

Institutional Reforms in Irrigation Sector for Sustainable Agriculture Water Management including Water Users Associations in Nepal



Prachanda Pradhan, Madhav Belbase

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Introduction

Out of 2.7 million hectares (Mha) of agricultural land in Nepal, only 1.4 Mha have irrigation facilities. The majority of irrigation systems are small and medium scale, which also includes groundwater irrigation. Agriculture is a mainstay of the economy of Nepal, providing about 33% of the gross domestic product (GDP) and supporting the livelihoods of most of the population. Livelihoods based on agriculture are vulnerable due to the vagaries of monsoon climate and the topography.

There is a need to both improve agricultural productivity and make it more resilient to climate uncertainty and changes in general. Recent increases in floods and droughts have raised concerns that the climate is changing rapidly and that existing arrangements for irrigation design and management may need to be reconsidered.

Background of Irrigation Sector in Nepal

Public sector irrigation development in Nepal took place only in 1950s. Only two public sector irrigation systems were constructed before 1950. One is known as Chandra Nahar (Canal) which was constructed in 1923. The other is Judha Nahar which was constructed in 1940s. Hence, Nepal is known more for her thousands of farmer managed irrigation systems scattered in the mountains, river valleys and Terai.

In 1950s, many farmer managed irrigation systems were rehabilitated in Kathmandu valley, which used to be one of the fertile valleys of Nepal, because of its elaborate network of irrigation systems. The Department of Irrigation was established in 1952. Many of these irrigation systems which were constructed in 1960s and 70s were made agency managed systems. Even the rehabilitated farmer managed systems were converted into agency-managed systems.

The irrigation systems were then considered more as technical and hydrological proposition. Human aspect of irrigation management was not taken into consideration. It was felt that government alone would be able to manage the irrigation systems. The role of the farmers was not duly recognized in agency managed irrigation systems.

In 1980s, the farmer-managed irrigation systems (FMISs) were first recognized by the government. It was ironical not to have their due recognition of them

before 1980s. For example, the First Five-year Plan of Nepal (1956-60) recognized only the existence of 14,000 ha irrigated land in Nepal. These figures indicated the existence of only government managed irrigation systems.

In mid 70s, Nepal embarked on the construction of large scale surface irrigation systems in southern part of Nepal with loans from the World Bank and Asian Development Bank. During this time, the concern of Irrigation Department was much more toward the physical construction of irrigation infrastructures, and institutional development did not receive due consideration.

In late 1980s, agencies providing support to irrigation development got amalgamated into one. The Ministry of Panchyat and Local Development (MPLD) supported irrigation component and Farm Irrigation Water Utilization Division (FIWUD), under the Ministry of Agriculture were merged with Department of Irrigation. However, the Agriculture Development Bank was allowed to carry on its role on irrigation development through the provision of loans. The reform was to make only one agency responsible for different types of irrigation development all over Nepal. It is now Irrigation Department which has mandate for irrigation development all over Nepal.

The amalgamation of these different agencies was necessitated in order to increase agriculture output to meet the basic need fulfilment of people by the year 2000. Hence, irrigation plays important role in increasing agriculture production.

Changes in the Approaches, Scope and Management of Department of Irrigation (DOI)

The amalgamation brought changes in the approach, scope and management style of the Department of Irrigation. Irrigation units at 75 Districts were established. The responsibility of providing assistance to farmer-managed irrigation systems also came within the jurisdiction of the Department of Irrigation. The thrust on participatory irrigation management was made. Irrigation Working Policy was brought out, emphasizing farmers' participation from planning to implementation of small and medium irrigation schemes. Necessary amendments in Irrigation Rules were made, with emphasis on the management improvement of the already completed irrigation systems.

Irrigated agriculture holds great potentiality to meet the development challenges and is key to increase agricultural production to feed the growing population of Nepal. Besides increasing the agriculture production, irrigation helps promote Green Revolution, contributes for poverty alleviation, helps promote rural growth, and ensure food security of the country. Dilapidated irrigation systems affect all these fronts of development issues. In order to meet these challenges, the important question is: how can irrigation sector be revitalized?

The existing irrigation schemes of Nepal are now getting old and they require improvement and modernization to boost food productivity from irrigated agriculture. It is often found that state built, and managed irrigation systems can be made to perform better, so they need to be revitalized. Similarly, FMISs in Nepal also have great potentiality for increasing agricultural productivity. Hence, improving the irrigation systems to meet the food demands of the future must be considered in an integrated manner; consisting of infrastructure rehabilitation, investment to raise productivity from irrigated land and promotion of appropriate institutions and innovative management modes.

Historical Perspective of Irrigation Organization Development in Nepal

The involvement of government in irrigation development started with the enactment of the National Statute (Muluki Ain 1854), which provided a legal foundation for the development of canal irrigation in Terai and made the District Revenue Offices responsible for construction, operation and maintenance of irrigation system. However, government's involvement, in real sense, began in 1923 when Government constructed Chandra Nahar Irrigation Project applying the then modern engineering techniques. The project was planned, designed and constructed by British Engineer. It was followed by development of few irrigation facilities till 1951 under the supervision of the then Public Works Department. A bureaucratic movement in planned irrigation development started with the creation of Canal Department (1952) with a chief engineer, two civil engineers and few support staff. It was established in Singh Durbar, then Administration Building of Government of Nepal, with just two rooms. Gradually the scope and activities of the Department were expanded. A number of organizational reforms took place before the Canal Department was developed into a full-fledged Department of Irrigation (DOI) in December 1987. The Canal Department was expanded to Department of Irrigation and Water Supply under the Ministry of Works, Transport and Communication. Later, further change was made in forming Department of Irrigation, Hydrology and Meteorology (DIHM) under the Ministry of Water and Power. After sometimes, this Department was brought under the Ministry of Irrigation and Agriculture, from 1972 to 1980. Afterwards, the DIHM,

which became DOI later on, was under the newly created Ministry of Water Resources until 2009. After this, Ministry of Irrigation was established by splitting Ministry of Water Resources into Ministry of Irrigation and Ministry of Energy. Though this Department has gone through many transformations, there has been steady capacity development of DOI's technical staff since 1970s.

