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Gender aspects of smallholder irrigation technology: Insights from Nepal[1]

Geschlechterspezifische Aspekte kleinbäuerlicher Bewässerungstechnologie: Innenansichten von Nepal

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Stichworte
Tropfbewässerung, Bewässerungstechnologie, Frauen, Politik, Wasser, Gemüseanbau
Keywords
Drip irrigation, irrigation technology, women, policies, water, vegetable farming

Zusammenfassung
Die vorliegende Arbeit berichtet von dem Versuch Erkenntnisse über geschlechterspezifische Fragen kleinbäuerlicher Bewässerungstechnologien zu gewinnen. Dies vor allem durch Untersuchung der Dynamik der Geschlechterbeziehungen, der Tropfbewässerungstechnologie und der ländlichen Lebensumstände. Auf der Basis einer in 2003 in ländlichen Gebieten des westlichen Nepal durchgeführten empirischen Studie, versucht die vorliegende Arbeit die Eignung der Bewässerungstechnologie, speziell der Tropfbewässerung, für die Beseitigung der ländlichen Armut zu bewerten.

Abstract
This paper attempts to understand gender issues in smallholder irrigation technology by exploring the dynamics of gender, drip irrigation and rural livelihood. Based on an empirical study undertaken in 2003 in rural areas of West Nepal, the paper tries to assess the appropriateness of the technology, particularly the drip irrigation system, from gender perspective in flushing out rural poverty.

A combination of participatory research tools, gender analysis, participant observation, daily activity profile and secondary sources were used to generate data. Paper revealed that women were found to be extensively contributing in vegetable farming under the drip irrigation system. The total mean hours used for irrigation in vegetable production was highest in comparison to other activities. Based on the study findings, the paper makes recommendations for better use and management of water resources by women and men alongside the adoption of appropriate technological innovation in irrigation. The author argues that policy regimes should address typical needs of smallholder irrigators, particularly women.

[1] This paper is based on a part of ongoing study led by the author.

1. Introduction

Irrigation plays a pivotal role in increasing crop productivity. Over the last decades availability of water for irrigation has been declining rapidly. On the contrary, the demand for access to irrigation water has been growing faster.

Water underpins food security, people's livelihoods, industrial growth, and environmental sustainability throughout the world. In 1995, the world withdrew 3,906 km^3 of water for these purposes. By 2025, water withdrawal for most uses is projected to increase at least by 50 percent. This will severely limit irrigation water withdrawal, which will increase by only 4 percent, thereby constraining food production (ROSEGRANT et al., 2002). In such a crisis scenario, effective and efficient use and management of water has been felt as an urgent need.

It is broadly felt that conventional irrigation method leads to inefficient use of irrigation water. Flood irrigation, for example, transit loses in the form of evaporation, conveyance and infiltration while distribution. Sadly, contrary to the vision of the millennium development goal (MDG), capital intensive technologies lack the promise of enhancing water supply coverage (PAUL, 2003). As sustainable agricultural development is dependent on efficient use of irrigation water, various technological measures have been subsequently introduced with a view of growing more crop per drop.

One of these measures is the introduction of precision irrigation system. To raise the productivity of water, it will be necessary to deliver and apply water to crops more efficiently and to increase crop yields. This can be done by using drip, sprinkler, and other micro–irrigation systems (WI, 2004). Drip irrigation, which is one of the methods among the precision irrigation technologies, refers to a convenient and efficient means of supplying water directly to the crop through emitters located along the water delivery lines.

Drip technology improves irrigation efficiency by reducing evaporation from the soil surface, reducing or eliminating runoff and deep percolation, and eliminating the need to drastically over-irrigate some parts of the field to compensate uneven water application. The application of fertilizer and other chemicals can also be optimized through the use of drip irrigation, weed growth can be reduced, and salinity problems can be mediated (SKAGGS, 2001).

