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PEOPLE-CENTRED APPROACHES TO WATER AND ENVIRONMENTAL SANITATION

Managing local water resources by communities in semi-arid environments in Nepal

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During recent years in Nepal, much attention has been given to promote participatory community-based water management as a viable means of support for the enhancement of rural livelihood. Undergoing water development trends in Nepal has instantly had contributed to the project efficiency and to the community's management but has done little for long-term sustainability and little to address water scarcity, conflicts and problems associated with equity and social disparities. In this paper the sustainability concept is discussed on the background of provision of community-based multipurpose water projects for the holistic development of rural-mountain communities in Nepal. Humble innovations of community's management for multipurpose water projects can provide powerful benefits to the poor and disadvantaged. It is hoped that these practical methods will assist agencies and communities to improve the operational strategies of any water development program.

Introduction

The Himalayan Kingdom of Nepal covers 147,181 Sq. Km. and contains large rivers, lakes, streams, springs as well as groundwater reserves, which form the backbone of rural and urban societies (Corley K. and Khadka R., 2002). Because water today is precious and has variable functions for the eradication of prevailing poverty in Nepal, its management becomes a momentous concern.

According to the National Planning Commission (NPC) of Nepal, roughly 42% of the 23 million inhabitants are living below the poverty line (earning less than US$1 per day). Over 85% of total population resides in rural areas and majority of that population inhabits in mountain region (NPC, 2001). The livelihoods of nearly 90% of them revolve around agriculture, which has predominantly been marginalized due to the poor availability of water in time and space. Moreover, while analyzing water issues and prevailing poverty, it is equally worthwhile to recognise other socio-economic parameters associated with poor water supply, sanitation, degraded watershed, energy constraint and on/off farm opportunities for mountain people.

Total potential of water resources in Nepal is 210.2 billion cubic meters (FAO/AQUASTAT, 1999). It accounts a per capita availability of around 10,000 cubic meters and in average of 2,700 cubic meters in non-monsoon seasons, which is well compared with a global average of fresh water supply and still in surplus from threshold level of 1,700 cubic meters for water stress. Despite the fact that the mountain regions are the largest storehouse of fresh water, many of its inhabitants do not have sufficient water all the year round. This is not due to natural scarcity but it is due to artificial scarcity. Surprisingly, to date only 42.9% of total agricultural land mostly from Terai (flat land) has been irrigated, whereas the yearlong irrigation covers only a half of that value. Electrification dependently through national hydropower production benefits 17% of total population and primarily covers the urban population. Water supply was expected to be available for cent-percent population at the end of the final year 2002 of ninth five-year plan but it remains at 69% (NPC, 2001) and on the other hand the provision for health and sanitation remains in critics.

Although an approach for local water development followed by the Nepalese Government and its associates is not lightly ignorable, there have not been remarkable changes in socio-economic concerns of mountain region. Finding of clues behind inefficiencies on prevailing water-management and its impact on rural livelihoods is becoming a complex task day by day.

Previous and ongoing trend

Previous centralized approaches that favoured sophisticated large-scaled, capital-intensive projects in Nepal did not deliver water to many households, power plants and farms. Government's attempts on developing large-scale water projects were mostly unsuccessful due to ineffective project implementation. This resulted in debt and increased frustration among people. The water act 1992 Nepal has clearly justified the provisions for the appropriate utilization, protection, management and development, prioritizing multi-disciplinary approach on socio-economic dimensions. The on-going development trend is therefore multi disciplinary in nature. The existing structure is still moderate and while addressing one social structure it often exclude powerless groups such as women, children, so-called cast groups and

manifestly the poorest of the poor. This is a common story of inefficiency of undergoing approach and is more attributable to the misunderstandings of local life and diversified and importuned need of local people (Bonn, 2001). Further looking on the scenario, such as over-representation of organizations in sector and poor coordination between those organizations have exacerbated the situation and led to the overlapping, duplication and form community more opportunity biased (Osti R, 2004). Problems aggravated because of the prevailing water development trend can be summarized as:

- Competition among water uses and users, conflicts associated with water rights
- Modified needs of communities according to the offers made by implementing agencies
- Inconsistency exists among the needs of local people
- Multifarious intervention, confused principles, technology changes, unfamiliar national policies
- Poor allocation of available water resource
- Distorted principles of multipurpose water-use or ignore the aspects due to unwillingness to coordinate, which simply draw the situation of scarcity in excess
- Communities are becoming more opportunist and are not aware in their responsibilities
- Poor community's management in case if there are more than one project under the management of that community

Multipurpose water project

The cheapest, most efficient way to increase the supply of fresh water is by managing its demand effectively and reducing waste (GDRC, 2002). This definition has somehow clarified the concept of multi-purpose water projects and tended to fulfil the gaps in current needs of community development by coordinating users, uses and supporters thereby eliminating single-event intervention.

