Symposium on Nexus Challenges in Irrigation Institutions

Edited by Prachanda Pradhan
Published by FMIST Nepal, 2018
# Table of Contents

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction of the Theme of Symposium</td>
<td>1</td>
</tr>
<tr>
<td><strong>Key Note Speech</strong></td>
<td>5</td>
</tr>
<tr>
<td><em>Douglas J. Merrey</em></td>
<td></td>
</tr>
<tr>
<td>Benefit Sharing between Hydropower and Irrigation in Nepal: A Case Study</td>
<td>22</td>
</tr>
<tr>
<td><em>Prachanda Pradhan and Devesh Belbase</em></td>
<td></td>
</tr>
<tr>
<td><strong>Panel discussion was initiated in the second session of the symposium</strong></td>
<td>28</td>
</tr>
<tr>
<td><strong>Bio-data of Panel Members</strong></td>
<td>31</td>
</tr>
<tr>
<td><strong>Presentation by panel members on the issues assigned to the eminent panel members</strong></td>
<td>33</td>
</tr>
<tr>
<td>Nexus Challenges to Irrigation Institutions</td>
<td>33</td>
</tr>
<tr>
<td><em>A. Hafied A. Gany</em></td>
<td></td>
</tr>
<tr>
<td>Nexus Challenges in Irrigation Institutions from Nepal Perspective</td>
<td>37</td>
</tr>
<tr>
<td><em>Susheel Acharya</em></td>
<td></td>
</tr>
<tr>
<td>Issue on Nexus Challenges in Irrigation Institutions</td>
<td>41</td>
</tr>
<tr>
<td><em>Masayoshi Satoh</em></td>
<td></td>
</tr>
<tr>
<td>Development and Challenges of WUA in China</td>
<td>43</td>
</tr>
<tr>
<td><em>Ding Kunlun</em></td>
<td></td>
</tr>
<tr>
<td>Nexus Challenges to Irrigation Institutions</td>
<td>46</td>
</tr>
<tr>
<td><em>Ashwin B. Pandya</em></td>
<td></td>
</tr>
<tr>
<td><strong>Overall View of the Symposium</strong></td>
<td>50</td>
</tr>
</tbody>
</table>
Introduction of the Theme of Symposium

Prachanda Pradhan
Facilitator of Symposium Program

In the 8th Asian Regional Conference of International Commission on Irrigation and Drainage (ICID) selected 6 Sub-themes. One of them is on Enabling Water Users Institutions (WUIs) for sustainability of irrigation Systems.

The thrust of the sub-theme is to enable Water Users Institutions (WUIs) for sustainability of irrigation systems which includes performance assessment, enterprising, and sustainability of WUIs; institutional and policy landscape of irrigation / drainage sectors; process and procedure of participatory irrigation development / operation / maintenance in various countries; role of irrigation/ farmers / water users’ organization in improved irrigation system performance; etc.

In this sub-theme, many papers were received and presented in the conference. Along with paper presentation, a symposium of eminent luminaries of irrigation development and management was organized focussing on “Nexuses Challenges in Irrigation Institutions”. There were two parts of symposium; one started with key note speeches by Dr. Asit Biswas (video presentation) followed by Dr. Doug Merrey and case study presentation by Engineer Devesh Belbase. The second session was the panel discussion by the event personalities from Nepal, India, China, Japan and Indonesia.

The responsibility of the organization of this symposium was assigned to Farmer Managed Irrigation Systems Promotion Trust (FMIST) and Dr. Prachanda Pradhan, Patron of FMIST took the responsibility of organizing and conducting the theme.
## Agenda

### Plenary-5 Symposium: Nexus Challenge to Irrigation Institutions

Day 2: Thursday, 03 May, 2018  
Hall: Regal 1  
Time: 1:30 PM - 3:00 PM  
Coordination by: Ashok Gautam

<table>
<thead>
<tr>
<th>Agenda</th>
<th>By</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introduction to Facilitator</td>
<td>Mr. Ashok Gautam</td>
<td>2 min</td>
</tr>
<tr>
<td>2. Introduction of the Theme of Symposium</td>
<td>Dr. Prachanda Pradhan</td>
<td>12 min</td>
</tr>
<tr>
<td>3. Video Presentation</td>
<td>Dr. Asit Biswas</td>
<td>16 min</td>
</tr>
<tr>
<td>4. Key Note Speech</td>
<td>Dr. Doug Merrey</td>
<td>30 min</td>
</tr>
<tr>
<td>5. Paper Presentation on &quot;Irrigation and Hydropower in Nepal&quot;</td>
<td>Mr. Devesh Belbase and Dr. Prachanda Pradhan</td>
<td>20 min</td>
</tr>
<tr>
<td>6. Questions and Answers</td>
<td>All</td>
<td>10 min</td>
</tr>
</tbody>
</table>
2. **What this picture tells us?**

This is a picture from Argeli Saili Kulo of Palpa district. This is over hundred year old system and the wooden proportioning weir now replaced by concrete but it is still in use in the system. The messages of this picture are:

- Water is community property.
- Water allocation is done within the community so irrigators from the system are present to see the appropriate fixing of the weir allocating water to different sections of the command area.
- Based on water allocation, water distribution is done.
- Water allocation is transparent.
- Resource mobilization is based on the amount of water title.
- Water title implies obligations of the users so that O&M is done on that basis.
- In order for the fulfillment of obligations, record of the landholding and beneficiary list is kept.
- Decisions are made in the general assembly and executive committee implements them.
• In order to see the implementation of the rules and regulations of the system, users committee is formed and it is accountable to the general assembly.

• Non-adherence of the rules will be subject to punishment which will be collectively decided and implement the punishment collectively.

• Rules and regulations (may be written or unwritten) are known to all members of the community.

• All these features are possible because of strong social capital development in the irrigator’s community over long period of time.

The irrigation system consists of multiple disciplines. They are:

1. Hydrology,
2. Hydraulics,
3. Civil Engineering,
4. Soil Science,
5. Agronomy,
6. Institutions and organization,
7. Agriculture Marketing.

Hence, they involve so many disciplines and so many institutions.
Key Note Speeches: With this introduction of Symposium theme, key note speech by Dr. Asit Biswas was screened, see link: https://www.policyforum.net/podcast-feeding-world/. Followed by this video screen, Dr. Douglas Merrey presented his key note speech. The text of his key note speech is attached herewith.


Douglas J. Merrey
Independent Consultant, Gainesville, Florida, USA
Email: dougmerrey@gmail.com

Abstract

The paper begins by discussing important lessons learned during the past fifty years on promoting water users’ associations for management of both small- and large-scale irrigation schemes. It argues that we must conceptualize irrigation as complex socio-economic-agro-ecosystems, not simply as infrastructure delivering water to farmers’ fields. Further, in the 21st century, irrigation farmers face many new challenges: the nexus of water-food-energy; the impacts of climate change; growing competition for water from other users; and rapidly changing markets. Currently, neither water users’ associations nor government irrigation agencies are “fit for purpose” to face these challenges. The paper concludes with five recommendations on the steps needed to support smallholders’ water users’ associations to be successful. These are: 1) radically transform existing government irrigation policies and agencies to enable them to support water users’ associations effectively; 2) recognize that water users’ associations have more functions than managing irrigation water; 3) invest fully in “software” – training and institutional support to water users’ associations; 4) facilitate and guide processes of social learning and institutional creativity (“bricolage”); and 5) support water users to gain access to and use new water management technologies.

