the distant bari is at a lower elevation than the tank(s), future MUS projects should consider the cost of system extension to these fragmented landholdings, and households that wish to cultivate their further bari can opt to pay the full cost of that extension.

RULES OF DISTRIBUTION

Domestic Use as a Priority

All the cases illustrate the desire to improve access to water resources. Within MUS systems there is a recognized hierarchy of access for the different uses, with domestic water taking priority. In some cases domestic priority is realized through system management (i.e. Chhatiwan), while in other cases (i.e. Senapuk) the priority is hardwired into the system. In Krishnapur there is a separate preexisting domestic water system, but the households manage their own water use priority with on-site storage and equal allocation. In essence, it was seen that with a greater quantity of water available, prioritization of use was not as necessary. For example, in Chhatiwan Tole, the abundance of good-quality water did not necessitate a prioritization of one purpose over the other, whereas in Senapuk the community clearly felt that they needed to safeguard the domestic supply. It is important to provide clear options that are visible to all users to establish the priority of domestic use and equity in access. Most MUS systems in Nepal (modeled after the Senapuk double-tank design) ensure through the system design that domestic water needs are taken care of first, with productive-use water being supplied by overflow from the domestic tank. In all cases, it was the user groups themselves that jointly decided upon allocation, but domestic water always remained a priority. See Yoder et al. 2008 for further discussion on system design for priority-use rules.

Allocation Flexibility

The combination of domestic and productive-use systems has led to interesting distribution patterns other than priority for domestic use. In single-use systems, rules of distribution vary depending on the system use. For domestic systems, the focus is on equitable supply, whereas in productive systems, distribution is sometimes based on landholding size or the proportion of financial input per household to the project. In MUS projects where the technology links domestic- and productive-distribution systems (i.e. the single-tank, one-line distribution type systems) the "equal share" concept from domestic-only systems supersedes other distribution rules commonly seen in irrigation-only systems. However, in MUS projects where the technology separates the domestic- and productive-distribution systems (i.e. the double-tank, two-line distribution type), the flexibility to apportion water for each purpose according to different rules and norms remains. For example, a community could supply equal distribution of domestic water and provide larger portions of irrigation water for households with more land. While none of the communities with MUS projects have utilized this distribution flexibility thus far, it is believed that this is due to the fact that each household has invested equally. If investments had been unequal, the opportunity to match irrigation distribution to investment proportion would likely have been used. Perhaps this is an argument for subsidization of at least the domestic water

portion of MUS projects to ensure that individual households do not capture a disproportionate share of domestic water.

Scarcity and Equity

While MUS systems displayed an interesting relationship between investment and allocation, they also showed a tie between water quantity and equity in distribution. Where water is more abundant, such as in the Chhatiwan case, domestic and productive water is distributed through the same pipeline. Flow regulation and homestead storage are not necessary because every household has continual access for whatever it needs. Where there is a moderate supply of water, as in Senapuk, allocation becomes important primarily in the dry season. In Senapuk, both domestic and productive water are available continually in the monsoon and postmonsoon seasons. However, in the dry season the WUC asserts greater control over distribution, creating schedules of access from both the domestic and productive tanks and distribution lines. Additionally, in-line flow-regulator technology[6] was incorporated into the system to ensure equal flow despite a difference in elevation of the various hybrid tapstands and offtakes. As the water-scarce case, Krishnapur took things one step further and showed the importance of household-level control over water allotment. To avoid conflict, the farmers worked to ensure that they not only received an equal share, but could store it themselves in homestead tanks to use when and how they chose.

> *"MUS helps to maintain the social harmony."*—DADO-Kaski

SIMI project staff mentioned that in all MUS cases previous water-use conflicts have been mitigated because water has been apportioned formally and clearly through the WUC, and all households know they will have adequate domestic supply throughout the year.

Adaptive Management

Despite thorough discussion within the WUC and with the SIMI team to come up with the optimal plan for allocation and distribution of each MUS system, the three cases studied in detail showed that none were quite following the planned allocation or distribution of water. First, this shows the difficulty in appropriate planning without the ability to collect sufficient data. Because of distance and time constraints, the selected water supply is generally measured only once and then seasonal variation is estimated by community members by comparing perceived seasonal flows to the measured discharge. There are also large year-to-year variations due to draught or larger-than-average-rainfall years that add to the inaccuracy of this singular flow measurement. Since the discharge available from springs is constantly changing, and data for determining the average and variance is inadequate, SIMI uses conservative estimates so that in most years there is an adequate supply.