As women play important roles in the provision and management of water, mainstreaming gender into water resource management projects and programs is important. The practice of acknowledging women's roles as domestic water managers has led to overshadowing of their meaningful contribution in productive water use. This will eventually lead to cutting out women's productive water use needs from the community water agenda, thus making it harder for them to acquire water for farm and other purposes (KOBAYASHI and BALAKRISHNAN, 2003). Important roles

played by women as irrigators and farmers have long been overlooked by development planners of Nepal (SHRESTHA and TANAKA, 2003).

Irrigation technology has tremendous potential for enhancing women's welfare and their empowerment. Low-cost, appropriate and reliable technology can help rural women meet their practical needs by allowing time and energy saving and providing extra income. While promoting a technology, delineating women as a target group is very important so as to help their empowerment, which is associated with stronger bargaining position in household and community decision-making.

To properly fit women's issues into a model of technological change based on employment, productivity and income-distribution paradigm, WHITEHEAD (1985) suggested incorporating sociological and economic aspects of intra-and inter-household relations in the analysis. The capacity of women to be independent producers depends on a number of factors, including access to productive resources (e.g., land), which is often mediated by their dependent position in the household, and to publicly provided inputs (e.g., credit facilities, technical-skills training, basic social infrastructures, etc.).

On this premise, this paper argues that a simple irrigation technology could make a lot of difference by reducing women's drudgery and helping them generate additional income, which could eventually help alleviate rural poverty. More importantly, access to appropriate irrigation technology can have substantial positive impact on food security and household nutrition.

Although Nepal possesses 2.3 percent of the world's water resources, the harsh terrain makes access to water extremely difficult for majority of resource-poor smallholders. Because poverty in the rural areas has increased over the last decade partly due to Maoist-led insurgency, many men have migrated to urban areas for work. When men increasingly seek off-farm employment, irrigated agricultural production is likely to become the sole responsibility of women (ZWARTEVEEN and NEUPANE, 1997).

With the growing feminization of farm labor, women's workloads are increased. Increasing workload and deteriorating natural resource base over time mean that they have less time for domestic chores. The lack of appropriate technology for women limits food productivity and their access to economic opportunities. Keeping this argument as frontline, this paper tries to assess the appropriateness of the drip irrigation technology by exploring dynamics of gender, irrigation and rural livelihood.

2. Materials, methods and study area

In consultation with International Development Enterprise (IDE)[2] , purposive sampling was done to select survey villages out of the intervened villages.

Drip irrigation systems[3] that were in use for more than two years were selected to have a solid impression on the impact of the system on smallholders' livelihoods. At village level, the focus of selection was also on those households, in which both men and women are involved in farming activities under drip irrigation system.

A total of 130 households were surveyed using separate sets of questionnaire for men and women respondents. Focus group discussions were also held separately for women drip users and non-users. In addition, participant observation was done to get clear picture of gender division of labor and to observe women's daily activity profile. Secondary data were also used in the analysis. Primary data were collected in 2003 from three villages of Palpa district of western Nepal. The findings are based largely on qualitative analysis.

Study villages are located in the mid hilly region, ranging from 1,500 to 2,500 m above mean sea level. Due to altitude variation, rainfall and temperature also vary. Majority of area is sloppy terrain with some river terraces. Demography represents mixed ethnic society. *Dalit*[4] was found to be the most deprived community group in the area. Livelihood of farmers is predominately rainfed agriculture based. Major crops like paddy, maize and millet are cultivated only during monsoon because of scarcity of water. Livestock rearing is common and women provide most of the labor required. Off-farm income is very low as only few are employed in government jobs of school teachers and post office staff.

Along with the introduction of drip system, water from traditional sources and springs has been tapped and channeled to store in small tanks for domestic purpose and irrigation.

3. Results

3.1 Institutional roles in growth of drip-irrigation

Conventional drip irrigation system was originally developed on a commercial scale in Israel in early 1950s. It was later widely adopted in India, USA, Australia and European countries. Likewise, in early 1980s Government of Nepal entrusted

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[2] IDE is an international non-profit technology and marketing organization, which develops and markets low cost technologies. IDE has been promoting drip irrigation for small plots in the study area.