Key words: Agro-ecological systems; collectively managed irrigation; institutional bricolage; water users’ associations
1. Introduction

Before I start, I want to thank the organizers of this ICID Conference for inviting me to speak. I am especially grateful to my old friend and colleague, Dr. Prachandra Pradhan. We met when we were colleagues in the early years of the International Irrigation Management Institute (now International Water Management Institute). We have remained friends since then. Dr. Pradhan has made enormous contributions to our scientific understand of farmer-managed irrigation systems and has raised their profile and helped us understand how important these systems and smallholder farmers are. Nepal is very lucky to have such an insightful and inspiring champion of farmer-managed irrigation, which remains the foundation of Nepal’s food security and economic growth. The only other presentation I have made to an ICID conference was at a 1987 conference hosted by Egypt. I presented on the sociology of warabandi. I was introduced as the first social scientist ever to speak at an ICID conference. I do not know whether this is really the case, but I am honored to be back speaking to this august body. I know ICID has changed a lot since those days. My paper falls under the conference theme, “Enabling Water Users Institutions (WUIs) for sustainability of irrigation systems”. I was asked to focus on “Nexus Challenges” facing irrigation institutions. I take this to mean that in the 21st century, the challenges faced by irrigation institutions, especially farmers’ irrigation institutions are a lot more complex than what was previously understood. Farmers still need to be concerned about management, maintenance and performance of their irrigation system. But they also need to worry about the sustainability of the water resource on which they depend, competition for that water from other users leading to growing scarcity and potential conflict, and often to rapid decline in water quality. They have to worry about the impact of climate change on their water supply and on the productivity of the crops they grow, and markets both for purchasing inputs and selling their produce profitably. This sometimes leads to water users’ associations getting involved in marketing, warehousing, and providing credit to the members, among other functions – going far beyond basic water management.

So, the plan of this paper is as follows: I will define and then focus on collectively managed irrigation and offer a brief, somewhat personal, perspective on the evolution and results of policies towards promoting farmer organizations for irrigation, based largely on research since the 1970s. I will draw on cases with which I am familiar – I acknowledge there are many other cases with which I am less familiar. This historical review will carry us close to the present and provides the foundation for understanding and addressing the challenges of how to support collective management of irrigation in developing countries in the 21st century. My use of the term “collectively managed irrigation” covers both smaller farmer-managed systems (“FMIS”) and large-scale agency-managed irrigation systems.
2. **WUAs in the Second Half of the 20th Century**

Let me start by distinguishing “individualized irrigation” from “collectively managed irrigation”. Individualized irrigation is becoming increasingly common as farmers acquire relatively low-cost pumps to bring water to their fields. In principle, this enables a farmer to irrigate his or her land without much regard for other farmers. Indeed, in research in Ethiopia focused on farmers who are members of farmer-managed collective schemes, those who had purchased pumps told us they did so in part to escape from the responsibilities involved in shared management of the older scheme (Dessalegn and Merrey, 2015).

Our research showed, however, that this perception of independence is a mirage: those pumping with no limits are having serious impacts on the availability of water for other farmers. This is an increasingly common occurrence and presents its own complex institutional challenges. My talk will focus on collectively managed irrigation, and the institutional arrangements through which farmers cooperate and share costs and responsibilities, as well as benefits. Infrastructure that is constructed to capture and transport water to a group of farmers, or many groups of farmers, requires institutional arrangements to construct and then operate and maintain it. This can, in principle, be done by a government agency or a private firm without involving the users – i.e. the farmers – aside from asking them to pay fees. But this is rare. There are two common models for managing irrigation schemes serving groups of farmers. One is complete ownership and management by the farmers themselves, through either informal or formal institutional arrangements – “FMIS”. The other is management of larger infrastructure by a government agency with farmers taking over at a defined “handover” point – for example a field channel serving a group of farmers. These groups of farmers may also work through informal institutional arrangements (for example, warabandi in Pakistan and northern India), or through more formal organizations, often called “water users’ associations” (“WUAs”). I use “water users’ association” as a generic term that applies to all farmer-based organizations intended to manage water for irrigation. Governments, international finance institutions, NGOs and researchers have been promoting water users’ associations for managing irrigation since at least the 1970s.

My career got its start when I was hired by an American university for the “On Farm Water Management Project” funded by USAID in Pakistan in the late 1970s. My main assignment was to work with a Pakistani sociologist to carry out research intended to prepare the ground for promoting water users’ associations. The project actually did lead to legislation in Pakistan’s provinces for establishing water users’ associations, though in some cases their functions and membership were limited. Subsequent legislation in the late 1990s pushed by the World Bank led to fairly radical reform and a stronger role for farmers in managing the Indus irrigation system – at least on paper (Bandaragoda, 1999). At the same time, other Asian countries were pilot testing ways of organizing farmers on irrigation schemes. Philippines, Nepal, and Sri Lanka were early experimenters and their experiences have been documented by many articles and books. I had the good fortune to be
directly involved in a major project in Sri Lanka, the Gal Oya Water Management Project, funded by USAID. In this project, the American and Sri Lankan partners worked with the Sri Lankan Irrigation Department both to develop and test both an approach to organizing WUAs using “institutional organizers”, drawing on Philippines’ experience with “community organizers” (Uphoff, 1992); and to develop a model for participatory planning and implementation of necessary infrastructure improvements and “joint management” of Sri Lanka’s major irrigation schemes. The project also piloted an approach to rehabilitation of irrigation schemes that subsequently was called “pragmatic rehabilitation”. This was based on the premise of “if it isn’t broke don’t fix it;” in other words, focus on making critically important repairs and upgrades but don’t try to remodel and make “perfect” the entire system.

The International Irrigation Management Institute (IIMI) was established in Sri Lanka in the mid-1980s as the Gal Oya project was finishing. IIMI staff remained involved with the Sri Lankan government to continue pilot testing and evaluating various approaches to organizing farmers and giving them a stronger legally supported role in scheme management. Again, I had the good fortune to be part of this process, which culminated in major policy reforms and legislation to support a stronger voice of farmer organizations (Merrey, de Silva and Saktihivadivel, 1992). IIMI research also demonstrated that the pragmatic approach to rehabilitation combined with a strong emphasis on strengthening capacity of farmers, and of engineers to work with farmers, led to higher and more sustainable benefits than the more expensive hardware-focused approaches being promoted by some of the international financing agencies (Kikuchi et al., 1992; Amarasinghe et al., 1998).

In Nepal, Sri Lanka, Philippines, Indonesia and elsewhere, on farmer-managed irrigation systems, policy shifted to finding strategies to help farmers upgrade their system while also strengthening – not weakening – their capacity to manage their system (previous policies had often undermined the existing institutional arrangements). Field research by IIMI and others in Nepal, in which Prachandra Pradhan was closely involved, provided much of the data and insights for Professor Elinor Ostrom’s work identifying basic principles underlying successful collective management of natural resources (e.g. Ostrom, 1992; Ostrom et al., 2011, Pradhan, 2012). Professor Ostrom won a Nobel Prize in economics based on this work. On agency or government managed systems in several Asian countries including Nepal, models were tested that involved “joint management”. In this model, WUAs directly manage lower-level canals, and their representatives sit on committees with engineers and other officials to make decisions on scheduling of water releases, allocation and use of O&M funds, and the like. Some countries, for example Sri Lanka, enshrined this joint management model in law, replacing previously chaotic seasonal mass meetings with farmers.

