Infrastructural and Institutional Development in Sustainable Irrigation Management

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ABSTRACT

The central focus of this paper is to evaluate the effects of infrastructural and institutional development in Irrigation System Management in Bijayapur Irrigation System in Nepal, primarily the practice and relevance of institutional and infrastructural development in irrigation management system. It is found that the institutional and infrastructural development in Bijayapur Irrigation System Management, or the irrigation system management in general, was satisfactory but still need to be improved to achieve total sustainability, and the focus should be given on the involvement of socially excluded, marginalized group and women and equity in resource mobilization and water allocation. Study findings, in relevance to the characteristics of the study area, are expected to be positively supportive to the sustainable development of irrigation system management.

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1. Introduction

The twentieth century was characterized by the widespread use of the term development which aimed to bring about prosperity in the contemporary underdeveloped societies in terms of health, education and infrastructure. Underdeveloped countries during that time, and even today, used development as a tool to bargain with so-called prosperous western countries and acquired foreign aid to transform their societies. From historical perspective, the 1950s was dominated with paradigm of modernization, which was soon replaced by the paradigm of dependency in the 1960s. Then came the neo-liberalism in the 1980s with a few shifts in between 1960s and 1970s. In 1990s, the concept of sustainable development emerged with a big shift in development paradigm primarily focusing on empowerment and sustainability of resources. Carley and Christie (1992, p.3), for example, maintained that "development is the process by which the members of a society increase their personal and institutional capacities to mobilize and manage resources to produce sustainable and justly distributed improvements in their quality of life consistent with their aspirations".

Over time, traditional and indigenous societies also came under growing influence of sustainable development efforts. One of the key transformational effects observed in these societies was in their traditional irrigation system. Pradhan (1989a) affirmed that most of the farmer-managed tradition irrigation systems were found to be working satisfactorily but there were still several systems that did not operate as desired requiring some intervention from outside. Their unsatisfactory performance could be attributed to financial, technical, environmental, and organizational aspect, and it was therefore required to extend some assistance in order to rehabilitate them through government agencies and NGOs. But the outcomes were mixed due to specific nature of farmer-managed irrigation systems depending on their geographic location and the nature of the community they were operating and due to different participatory and cost-bearing approaches taken by involved implementing agencies.

Before 1950s, farmer-managed irrigation systems (FMIS) existed in several districts of the western hill region in Nepal including Kaski, Nuwakot, Palpa and Syangja. These systems were maintained through the compulsory labor contribution of the farmers whose rice fields were supplied with water. After 1950s, newly established Department of Irrigation (DoI) undertook several reconstruction and extension programs for FMISs under government funding. Best examples are Rajkulos (state canals) of Kathmandu and Pokhara valley. While many private systems were converted into the public systems then, the intent, however, was mostly to turn these systems into private organizations owned and managed by farmers themselves. This was necessary to instill the feeling of ownership and accountability toward its management in them which is one of the basic principles of the sustainable development. Even though many systems were managed by farmers or agency in Nepal during the time, the practice of irrigation development in the prospective of sustainable development was slowly starting.

On the other side, most of the traditional societies lacked the modern knowledge of managing water resources that led to the decline in the productivity of the land and pushed the societies gradually towards hunger, food insecurity and famine. Imposing advanced practices never emphasized the participation of local and indigenous people and their know-how which created a number of problems in managing water resources. Subsequently, participation was viewed as both mobilizing and empowering masses and produce better outcomes (see, for example, Korten, 1983; McPherson & MacGarry, 1987; Shukla & Sharma, 1997).
In this context, the main focus of this study is to evaluate the infrastructural and institutional development in Irrigation Systems Management in traditional society as a case study of Bijayapur Irrigation System (BIS) where beneficiaries are mostly marginalized people. The study also aims to diagnose the practice and the relevance of institutional and infrastructural development in irrigation management. The paper is organized as follows: Section 2 describes history of institutional and infrastructural development of irrigation in Nepal, methodology is outlined in Section 3, key findings are discussed in Section 4, and Section 5 concludes.