[3] Drip irrigation refers to the slow and frequent application of water to soil through mechanical devices or emitters. It eliminates spraying or running water down furrows and allows water to dissipate under low pressure. Water is carried through a pipe network to each plant. In the surveyed areas majority of the respondents used micro tube as emitters. The tubes were attached to a 50 litres drum kit. The system is useful for family yard and for small and marginal farmers.

[4] Dalit is considered a low caste and untouchable community in Nepal by higher castes, and is the victim of caste-based discrimination. Dalits women represent almost 12% of total Nepalese population.

Agricultural Development Bank, Nepal (ADB/N) to promote micro-irrigation program. Thereafter, a micro-irrigation development cell was established to provide technical support, where needed. For diffusion purpose, ADB/N demonstrated the drip system in several Village Development Committees (VDCs) of eastern Nepal together with promise of subsidy for the adoption of technology.

In early 1990s, IDE/Nepal, an international non-government organization (INGO), came in accord with ADB/N to promote micro irrigation. Since then, IDE/Nepal has been implementing the low cost drip irrigation program in water scare regions of Nepal.

Larger state financed irrigation projects have not been able to irrigate more than 20 per cent of the total arable land in the country. These projects have generally tended to benefit relatively larger farmers. Small farmers cannot involve themselves in large-scale capital-intensive schemes due to lack of resources (GURUNG, 2000). Realizing this fact, drip irrigation technology is made available to the smallholder farmers through local dealers and IDE, in collaboration with local institutions, is espousing the adoption of drip irrigation system by conducting various extension programs to promote high value crop cultivation.

Farmers in the study area can be broadly categorized as either privileged or underprivileged. Privileged village groups are those who are relatively better off socio-economically. Generally, they belong to higher caste categories such as Brahamin and Chetri. Underprivileged are certain ethnic minority groups like *Dalit*, who have been traditionally left behind by development interventions. IDE promoted drip system in hills of Palpa for commercial vegetable farming as a means of livelihood for smallholders, taking special note of underprivileged groups. Female members of family are actively engaged in the use and maintenance of drip system.

IDE, through its, Local Initiative Support Program (LISP)—which is supported by Helvetas, started working with communities since 1998 in villages of Palpa with a view of helping rural poor to improve their living standards by increasing income through high value crop production. After developing a network of 779 drip users, 36 leader farmers and one dealer and two sub dealers, it has started consolidating and expanding this network towards benefiting a large number of women farmers through wider dissemination of low-cost drip irrigation system and high value vegetable production and by strengthening local institutions for marketing on a sustainable basis. Now, the program is being implemented in 32 VDCs and one municipality of Palpa district (HURDEC, 2000).

To promote commercial vegetable farming as a family activity, LISP espoused that each family member's contribution should be valued and benefits would be equitably shared. LISP focused on three major work strategies: capacity building of farmers, particularly of women groups; promotion of increased vegetable production; and, creation of linkages between private entrepreneurs and commercial groups for marketing purpose.

LISP motivated women groups by providing training on installation of the drip system, seed preservation, vegetable cultivation and protection with focus on organic vegetable farming. Farmers were motivated to adopt the technology because it is cost-effective, easy to operate and maintain, less labor intensive, gender sensitive and suitable for places where access to water is limited. Because of economic and social viability of the technology, demand went so high that it exceeded the total sale target in 2000. The sale target of 980 units was overshot by more than 50 per cent.

Majority of respondents reported that the plots that are currently under drip irrigation used to be barren earlier as no reliable source of irrigation was available. Then, they were exclusively dependent on vagaries of monsoon for cultivation of common crops such as pumpkin and cucumber. Now, they have a wider choice of high value vegetable crops for cultivation and a steady source of water. They feel better off now because they are also regularly offered advice by IDE on crop diseases, crop choices, inter-cropping, productivity enhancement, precision irrigation, etc.

Obviously, there has been a boom in vegetable production after the project intervened. Unpaid female laborers became commercial vegetable producers. Before the project, they had no productive work and used to assist in household agriculture as unpaid laborers. Respondents feel that institutional facilitation has been of tremendous help in making their lives easier.