Other countries took up this type of reform during the 1980s to early 1990s, including Egypt, India, Indonesia, Thailand, and People’s Republic of China. In the early 1990s, with World Bank support (and sometimes pressure), a few countries
carried out larger-scale reforms, with Mexico providing a model for others like Turkey and South Africa (Johnson, 1997; Faysse, 2004; Ghazouani, Molle and Rap, 2012). We also began to see some interesting case studies of successful institutional reforms at the local level from the People’s Republic of China (e.g. Zhang et al., 2013).

In the 1970s and 1980s, some of us were very optimistic and idealistic: we thought that if we could "get the process right" (Uphoff, 1986) and promote changes in the mind-sets and structures of traditional irrigation departments, a process of rural democratization might be initiated. However, in most of the cases where WUAs were promoted on larger schemes, the main goal of the government was to off-load the financial responsibility for O&M. Sometimes the additional justification offered was that it would improve irrigation performance. However, most of the research on the impact of transferring some aspects of management to WUAs carried out by IWMI and others has demonstrated very little real impact either on mobilization of O&M resources or on agricultural productivity (e.g. Vermillion, 1997). Overall, and despite some exceptions, it is fair to say that governments, donor agencies, and indeed farmers as well as researchers have been disappointed with the results of several decades of promoting WUAs.

3. Has the 20th Century WUA Model Failed?

This leads to asking a serious question: has the 20th century water users’ association model failed? Overall, there is certainly a large gap between the expectations of the proponents of this reform and the results. The performance of both farmer-managed and government-managed irrigation schemes serving smallholder farmers is still way below the potential in most Asian and African countries. This is so regardless of the indicator used for measuring performance: equity and timeliness of water distribution, matching water supply to demand, irrigation “efficiency”, water productivity, or yields and profitability. Collection of service fees sufficient to cover the full cost of irrigation O&M is the exception, not the rule (and found only on systems serving well-capitalized commercial farmers). Some countries, such as Sri Lanka, found it politically impossible to sustain its attempt to collect irrigation service fees, and had to resort to giving contracts to water users’ associations to carry out basic maintenance of lower level canals. In Pakistan, the irrigation fee rate has not been increased in any province since the early 2000s.

So why has the water users’ association reform model been such a disappointment? The reasons vary among countries, and a full analysis would require a long paper in itself. Here, I will point to a few factors that I believe were important, with a focus mostly on large government-managed schemes.

First, there was considerable confusion and disagreement about the objectives of the irrigation reform process and specifically of organizing formal water users’ associations. Were they really for the benefit of the farmers? Or was their purpose simply to off-load the significant liability that the costs of O&M entailed? There were
no transparent and agreed indicators for success. Clearly, farmers are interested in maintaining and improving the water delivery service while limiting the cost to them – which seems reasonable given their low incomes. Governments tended to promise that the service would improve – if the farmers would take on the responsibility for improving and maintaining lower levels of large schemes while also paying fees to cover the government’s costs. In Sri Lanka, farmers did pay newly-introduced fees the first year, but found that service did not improve, and indeed it was not clear the funds were being plowed back into maintaining their system (it wasn’t). Similarly, in Pakistan, after the introduction of the 1997 reforms, collection of the irrigation fee (abiiana) increased, but quickly dropped off as it became clear that funds were not being used as promised. The total collected covers only about 20% of the O&M budget (which itself is too low to cover the real costs of maintaining and managing the system). To put this observation in different terms, there was an implied contract between the farmers and the government: if the farmers took on additional responsibilities and expense, the government would improve and maintain the irrigation service provided. However, in many cases, the government broke the contract. Irrigation service did not improve and there was no transparency regarding the use of the funds. Farmers became disenchanted.

Most of us who were researchers or consultants trying to support the development of strong farmer organizations recognized that they could succeed only if there were also major reforms in government policies and the structure of government irrigation bureaucracies. A favorable policy environment, for example clarity on the rights of water users’ associations, on water rights, and on ownership of irrigation infrastructure, was a prerequisite for sustainable farmer irrigation organizations. This is found in countries where water users associations are strong, for example USA, Taiwan, Japan and Australia. South and Southeast Asian and African countries did not create this favorable policy environment. Further, the strong civil engineering-dominated hierarchical irrigation departments, most of them created during the colonial era in South and Southeast Asia, successfully resisted making the major reforms that were needed to support farmer irrigation associations (Merrey et al., 2007). Some of them partially adapted, for example the Sri Lankan and Nepali Irrigation Departments did become much more adept at working with farmers in the management of irrigation schemes. In Pakistani Punjab, Andhra Pradesh in India, and a few other places, the Irrigation Departments have adopted some new technologies and practices. But in general, these departments retain their traditional structures and culture and are not “fit for purpose” to face 21st century challenges. I return to this in the conclusions.

Another factor was the reluctance to invest adequate resources in building the capacities of farmer irrigation organizations. For example, both the Philippines and Sri Lanka pilot-tested the use of well-trained and highly motivated young community organizers that facilitated the development of water users’ associations and provided training in a variety of technical and organizational skills. But when it came time to scale these efforts out, they were seen by engineers, politicians and donors as being “too expensive” – even though the cost was a small fraction of the
hardware cost. Governments and donors have consistently under-invested in the software required to sustainably improve and manage irrigation hardware. This underinvestment in capacity building continues today and is a major problem.

A related problem is that in too many cases, “paper” water users’ associations were created. This has two dimensions. One is that governments have often adopted legislation that imposes specific organizational structures and procedures on the water users’ associations. The organizational constitution and bylaws are fixed by law, and not developed by the users in an organic process. There is now a large scientific literature showing that imposing organizational structures on local communities rarely works as planned (e.g. IWMI, 2011; Mukhtarov et al., 2015; Kazbekov et al., 2015). Rather, it is important to facilitate and encourage a flexible creative institutional innovation process led locally – what is called “institutional bricolage” (Cleaver, 2012; Merrey and Cook, 2012). I return to this below.

The other dimension of the creation of “paper” water users’ associations is that too often the process involves a government official arriving in a community, organizing a meeting, and simply getting signatures to show that a water users’ association has been created. This fulfills the letter of requirements by donors and governments that farmers form a water users’ association and “participate” in an irrigation construction or rehabilitation project. But clearly, there is no real organization at all. There are serious problems at the local level as well. In many rural communities, there are high levels of socio-economic inequality, usually based on land tenure arrangements, political power and gender: even women who own and operate irrigated farms usually have no real voice. It is no surprise, therefore, that water users’ associations are often dominated by a few powerful men, who tend to reap most of the benefits while failing to shoulder their fair share of the costs. It is extremely difficult for government officials to overcome these deep seated structural inequities; policies such as allocating some seats to women on decision-making councils rarely truly empower women.

To conclude this section, I am certainly not claiming that the past fifty years of efforts to support farmer irrigation organizations has failed. We know there are many cases of water users’ organizations that do provide services to their members. But I am saying that we did not achieve the expected results of creating a sustainable, prosperous equitable irrigated agricultural sector in which the farmers play a leading role and along with consumers are significant beneficiaries. Most large and small irrigation schemes continue to fall far short of their potential productivity and profitability, and in some cases face existential threats as aquifers are pumped dry, water quality and soil fertility decline, and competing urban and industrial water users take ever larger shares of the limited water resource.
4. Moving Forward in the 21st Century

4.1 Current status

Even if the past results were disappointing, we have learned a lot about what it takes to support empowering irrigation farmers. The research I have seen during the 21st century on water users’ associations has largely confirmed the lessons of the 20th centuries but, with a partial exception I will address below, has not offered new insights or breakthroughs. My work is now focused more in Africa than Asia, but what we see there largely confirms previous findings from Asia: governments are repeating the same mistakes we saw in the 20th century, with similar results (e.g. Yami, 2013). There are many published papers from Africa showing that in general, provision of irrigation does indeed reduce poverty and increase agricultural production (e.g. Tesfaye et al., 2008; Gebregziabher, Namara and Holden, 2009); but the weakness of farmer organizations combined, in some countries, with an unfavorable policy environment, limits the benefits achieved and undermines the long-term sustainability of both farmer-managed and jointly-managed irrigation schemes. But work on other irrigation-related issues has shown new insights, again mostly in Africa but applicable to Asia as well.