During the initial stage of government intervention in irrigation activities, the department would establish individual offices for specific projects. Many of these offices were transformed later on into divisions and sub-divisions to take care of maintenance of completed projects along with implementation of other projects in the vicinity. Following major administrative restructuring of the country; making four regions in 1974, Regional Irrigation Directorate (RID) was established in each region. The divisions and sub-divisions came under the administrative control of these directorates. In 1983 the Far-Western Region was split into two and named Mid-western and Far-western regions. However, implementations of large projects were carried out under direct supervision of DOI. This practice is continuing even today.

In 2015, the Department of Irrigation has been further expanded by establishing a 57 Division and 16 Sub-division offices for the implementation of medium sized irrigation systems. Irrigation Management Directorate has also been created with the overall objective to improve the irrigation management of large irrigation systems. Under this directorate, ten Irrigation Management Divisions and three Sub-division offices have been established. Ground Water Irrigation Directorate along with ten Ground Water Irrigation Divisions have also been established to plan and develop groundwater shallow and deep tube wells.

Evolution of Governing Policy, Legal Framework, Rules and Regulations

Farmer managed irrigation systems have been traditionally governed by social norms and collective decisions. Although legal instruments like *Sanad*, *Sawal*, etc. were issued by the then Rana Rulers to regulate the operation and maintenance of state built and operated irrigation systems, the farmer managed systems were under operation and management of the beneficiary farmers guided by the social norms and values of the community.

National Statute of Nepal, 1854

Muluki Ain (National Statute of 1854, Land Cultivation Section) was the only governing law at that time. Some of the provisions of the *Muluki Ain* are as follows.

- One who constructed the canal should get priority in receiving irrigation water.

- Lands in lower reach shall not receive water until lands in the head reach are irrigated.
- Irrigation canal in the upstream from an existing canal in a river can be constructed only when it has no effect on the availability of water in the existing system in the downstream.
- Farmers should first try to rehabilitate a canal themselves, if it is damaged by natural calamities. If it was not possible to rehabilitate by themselves, they may request the government for grant of fund required for the rehabilitation.

Irrigation Act, 1962

Even until the beginning of the first planned development in 1956, government policy for irrigation development was nonexistent. Nepal introduced the Irrigation Act for the first time in 1962.

Some of the features of Irrigation Act, 1962 were:

- Costs of construction and maintenance of field channels including the land occupied by the channels are to be borne by the farmers. However, higher order canals are to be constructed by the government.
- Permission to use irrigation water is granted either for a crop season or for a year, which is however renewable.
- Water use right is not transferrable without permission of the Canal Officer. However, the water right can be transferred to the cultivator authorized to use the land for cultivation.
- Water use permission is transferred along with the land entitlement.
- Water right cannot be established merely by getting permission to use the canal water.
- Farmers are entitled to receive compensation, if the irrigation water supply is interrupted without a valid reason.
- Provision to penalize anyone who misuses canal water.
- Water-cess is collected by the Land Revenue office along with land tax on annual basis.

Canal and Electricity and Related Water Resources Act, 1968

The Irrigation Act, 1962 was later replaced by Canal and Electricity & Related Water Resources Act, 1968

Some of the features of the Act were as follows:

- Provision was made to obtain license for water use for commercial purpose, including for irrigation and right to collect irrigation service fee by such private agency.
- Provision was made restricting any activity which results into adverse impact on environment while developing such project.

Irrigation Working Policy, 1988

In late 1980's, there was a major policy shift in irrigation development and management approach in

Nepal. The government introduced Irrigation Working Policy which emphasized on participatory planning, development and management of the irrigation systems. Irrigation Regulation, 1988 and Irrigation Directives were also brought out by the government in sequence. The Irrigation Directives, 1988 provided detailed procedures for the formation of Water User's Association (WUA). Some of the features of the directives were;

- Involvement of Water Users Groups (WUGs) in construction and operation & maintenance of tertiary canals, field channels and drainages of large Agency Management Irrigation Systems.
- Water allocation and distribution by the agency in an irrigation system in coordination with WUA.
- Provision was made for the formulation of Constitution of WUG/WUA defining its roles and responsibilities.
- Irrigation Service Fee (ISF) is to be paid by users and ISF is to be determined by the Government based on the criteria stipulated in the Regulation.
- WUG/WUA receives incentives for facilitation in collecting the ISF.
- Issuance of license to use water for irrigation or any other agricultural use to a formally registered Water Users Association.
- Provision was made for registration of WUAs under Association Registration Act, 1978 in respective District Administrative Office.
- Formation of WUAs consisting of 5 to 11 members including a representative from Irrigation Office of the government.

The formation of WUA was mainly meant to involve the beneficiaries in the construction and operation & maintenance of the systems.

Irrigation Policy, 1992 and Subsequent Amendments

Irrigation Policy in Nepal was formulated in 1992. One of the six objectives set forth in the policy was to provide continuity to the Nepali farmers' traditions and managing their irrigation systems as autonomous entities in the private sector by making it more stable and extensive. The policy had categorized the irrigation systems into the following four groups:

- Irrigation systems operated by water users or to be operated by them in future.
- Government irrigation systems to be turned over to the Water Users' Associations.
- Irrigation systems under the Joint Management of the government and WUAs or irrigation sub-systems under the multi-purpose project/systems as per national requirement.
- Private irrigation systems.

The policy mentioned that recognition should be granted to the Users' Associations. They should be made self reliant and strengthened gradually. No investment would be provided unless there is a registered WUA in place. Sharing of construction cost by the users is made mandatory. However, the amount of construction costs

to be borne by the beneficiaries depends upon the type of the irrigation systems, as per the Policy. Modalities for the intervention to the farmer's are as follows:

- There could be agency intervention only if there is a formal request from the majority of the farmers.
- In the implementation of such demand driven projects, there should be full participation of organized users from the very beginning. The full responsibility of operation and maintenance of the system after completion of the construction should be shouldered by the users' association according to the agreement made with the user's association.