2. History of Institutional and Infrastructural Development of Irrigation in Nepal

Before 1950s, Nepal was far behind in formulating and implementing development plans and thus institutional foundation in Nepal's irrigation sector was virtually non-existent. During the time, the policy-makers used the idea of development in a limited sense only to the management and development of land, animals, and agricultural products. After 1951, the year when autocratic Rana regime was abolished, Nepal got exposure to the outer world and familiarized herself with the modern concept of development. When Nepal was in transition stage from one regime to another, the world was pre-occupied with the concept of development and modernization, owing primarily to Marshal Plan being implemented in Europe after World War II. Nepal's irrigation sector wasn't immune to this change. Pradhan (1989a) highlight the fact that the rapid expansion of public sector irrigation development in Nepal took place only after 1950s as there were only two public sector irrigation systems in operation prior to that (Chandra Nahar (Canal) and Judha Naha, constructed in 1920s and 1940s, respectively). Pradhan and Belbase (2018), however, postulated that the involvement of government in irrigation development started long while ago 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.

With little presence of public sector irrigation projects, farmer-managed irrigation systems (FMIS) scattered in the mountains, river valleys and Terai was a typical characteristic of Nepal's past irrigation system. The FMISs were first recognized by the government in 1980s. As an example, the First Five-year Plan of Nepal (1956-60) recognized only the existence of 14,000 hector irrigated land in Nepal which indicated the existence of only government-managed irrigation systems and this practice continued for next few decades. Canal Department was established in Nepal in 1952 which was characterized as the start of the bureaucratic foundation in designing and implementing the projects and it was then staffed by a chief engineer, two civil engineers, and few other supporting staff. A number of organizational reforms led Canal Department to a full-fledged Department of Irrigation (DoI) in December 1987. This was later expanded to Department of Irrigation and Water Supply under the Ministry of Works, Transportation and Communication, and further to Department of Irrigation, Hydrology and Meteorology (DIHM) under the Ministry of Water and Power. This Department was later brought under the Ministry of Irrigation and Agriculture from 1972 to 1980. Afterwards, the DIHM, which became Department of Irrigation (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. All these transformations characterize Nepal's constant and rapid evolution of irrigation management system and its modernization.

Turning to indigenous and traditional knowledge of managing water resources, while Nepal recognized the importance of such knowledge in line with emphasis put forth on it in other
parts of the world, the programs are questionable in term of following right measures to bring success. Pradhan (2003), for example, revealed that the non-recognition and ignorance of the indigenous knowledge and practices in managing irrigation systems led to the unsustainability or the failure of the government-assisted FMISs due to the lack of mutual beneficial collective action between government staff and farmers. Outsiders, including governments and NGOs, have tendency of rarely appreciating the validity of rural knowledge and their intervention often brings instability². Traditionally, both men and women were involved in agriculture in Nepal but the majority of farmers had no access to the modern agricultural inputs, practices, techniques, and particularly modern irrigation facilities. Nepal is mostly known as the land of farmer-managed irrigation systems (FMIS) and it is estimated that about 45% of cereal crop requirements of the nation is met by the production of FMISs. Some community efforts are exemplary to even prevent the influence of droughts and meeting water requirements to increase crop yield (Ansari & Pradhan, 1991).

With an increased involvement of government in irrigation sector beginning 1950s, efforts were concentrated only on the construction of infrastructure during initial period of its development. Less attention was given in operation and maintenance aspects of water management. The farmers were not involved in the various stages of the process such as policymaking, project planning, and design of infrastructure, project implementation, resource allocation, benefit sharing, and ownership of the system. The Water Users’ Associations (WUAs) were formed after the enactment of Irrigation Policy 1992 in all governmental projects. The policy classified the whole existing irrigation system of Nepal into four categories: Farmer-Managed Irrigation System (FMIS), Government-Managed Irrigation System (GMIS), Jointly-Managed Irrigation System (JMIS is the system where both FMIS and GMIS are merged), and Private-Managed Irrigation System (PMIS). These projects are collectively known as Agency-Managed Irrigation System (AMIS). There were also many traditional farmer-managed irrigation systems (FMIS) but these were not formally recognized by the government (although many did get some governmental or external support in various ways).