For example, there is a growing literature on “farmer-led irrigation”, which has revealed that African farmers are investing in mostly individualized irrigation technologies such as pumps and drip irrigation (Woodhouse et al., 2016; Merrey, 2018). Much of this investment is “invisible” to governments. This trend is replicating one that began earlier in Asia. It turns out there is a lot more potential for exploiting shallow aquifers for small-scale irrigation in sub-Saharan Africa than had previously been assumed (Pavelic et al., 2013a, 2013b). And in part because of this, it is now clear there is a lot more irrigation occurring in Africa – mostly on farmers’ own initiative – than is captured in official government or FAO figures. Evidence from satellite imagery shows that the irrigated area in SSA is two to three times the official figures; in Ethiopia, the irrigated area may be as much as 4.1 million hectares – 14 times the official figure! Until recently, the rate of increase in irrigated area in sub-Saharan Africa was very low, but this is now changing as new technologies and market opportunities arise (Merrey, 2018).

I mentioned an exception to the lack of new insights on water users’ associations in the literature coming out of Africa. A set of case studies of small community-managed irrigation schemes in three countries in southern Africa (Mozambique, Tanzania and Zimbabwe) has focused our attention on the complex set of reasons for the continuing low performance of these schemes. While the specific findings and recommendations vary in the three countries studied, the broad finding is clear: reform of currently insecure land (and water) tenure, strengthening farmer organizations, and reforming policies so that governments step back from scheme management and foster market access are required (Mwamakamba et al., 2017).
Four lessons emerged that are broadly applicable (Pittock et al., 2017; DWFI, 2017):

1. Because small-scale irrigation schemes are complex systems, multiple, concurrent interventions are required to transform them to more profitable and sustainable states.

2. It is as important to invest in people as in hardware to achieve success: “soft barriers were most limiting for the farmers.”

3. Governments need to clarify their objectives and empower farmers. Farmers should be encouraged to produce profitable crops for local markets, and to expand their enterprise where they can.

4. Effective markets provide both the incentive and the means to invest: “it is this positive reinforcement from the agricultural market that will maintain more sustainable and profitable irrigation.”

These studies bring out two critical points: first, there is no single reason for the disappointing performance relative to the potential of smallholder irrigation in general, and water users’ associations in particular; therefore, there is no “silver bullet”. Rather, it is critically important to address multiple issues simultaneously. Second, irrigation systems, both small and large, are complex socio-economic-agro-ecological systems, or in Ostrom’s (2007) terms, “Social- Ecological Systems” (SES). They are nearly always multi-purpose water delivery systems, and not limited to irrigation supply. Therefore, interventions must be designed based on an understanding of the entire system to avoid unanticipated negative impacts.

A third important point, not captured specifically in these studies, is that irrigation farmers must be prepared both to address a range of entirely new challenges such as climate change and competition for increasingly scarce water; and to respond to new opportunities and adopt new technologies and practices that will enable them to meet the new challenges and sustainably achieve high levels of production and profitability. This makes it even more imperative that they themselves form effective democratic organizations.

4.2 The way forward

In this section I outline some of the steps and requirements I believe are critically important to enable smallholder farmers to organize themselves effectively, reach their full potential in terms of production, profits, and quality of life, and adapt to nexus and climate change challenges. It is not exhaustive, but I believe all of these points are necessary.

Policy and institutional transformation

In 2007, the Comprehensive Assessment of Water Management in Agriculture reviewed the challenges as then perceived of making more productive use of water for agriculture (Molden, ed., 2007). The chapter on policies and institutions argued
that even with the growing role of markets, the state must continue to play a central role in water management. However, as currently structured, state agencies are not as effective as is needed. While recognizing the “inherently complex, political, and contentious nature of institutional transformation”, the chapter argued that countries should develop a strategic plan to guide reform. The plan should be flexible, based on experience, be context-specific, and responsive to new opportunities (Merrey et al., 2007). Unfortunately, this advice was not heeded.

Now, a decade later, it is clear that we underestimated how rapidly conditions would change: climate change has exacerbated changes in rainfall patterns more rapidly than anticipated; and the energy-food-water security nexus is tighter than we expected. Therefore, I believe that it is now even more critical for governments to re-examine the policy and institutional frameworks for irrigated agriculture and design radically new agencies able to support irrigation farmers to be successful this century. Single-discipline engineering line agencies may have been effective in the era of major new construction; but they are not fit for purpose to support irrigation farmers in the current context. What is needed are nimble multi-disciplinary government agencies with the mandate to provide broad policy support as well as specific assistance in sharing and disseminating information, strengthening farmers’ organizations to be effective and self-sufficient, and capacity development aimed at helping farmers to take advantage of new technology and market opportunities while also adapting to threats.

**Water users’ associations are not just for managing water**

I have made the point above that irrigation systems are complex, ever-changing socio-economic-agro-ecological systems. Construction of an irrigation system transforms the existing agro-ecosystem, destroying some elements of that system but creating other new elements, potentially including new ecosystem services. Almost universally, schemes designed for irrigation also provide other water-related services, for example water for household domestic uses, livestock, fishing, and drainage of waste water. These systems are also nested in broader social and economic systems through information exchange, markets, and other infrastructure; and they are seriously affected by changes in markets, rising temperatures, changing rainfall patterns, and other external forces. The implication of this observation is that water users’ associations can no longer limit their role to basic water management. They must be equipped to take on new roles and responsibilities, or at least ensure that complementary institutional arrangements are in place to help irrigation farmers adapt to these new challenges. An additional challenge for both farmer- and government-managed irrigation schemes arises from the rapid spread of private pumps, which will grow even more rapidly as low-cost solar powered pumps become available. These disrupt the traditional, orderly management of canal-based schemes, and create new systemic conditions that must be managed to sustain these systems and the water resource on which they depend.
Very few water users’ associations are equipped to respond effectively to these complex new challenges. Past efforts to encourage them to take on non-water management functions such as marketing have had mixed results – there are success cases, but there are many more failures. This is another challenge the supporting institutions must be willing to take on: providing the training and information needed to enable water users’ associations to up their game and take on new responsibilities. The training needed continues to include basic financial and organizational management as well as water management skills; but in the future will also include negotiating and lobbying skills, and how to take advantage of new financial opportunities (for example, payment for environmental services).

A corollary of this observation relates to new irrigation construction or rehabilitation/ modernization projects: these should no longer be conceived as building infrastructure that is then “handed over” to water users’ associations. Rather, they should be conceptualized, designed and implemented as a program aimed at creating a viable, sustainable, productive socio-agro- ecosystem based on management of the water supply. There are multiple stakeholders in this system, beyond the irrigators, government officials, and those involved in the input and output markets (Lankford et al., 2016). This point also reinforces the importance of investing in building functioning institutional arrangements to manage this complex system.