Second, it shows that ideally system design should better account for variation and projections of population growth and increased demand. The village community is always changing—be it because of population change due to flux of community members for employment reasons, or because of an uneven desire of various households about whether or not to maximize vegetable production and subsequent change in water need per household.

Third, it indicates that MUS systems better account for the high elasticity of demand for water. Even when domestic systems are designed with an extra percentage built in for productive purpose or population growth (or both), the water is used immediately in the community. If water is abundant, uses are found for what is available. As needs increase over time, households start queuing up for collection, and uses become more restricted (for example, clothes washing and bathing is done at the nearest stream). Systems designed to be domestic with some percentage extra for "additional uses" will likely not account for the future productive needs of the community. By using 45 liters/capita/day and assuming an average family of six, domestic need is 270 liters/household/day whereas vegetable production need is 400–800 liters/household/day.[7] The percentage extra available based on a small (usually 15–20 percent) portion of projected domestic water demand is not enough to provide adequate productive water for very long to all households. On the other hand, MUS system demand is calculated on the projected future productive and domestic demand. With domestic use clearly having priority in MUS systems, it is likely that as domestic demands increase with time, the productive portion will decrease accordingly. However, there is greater likelihood that the productive-use portion will not be removed altogether.

TECHNOLOGY COMBINATION

MUS projects in Nepal have shown that the use of microirrigation in conjunction with MUS is a potent combination. And it may become even more important as greater domestic demands from population increase take water away from productive supply. SIMI has seen a much higher interest in purchasing microirrigation technologies as part of MUS projects than projects that are solely focused on microirrigation without source development. For example, the chairwoman of one WUC in Palpa District relayed an interesting story about her community. They had originally worked with IDE/SIMI on microirrigation for vegetable production without source development. However, as soon as the SIMI project phased out, they stopped using the microirrigation kits and were instead using the drip "header" tanks to store water for latrine use. Although the community realized that their problem was lack of water, the microirrigation project had not addressed it, so they reapproached IDE/SIMI, and a MUS system was built. Now that they have an adequate source of water, they are regularly using the microirrigation kits. Due to stories like these, SIMI staff recognized that success of microirrigation is largely dependent on availability of an easily accessible water source. Coupled with higher-

volume domestic water, the benefits of the system dramatically increase. Therefore, all current SIMI projects are incorporating the two.

Likewise, microirrigation provides farmers with a useful tool to optimize the productive-use portion of MUS, and farmers have recognized that drip irrigation as an application technology has its greatest advantage under extreme water shortage. Therefore, microirrigation systems were predominantly used during the dry season in communities with MUS systems. MUS water used with drip kits allowed households to grow high-value vegetables during the off-season months when their value was greater.

However, when water is more abundant during the other two seasons or the plot is very small, application by sprinkling can, bucket, and dipper, or a "garden hose" moved from one plant to the next is often easier. A survey conducted by a consultant for SIMI (Shrestha 2007) to assess the reasons why uptake of drip irrigation was less than expected found that 30 percent of the 50 respondents in Syangja District and 24 percent of the 50 respondents in Palpa District did not expand their drip production. Instead, they used manual application because they felt that drip systems were "inconvenient to handle." This inconvenience was explained further as frequent blockage of emitters by particulate matter and lack of ease in shifting the whole drip system to expand the irrigation area. The same percentage of farmers also claimed that due to an abundance of water, there was no need for drip irrigation. However, those interviewed that had MUS systems in their communities had more drip pipes than those who did not have MUS systems. Ultimately, there is no single "best" technology to meet a household's needs in all situations. Instead, a large menu of alternatives must be available from which communities and individual households can pick and choose the best options to meet their specific conditions and needs. This is discussed further in Yoder et al. 2008.