Multipurpose Water Projects (MPWP) can be explained by two different definitions

- hardware and
- software type.

The hardware aspect of MPWP can further be subdivided into a project for reuses and projects for multiple uses. In the former type, there is no need to significantly change the engineering parameters. For example, plant producing hydro electricity by using canal flow in irrigation systems or by using excess pressure on gravity water supply schemes. Secondly, integrated water project, in which several aspects of water are taken into account, are considered as a complement to one or more projects. For an example, where irrigation and/or water supply schemes are integrated with micro-hydropower plant, a high degree of preciseness is necessary to allocate available water for different uses as well as for future demands as demands vary with time and scale. Because of integration, it facilitates an economical and easy implementation, operation and management of the project; however the system requires larger quantity of water to serve many functions and meanwhile requires considerable structures. Independent water projects also fall in this category. Both consumptive and non-consumptive uses of either renewable or non-renewable water sources can be considered. Projects can be carried out in several phases according to the priority or needs and available funds.

Indirect or software type definition of MPWP can be explained as a water project, which can be an entry to address several other local issues. It covers all most all aspects of social, economical and environmental development e.g. organization development, capital formation, skill development, technology promotion, gender sensitization, environment conservation and promotion of culture and indigenous practices. Single water project can be viewed as an entry to the holistic development of local community. Watershed management in general and water induced disaster prevention in particular can also be categorized in this class but these measures can sometime be integrated into former types of water utilities or vice-a-versa. This aspect of MPWP does not account whether the project is stand-alone or integrated.

Integration of all these aspects of multipurpose water

Box 1. Traditional entrepreneur & his experience

Mr. Thir Bikram Karki, a traditional entrepreneur in his mid-sixties, lives in Mohan Tar, a small hamlet near Gajuri village in Dhading district. He has some bitter experiences with the failure of local Micro-hydropower (MHP) plants, granted for the local people by His Majesty The King Late Mahendra Bir Bikram Shahadev. Mr. Karki understood the philosophy on MHP particularly from that unsuccessful government-managed project and decided to establish one through his own resources. With technical supports from Kathmandu based manufacturer, he installed a MHP plant of capacity 10 KW, using water of 50 litters per second from local stream with available 30m working head at site (Fig. 1). He electrified Gajuri Village, a small roadside community, which is about 2 Km from power plant. Interestingly, there is another water mill (grinding mill) downhill to the MHP station. It belongs to another entrepreneur and getting tailrace water from power plant, which further irrigates the paddy field.

Local farmers, those living in roadside, started seasonal and off-seasonal vegetable farming and are getting attractive revenue from that occupation. Unfortunately, Mr. Kari has no land where he can get year round irrigation and can grow vegetable like his friends. He decided to adopt Hydraulic Ram, a self operated appliance, which he came to know through local ram-promoters. Hydraulic Ram was installed by using small drop of about 1.0 meter at the inlet of forebay tank of his power plant. H-Ram uses only 10% of fed water and irrigates the land located at 14 meters vertical space above canal with full hour supply of about 1 litre per second. Although the effort given by Mr. Karki alone to maintain the system is burdensome, it becomes a successful illustration and demonstration tool for water managers at micro level. Surprisingly, once the national electrification scheme has started to serve people of Gajuri village, entrepreneur like Mr. Kari has had some positive as well as negative impacts.