Besides, the users should have provided all lands, required for the construction, rehabilitation and improvement of such systems, free of cost. Different provisions were set forth for different types of irrigation systems regarding cost sharing.

Irrigation Policy Amendment in 1997

The Irrigation Policy was later revised in 1997. The revised policy had the following features:

- Irrigation system owned by the farmers would be governed by the irrigation policy.
- Institutional development of farmers to be promoted to make irrigation systems more productive.
- Formation of WUAs should be towards a multipurpose organization working for the farmers.
- Responsibility of WUAs should include planning and implementation of schemes.
- Involvement of farmers is envisioned in project identification, selection, construction, operation and maintenance, monitoring and evaluation.
- WUAs of FMISs could raise the funds, from the users, in cash or kinds, required for the operation and maintenance of the systems.

Irrigation Policy Amendment in 2003

In 2003, Irrigation Policy was further revised, and it had following important features;

- An Irrigation System has been defined as "all infrastructures built for irrigation purpose and all units including irrigated area. This provision refers the completed irrigation system which is in operation."
- The maintenance, rehabilitation and reform of the system constructed/operated by the users' association and traditional irrigation system managed by farmers shall be rehabilitated with the farmers' participation upon their request. Users' association shall be made competent for sustainable management.
- For the purpose of management of irrigation systems, following classifications have been made:
 - Operated by the users
 - Traditional irrigation systems
 - Systems transferred by government and non-government agencies to the users' association
 - Operated by the government
 - Operated in joint management by the government and the users' association

- Operated in joint management by the local bodies and the users' association
- Operated by private sector
- Irrigation systems rehabilitated/improved on the demand of users and operated by them shall be managed by the users' associations.
- GoN shall invest in the project only after having formal agreement with the users' association; by clearly defining the functions, duties and rights of the Department of Irrigation and the users' association, by adopting a transparent method in relation to construction, operation and management of the project.
- Users' associations may claim for compensation in cases where one faces loss due to non-fulfillment of the responsibility by GoN under the agreement.
- Capital contribution from the users is based on the average size of the landholding and it varies from 3% to 15% of the total estimated cost of the rehabilitation of the scheme.

Irrigation Policy Amendment in 2013

In 2013, the Irrigation Policy was revised, and it has the following features:

- Irrigation Master Plan based on Integrated Development and Management of River Basin shall be prepared at the National as well as District Level.
- The Government of Nepal shall declare Irrigated Area where the irrigation facilities are made available and use of such land other than for agricultural purposes shall require prior approval of the government.
- Coordination and partnership between the stakeholders shall be promoted to enhance the productivity in the irrigated area.
- Appropriate Irrigation Technology suitable to particular geographical location and topography shall be promoted.
- Irrigation projects shall be planned based on Integrated Water Resources Management (IWRM) principles.
- In order to provide year-round irrigation from existing seasonal irrigation systems, reservoirs, rain water harvesting, and ground water irrigation shall be developed.
- Priority shall be accorded to develop large reservoir and inter basin water transfer type of projects.
- Private sector, cooperatives, communities shall be involved in the development, operation and management of irrigation systems.
- In order to address the impact of climate change in the irrigation systems, programs related to adaption and mitigation measures shall be implemented.

The Irrigation Policy of the government has been made effective by the enactment of Water Resources Act, 1992, Water Resources Rules, 1993 and Irrigation Rules, 2000.

Proposed Irrigation Act, 2015

Irrigation Bill 2015 has been drafted by the Ministry of Irrigation and has been tabled in parliament for approval. Features of Irrigation Bill 2015 are as follows:

- A person or organization planning to survey and develop irrigation system shall have to obtain the license.
- Government of Nepal may collaborate with private sector for identification, selection, construction, implementation, operation, maintenance, improvement or management of irrigation system on the basis of public private partnership (PPP) modality. Similar modality regarding multipurpose project which are commercially viable for operation would also go to PPP model.
- The Government of Nepal can handover the irrigation systems constructed, developed or managed by it to the Water Users Association, Farmers Cooperatives, and Management Board in accordance with the prescribed procedures.
- The Government of Nepal, by publishing in the Nepal Gazette, can declare an irrigated area that has fulfilled the prescribed requisites as special irrigated area, where use of land for other purposes, without permission of the Government, shall be prohibited.
- The related Users willing to develop, use, maintain and protect any irrigation system can form Water Users Association by following the prescribed provision.
- The functions, responsibility and authority of the Water Users Association shall be following:
 - To update and protect the assets of an irrigation system shall be the responsibility of Water Users Association,
 - To repair, maintain or reconstruct the structures of the irrigation system, if damaged,
 - To plan and implement sustainable irrigation service and distribution management,
 - To prepare list of users of the concerned irrigation system,
 - To collect irrigation service fee as per the regulation prepared under this Act,
 - To implement local level irrigation development programs in coordination with the concerned agencies,
 - To prepare standards and action plans for protection of canal infrastructure and irrigation water and implement them.
- The Government of Nepal can form an Irrigation Management Committee for sustainable development and effective management of each of the large and major irrigation systems developed. The Committee shall have the representation from water users, central government, provincial government and local government.
- The Government of Nepal will establish a Central Irrigation Development Fund by publishing notice in the Nepal Gazette from the prescribed date for overall development of irrigation systems and their sustainable management. The Fund Board shall be headed by the Secretary, Ministry of Irrigation. Following amount will be deposited in the Fund:
 - Amount received from the Government of Nepal,
 - Amount received from national or international agencies and organizations,
 - Amount received from interest, profit or other fees and taxes earned from the investment of the amount

of the Irrigation Development Fund,

- Other amounts as prescribed.
- The users of the irrigation system shall pay the prescribed irrigation service fee. Irrigation services shall be ceased for those users failing to pay the Irrigation Service Fee.