**Invest in irrigation software**

Irrigation farmers in Asia and Africa still need support to establish and develop their organizations – i.e. water users’ associations. There is recent evidence that investing in training can improve the performance of water users’ associations (e.g. Balasubramanya, Price and Horbulyk, 2018). One lesson from the 20th century is that underinvesting in providing this support, or limiting its time frame, is a big mistake. The evidence is clear that the returns on investments in hardware are far greater if they are accompanied by substantial, appropriate and long-term software investments. I find it difficult to understand why this lesson has not been learned by Asian and African countries, or by their financing partners – but that probably reflects my own biased background.

Further, there is some evidence, even if not conclusive, that these institution-building services should not be provided by the agency in charge of either construction or O&M of the hardware: I advocate using specialized organizations with the right skills and culture to provide institutional support, training and facilitation to water users’ associations. In the 1990s, Sri Lanka experimented with this concept by creating an “Irrigation Management Division” of the Ministry in charge of irrigation. It was entirely separate from the Irrigation Department but charged with collaborating with that department. At least during the period when I was associated with these departments, I think it worked moderately well despite some resistance within the Irrigation Department. However, as a government bureaucracy it had some limitations. Therefore, I advocate experimenting with using
civil society organizations having the necessary capacities (even if strengthening them is needed at the earliest stages). They should be provided with flexible performance-based contracts which extend for a decade at a time with the possibility of renewal.

**Facilitate and guide creative social learning: bricolage**

A major error in the past, all too often repeated even today, is attempting to impose a specific organizational design, a blueprint for what a water users’ association (or indeed a government irrigation management agency) should look like and do. This is often referred to as “social engineering”: laws are written, not as enabling documents, but as specific rules and regulations specifying what must be done and how. More often than not, these do not resonate with local customs and ideas about how people should work together collectively. Transferring institutional designs that work in one context to another totally different context also rarely works. As a result, they are either completely ineffective, existing only on paper and useful only to check a box (“water users’ association created-check!”); or they are soon subverted, often taken over by powerful people for their own ends. As Merrey and Cook (2012:7) note, “social engineering’, the idea that one can replicate in a new context an organizational structure or institution that may have worked elsewhere, is based on a fundamental misunderstanding of the complex, nondeterministic, and stochastic nature of social organizations.” This adherence to a social engineering paradigm is a major reason why irrigation management transfer and participatory irrigation management initiatives of the past produced such disappointing results.

Legitimate effective institutions are rooted in the local cultural, historical, and political context. They both constrain behavior – setting out the rules and limits on what is acceptable – and they enable people to achieve their ends. Institutions – the rules of the game – are constantly tested and contested, and people adapt them to changing circumstances or new opportunities. The term “institutional bricolage” has been proposed as a way of conceptualizing how mechanisms for collective action and resource management are borrowed or reconstructed from existing sources, i.e. from existing institutions, styles of thinking and social relationships (Cleaver, 2012; Merrey and Cook, 2012; Hassenforder and Barone, 2018). The point here is that the most effective approach to helping farmers establish and strengthen water users’ associations that fit their needs is to encourage and facilitate a creative, even if somewhat messy and unpredictable, process whereby local people construct their own organization. Merrey and Cook (2012:8) put it this way: “institutional bricolage is an active, conscious creative process of adapting norms, values and social arrangements to fit new purposes, while also reflecting and being shaped by deeply embedded unconscious principles.”

In recent years, researchers have been testing the use of “innovation platforms” as a means to enable stakeholders in complex agro-ecosystems to experiment and learn together. For example, Van Rooyen et al. (2017) report on the use of agricultural innovation platforms in six small-scale irrigation systems in southern Africa.
Innovation platforms are an institutional innovation through which multiple stakeholders, both traditional (such as irrigation engineers and farmers) and non-traditional (such as value chain players), can come together to facilitate communication and coordination, and test innovations that are mutually beneficial. The innovation platform therefore brings together stakeholders from the larger socio-ecological system within which the irrigation scheme is embedded. The process facilitated through successful innovation platforms is an example of institutional and technological *bricolage*.

**Promote adaptation and use of modern technologies**

In both Asia and Africa, we are beginning to see technological innovations reach smallholder farmers. In part, this has been initiated and facilitated by NGOs, for example making low-cost drip irrigation kits widely available; and in part it is driven by the market as private firms begin to offer affordable technologies. We now see a similar evolution in the availability and uptake of solar-driven pumps for irrigation. Other technologies are being piloted and, in some cases, scale up. Examples include the use of soil moisture sensors to target irrigation water better (Stirzaker et al., 2017); and the use of cellphones to keep farmers informed of weather conditions or to stay in touch with changes in prices. Even low-cost drones are coming into use in Asia for surveying crop conditions cost effectively – creating business opportunities for entrepreneurs.

How such new technologies are made available to farmers will be a critical factor in their uptake. For example, although the promotion of low-cost drip irrigation kits has apparently had some success in Nepal, in Africa they have not taken off: farmers use them while participating in a project with NGOs but stop using them when the project ends. There are many reasons for this, but one important reason is these projects are driven by a consortium of donors, governments, NGOs and in some cases private firms who have come to believe that using small drip irrigation kits provide a way out of poverty; they continuously invest in supply-driven pilot projects that somehow never take off (Merrey, 2017). In contrast, Stirzaker et al. (2017) report on a social learning-based approach to introduce irrigation farmers to the benefits of soil moisture sensors. This is an example of the use of “innovation platforms” described above. Although still at an early stage, this approach shows considerable promise. In the end, new technologies will only be used at scale if they are affordable and bring real benefits to farmers.

5. **Conclusions**

The global community has committed itself to eliminating hunger and malnutrition, among other Sustainable Development Goals (SDGs), by 2030. In a context of increasingly common and devastating natural disasters as a result of climate change, and growing competition and conflict over water and other scarce resources, it is critical to drastically increase agricultural production in Asia and Africa, and to do so in a way that provides employment and a good income for farmers, affordable
food to non-farmers, while also reversing natural resources degradation trends. Irrigated agriculture has a major role to play in achieving these ambitious goals. The past fifty years of testing and implementing irrigation institutional innovations, especially the promotion of irrigation water users’ associations, has not achieved the level of success that had been expected. In the 21st century, irrigation farmers are facing new and even more complex and difficult challenges. Nevertheless, we have learned many lessons and, I submit, we now have a good idea as to what will be necessary to meet these challenges and achieve the SDGs. But doing so will require a major commitment by politicians, financing agencies, and, yes, water professionals such as those gathered here today. I remain an optimist that we will rise to the occasion.

References


paper submitted to IFAD by IWMI.


Followed by Dr. Doug Merrey key note speech, the case study jointly prepared by Dr. Prachanda Pradhan and Engineer Divesh Belbase. It was presented by Engineer Devesh Belbase. The summary of text of the case study is attached herewith.

Benefit Sharing between Hydropower and Irrigation in Nepal: A Case Study

Prachanda Pradhan¹ Devesh Belbase²

1. Introduction

With the socio-technical change, intensification of infrastructure development in water sector, upstream downstream water allocation in the river system and potentiality of financial resources mobilization from the hydropower units in the irrigation channels, the scenarios of irrigation sector in Nepal have changed. These situations have drawn the attention of irrigation sector managers in Nepal.