LOW-COST SYSTEM IMPLICATIONS

Community Contribution and Ownership

Despite the exact configuration of the various components in MUS systems, SIMI always attempted to find the design with the lowest cost and allow for the greatest input by the community. The SIMI irrigation and agriculture technicians mentioned that prior to MUS the prevailing thought was that water resource development was an expensive venture because of existing construction practices. However, MUS projects implemented by SIMI use local materials and labor, keeping the cost relatively low compared to other water resource development projects. SIMI staff felt that MUS had helped to legitimize the benefits of low-cost technology within Nepal. MUS showed that low-cost systems could be an effective way to manage water resources in the hills, which made the line agencies more receptive to the use of these low-cost technologies and facilitated the working relationship between SIMI and the line agencies.

The low system cost is a huge selling point for all MUS stakeholders. Because the system is kept low-cost and utilizes resources that the community has available to contribute, it allows them to provide around 50 percent of the project cost, which is high compared to other water resource development projects in Nepal. Households and entire communities are more willing to contribute because they gain reliable domestic water and can achieve rapid returns for a low investment in microirrigation. The microirrigation kits are affordable for most farmers who typically recover the cost in just one agricultural season.[8]

And, unlike previous government projects where contractors were hired for construction (sometimes hiring local labor and sometimes not), the community has ownership from the onset of system design and construction. The social and community mobilizers who work in MUS villages stated that due to this ownership, community members take much more care and responsibility for the systems.[9] While the Fund Board and other rural domestic water scheme implementers also require investment from communities, it is generally a lower-percentage investment of the overall cost (around 35 percent) and that, mostly unskilled labor and local materials. Although government implementers of rural domestic water schemes consider communities to "own" their projects, the understanding is somewhat different. They generally hire contractors for construction and then "hand over" the system once it is built, requiring the communities to be responsible for maintenance, thereby "owning" the system. However, IDE considers "ownership" to be complete control over the future of the system. When a community or group initiates and manages the construction of the system, they maintain the right to add or exclude users, make operation and maintenance rules, and have the power to enforce those rules to the point of denying use rights for noncompliance. When the government is the primary motivator behind a water system, it is the project implementers—department or NGO staff, consultants, contractors—not the community, who maintain primary control over who gets to use the system.

Ease of Encouraging Investment

The low cost of the systems also makes it easier for the community to request funding support from other NGOs, the VDC, municipality, and local line agencies. Because the amounts requested are low, funders are more willing to contribute. Government agencies can get acclaim for a small investment. Additionally, success in obtaining matching funds from other sources strengthens the understanding of community ownership of the MUS system.

Not only is the system low-cost, but the technology is easy to install or construct so it generally only takes a couple of months to complete, and farmers start reaping the rewards of the domestic water portion immediately and the productive-use portion a few months later as crops mature. For a government agency, showing such successful results in a short time with a small financial

contribution is highly beneficial. This is discussed in greater depth in chapter 7 on the Learning Alliance.

Quality and System Lifespan

On the downside, some believe that the focus on low cost has compromised quality, making system lifespan an issue that several villages and partner NGOs are concerned about. For example, villagers have complained that the tapstands are not robust enough. In Senapuk a drunk man kicked the tapstand and broke it. In other cases the livestock have damaged them. Although the tapstands may be more robust than the community believes due to these incidents, they are concerned that their maintenance costs could be too high if the system quality degrades. On the NGO side, they are hesitant to fully embrace MUS upscaling until system longevity and sustainability has been proven (one NGO quoted a five-year minimum requirement for trust in the quality of the system).

Despite doubts about system longevity, as more MUS systems are constructed, SIMI seeks to find design solutions to regularly occurring problems. For example, it became evident that some of the MUS systems had problems of air pockets in the transmission lines, which restricted flow and reduced performance, so air vent pipes were included in future systems to ameliorate this problem. Low cost does not necessarily equate to low quality. IDE continually seeks to find the best balance between cost and quality in order to present appropriate options for farmers to choose from.

INCLUSIVE INSTITUTIONS

FACILITATING LOCAL AND DISTRICT-LEVEL INTERACTION

There are several ways in which SIMI has attempted to facilitate the interaction between communities and other organizations at the local and district levels. For example, during water-rights negotiations, communities are encouraged to either provide the formal agreement to the VDC chairperson upon completion of negotiation or, better yet, request the VDC chairperson's presence during the negotiation process. Involvement of the VDC creates a more binding agreement and sometimes facilitates easier compromise between the two communities.