Policy and Strategic Framework for Irrigation Development

The Government of Nepal attempted to address the issues of increasing the performance and potentialities of irrigation sector through Water Resources Strategy (WRS) initiated in 2002 (WECS, 2002). It defined short to long-term institutional and physical targets and activities to be undertaken based on Integrated Water Resources Management (IWRM) principle including irrigation sector.

Place of Irrigation Development in Water Resources Strategy of Nepal

Beside other Water Sector Issues, the strategy document highlights Irrigation Issues as follows:

- Reorientation of supply-driven approach,
- Poor performance of irrigation systems,
- Lack of effective implementation of Agriculture Perspective Plan (APP),
- Farmers' dependency syndromes and sustainability,
- Problems of river basin management,
- Weak institutional capability,
- Symbiotic relationship between agriculture and irrigation (weak linkages), and
- Strengthening of WUAs.

Water Sector Objectives

Water resource development, like other national development agenda, should aim to contribute to improving the quality of life. Beside other objectives, the objective to increase agricultural production, productivity, and ensuring food security of the nation is prominently highlighted. Water Resources Strategy outputs will contribute to this goal through the achievement of short, medium and long-term purposes. These purposes have been defined as follows:

- *Short-Term (5 Year) Purpose:* Implementation of the comprehensive Water Resources Strategy provides tangible benefits to people in line with basic needs fulfillment, supported and managed by capable institutions of all stakeholders.
- *Medium-Term (15 Year) Purpose:* Water Resources Strategy is operationalized to provide substantial benefits to people for basic needs fulfillment as well as other increased benefits related to sustainable water use.
- *Long-Term (25 year) Purpose:* Benefits from water resources are maximized in a sustainable manner. To achieve these purposes, the Water Resources Strategy has defined ten strategic outputs. One of the specific outputs of the irrigation sector is to make: "Appropriate and efficient irrigation available to support optimal, sustainable use of irrigable land."

- National Water Plan (NWP), 2005.
- *The National Water Plan (NWP), 2005* was prepared in order to implement the provisions of the Water Resources Development Strategy approved by the government in 2002. It guides stakeholders to implement and manage resources and water related services including irrigation services in an integrated manner. The NWP recommends the short-term, medium-term and long-term program and project planning along with investment projection and institutional reorganization (Gurung 2007; Dhungel 2007).

Irrigation Policy and Agriculture Policy

The Agriculture sector and the irrigation sector as a whole, with the collaborative effort of both public and private entities, have to respond to translate those short-term, medium-term and long-term objectives of the National Water Plan. Agriculture Policy proposes to implement the Agriculture Perspective Plan (APP) by adopting more effective, liberal and market-oriented economic policies in the agriculture sector by promoting active private sector participation in agriculture inputs like (a) chemical fertilizer, (b) shallow tube wells and (c) micro-credits along with improvements in agriculture inputs, policy reforms and institutional restructuring. However, the time frame for the APP implementation was until 2015. Government of Nepal has formulated Agriculture Development Strategy, a long term vision for agriculture development.

Agriculture Development Strategy

One of the issues to address the periodic plans is the preparation of district/ river basin-based irrigated agriculture development strategy. The District Irrigated Agriculture Development Strategy (DIADS) was proposed as a tool for planning and selection of district level agriculture strategy, but the implementation of DIADS could not take place. This tool aims at getting the information of natural resources of the district for agriculture and irrigation planning.

Irrigation Institutions

Irrigation occupies substantial share of annual investment in the national budget. Along with the World Bank (WB), Asian Development Bank (ADB) and other donors, the Government of Nepal (GoN) has substantial share of investment in irrigation sector of Nepal. This is an important driver to promote irrigated agriculture, which occupies important place in domestic production as well as rural employment in Nepal.

There are different agencies, which influence the irrigation sector of Nepal. The National Planning Commission (NPC), Ministry of Irrigation (MoI), Ministry of Finance (MoF), and Water and Energy Commission Secretariat (WECS) are responsible for initiating appropriate policy on irrigation development in Nepal. Recently, the GoN has shifted towards mega-irrigation projects and inter-basin water transfer projects as well.

However, the micro-irrigation like non-conventional irrigation systems, small and medium irrigation systems also contribute to ensure food security. These policy making bodies have to take comprehensive approach to incorporate all these resources (mega, medium and micro systems) to decide on investment, choice of appropriate technology, water right issue on different water sectors, allocation of water resources to different sectors keeping in view the integrated water resources management program, direction towards management types and governance modes, etc.

Irrigation development and management has been undertaken by different agencies of the government and private sector in Nepal. The institutions that are contributing for irrigation development in Nepal are: (a) Department of Irrigation (DoI), (b) Department of Agriculture (DoA), (c) Ministry of Local Development (MoLD) through DoLIDAR (Department of Local Infrastructure Development and Agricultural Roads), (d) Ground Water Resources Development Board (GWRDB), (e) ADB/Nepal (f) Farmers' community, and private sector organizations (e.g., NGOs such as International Development Enterprises (IDE), SAPPROS/Nepal (Support Activities for Poor Producers of Nepal), etc.).

Similarly, the educational and research institutes like agriculture and engineering colleges and the Nepal Agricultural Research Council (NARC) are also important players to contribute for the better performance of irrigated agriculture. Among these different agencies involved in irrigation sector development, the DoI has a major share in promoting and managing the irrigation systems in Nepal. The DoI is involved in multiple facets of irrigation development. Prominent among them are surface irrigation system of all sizes above 25 ha (small, medium and large), ground water development by shallow tube well (STW) and deep tube well (DTW), and lift irrigation systems, including non-conventional irrigation techniques in water distribution.

Focus on Revitalization of Irrigation Systems in Nepal

The National Water Plan (NWP), 2005 puts a set of physical targets in irrigation sector for increased agriculture production. These targets are for round the year irrigation, increased irrigation efficiency, increased cropping intensity as well as increased irrigation facilities in the potential irrigable area.