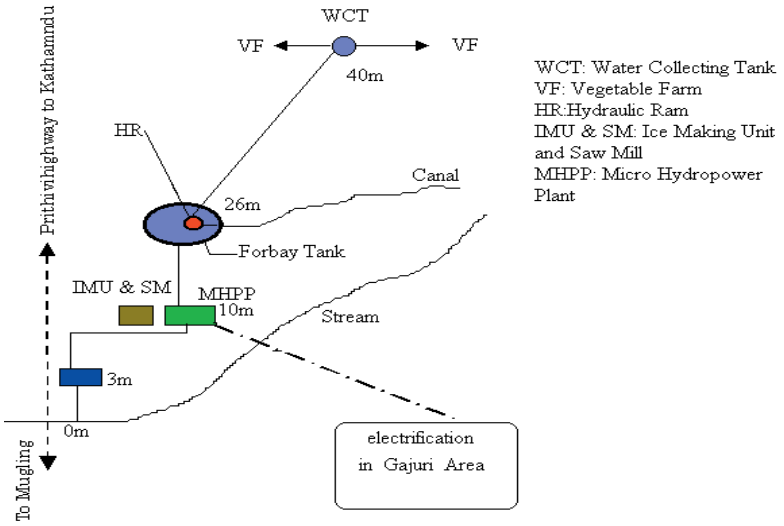

Figure 1. Water schemes adopted by local farmers

Box 2. Project supported by agency

Piughar is a small village of Deurali Village Development Committee in Tanahun district, 45 minutes along Seti River from nearest road head namely Ghumauneghat in Narayangargh-Mugling highway. Piughar is composed of 53 households and people from different races and religions.

The Rural Energy Development Programme was implemented in 1997 with a pilot package of community mobilization. Empowered community decided to implement micro hydropower scheme as add-on type system to the existing irrigation canal. Irrigation scheme was completed in 1988 in support from Government but was no more in function because of poor maintenance that due to the minority of local farmers served by the scheme. The system is now rehabilitated by the community, providing financial support from agency and local government. Communities have used the sloppy ground nearby 1.5km canal distance from intake and utilized part of discharge that supposed to provide irrigation for the land in vicinity. It produces hydroelectricity of 10 KW in capacity, which has served all most all households of its locality. One of local entrepreneur has adopted a fishpond attached with pig-farm by using tailrace water of the power plant. Water after serving that enterprise, can irrigate several hectors of land and/or fall down to the natural drain, which passes through the settlement, where the people can use this water again for operating biogas plants, irrigating vegetables and feeding cattle (Fig. 2). Finally, water is drained out into the Seti River, which is also famous for white-water-rafting. Now community is planning to develop the bank of Seti River, making small park around and introducing some restaurants and rest rooms; expecting to serve tourists and pedestrian along the roots. Electricity, in another hand, becomes a life of local people. It facilitates local people on their daily life as well as helps them to run several enterprises and finally to form self helped community. Salient features of micro hydropower project:

Statistics:

Gross Head: 40 m
Dry weather flow: 120 Lps
Irrigation Sector-1: 60 Lps
Power + Irrig. Sector 2: 60 Lps
Power output: 12 kW
Canal Length: 2 Km
Canal Length Upto Fore-bay: 1.5 Km
Penstock length: 60 m
House-holds: 53
Transmission: 1.5 Km
Site Elevation: 1500m
Total-cost: 1,201,202 NRs
(1US$=75 NRs)
Lps: litre per second

Box 3. A Government funded project

Artauil-Puttar a small irrigation project, which supplies water from Maidi Khola (small stream) to the command area of 475 ha. was constructed in 1990. Scheme is located in Gajarkot Village Development Committee in Tanahun district. It takes several hours of brisk walk to reach the place from nearest town Tansen. Agriculture is the main occupation of the people of Artauli Puttar area, where distribution of landholdings is skewed and majority of them used to depend on monsoon rain for irrigation. Community was provided with an irrigation system for the first time through a state project in support from World Bank. System is now partially failed due to varieties of reasons including poor planning, unreasonable design and obviously due to poor system performance, however some portions of canal are still feeding water particularly in rainy season (Paddy-season) from main source as well as from other natural drains, those merged into it.

In the year 1999, community was again looked from the prospective of electrification by producing hydro-electricity from the same source, this time through a local government in support from INGOs. Expert team surveyed the possibilities to rehabilitate the existing canal system and to adopt micro hydropower unit, preferably using canal drop of 7m provided at Artauli. But no such alternatives were found suitable. The source is now restricted only for minor irrigation, neither the community can realign and bring the system in full function nor the national policies allow them to use this source for other purposes. It has been observed that if the first irrigation project was properly planned it could serve variety of water and energy needs of local people.

project including software and hardware meanings into a program would be more realistic than understood. Different sample schemes are described in Box 1, 2 & 3 and in Fig. 3.