For any irrigation system, the governance of water is discussed in four different aspects. First, it starts with making the decision and implementing the strategies. Decision-making process involves, but not limited to, public meeting, formation of committee, and election processes or the independent judgment of a powerful individual or intervention or exercise of power. This can be implemented by selection of water users, or by staff employed by a Water User Association (WUA). Secondly, relationships between different groups of people among different stakeholders determine the processes and the decisions to be made. This includes diverse relationships among farmers themselves, between farmers and Water User Association (WUA) committee members, between farmers and agency staff (if the system is agency-managed), and between political power and donor agency or their representatives. The aspect of relationships depends on the nature of communication, access to information, trust and transparency of its implication. Thirdly, governance also depends on the way stakeholder’s decisions are shaped by values, institutions (laws and rules), and policies. Finally, it involves the exercise of authority. Stakeholders determine whether WUAs have the authority to implement decisions or not. The authority of WUAs depends

² For further understanding of such instabilities and a detailed discussion of infrastructural and institutional development in sustainable irrigation management, see Chambers (1983), Brokensha et al. (1980), Hobart (1993), Pradhan (1990), Rana (1988), and Pradhan (1983, 1989a, 1989b).
on relationships among stakeholders, influence or exposure of the members, exercise of power, and legitimacy and compliance with legal system of the nation.

3. Methodology

The study founds primarily on exploratory and descriptive research design. Data collection techniques were ranged from key informants interviews and participant and non-participant observations which was conducted in Bijayapur Irrigation System (BIS) of Kaski district in 2017. Some information was also collected from existing documents published by the government and other sources. Out of 809 Water User Groups (WUAs) in the study area, 81 (about 10%) of households were selected by using stratified random sampling method by dividing both canals into three strata: head, middle and tail. A total of 5 landless households were also included purposefully to make the study more inclusive. Similarly, one women and one marginalized household were purposefully selected from each strata of the each branch, by due consultation with key informants in order to make it further socially inclusive. Direct observation was a dominant form of gathering information.

4. Discussion and Findings

4.1 Canal Structure

There are three major categories of Bijayapur Irrigation System: head works, sand traps and canal system (main canal, branch canals, tertiary canals, and watercourses).

Head works

As observed in field study, BIS has a permanent run-off river type of diversion headworks located at an altitude of 800 meters from sea level in Bijayapur Khola at Sanghukomukh. Mathillo Kulo (upper waterway) and Tallo Kulo (lower waterway) were in existence before the rehabilitation in 1956 and were used to be diverted by using the locally available raw materials like wooden logs, branches, and boulders. The semi-permanent type of diversion was constructed at the place of Mathillo Kulo in cooperation with the Indian Cooperation Mission in 1956 for its rehabilitation. The Tallo Kulo was abandoned in consultation with farmers. The headworks consisted of wooden flash shutter hinged at the bottom and a canal head regulator. The present canal system, along with the headwork having gated regulator with a permanent type headworks, was constructed from 1983 to 1987 under the financial support of Agricultural Development Bank of Nepal. The heavy flood in 1999 damaged aqueduct-like structure across the river which was used as footbridge for crossing the river and the same flood also damaged gabion spillway but other parts were functioning well and even the diversion was not obstructed.

Sand Traps

The system does not have any dislodging basins and is not planned to construct even though the irrigation water to the agriculture fields of the farmers has transported quite considerable amount of sludge. But the system has three sand traps in the main canal near the headworks. Farmers claimed that the design of the traps is faulty because the silt deposits in opposite side of the sluice gate and needs to be excavated manually for removal.

Conveyance System

Water conveyance system includes the structures for carrying irrigation water from headworks to the fields of the water users. This task is performed by main canal, branch canals, sub-branch canals, and watercourses along with energy dissipaters and control structures.
Main Canal

Observation found that the water from headwork is carried to the branch canals through 4.32 kilometer long main canal, locally called *Mul Nahar* (main canal). The main canal is lined with stone masonry at both sides and concrete at its bottom throughout its length. The canal is designed to carry water at $6m^3/sec$. Initially along the left bank of the Bijayapur *Khola* (waterway), it passes through the stable ground and deviates eastwards just upstream of the Bijayapur Army Barrack, crosses the Prithvi Highway near Budhi Bazar, and runs parallel to the Highway. Consequently, the canal banks have been continuously lowered as a result of which, as stated by farmers, farmers placed sandbags on the canal banks in order to adjust their height in 1999 and 2002. As stated by the respondents, the problem still persists and need to be solved soon.