At both the local the district levels, partners contributing to the schemes (NGOs and GOs) are invited to participate throughout project implementation. The involvement of these partners throughout the whole process builds relationships between the community and organizations, improving villagers' ability to access resources. Furthermore, SIMI encourages the contribution of GOs to community trainings. For example, the DADO is often invited to

provide one or more of the vegetable production trainings given in the community, filling in a key gap in the community's knowledge and abilities and connecting them with a useful technical resource. This increased interaction with government agencies encourages communities to tap into financial and technical resources they did not previously know were available to them. Additionally, communities realize that through developing a relationship with one stakeholder (either government or an NGO), doors to other stakeholders open for them. For example, in some cases, it was the DADO that connected the community with SIMI.

Due to these efforts at community building and facilitating communication between groups, positive changes were noticed by SIMI staff and the communities themselves. SIMI Social Mobilizer/Community Mobilizer staff said they noticed a change in attitude in some communities where people became more helpful to others and arguments in the communities decreased. Staff also noticed community members were more eager to share their knowledge with others. This desire to share with others manifested in greater connection with outside groups and other communities. The MUS communities interviewed said that before project intervention they felt very isolated from other communities, but through the project they received more exposure to other villages and what was happening in them. This peaked their interest in visiting other communities, sharing information, and discovering how to get new technologies and from what sources.

"MUS can be an entry point for empowering the people."—DoA Planning Division Director

IMPACTS OF MUS ON WOMEN

Gender equity remains a challenge despite positive impacts of MUS systems. Women had less decision-making power and provided more of the labor throughout the MUS construction (60%, 55%, and 66% in Chhatiwan, Senapuk, and Krishnapur, respectively). SIMI does encourage at least 33 percent female representation on the WUC and recommends that women hold key positions such as chairperson, secretary, and treasurer. But the power is by no means equally shared between women and men. Gender composition on the committee remained the same for both Senapuk and Chhatiwan even after they transitioned from construction committee to WUC. Chhatiwan had the least female representation, only two of the eleven committee members. In Senapuk, three of the seven committee members were female. The gender composition in Krishnapur, however, changed from the beginning of the process; they began with two women on the seven-member construction committee and shifted to five women of nine on the WUC at the end of project implementation. Although the increase in representation of women on

the management committee in Krishnapur displays an increase in women's decision-making role post-project, equal decision making is by no means universal in MUS projects to date.

Despite less inclusion of women on the WUC, in most communities the MUS project represented the first step toward increased gender equity. Follow-up meetings to MUS-system construction in Nepal found women represented at meetings as well as or better than men and speaking up more than IDE staff anticipated based on previous village experience. One of the female village motivators took the initiative to highlight a problem where river erosion damaged an irrigation canal. Having worked to solve problems for the MUS, she took an unprecedented initiative in rural Nepal to address even larger problems outside her official job description.

The vegetable production component of MUS has had a positive impact on women. In Nepal, it is women who have traditionally been responsible for growing the few vegetable plants near the home. The fact that MUS lets them grow more vegetables close to the house makes it possible for them to cultivate a significant quantity of vegetables and more conveniently perform household work. Therefore, women have played a significant role in vegetable cultivation in MUS communities, giving them much more say in cultivation decisions. Perhaps most striking is the impact of women's increasingly taking the vegetables to market for sale. Generally when money is brought home from the market, women either give the money to the male or report the amount received from sales and what was purchased with the money. Male financial dominance has not fully changed, but the direct sale of vegetables gives the women cash to purchase personal items without the embarrassment of requesting it from and justifying it to male members of the household. Of the three detailed case studies, the women in Senapuk seemed to be benefiting the most because of their direct involvement in sales.[10] The result was an increase in financial independence and self-esteem/empowerment for the women of Senapuk. In contrast, the men in Chhatiwan remained in the village, and even though they did less of the vegetable-cultivation work than the women, they remained the primary decision makers. And since the Chhatiwan community is largely Magar, there is less stigma for men to carry vegetables to market. The overall indication is that the more directly the women are involved in cultivation decision making and sales of vegetables, the more they benefit from the scheme.