Challenge and prospect

As discussed above, MPWP could be an alternative to eliminate the ongoing confused development process in

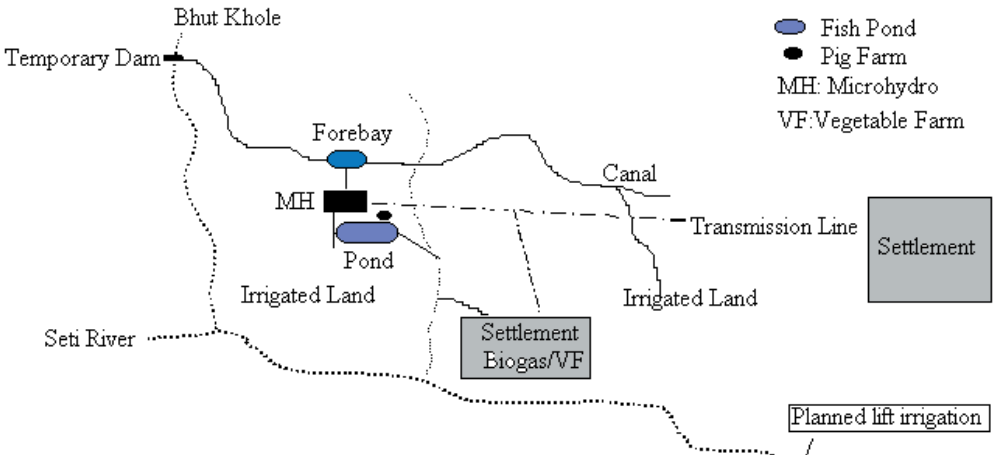

Figure 2. Multipurpose water project at Piughar, Tanahun

Nepal. MPWP can deliberate greater efficiency in system performance, improve cost-effectiveness for both communities and agencies and has better prospect for the long-term sustainability. Currently in Nepal, community-management in the background of rural development has been accepted in national policy; however communities are usually not treated as future managers in the sense that they can manage their needs from range of options (Bolt and Khadka, 2001). Bolt and Khadka further added that on community side, there is often a lack of experience with the management of local water system. In addition to the agency side, there is often a lack of skills to facilitate community process. Water is distributed inequitably to users and uses. There is unreasonable water right reserved by traditional users, who are so called power-group and still dictate the ownership. Poorest of the poor are principally the problem groups, who generally pay or contribute to the project comparatively more than that do the rich (GDRC, 2002) but get minor facilitations from project or simply the project does not cover their needs. Finding of program that can benefit all users and uses at a time is becoming a challenging job. There is not only the need of conflict resolution but also the need of engineering solution. MPWP is found to be a good form of cooperation. Sustainable development is a today's prerequisite, for which MPWP can play a vital role.

The development that has considered present needs without compromising the fundamental needs of future generation is sustainable. There could be an inaccuracy in our attempts

Figure 3. Location of projects

as we cannot look into future with any degree of certainty. On other hand, we cannot precisely realize and analyze the long-term vision and the vision of our future generations. This is why, finding a goal of sustainable water management as an end is rather difficult than what we usually advocate on. What we can do is; we can work for better water systems by promoting, preserving, regulating and allocating local renewable as well as non-renewable water resources and in the meantime by maintaining ecological, environmental and hydrological integrity. In order to achieve these objectives, we can implement several programs and projects, which are fully functional and has contributions to the present and future needs of society. Multi purpose water project would therefore be a key part of local water system, which has power to integrate several socio-economical, environmental aspects at a time and has great influence on sustainability. Although the components are designed for certain life span, after the life span, if the project is said to be non-functional or inefficient, it can be rehabilitated or replaced with another system according to make it fit for the needs of that time and the needs of corresponding future. The MPWP is conceptualized in accordance with the basic guidelines (Loucks, 2000) provided for planning and management of sustainable water system, which has prioritized to (a) Develop a long term shared vision of desired socio-economic, environmental goals (b) Coordinate approaches among all concerned and interested agencies and collaborate all stakeholders in recognition of mutual understandings (c) Use approaches that restore or maintain economic vitality, environmental quality, natural ecosystem, biodiversity and health (d) Support actions that incorporate sustained economic, socio-cultural and community goals (e) Respect and ensure private property rights (f) Recognize the economics, ecosystems and institutions, which are complex and dynamic (g) Integrate the best sciences both in engineering technology and decision making process and (h) Establish baseline to make reference for monitoring and evaluation. While these are the points that must be justified by the implementation of MPWP, it is equally important to judge how it works to sustain itself as a project by providing services to the community. Some indicators are proposed and explained in table 1.

Conclusions

Water becomes a precious commodity everywhere and its management at all levels is important. Even at the micro level of a relatively small river system in south Asia, the context of water management exhibits high physical, social, institutional and cultural variability (NWCF, 1999). Water is continuously flowing resource with unreliable dimensions and whose characteristics vary tremendously across societies. Trapping and managing of such flowing commodity for the enhancement of livelihood in natural and social diversity is equally challengeable.