Branch Canals (BC) and Sub-Branch Canals

The main canal consists of four branch canals among which BC2, BC3 and BC4 off take from the main canal whereas the continuation of the canal after BC4 is considered as BC1. Each branch canals are rectangular in cross section with stone masonry lining on both sides and concrete lining at canal bed. These canals arise in many sub-branch canals. Many irregular shaped unlined outlets off take from branch canals are called sub-branch canals.

Watercourses

This is the last point of the water transmission system. It is also called *Garve Kulo* and passes inside the plot of land and connects each plot of land to the sub-branch, which ultimately connects to the branch canals, and so on.

4.2 Institutional Development

The operation and maintenance of any physical system requires an institution as an organized group of people with clear role of command and the discussion below outlines the framework used in Bijayapur Irrigation System (BIS).

Institutional History of Bijayapur Irrigation System

Respondents mentioned that the construction of BIS was carried out in 1956 by the agreement between Government of Nepal and Indian Cooperation Mission. Later, when the system was rehabilitated in 1986, with the financial aid from Asian Development Bank (ADB), the lower canal (*Tallo Kulo*) was abandoned. Even after rehabilitation, the water in the irrigation system was insufficient and it is, therefore, Seti feeder was constructed in 1989 which supplied the additional water required to fulfill the increased demand during dry season that normally runs between 15 October and 15 June. In 1993, Bijayapur Water Users’ Coordination Committee (WUCC) was formed with 11 members in its executive committee and was the first formal and legal committee of BIS. All members were only men at the time indicating that women were confined in household chores and were assumed that they couldn’t take right decision required for the operation and maintenance of the project. Similarly, all members represented only three caste groups: Brahmins, Kshetris and Gurungs.

The major function of the WUCC was to mobilize the people during construction period and support the construction contractor and district irrigation office (DIO). The committee was terminated later in between 1995 and 2002 due to the dispute that had been arisen between WUCC and DIO in an issue of canal maintenance. After realization at some point later that such committee
should reinstituted, Department of Irrigation (DoI) in Kathmandu took initiation and Water Users’ Committee (WUC) was formed in 2002.

Informants also stated that out of 60 water users at that time, 49 members were present in general assembly of water users and they elected 11 executive members of Water Users’ Association. This Committee also contained all executive members from the same three castes Brahmans, Chhetris and Gurungs, ignoring other minorities and Kumals, an indigenous group with significant presence in the community. Yet, this committee first time accepted the role of women in water governance and two women were selected as members as provisioned in the bylaw.

**Constitutional Provision of Water User’s Committee (WUC)**

According to rules outlined in the Water User’s Committee (WUC), general assembly is the supreme level and representation from each branch is mandatory. All 11 members of executive committee are anonymously selected by general assembly. The executive comprised of a chairperson, a vice-chairperson, a secretary, a treasurer, a joint-secretary and 6 members. Accordingly, the representation from each branch is made of 4 from BC1, 2 from BCs 2 & 3, and 3 from BC4. Chairperson is represented from BC1 and female members are from BC1 and BC2 (see Fig. 1). In this structure, the fundamental of equal representation was not followed properly though as none of the female members were BC3 and BC4.