Taking the irrigation facility base as 1.2 million ha in 2011, by 2027 (within 15 years) 442,000 ha irrigated area is to be added, if 97% of irrigable area is to be provided with irrigation facility. This will require adding about 30,000 ha irrigation facility each year for next 15 years according to NWP of Nepal. On top of that, effort must be made to increase cropping intensity, agriculture productivity and irrigation system efficiency.

In order to meet the above-mentioned targets to increase agriculture productivity and irrigation facility, revitalization in the irrigation systems must be undertaken.

Stages	Potential Irrigable Area, ha	Irrigated Area, ha	Round the Year Irrigation, ha
Stage I	1,700,000	1,207,000 (79%)	586,000 (49%)
Stage II	1,700,000	1,445,000 (85%)	924,000 (64%)
Stage III	1,700,000	1,649,000 (97%)	1,104,000 (67%)

Table. 1. Irrigable and irrigated area (ha)

The revitalization of irrigation systems should include (a) physical improvement, (b) increased irrigated agriculture productivity, and (c) institutional reforms.

Case studies of Irrigation Management Transfer (IMT) and FMIS of different sizes are referred. It is important to mention here. The annual loss of irrigated land is caused by flood, river bank erosion, landslides, unfriendly weather condition causing the destruction of crops, housing developments in prime lands and sand mining in the rivers. However, there is no comprehensive record which can help make a comparison of the newly added irrigated land with that of land loss by natural disaster and unplanned man made developments.

Improvement of Agency Managed Irrigation Systems (AMISs) through Irrigation Management Transfer (IMT) Program

It is reported that agency managed irrigation systems (AMISs) have poor performance and there are potentialities for their performance improvement through appropriate type of Irrigation Management Transfer (IMT). IMT is a process in which some functions and responsibilities of management, formally exercised by a state agency, are transferred to an organization of the users of the irrigation system. Appropriate IMT with well defined objectives to the users address the target of increasing agriculture productivity and better irrigation infrastructure performance. Hence, IMT attempts to address the problem of below capacity performance, poor O&M, negligible cost recovery, inadequate funds for management of irrigation systems and finally the problem hindering increased agriculture production. IMT is one of the most important methods of revitalization of irrigation systems.

It is recognized that there is scope for performance improvement of AMISs by;

- improving the service delivery through responsibility division between the agency personnel of DoI and water user associations (WUAs),
- support to strengthen the WUAs,
- the agency needs to consider that IMT is not just physical improvement, and
- it includes the institutional reforms and agriculture productivity improvement.

These components have to go together. One of the important features of IMT in the new approach adopted in Nepal is the signing of agreement between the farmers group and the agency with the responsibility division between DoI taking charge of maintenance and management of headwork and main canal, and WUA taking charge below the main canal. The agreement thus signed between these two parties includes the provision of penalty for failure to comply the terms of agreement by either party.

Modernization of Large Scale Farmer Managed Irrigation Systems (FMIS)

It is estimated that 70% irrigated area in Nepal fall in the category of farmer managed irrigation systems (FMISs) (Pradhan, 1988). FMISs have greater potentiality for management improvement and increased agriculture production. Recognizing the potential for improvement of these systems, the Nepal government has mobilized funds from donor agencies for their augmentation.

Two interesting examples of Nepal are presented here: the farmer managed Rani, Jamara and Kulariya Irrigation Systems (RJKIS) of Kailali District and the Rajapur FMIS of Bardiya District. Both of them are each about 15,000 ha and over a hundred year old systems. Both have the Karnali River, one of the big river systems, as the source of water. For RJKIS, the source is the Karnali and for Rajapur is the Geruwa, a bifurcation of the Karnali River. The water flow fluctuation in the river ranges from 173 m³/s during dry season to 16,000 m³/s during monsoon. The farmers have organized themselves to get irrigation water despite the huge fluctuation of river water. Within those 15,000 ha, there are several systems, but the command area is physically contiguous.

The Rajapur Irrigation System has potentiality for increased agriculture production. The objectives of the rehabilitation of Rajapur Irrigation System are: (a) increasing agriculture production and farm income, (b) protection of land erosion due to flood, (c) reduction of environmental degradation through decreased reliance on forest products for repair of irrigation systems, and (d) strengthening institutional base and technical capability of WUA members.

The loan covenant of the Asian Development Bank (ADB/Manila) stipulates that the farmers will get timely access to necessary agriculture support services. The completion report of ADB states that the absence of integrating these two elements (agriculture and irrigation) with the project has hindered farmers taking full advantage of improved irrigation facilities to increase agriculture production (ADB, 2003).

Drawing lesson from the Rajapur Irrigation Rehabilitation Project, Rani, Jamara and Kulariya FMIS of about 15,000 ha command area of Kailali district

located on the opposite side of Rajapur Irrigation System, the modernization of this system is designed in two phases with four components (WB, 2011). They are: (a) physical rehabilitation called scheme modernization, (b) strengthening water users associations, (c) agriculture production support, and (d) project management.

They have great potentiality for increasing agriculture production. Both these systems are flood irrigation types, not having any water control structures for proper water distribution in the command area. In the Rajapur Irrigation System as well as in the Rani, Jamara and Kulariya system at the first phase, it is proposed to have control structures at the intake point of the system. The stages of irrigation development can be characterized as, firstly, flood irrigation (capture the water when there is flood in the water source). The second stage of irrigation development is the establishment of control structure at the intake point so that water flow in the system can be regulated. The third development of the irrigation system is the installation of number of control structures and field channels in the command area so that water can be made available where water is in need for crop growth. The fourth stage is the automation of the regulators to let the water flow according to the size of the command area and demand of the users. Finally, the irrigation system will be designed in such a way that water distribution will be regulated by computer programming based on the moisture requirement to the crop roots. Many irrigation systems have come to third stage development in Nepal. However, government made a clear policy that the farmer managed systems will remain under the management of farmers even after major rehabilitation.