Inefficiency in existing water development in Nepal is greatly influenced by the poor coordination among agencies and this is the cause behind overlapping and duplication thereby the inutilities of aids and government's budget. Communities are still weak in sense of thinking highly efficient technologies regarding the management of local water resources and obviously the aspects of multi use/purpose projects. Moreover the communities are not provided with a favourable condition as they are only guided for specific tasks and for the accomplishment of targeted project, supporting through grants. This problem in community is further exacerbated due to struggle for opportunities, which is normally in the hands of so-called powerful groups or moderate poor, those who can precisely deal with donors and/or government. On the other hand, the real problem-group is neither motivated nor given interest. The MPWP has multifaceted advantages over burning problems. The pros and cons may refer to:

- Improve technical efficiencies
- Manage artificial water-scarcity
- Support reliable allocation system and make provision for future demand
- Promote and encourage management by community
- Promote economical and environment friendly technology
- Coordinate agencies and communities and avoid duplication and overlapping
- Resolve conflicts and competitions on water uses
- Consider several demands of several class of water users

The 10th five-year development plan of the country has recently been announced, which has covered most aspects of water development and poverty issues but has again missed to encompass the strategy for the promotion of micro scaled multipurpose water projects and thereby to address the equitable empowerment of different poverty-groups. Government has also announced the decade of Agriculture; through which it has expected to promote extensively the ground and surface irrigation but it may overlook other concerns associated with integrated water resource development and management.

Looking at the prevailing attempt and community's behaviours, it has been noted that mostly the disputes in water projects are associated with lack of awareness on existing legislations, tendency to hold the nearer sources, wanting more water than really required and expressing reluctance to share common source (A. Luitel, 1998).

This in one hand persists due to ignorance and in other hand due to poor knowledge of water allocation and water rights. While mobilizing community for the execution of community managed water development, transparent and comparative analysis among several alternatives and prospective water demand and benefits should be conducted rather than just ranking the needs and addressing one.

In case of knowledge shear, agencies and community need to operate in a partnership in which perception of problems and solutions can be discussed on the basis of equity and

Table 1. Performances of Multipurpose Water-projects	
Indicators	**Pros and Con**
Function and Uses	- Single project, simple operation, multiple functions and adjustable system - Fully used and serves several demands of farmers at a time - Good performance and brings full participation to maintain
Deliver of Benefits (quality, quantity, convenience, continuity, efficiency, equity, reliability, services and health)	- Maintained water quality and quantity for different purposes - Higher efficiency and comparatively less conveyance losses - Economized - Equitable distribution among uses and users at the same time - Benefit/cost ratio is high and project is affordable - Easy to allocate and regulate local water
Functions of Project in Prolonged Period of Time	- Create more dependents and thereby caretakers - Durable in sense of water allocation and technology management - Good returns, which helps to maintain good operation & maintenance - Dissimilar demand projection for different uses but can make provision on planning stage
Affecting Environment	- Take provision of all kinds of environmental aspects corresponding to the different water uses - Less construction and less destruction - Based on the approach of watershed management - Cover all most all aspects of environment preservation
Investment, O & M and Replacement Costs	- Economized engineering construction - More users, good revenue that radially available for operation and maintenance - Create single community/ project fund, which makes easy & maintain transparency - Few salary based operators and managers required - Higher the dependencies on project, greater will be the participation in need
Institutionalized Management (Community management, gender, partnership with agencies, formal/informal private sector involvement)	- Single and simple managerial system established in community - Avoid confusion, competition among users and maintain good cooperation with external agencies thereby eliminate overlapping and duplication - Gender sensitive by considering varieties of problems of different groups - Private sector involvement under community's management is also possible
Feasible External Support (Technical, Financial, Training)	- Broad coverage and effective support - External agencies need to be in good cooperation thereby effective use of aid or national budget can be achieved - Less inputs but aggregated outputs - Avoid overlapping and duplication
Close and distinct sco-economic relation	- Gender sensitive approach - Easy to address several social problems - Generate incomes through on/off farm opportunities - Inter-linked and inter supportive system established - Conflict-free community developed
Local Skills and Technology	- Enriched with local skills and innovative in management - Both traditional and modern technologies are acceptable - Simple to train local people for its operation and management
Risks	- In case if one system is failed, another can be affected so the risk is existed in whole system - Essential countermeasures should be incorporated

respect, valuing both agencies and community knowledge in the same way. (Bolt and Khadka, 2002). It is a fact that each and every water project can serve different purposes but its optimization is an importance. Those water projects, which are already implemented without considering the principles of multi-functions, should be modified accordingly to serve more purposes during their rehabilitation.

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