3.2 Gender representation in policies

Women's work in rural areas is strenuous and time consuming. Besides farm activities, they are also responsible for household chores. Women farmers are responsible for more than 50 per cent of global food production. In developing countries, women produce between 60 and 80 per cent of the food. In Asia, between 50 and 90 per cent of the work in the rice fields is done by women. After the harvest, rural women in developing countries are almost entirely responsible for storage, handling, stocking, marketing and processing. An overwhelming majority of economically active women in Nepal, more than 80 per cent, work in agriculture.

As far as extension and adoption of agricultural technology is concerned, they are still predominated by male. There are a handful of cases where extension services have reached women farmers. A study by UPADHYAY (2002) revealed that 94 per cent of women in Jamuna[5] and 91 per cent in Chhita[6] did not have any contact with extension agents in 1998-99. Only 5 and 7 per cent of women farmers of Jamuna and Chhita respectively had contacted extension agent only once in 1998-99.

Rural women are one of the deprived groups in Nepali communities to benefit from modernization and the introduction of new technology. Outside IDE project areas, the extension and adoption system is still largely male dominated and women

[5] Jamuna is located in upland area of Ilam district of eastern Nepal.

[6] Chhita falls under Terai, lowland region of Sunsari district, which has a humid subtropical climate with rainfall varying from 1,000 to 1,500 mm a year.

receive little or no information on technological innovations in agriculture and irrigation. Also, much of the technology that is developed does not address the needs of women farmers.

Review and analysis of various national plans revealed that there was a clear mention of the policy of agricultural mechanization in the Fifth plan (1975-80), however, Sixth (1981-85) and Seventh (1986-90) plans were silent on the promotion of mechanized farming, perhaps due to government's apprehension about the negative impact of mechanization on rural livelihood. Eight plan (1992-97) emphasized the need to give priority to the use of small tools and machines that do not displace labor.

Ninth plan (1997-2002), in particular, has emphasized participation of women in irrigation development. Increased participation of women has been envisaged through emphasizing their roles in water user groups and in management of irrigation and watershed. Similarly, significance of research work in generating technology to help reduce workload of women in household and other farm activities is recognized by the Ninth plan. The plan has also emphasized the need to identify and recommend technologies that are easily accepted by women farmers.

Agriculture Perspective Plan (APP) has also accorded gender issue a higher priority and recognized it as one of the important implementation strategies. One of its objectives is to bring women into the mainstream of agricultural growth. Not only does it give explicit consideration to gender issues in all aspects of the plan, but also specifies for every aspect as to how women may be brought into the mainstream of accelerated growth. Specifically, the APP aims to improve access of women to production inputs and credit, bring women actively into the income generation and marketing activities and ensure that both women and men have access to development opportunities being promoted (APROSC, 1992).

In order to address the issue of irrigation technology dissemination among women, APP has formulated several interesting strategies. For instance, APP has emphasized research on water harvesting and developing sprinkler, drip and other forms of water conserving irrigation.

Traditionally, most extension services have been devoted to those farmers who own land and can obtain credit and invest in inputs and technological innovations. Since women often have no or very limited access to land or to other collateral to obtain credit, extension services unintentionally bypass women. Furthermore, extension services are also little oriented towards improving female tasks. Despite their significant involvement, women are categorically denied access to water, institutional membership and irrigated land in patriarchal communities of South Asia (UPADHYAY, 2003).

Mainstreaming gender in agriculture within the overall policy framework is important, as comprehensive and well-written policies and strategies are the basis of

any sound program. While many private and public sector agencies realize the importance of these policies, they fail to insist upon their proper implementation.

Several programs targeted to women are under implementation in villages of Nepal. In general, these programs have helped raise women's status in the society through their social and economic empowerment components. The approach adopted by most of the targeted programs supported by donors and implemented by non-governmental organizations (NGOs) and community based organizations (CBOs) through forming groups appears to have produced good result. However, because of their limited coverage, the overall impact has not been that significant.