Towards Medium Size FMIS

FMISs are owned and managed by the farmers themselves. At present, about 40% of food requirement of the country come from these irrigation systems. Hence, they have an important role for food security as well as their contribution to the Nepalese economy. There have been many modes of intervention in the FMIS in Nepal (Ostrom, et al., 2011; ADB, 2006; WB, 2007). Irrigation and Water Resources Management Project (IWRMP), a project funded by the World Bank and Community Managed Irrigated Agriculture Sector Project (CMIASP) funded by Asian Development Bank have the objective to improve agriculture productivity of existing small and medium size FMIS suffering from low productivity and high poverty incidence and help enhance the livelihoods of the poor men and women. These objectives shall be translated by providing improved means for WUA empowerment, improving irrigation facilities, promoting agriculture extension, targeting livelihood enhancement to build human capital of the poor and strengthening policies, plans and institutions for more responsive service delivery.

Other Types of Irrigation Systems and their

Implications

Other important segment of irrigation sector which is unorganized yet contributes substantially to the food security of Nepal and helps alleviate the poverty is the small irrigation systems below 25 ha, utilization of groundwater through individually owned shallow tube well (STW), and micro-irrigation systems utilizing small local sources of water with different technologies. This sector deserves special attention to revitalize and consideration for physical improvement, support system for increasing agriculture production and policy and institutional arrangement and governance mode whereby users can derive benefit out of this sector. It is estimated that this sector covers thousands of hectare of agriculture land and millions of users both in plain area of Terai for STW as well as in the difficult inaccessible remote hill and mountain areas (Upadhyaya, 2000; Chapagain, 2000). Recently, there has been consideration of multiple use systems (MUS) of small source of water for drinking purpose as well as for economically productive activities (Pant et al.2006). Except for ground water utilization, there is no strong institution to promote and protect this category of irrigation systems with different technologies.

Multiple Approach in Irrigation Development

Out of those case studies, one finds that there are still potentialities to derive enormous increased agriculture productivity benefit from the revitalization of different types of irrigation systems in Nepal. With appropriate physical improvement and improved governance mode empowering the users group, the agency managed systems bring out their potentiality and improve under- performance. Similarly, appropriate physical improvement activities along with proper institutional arrangement and agriculture production promotion program would generate positive results to feed the growing population as well as meet the challenges of water scarcity. There is a need for considerations for the revitalization of small and micro- irrigation systems. The approaches of revitalization of this sector have to be unconventional irrigation rehabilitation and intervention program. The focus of revitalization of this sector of program must be the people and their way of managing natural resources within the community. The physical improvements of irrigation systems cost substantial investment. Hence, the Department of Irrigation and Ministry of Irrigation take high consideration while undertaking physical revitalization from poverty alleviation, gender concern, regional balance and inclusiveness.

Increasing agriculture production is the main agenda behind the revitalization of the irrigation systems. There are tremendous potentialities of increasing agriculture production through appropriate mix of improved water management, agriculture improvement technologies and market-oriented agriculture production. Rice production

occupies major share of irrigated agriculture. Out of 1.4 million hectare rice production area, about one million hectare has irrigated rice cultivation. Rice yield/ha is very low in the region, amounting in an average of 2.79 ton/ha (Upreti, 2007). However, records of production from agriculture research farms show that there is potentiality for increasing production of 6 ton/ha of rice. Similarly, pilot experiments of the adoption of the System of Rice Intensification (SRI) in Nepal show the yield of 6-10 ton/ha (Upreti, 2007; Uphoff, 2007). Other crops also have potentiality to increase yield.

The governance of irrigation management is important. The centralized management system of irrigation systems has proven that it is not conducive for better water management, resource mobilization and agriculture production. There is a big debate going on whether bureaucracy or community should be managing irrigation systems. There are even debates going on stating neither state nor private sector, but the community can better manage the irrigation systems (Ostrom, 1994). Therefore, revitalization of irrigation systems has to have multi-dimensional features to address resources (water), physical infrastructure (canal and other control structures) as well as placing the farmers in the driver's seat and creating appropriate governance procedures (irrigation institutions) (Ostrom et al., 2011).

A central agency is necessary for planning, investment, monitoring, and evaluation of the sector in the larger context. At present, one feels the absence of such a central agency to oversee the overall irrigation sector encompassing all sizes, types and technologies as the national resource to ensure the food security.

Changes in the priority of the irrigation systems and investment portfolio

Over period of time, investment in irrigation sector through public funding has increased. In late 70' and 80s, large scale systems were developed. Nepal has now 1.4 million ha of irrigated land out of 1.76 Million ha potential irrigable area. Irrigation facility development in the remaining potential irrigable area calls for higher level technical and financial challenges. Department of Irrigation has changed its role from constructing and managing the surface and some ground water irrigation systems to adaptation of new non-conventional irrigation technologies. DoI has changed its role from irrigation water management to water resources distribution for the benefit to the marginal farmers and deprived group of farmers. Non-conventional irrigation systems like drip, sprinkle, solar pumps, traddle pumps are promoted where water scarcity prevail, or water availability has been a major problem.

Department of Irrigation has changed its role from only infrastructure development to socio-economic change agent by making irrigation water equitably

distributed among all sectors of people both rich and marginal farmers to improve cultivated land to marginal lands as well. Department of Irrigation is making effort in its policy and program to have inclusive policy and gender equality. They are in appreciable directions that DoI is moving forward with, and yet there are many challenges that DoI has to face.

Changes in Irrigation Agency

Water resources management is a dynamic process which is influenced now by climate change and population growth. Water resources are getting scarce and the allocation of water in irrigation sector is also comparatively decreasing, in order to meet the expansion of irrigated area and cope with increasing food production for growing population.