In the social front, urbanization and migration from rural area have brought tremendous changes in agriculture profession. In many villages, young people prefer to be engaged in non-agriculture activities. Because of expansion of urbanization, agriculture lands are now converted into housing plots making the investment on irrigation system development redundant. Similar examples are

¹ Patron, Farmer Managed Irrigation Systems Promotion Trust, (FMIST), Kathmandu, Nepal.
email: pradhanpp@hotmail.com

² Employed in ICIMOD, Kathmandu, Nepal
emerging in many places. Hence, there is now need of serious rethinking in irrigation sector investment close to places where there is intense process of industrialization and urbanization. Interesting examples can be drawn from Butwal-Bhairawa industrial corridor. There exist similar examples in many parts of Nepal. It is difficult to find the data on loss of agriculture land from housing development and urbanization. Hence, there is now need to make serious consideration of these factors in making investment in irrigation sector. It is no longer only technical feasibility of irrigation development. There is need to make assessment of socio-cultural environment governing to agriculture practices.

Water is source for agriculture development through reliable irrigation systems. Similarly, drinking water is the source for the survival of living beings. Water is the source for electricity generation. Sometimes ago, over 95% water use in Nepal was in agriculture. But the water use scenario has changed. Priority of water use is given to drinking water. Since drinking water is for consumptive use, competition between irrigation use and drinking water have become phenomenal. Rural electrification, pumping technology and high density pipes for transportation of water across all terrains have posed a big challenge to existing and potential irrigation systems in Nepal. One can see now increasing number of conflicts between irrigation and drinking water use of water,

Water is source of renewable energy in Nepal. There is great demand of energy for domestic and industrial use. Both government sector and Independent Power Producers (IPP) have been encouraged to produce hydropower to meet the need of energy in Nepal as well as some hydropower units with foreign investment are aimed for export to neighboring country. There are both positive and negative impacts of hydropower units development in a river systems.

The broad typology of hydropower – irrigation development can be categorized as follows:

1. Hydropower development in the existing irrigation systems like in Seti, Bijaypur, Phewa of Kaski district and Rani, Jamara and Kulariya of Kailali district, Chatara Hydropower Project of SMIP for example
2. Reservoir system like Kulekhani and Tanahu High dam Project, Karnali hydropower Project
3. Basin transfer project like Adhi Khola, Syangjya, Jhimruk, Puythan, Bheri-Babai Diversion, Surkhet district.
4. Multiple hydropower units in a river system like in Puwa and Mai Khola of Illam or Dordi Khola of Lamjung for example.

Out of these typologies of hydropower and irrigation benefit sharing, a number of serious considerations are now required in a) water right issue, b) water allocation principles in the catchment area, c) impact assessment methods for people and place d) benefit sharing between irrigation and hydropower and e) monitoring and
evaluation of upstream down stream impact and mitigation measures. In this benefit sharing exercises, the developers, government agencies issuing license for hydropower development, fragmented water resource management agencies play important role.

**Typology 1:** As mentioned above, irrigation agencies could not get benefit from the hydropower units. As of now, the revenue out of power generation from these units are not plough back for the irrigation channel maintenance. Recently, the Department of Irrigation is renovating the dam and channels of Seti Irrigation systems in Pokhara which will get benefit by Seti hydropower, Bijaypur and Task. However, there is no sharing of revenue for the maintenance of the irrigation channels. Time has come to think by Department of Irrigation as a means of resource mobilization for system maintenance from the revenue generation from hydropower. There are many irrigation systems which can produce hydropower. In order to materialize these alternatives for Department of Irrigation, appropriate legal provisions are to be in place.

**Typology 2:** With reservoir systems. Such systems are being developed. As of now reservoir systems are only for hydropower, not multipurpose ones. Hence, such systems have to make consideration of upstream and down stream impact. It was reported that the Karnali Project is going to bring adverse impact in downstream to the Chisapani Irrigation project aiming to irrigate 40,000 ha. Hence, river basin planning along with Integrated Water Resource Management (IWRM) has now becoming very important for irrigation and hydropower development in Nepal.

**Typology 3:** Inter-basin transfer for Hydropower and irrigation. Such project can bring both benefits as well as adverse impact on irrigation. Andhi Khola Project brought positive benefit to irrigation where as Jhimruk brought adverse impact on existing irrigation systems in the downstream of dam especially during dry period. However, Bheri -Babi Diversion Multipurpose Project (Surkhet) brings benefit for hydropower generation as well as ensuring irrigation for over 40,000 ha land in Banke and Bardiya districts. The proposed 45MW power generation revenue can finance operation and maintenance of many irrigation systems in Nepal. The modality of operation of hydropower by DOI is yet to be developed.

**Typology 4:** Intensification of water infrastructure development in catchment area. There are now many water related infrastructures being developed in catchment area (specially hydropower units, drinking water projects and new and existing irrigation systems) where the irrigation systems and hydropower units are to co-exist. The first hydropower project was constructed in 1911. For next 50 years, only 3 hydropower projects were constructed. After 1990, many hydropower projects have come into operation and many of them are under construction an example from Dordi Khola of Lamjung and Puwa and Mai Khola of Illam. They have been affecting to each other in operation. Hence, institutional and legal framework are to be in place in this regard so that the benefit sharing between irrigation and hydropower can be ensured.
2. **Observations on benefit sharing between irrigation and hydropower in Nepal**

   a. **Inter-relation in benefit sharing between hydro and irrigation**
      It is found, on many sites, that good benefit sharing between irrigation and hydropower can be secured. Mostly, hydropower projects can complement in improving irrigation infrastructure and introducing new technologies like lift irrigation systems. However, there is need to plan about this before project implementation takes place. (Tanahu High dam Project is under construction)

   b. **Negotiation about water sharing between hydropower and irrigation**
      On many occasions, negotiations have made the benefit sharing possible. The examples are of Bijayapur, Dordi, Andhi khola, and Khopasi.

   c. **Catchment area and water right issue**
      While issuing license for hydropower project, catchment area and water quantity for the project is defined. How is that monitored and supervised is not clear? How is the flow of river is regulated? In most of the systems, 10% river flow is hardly maintained during dry season.

   d. **Issues in new irrigation development in Marsyangdi river corridor**
      Once the catchment area is assigned for the hydropower project, other activities are not allowed in the catchment area. Even for the new hydropower development in the same catchment area, the prevalent laws do not protect the water right of the existing project. There was conflict for construction of Rainastar Irrigation System from Chepe River with Marsyangdi Project of Abu Khairani which is one of the tributaries of Marshyangdi river (Reported by SDE of Lamjung, March, 2018). Department of Irrigation is planning to develop irrigation in the Marsyangdi corridor where it is estimated to have 20,000 ha river terrace suitable for lift irrigation. Will the hydropower of Marsyangdi allow the use of Marsyangdi river water for this irrigation development? One has to see how the water use priority set by Water Resources Act is being implemented between hydropower, irrigation and drinking water supply.

   e. **Sectoral approach on investment decisions**
      It has been sectoral approach in investment. Hydropower people are concerned only for energy generation. However, it is found that irrigation development is usually accompanied by hydropower component as well. There are many examples like Rani Jamara and Kulariya irrigation, Fewa, Bijaypur, Seti in Kaski, Chataka Hydropower in Sunsari Morang Irrigation System, Bheri Babai River Diver Project with both irrigation and

---

3 These preliminary observations are drawn from the reconnaissance study of multiple hydropower and irrigation systems in Nepal ranging from 500 kw to 144 MW. Support for this study was provided by ICIMOD, Kathmandu, Nepal.
hydropower. However, there is no incentive for the hydropower developers for integrating irrigation system in the project.

f. Registration of hydro and irrigation in different agencies
Hydropower development by separate agency including government companies and private investors company. Integrated approach in water resources infrastructure development has not taken place as yet.