The option of enlarging NGO operations to bring wider coverage of targeted programs is constrained by fund limitation. Greater emphasis to target women through locally based organizations will not only cost lower but also will be more effective.

3.3 Women's workload

Majority of activities pertaining to vegetable farming under drip irrigation in studied areas is carried out by women. Men's involvement is relatively limited. Data show that a total of 186 hours of labor is required for vegetable production in dry season, in which women's contribution is significantly higher (86%). The total mean hours used for irrigation in vegetable production is highest (80 hours) in comparison with other activities. Interestingly, activities like harvesting, weeding, fertilizer application and marketing are completely dominated by women. Women spent a total of 328 hours per annum for vegetable farming while men spent only 44 hours.

General perception about the drip system in relation to women's drudgery is that it increases women's workload. However, in-depth analysis of daily activity profile from household survey revealed that women's workload in fact has been reduced by the adoption of this system. Very few households used to do vegetable farming under conventional irrigation system, when female members of households used to fetch water from long distances. Even after such drudgery, the use of water was not optimal, unlike with the present system. They used to spend 2-4 hour(s) daily just to fetch water and additional 1-2 hours irrigating the field on an average.

Now, with this technology, the time spent on irrigating has been drastically reduced because of the nature of the technology. In this system, women have to just fill the drum of 50 litres and turn on the gate valve of the drum to allow passage of water through small pipes laid in the field. They do not have to irrigate manually, as they used to in conventional irrigation.

IDE, in coordination with community members, took initiatives in identifying potential water sources for the communities. This reduced the time required for fetching water. After the adoption of the drip technology, women spend just an hour for both fetching water from the nearest source and irrigating field. Thus, the system helped reduce drudgery as well as attain time saving.

BILGI (1999)'s work in Aurangabadd and Bijapur, India, suggests that the computation of time spent in different agricultural activities in both drip and non-drip areas showed that on an average 58 per cent time was saved in drip irrigation system.

The overall workload of women and children has also reduced due to lesser weeds on the farm under drip system. As the water is delivered near the root of the crops by the help of emitters in drip system, the weed growth is restricted to the periphery of the wet zone only. The excess watering in flood irrigation results in growth of wild grasses in the whole cropped area. This not only hinders the crop growth but also consumes a lot of labor.

Less drudgery and time saving are rarely reported as benefits of adoption of micro-irrigation technology. Women have collectively utilized the saved time to carry out other innovative works, such as forming self-help groups and operating saving-credit accounts in the study villages. This kind of innovation will help illiterate rural women to move forward, know their rights, realize their potentials and raise voice whenever necessary.

Better cultivation practices and improved water savings through the use of micro-irrigation techniques lead toward more sustainable use of natural resources. Besides technical and social support, IDE also provides assistance in marketing the produce (CLARK, et al., 2003). It helped establish vegetable collection centers in each village where women can just walk in and deposit produce and claim their return the following day. Acknowledging fully all the institutional support received, women of these villages seem very satisfied of their efforts and consequent success.

3.4 Access to resources and household nutrition

In Nepal, although labour and land allocation are grounded in cultural construction of rights and responsibilities, income distribution is largely governed by patriarchal ideologies favoring male prerogatives.

Drip technology not only improves irrigation efficiency by reducing evaporation from the soil surface but also provides an affordable entry into irrigation for poor women thereby giving them an opportunity to generate income. This eventually helps them in terms of capacity building and decision-making at both household and community levels.

Data suggests that with just US$12 as capital investment, women farmers are making about US$70 annually by selling surplus vegetables from a 0.0127 ha of land, which used to be barren earlier. Before the introduction of drip system in the study area, women did not have any income source and used to work as unpaid family labor. Compared to baseline data of average annual household income (from vegetable) of about NRs 427 (equivalent to US$5.47), the survey data revealed that a household under drip could fetch about NRs 15,292 (equivalent to US$ 196.05) (GURUNG, 2000).