Other aspects of MUS have also resulted in change for women. In Senapuk, some (but not all) of the cultural barriers around water collection by women during menstruation have decreased due to the project. In some villages the increased water has also allowed for increased latrine construction, cutting down on harassment when going to the toilet in the open and health problems from holding in their waste all day to prevent embarrassment.

SHIFT IN POWER DYNAMICS

MUS has also had an interesting impact on caste. The Lele project in Lalitpur District is a prime example. A neighboring cluster had a stark split between lower-caste and upper-caste communities, and although their domestic water source was a tapstand that had been built by a Canadian project with equal unskilled labor contribution from all households, the upper-caste portion of the community prevented the lower-caste women from collecting water at the same time as they did, decreasing their water access. The Lele community members, also lower caste and Janjati,[11] decided to build a tap specifically for the lower-caste households in the neighboring community, and if the higher-caste households were also interested, they would have to jointly contribute labor for the hybrid tapstand. Due to the construction agreement, even though both the higher- and lower-caste households constructed it together, it is the lower-caste households that have priority use of the tap. Through the project, disparate parts of the community had to come together under one umbrella user committee. The Social Mobilizer from Lele stated that she learned that "we cannot work in isolation. A group is required because each and every person is dependent on others in these villages."

ADEQUATE FINANCING

The Nepal cases illustrate the difficulty in finding opportunities to test the hypothesis that productive use can pay for the entire cost of domestic-plus systems. In Nepal, both domestic and irrigation "projects" are heavily subsidized. While individual households may choose to make a private investment to gain immediate benefits, no communities come forward to make collective investments when aware that government or programs from other organizations will provide subsidized inputs. And many households believe that it is the responsibility of the government to provide these services for them. The conclusion, sometimes additionally driven by politicians claiming they "will bring a project," is to wait until a project comes to them nearly free of charge.

On the other hand, SIMI MUS projects range from 24 percent to over 80 percent investment by the community of users, with the remainder coming from VDC grants, district and central-government grants, other related projects via NGO partners, and some share directly from SIMI. This percentage investment is actually much higher than is currently common in single-use schemes. And in order to ensure equitable investment per household, poorer households have been allowed to provide more labor to make up for their lack of available cash resources for investment.

The responsibility to search for additional funds rests in part on the community. This has some positive benefits in mobilizing community members, generating ownership, and spreading awareness of the MUS concept to gov-

ernment and other organizations. In fact, the need to search for outside funding was largely responsible for the expansion of partnerships and support of the MUS concept in Nepal (this is addressed more fully in chapter 7 on the Learning Alliance). Increasingly, communities that have heard about MUS from other villages have taken it upon themselves to acquire partial support from other sources as well as coming to SIMI to request assistance to implement the MUS approach.

Even with the low cost of the system and the microirrigation kits, some households have difficulty coming up with the requisite funds. So CEAPRED recommended improving access to credit, particularly larger loans than just the small revolving fund that the WUC\ has; farmers had mentioned to them their difficulty in purchasing the microirrigation technology or inputs and felt they could benefit from other ways to access credit. SORUP, IDE's implementing partner organization in Kaski District, added that matching funds for repair and maintenance would help the communities when problems arose because some communities have difficulty collecting sufficient funds.

Some of the very poor households even find it difficult to give the labor contribution to the project because that is time spent that is not earning them wages. In others, the wealthy are actually paying the poor to contribute the labor required by the wealthy household. According to SORUP, the poorest of the poor cannot transport the produce to the market because they lack money for transportation. Therefore they sell their produce to the rich people in the village to consume, replacing the vegetables the wealthy used to purchase from the market.

CONCLUSION AND LESSONS

Affordable technologies and full participation in planning and design give full ownership of MUS. Ownership means assisting in finding funding and developing institutions for operation and management. Partnerships uncover new options and opportunities, actualizing water resource development in new ways, better meeting community need, and developing the necessary links between organizations and communities. Community-based MUS are an excellent example of developing local governance skills and allowing communities to creatively find solutions to their water-use needs while building community strength and changing water-use behavior. Inclusion of a productive-use component enables individual action and community action to reinforce each other, improving the situation of both independent households and the community as a whole.