g. Intake and power generation (in between effect)
Headwork diverting water for powerhouse through tunnel or different channel make irrigation water unavailable to the farm lands. Some mitigation programs are implemented. The case of Jhimruk is interesting in this context. Puwa khola of Ilam has also the similar experience.

h. Other economic activities in assigned catchment area (like distillery, poultry and others)
It is found that there has been hardly adherence of natural flow of 10% downstream of temporary ponding place of Marsyangdi Project. Due to this situation, other economic activities between the dam and powerhouse became difficult.

i. Water flow and environmental flow of water
It is not clear how and who are monitoring the river flow and environmental flow of river. This situation of maintaining minimum flow of water will be crucial when many economic activities will have to take place above and below the dams. Enforcement and monitoring agency (licensing agency, monitoring and implementing agency) has to be effective for evaluation and monitoring of the status.

j. IWRM approach, basin approach and water resources inventory, etc.
Keeping in view of the situation as developed for development activities and other water infrastructures, there is now urgent need of basin planning with clear allocation and good analysis of trade-off water use in different sectors. Basin Planning will help to take the IWRM approach.

k. Revenue of hydropower can help maintenance and operation of irrigation systems
There seems to be no system of revenue sharing between hydropower and irrigation. In Pokhara, hydropower generation is made by using irrigation channels constructed by Department of Irrigation but revenue from power generation is not shared with DOI. However, DOI keep on maintaining the diversion weir and channels out of its own resources. DOI now must use the falls in the channel for power generation and use the revenue for irrigation system maintenance.
1. **Defining impact area and its basis**
   There is need to fix criteria to define impact on downstream area of a hydropower or to downstream irrigation systems. In the case of Jhimruk, 10 VDC is considered impact area of this project.

2. **Change in land structure**
   On one hand, agricultural lands are being largely converted as urbanization accrues. People are shifting vocations from agriculture to some other income generating activity, as a result, irrigated lands are left barren. Those, into agriculture face manpower shortages. Furthermore, the previously observed enthusiasms in farmers and water user's group have lost voicing, as the problem cumulates. This has left hydropower projects at an advantage as previously allotted water for irrigation is now diverted completely for hydropower generation. Example: Phewa and Mardi hydropower.
Panel discussion was initiated in the second session of the symposium:

Dr. Prachanda Pradhan introduced theme of the panel discussion along with the guidelines for discussion.

- Among many factors for sustainability of irrigation systems, irrigation institutions including water users institutions play important role.
- It includes making water users associations self-governing, self-regulating and self-supporting.
- It requires process and procedures for participatory irrigation management.
- Different institutions contribute for improvement of irrigation systems.
However, irrigation institutions are often operated in silo.
Hence, there have been nexus challenges in irrigation institutions.

Nexus Challenges in Irrigation Institutions

Socio-Institutional and Technical integration is required for increasing agriculture production.
Questions to address in panel discussion:

- What policy instruments would help break the silo approach in irrigation institutions performance improvement?

- How should irrigation institutions be promoted with features of self-governing, self-regulating and self-supporting?

- How can irrigation institutions and agriculture institutions work together to ensure food security?

Con’ted

- How can external and internal factors of irrigation institutions be integrated to meet the growing impact of climate change?
Bio-data of Panel Members

Dr. A. Hafied A. Gany

A. Hafied A. Gany, Ph.D., P. Eng., born in South Sulawesi, Indonesia in 1944, graduated the M.Sc. Irrigation Engineering Studies at the University of Southampton UK in 1979; He did his Interdisciplinary Ph.D. Study (Engineering, Economics, Sociology and Demography) from the University of Manitoba, Winnipeg, Canada in 1993. He has worked for 45 years at the Ministry of Public Works Indonesia, as the Director of Water Resources Management; Director of Research Institute on Water Resources Ministry of Public Works. He has retired since 2009 and engaged now as a Freelance Consultant in Irrigation and Water Resources. Dr. Dr. GANY is also the Vice President Honoraria of ICID.

Mr. Susheel Acharya

Mr. Susheel Acharya, born in Gorkha district in 1970. He has B.E. Civil Engineering and M. Sc. in Land and Water Development from Delft, the Netherlands. He has joined Department of Irrigation in Nepal since 1996. He has constructed and managed many irrigation systems in Nepal. He has been in many administrative jobs in Department as The Regional Director of Irrigation in Dhanagadi and became Project Manager of many irrigation systems.

Dr. Masayoshi Satoh

Dr. Satoh graduated from Faculty of Agriculture, Tokyo University in 1970 and got Doctoral Degree in 1976 from the same University. He had his teaching and research jobs for 40 years at Gifu University, Iwate University and University of Tsukuba, Japan. He is now Professor Emeritus, Univ. of Tsukuba since 2012. He has been conducting research activities mainly on irrigation management, with a special focus on participatory systems, and water resources management in target regions in Japan, East and South-East Asian countries and some African countries including Egypt.

Professor Dr. Ding Kunlun

Dr. Ding Kunlun is the Vice President of International Commission on Irrigation and Drainage (ICID) from 2014 to 2017 and the Chair of Permanent Committee for Technical Activities of ICID from 2017, the Deputy Secretary General of Chinese National Committee on Irrigation and Drainage (CNCID) since 2008. He has worked at China Institute of Water Resources and Hydropower Research (IWHRI) for...
Mr. A. B. Pandya

Mr. A. B. Pandya, a Bachelor in Civil Engineering from Saurashtra University and M. Tech. in Structural Engineering from IIT Delhi, is a former Chairman of Central Water Commission and Ex-Officio Secretary to Government of India, Ministry of Water Resources, River Development & Ganga Rejuvenation. Mr. Pandya, joined the Central Water Engineering Service in Central Water Commission in October 1977 and held various positions in the Department and other organizations under the Ministry of Water Resources like Water and Power Consultancy Services, National Water Development Agency and National Projects Construction Corporation. His major areas of works include setting up policy initiatives, planning, design and financing of water resources projects for hydropower and irrigation including regional planning for optimum water resources utilization.

Presently, he is engaged with Government of Gujarat, Andhra Pradesh, Odisha and WAPCOS as well as the World Bank for various hydropower and other projects. He has been honoured by the Government of India for his excellent contributions in Water Sector. Presently, he is working as Secretary General of International Commission on Irrigation and Drainage, an international government supported organisation comprising of 77 countries spanning across globe and covering almost 90% of the world’s irrigated area.
Presentation by panel members on the issues assigned to the eminent panel members:

**Nexus Challenges to Irrigation Institutions**

A. Hafied A. Gany⁴, Ph. D., P. Eng.

1. **General Challenges**

Irrigation institution as amongst the most important determinant aspects of success or failure of irrigation as well as drainage agricultural development and management has recently been identified to have a series of crucial nexus challenges in line with other socio-technical as well as socio-cultural parameters. In this regard, when we speak about irrigation and drainage institution in conjunction with agricultural development and management, there have been identified at least five important determinant aspects that must be properly comprehended along the series of nexus challenges. These are: i) human resources development and management; ii) institutional and organizational arrangement; iii) technology for sustainable operation and maintenance (O&M); iv) sustainable O&M funding; and v) effective regulatory instruments and enforcement on irrigation management implementation. The five aspects should therefore be treated as integrated series of nexus involving all stakeholders and cannot be seen or treated in isolation. And hence the absence or unbalanced treatment amongst the five parameters would cause the irrigation system management be operated in silo and easily fallen apart.