After the intervention, they have access to financial resource and are actively participating in training and workshops. They hold monthly group meeting and discussions. This has increased their bargaining power in both household and the community. Previously, men hardly used to help their female counterparts in household chores but since women started earning, men have started helping them in domestic chores. This implies that economic independence can not only change gender division of labor but also trigger shift in power relations. Majority of women (67%) reported that they are being frequently asked for their opinion with regard to any household decisions. Earlier, they were barely consulted by male family members before making decisions.

With the help of fraction of income women earned from vegetable selling, they were able to establish self-help saving-credit groups with the purpose of providing loan during the time of hurdle. They were able to accumulate more than Nepalese Rupees (NRs) 100,000[7] in group funds. The group has become a network to mobilize other oppressed women in the community and to motivate them to join the group. Some of the women were chosen as leader farmers by LISP to train other adopters. These kinds of interactions help them realize their capacities and potentials.

When inquired about the use of income generated from vegetable selling, majority (96%) revealed that they spend it on household expenses and education of their children. Because they are marginal landholders, extra income has been predominantly used for food by majority of adopters.

With the help of vegetable production, not only these women have become financially strong but also are able to secure their and family's nutritional intakes. Efficient and effective water application, organic cultivation practices, improved cultivation using better seed quality, proper use of fertilizer, etc., lead to better productivity and food security. Better food consumption leads to improvement in dietary habits and reduction in malnutrition, which are particularly needed in rural areas to arrest higher mortality rates.

Nepal remains one of the lowest ranking countries in terms of Gender-related Development Indicator (GDI), which clearly illustrates the gender inequality prevalent in the country. It is also evident that those countries that are lower achievers in GDI are predominantly represented under low-income food deficient countries (LIFDC), and so is the case of Nepal.

In Nepal, about half of all young children are smaller than expected. National Nutrition Survey (NNS), done in 1998, shows that 50.4 per cent of children below three years were stunted while 48.5 per cent were underweight. An earlier survey conducted in 1996, found similar figures (under weight: 54%, stunting: 55%) with relatively lower levels of malnutrition in the eastern region and higher in the mid and far-western regions. It was clear from these surveys that despite the efforts to deal

[7] Equivalent to approximately 1,300 US dollars.

with protein, energy and nutrition over the last 20 years, malnutrition is almost as high today as it was in 1975.

Data in the surveyed areas suggest that vegetable intake has been significantly improved after the introduction of drip system. Majority (82%) of respondents reported that they hardly used to grow vegetable even in the family yard because of the hardship of fetching water from distant sources. They used to serve their daily meals always without fresh and green vegetables even to lactating and pregnant and children. These days vegetable menu is almost there in the daily meals. Since vegetable production has increased normal vegetable intake, it has positive impact on nutrition. PHANSALKAR (2002) also noted increased access of families to vitamins and minerals due to cultivation under drip.

4. Conclusion and policy implications

This paper has attempted to unfold a success story, which depicts as to how a disadvantaged cluster of resource-poor women from remote villages was able to transform the entire village economy by entering into an agency-led commercial vegetable farming. Sustainability of the practice is ensured as community people, particularly women, are trained and entrusted with the responsibility of operating and managing the irrigation system.

Prior to replicating the system, a couple of important points should be pondered on. First, irrigation technology developers should be aware of the need of gender sensitive technologies together with considering socio-economic and cultural scenarios of the region where diffusion of the technology takes place. The paper revealed the potential of drip-irrigation technologies to help resource poor women farmers earn much needed cash income. Besides economic benefits, positive impact could be felt on household nutrition and food security. More importantly, it depicted the potential of the technology to alleviate rural poverty.

There is a need to revisit irrigation policies and technology development strategies. Technology developers and policy makers should understand the productive roles of women in using drip-irrigation technologies.

Secondly, government should shy away from its conventional habit of introducing larger farmer friendly subsidies and rather facilitate tie-ups with non-government sector so that poor friendly technology becomes available at affordable prices for a broader population. Offering mortgage-free loan to landless farmers to enable them to lease the land and subsidy to install the technology will be an appropriate policy response to the problems of poorest of the poor, usually women. It may be useful to launch such packages in conjunction with local micro-finance schemes.

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