Department of Irrigation has entered into high level multi-sector water resources management approach through inter-basin water transfer for expansion of irrigated area and hydropower generation through the head gain via water transfer from one basin to another. One inter-basin water transfer project called Bheri-Babai Diversion Multipurpose Project is under construction and another project called Sunkoshi-Marin Diversion Multipurpose Project for Bagmati Basin is under final study, in which both projects will have irrigation facility development as well as hydropower generation. It is yet to be decided whether DoI will also look after hydropower management or only take the royalty for department by assigning the management to other agencies. It may also be asked whether the Basin transfer program will be handled by the existing DoI or is there a need to create another entity to consider basin transfer program separately with an approach of integrated basin water resources management. Besides, as per the Constitution of Nepal, part of functions carried out in the past by DoI as a central organization, will be devolved to provincial and local government. Thus, role of DoI in the future will be limited to planning and developing large irrigation and multipurpose projects.

In five decades of Department of Irrigation's history, it has gone through many change cycles. Every time, it has proven that it can accept new challenges. Along with these changes, Department of Irrigation, now, should develop its own strong Research wing and form linkages with other research institutions within Nepal and elsewhere.

Changes in Farmers Organization

Conditions for a Functional Water Users Association (WUA):

At the very heart of any effective WUA is a functioning water share distribution system. The water share arrangement should ensure that each member of the irrigation community has a legitimate access to water

within the arranged rules, and it confers an obligation to contribute an agreed-upon share of the cost of managing water in the system. The concept of water shares unites two essential aspects of organizational operations - resource acquisition for operation and maintenance and water allocations along the canals.

Members of the irrigation committee should be irrigators who represent the various reaches of the canal system, and are fully accountable to their fellow irrigators.

WUA Dependency Syndrome

Almost all schemes of management transfer suffer from a dependency of the new organizations upon the government. Pradhan and Bandaragoda 1997, quoting a regional study of WUAs in South Asia, put the problem as follows: "Water Users' Associations have not been effective because they did not reflect the multiple needs of the farmers, rather they work as an extension of the irrigation department in many places. Water Users' Associations should develop a self-reliant basis for their functioning, in their areas of jurisdiction, while they pursue an interdependent relationship with the government agencies." This pattern of dependency on the promoting agency has been reported frequently, and from many different types of economic and political environment.

Definition of Success

We can define our concept of success in a management transfer operation relatively simply. Success is achieved when we have genuinely independent organizations, which choose their own objectives, make and amend their own rules, select their own leaders, raise and spend their own funds, and ensure rule-compliance through their own internal processes. If an organization exhibits these characteristics, it is likely that some of the government objectives will also be achieved, and that the dependency syndrome will come to an end.

This condition of independence is defined well in the three conditions quoted by Pradhan and Bandaragoda, 1997: the organization should become "self-governing, self-regulating and self-supporting." It is evidently necessary, as one of the first steps in the preparatory phase, to undertake consultation among the putative future members of the new organization, and to discover their objectives. It is not very likely that members will want to pursue a set of official objectives. However, if the WUA pursues objectives that its members do see as important, they may be amenable to making adjustments, so that some of the official objectives will also be addressed.

Transition from Agency to Farmer Management

It is important to understand the distinctive differences between agency management and farmer

management in terms of their intrinsic values. The irrigation infrastructure in agency managed irrigation systems (AMIS) is designed according to conventional engineering and agronomic practices. By contrast, irrigation infrastructure in farmer management system does not follow standard engineering design.

Department of Irrigation has to promote following features for Better Functioning WUAs

1. Wide participation of the members of the system and equal distribution of stakes among head, middle and tail-end farmers make a strong organization.
2. Mutual dependence between head and tail farmers due to difficulty of water acquisition or resource mobilization. Social cohesion leads to a more equitable distribution of benefits.
3. Transparency of activities, as demonstrated at the annual general assembly meeting of the WUA. Rules, regulations, statements of income and expenditures should be discussed. Elected members of the WUA should be accountable to the general assembly.
4. Resource mobilization based on equality. Cash, in-kind and labour contributions must be recorded properly. Accounts should be open to all members for inspection.
5. If water is to be considered as a community resource, the rules for its distribution must be agreed by all members. Decisions on water distribution should be made collectively and enforced by the committee. Punishments for non-compliance with the water distribution rules must be clear and understood.
6. Water rights should be clear and linked to obligations, including mobilization of resources.
7. The Executive Committee, formed on the basis of the voice of member farmers gives room for wider representation. It should be accountable to the general body.
8. The General Assembly should meet at least twice a year to approve rules and regulations for the management of the system.

These are general features of effective WUAs. However, the functioning of WUAs in practice is influenced by the availability of, other than water, the procedures for acquiring water rights and water distribution. The relationship of the WUA with the government agency and other external agencies is also very important.

Toward Self-Management of Irrigation Systems in Nepal

A farmer from Sindhupalchowk district of Nepal once told us that "the irrigation channel up there cannot stand in that fragile terrain only by iron rods and cement concrete, it is our organization which kept the irrigation channel functioning"

What the farmer is talking about is the social capital and farmer organization which have helped better utilization of the physical capital like channel, and natural capital like irrigation water. Individuals usually

derive the benefit of physical and natural capital but social capital, in contrast, is expected to produce goods that are more collective than just for individuals. The mutually beneficial collective action of farmers makes irrigation system perform better. This mutually beneficial collective action, in other terms, is the self-management of irrigation systems. It requires a change in the role of the government from implementers to facilitator. The government takes the responsibility of helping the farmers build up their management capacity and carry on further improvement activities through the WUA.

The role of the organized group of farmers becomes important. Hence, appropriate form of WUA becomes important. Such program helps promote self-management of irrigation systems.

Farmers Organization as Focal Point for Self-Management

The intelligence of the farmers is to be recognized and respected by the officials. Of course, many farmers are illiterate but not necessarily foolish. We must have faith on them and help develop their capacity to manage. Hence, the WUA formation needs to be carefully handled. It is necessary to the farmer's community to discuss about WUA. They need to develop trust among themselves and sense of cooperation. Reciprocity and mutual understanding among the farmers themselves are important conditions for proper functioning of WUA. With these conditions, social capital within WUA develops. This social capital will complement to physical and natural capital to increase their agriculture productivity. This comes only through frequent interactions among themselves.