**Figure 1: Organizational Structure of WUC**

**Function of Water User Committee (WUC)**

As noted in the field, WUC is responsible to conduct regular meeting, inform all branch committees and users for operation and maintenance of irrigation system, select trainees with close coordination of respective branch committee if training offered by concerned office or line agencies, and operate and maintain bank account. Similarly, this committee is also responsible in resolving conflict if arise in respect to the water distribution and other pertinent issues (such as conducting maintenance work at Aunsi (dark fortnight) and Purnima (bright fortnight), instruct Dhalpa (Water guard) and Katawal (Messenger) for necessary action and implementation of irrigation system, participate in the meeting of line agencies, and so forth). In addition, WUC has responsibility to carry out all the constructional work of Bijayapur Irrigation System (BIS) if the budget is provided by District Irrigation Office (DIO), mobilize the local resources, and protect the canal demarcation line.
Function of Branch Committee

Branch Committee’s functionalities are to operate and maintain the branch and sub-branch canals, arrange necessary equipment for operation and maintenance, inform all water users at operation and maintenance time, solve any problems if arises within the water users, nominate trainee if offered by the line agencies, and mobilize the local resources. As the functions seem to be conflicting with the functions of Water User Committee (WUC), these functions are practiced in coordination with WUC. The observation found that the branch committee is a new structure and official records have not been properly maintained in the committee.

Duties, Responsibilities, and Rules and Regulations of Water Users

Respondents mentioned that water users are the major stakeholders of the system. Even though there is a provision of various responsibilities within WUC and branch committee, water users also have certain duties and responsibilities. Such responsibilities are to maintain the damage parts of canal, participate in operation, maintenance of the canal as instructed by WUC or branch committee, participate in training, select the members for branch or WUC, and participate with tools in operation and maintenance.

Poor Inclusion in Irrigation Institution

It is argued that traditionally water sector activities need to be gender sensitive at all levels, from policy level to the community activities, and gender concerns need to be integrated in policies, plans, programs and projects. Women are found to be playing a central role in provisioning, managing, and safeguarding of water (Asian Development Bank, 1996). Historically, women in south Asia have played a critical role in water conservation. As water bearers, women had specialized knowledge of conservation, purification, and treatment of water. The role of South Asian women in water conservation and water management has, however, shrunk with modernization. Indeed, the paradigm of development has brought the subject matter of water management under the hegemony of “Masculine Reductionist Science” and helped displace women from water conservation and water management. This displacement, and the silence and powerlessness it has enforced on women, has distorted the basic configuration in this part of the world and impoverished them (Ahmed et. al., 1997). On the other hand, it is said that ensuring gender equity in irrigation is important because the level of agricultural productivity of women can be the same as that of men when they have access to the same quality and quantity of agricultural inputs, potentially increasing women’s yields by 20-30% above current levels (Food and Agriculture Organization, 2011a).

As observed in this study, the representation of women in main or branch committee is well provisioned in constitution. However, women are mostly seen to be participating in maintenance work and other physical works but the representation isn’t satisfactory in Water User Committee (WUC), particularly in decision-making role. Male members were found to be deciding all major problems of irrigation activities at the executive committee and general meetings of the WUC. It is a crucial point of debate that the involvement of women, including poor, is minimal in major decision-making processes and has to be addressed.

Management of Water Users’ Conflict

The observation revealed that earlier there was a chance that some users may not have equal benefits as others because the system was running in the principle of 'might is right' and some had to be alert even all over night to be able to secure water particularly at the time of
planting and irrigating the paddy field. But after the rehabilitation of the system and the additional supply from Seti feeder, the condition was greatly improved. According to the key informants, to minimize water conflicts during water shortage time they provisioned Panibause (water guard) and its usual role was to do surveillance and guarantee regular supply of water for all. It is quite interesting that Panibause should have some special skills like physically strong, having skills of fighting, and talkative. This could potentially be the reason for gradual reduction of conflicts that was happening during the time. The cost of Panibause should be borne by the landowner though.

5. Conclusion

The institutional development of irrigation system in the study area was found to be gradually advancing from ancient Mukhiya, Jimuwal, Jimindar systems to the modern Water Users’ Association (WUA) system. Upon diagnosing the institutional development of Bijayapur Irrigation System, it was observed that the subsistence in farming was progressively turning into the sustainably developed farming, yet many shortcomings were still present. The feeling of ownership, accountability, and strength of the decentralization were key areas of development in utilizing common resource of irrigation but there existed less awareness among the water users for its sustainability. The unsolved issue of equity among water users of head, middle, and tail regions still existed significantly and needed more attention. This is significantly causing the goal of sustainable development and good governance being still far to be achieved.
References