Conditions for WUA Formation

It will be useful to consider establishing WUA on hydrological basis. These criteria will make it easy to identify the members of the irrigation systems who are water users. Consequently, resource mobilization for O&M and other purposes will be easy. List of water users and size of landholding must be prepared before the formation of WUA/ WUG. Based on the list, meeting of members of WUA has to be organized by the facilitator and inform about the role and responsibilities of the WUA.

Based on water distribution system, sanction for non-compliance and resource mobilization based on land holding has to be encouraged and incorporated in the constitution for the WUA.

Impact of Participation on Self-Management

Participation of the farmers during rehabilitation is important for institutional development as well as for good quality physical infrastructure construction. Externally imposed WUA would not be effective. Usually, the irrigation agency attempts to introduce "uniform"

rules in all irrigation systems without recognizing the diversity inherent in the irrigation systems. They are different from region to region. Even within a system, there are differences from area to area. Imposing prototype rules and regulations of WUA in the irrigators community would take away the opportunity of the irrigators community to craft the institution suitably to their specific situation and ecological conditions. The level of passive participation allowed in this process would deny people the opportunity to make "Collective choice" appropriate for their condition and environment. Because of low level participation in the process of rehabilitation and assistance to FMIS, the social capital development does not take place. If we take the rules and regulations as one of the attributes of social capital development formation, it is important to see how their rules and regulations as "structured social capital" have evolved. They have to evolve based on understanding, negotiations and cooperation among the users. Imposition of prototype rules and regulations to govern the irrigator's community would not contribute to promote social capital, which should act as glue to bring together the members of the irrigator's community and help promote self-management of irrigation systems.

In analyzing 102 irrigation systems of Nepal from Nepal Irrigation Institute Data Base (NIIS Database) stored in Workshop in Political Theory and Policy Analysis at Indiana University, on the impact of farmer participation in economic and technical efficiency, physical and agriculture condition, it is found that the systems with high level of farmer participation perform better (Joshi et al. 2000). The table given below clearly shows that the system with high level participation has good result on economic and technical efficiency. The physical conditions are considered much better. The difference of cropping intensity between head and tail is low. The water supply in head and tail is not much different. On the other hand, systems with low level participation have poor performance in economic and technical efficiency. The physical condition of the large percentage is not good, water supply between head and tail is different making scarce supply at the tail end.

	High Level Participation	Moderate Level Participation	Low Level Participation
Economic Efficiency	82.4% (16/19)	31% (21/66)	33% (9/27)
Technical Efficiency	73% (12/19)	13.6% (9/66)	22% (6/27)
Difference between head and tail cropping intensity	2.5%	3.5%	6%
Water supply at the tail end (Adequate and Predictable)	78.9% (15/19)	58.7% (37/63)	26.9% (7/26)

Table 2: Result of Farmers Participation Levels on Economic and Technical Efficiency and on Physical and Agriculture Conditions

Source: This table is adopted from Niraj Joshi, et al. 2000. "Institutional Opportunities and Constraints in the Performance of FMIS in Nepal."

The study shows clearly that the investment in physical infrastructure alone does not produce positive results. The formation of social capital compensates even in weak infrastructure. However, in the absence of social capital, permanent structures would also be less productive. Therefore, the social capital helps towards self-management of irrigation systems. With such management type, the important issue of equity, participation of the farmers, accountability and transparency are institutionalized.

Towards Self-management of Irrigation Systems

It is to encourage the irrigator's community to take the responsibility of management of irrigation systems. Since there have been changes in the management of state affairs and less importance given to state control of management of public enterprises and natural resource management, the community of irrigators have proved that they can manage systems in self-management mode.

In order to make self-management effective, active participation of the irrigators, polycentric mode of governance, effective water users associations and social capital development must take place. Hence, DoI is implementing WUA towards self-management.

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Prachanda Pradhan, born in March 1939, was Professor of Public Administration in Tribhuvan University, Kathmandu, Nepal. In 1972-75, he was Dean of Institution of Business Administration, Commerce and Public Administration, Tribhuvan University, Nepal. He earned his Ph.D. in Government from Claremont Graduate School and University Center, Claremont, California, in 1969. He was a Research Associate at John Kennedy School of Government, Harvard, in 1972, and a Fulbright Visiting Professor at Center for International Studies, Cornell University, in 1979 and Visiting scholar at Workshop in Political Theory and Political Analysis, Indiana University, USA in 2002. He is the Patron in Farmer Managed Irrigation System Promotion Trust, Kathmandu, Nepal. He has several books to his credit. He has worked in national and international organizations including worked at International Irrigation Management Institute (IIMI) based in Sri Lanka from 1986 to 1993. He has worked in Nepal, Bhutan, India, Bangladesh, Sri Lanka, Pakistan, Lao PDR, Vietnam, Nigeria, Niger and Guyana. Corresponding E-mail: prdhanpp@hotmail.com

Madhav Belbase is a Joint Secretary and presently working as a chief of Water Resources Division at Water and Energy Commission Secretariat of Nepal, a government organization and an apex body for plan and policy formulation in Water and Energy sector of Nepal. He has more than 30 years of experience in the field of irrigation and water resources planning and development in Nepal. He has served as Director General of the Department of Irrigation of Nepal for about two years. Under his leadership number of policy reforms and institutional reforms in irrigation sector including the drafting of Irrigation Bill, restructuring of Department of Irrigation, were accomplished. He authored and presented papers in national and international seminars and conferences and published articles related to irrigation and water resources issues in Nepal. Mr Belbase is actively involved in national and international professional organizations related to irrigation and water resources in different capacities and presently he is one of the Vice-President of International Commission on Irrigation and Drainage (ICID).

E-mail: belbasem@gmail.com

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