2. **Involvement of Stakeholders**

In an attempt to secure the functional sustainability of irrigation and drainage development and management, all the relevant irrigated agricultural stakeholders must be fairly given proportional chance to participate in line with their relevant roles in the irrigation and drainage development and management process. And hence, the role of stakeholders must also be properly and fairly identified.

General Definition of Stakeholder: In general a ‘stakeholder’ is defined as: *Any individual, group, or institution who has a vested interest in the natural resources of the project area and/or who potentially will be affected by project activities and have something to gain or lose if conditions change or stay the same* (International Union for Conservation of Nature (IUCN), 2008). Thus, stakeholders are all those who need to be considered in achieving project Goals and whose participation and support are crucial to its success.

Perspective of Agriculture Water Management (AWM): In the field of agriculture water management, a number of disparate stakeholders have an interest through

⁴ Vice President Honoraria of ICID and Freelance Consultant in Irrigation and Water Resources
implementation of policy formulation. For ICID stakeholders are categorized into: i) primary or core stakeholders – which are the National Committees of ICID, farmers and irrigation and drainage professionals; ii) secondary stakeholders – which are policy makers, researchers and the industry who directly influence the activities of the agriculture sector; iii) tertiary or peripheral stakeholders – which are the society members at large.

In line with the ICID activity to seek partners by means of providing inputs and assistance in the implementation of its activities, a number of United Nations and other international organizations are engaged in the water sector as well as the agriculture sector. They support their member national governments in meeting various sustainable development Goals (SDG) in the spirit of SDG 17 to strengthen the means of implementation and to revitalize the Global Partnership for Sustainable Development.

Challenges on Multi-Disciplinary and Multi-Stakeholder: Irrigation water systems, locally and nationally, are designed to fill the gap between water supply and demand in spatial and temporal scales to make agricultural resilient to unpredictability of climate. They ensure the availability of water not only for agriculture but also for domestic use and for small entrepreneurs. The assured production of irrigated agriculture encourages re-investment in the sectors and generates surpluses to be invested in other social sectors. Irrigation is often a multifaceted endeavour requiring interaction among various sectors, institutions and users. The challenges of sustainable use and efficient management of irrigation systems is the demand for mutual understanding and cooperation amongst those involved in the multiple actors.

Integration of hard and soft components for maintaining sustainability: The most important prerequisite of sustainable irrigation development and management is harmonious integration between hard and soft components along the implementation process. The initial asset to integrate is ‘hard component’, which is consisted of investment in terms of good infrastructural networks for ensuring irrigation water availability in adequate quantity, proper quality and equity distribution without allowing the development of ‘silo-effect’ or at least to help breaking up the existing syndrome of ‘silo-effect’. The subsequent and not least important assets to integrate is ‘soft component’ which is consisted of: i) ‘funding sub component’, for assuring proper O&M and agricultural management skill of water user association (WUA) through consistent empowerment and capacity development; and ii) ‘farmer-skill sub component’, for assuring the development of appropriate water management and effective agricultural technology toward increase of productivity and income along the support toward food security through consistency of capacity development of human capital.

Maintaining the logical framework of “inputs – outputs – outcomes – impacts”: in line with sustainable development and management implementation without neglecting self-governing, self-supporting and self-regulating efforts on production
strategy as well as jointly maintaining internal and external awareness and adaptation to the growing impacts of climate changes along the entire irrigation and drainage agricultural development and management process on participatory basis.

3. The Way Forward Trend

Despite all the underlying constraints and challenges affecting irrigation and drainage agriculture development and management, it is apparent that the general trend of development and utilization of the developed infrastructures is continuously the case supported by improvement of institutional set up to support value added production approach toward strong rural farming livelihood through implementation of participatory approach supported by the related stakeholders.

At present, irrigation development and management planners are currently working hard to set up the most relevantly and effectively possible future roadway toward optimized use of irrigation and drainage agricultural infrastructures with the effort to optimize the use of hard and soft components by integrating the relevant development sectors in agriculture, fresh water fisheries, energy and industries and other related development sectors toward modern irrigated agriculture.

Among the most obvious efforts to mention are; setting up of the holistic reformation of mind-set, development of strong irrigation based economy of the rural farmers, decentralization of irrigation services, and taxes, development of capacity building and capacity development toward sustainable irrigation and drainage agriculture development and management.

Supporting Figures

**Figure Box 1.** Five important determinant aspects must be properly comprehended along the series of nexus challenges to irrigation institution. These are: i) human resources development and management; ii) institutional and organizational arrangement; iii) technology for sustainable operation and maintenance (O&M); iv) sustainable O&M funding; and v) effective regulatory instruments and enforcement on irrigation management implementation. They are highly integrated and cannot be seen in isolation.
Figure Box 2. Maintaining the logical framework of “inputs – outputs – outcomes – impacts”: in line with sustainable development and management implementation without neglecting self-governing, self-supporting and self-regulating efforts on production strategy as well as jointly maintaining internal and external awareness and adaptation to the growing impacts of climate changes.

Figure Box 3. At present, irrigation development and management planners are currently working hard to set up the most relevantly and effectively possible future roadway toward optimized use of irrigation and drainage agricultural infrastructures with the effort to optimize the use of hard and soft components by integrating the relevant development sectors in agriculture, fresh water fisheries, energy, industries and other sectors.
Nexus Challenges in Irrigation Institutions from Nepal Perspective

Susheel Acharya

1. Introduction

State agency started planned development of irrigation infrastructure from 1956 without giving due consideration towards farmers contribution for almost 30 years assuming all responsibility lies within state. So the role of farmer’s centuries old contribution was minimized during those period.

At the mid of 1980s state agency again started integrated approach of irrigation development which is continued till now. Even today contribution of Farmer Managed Irrigation Systems (FMIS) in terms of irrigated area and crop production are 3 times more than DOI developed AMIS.

If we look the performance in terms of service delivery and local resource mobilization as well as output, FMIS are far better than AMIS.

But the state resource for the Maintenance, Operation and Management and modernization of FMIS is less compare to contribution.

According to Uphoff, activities on irrigation management can be grouped into three categories. Activities related to water for abstraction from the source, allocation and distribution to individual farmers and disposal of excess water. The activities deal with structures are planning, design construction and O&M. Basic organization activities are Decision Making, Resource Mobilization, Communication and conflict resolution if different of interest arises.

Nexus challenges to irrigation institution are basically based on these three categories of activities.

2. Water

Availability of water in Nepal is many times more than the requirement for irrigation and other sectors. But the location and time of water availability does not match with the requirement. So management of water resources is important for optimum use. In the past land and water resources was sufficient for less population. Irrigation sector did not have any acquisition problem.

After the enactment of Water Resources Act of Nepal at 1992 (WRA), water use for irrigation got second priority and domestic water supply got highest priority. Because of population growth, rapid urbanization and migration into river valley,
there is need of development of more water supply project which is hampering the prior use right of irrigation sector.

Private hydropower developers also getting license targeting use of the water used by existing irrigation system. This happen because of the lack of river basin authority, whose responsibility could be the allocation of water among potential sectors/users. Another problem related to water is environmental deterioration of river passing through urban area and irrigation system utilizing those rivers is facing the problem of high O&M cost.

In recent years, another serious problem faced by irrigation system is undermining of river bed due to over extraction of river bed materials. Local government agencies take them as source of revenue.

2. Structures

Challenging issues related to structures are, heavy sediment load due to rugged topography, young mountain, extreme events of flood due to climate change, difficulty to assess the quantity sediment and flood data for planning and design of structures.

As per the irrigation policy of Nepal, local body has responsibility to the development of small irrigation system but their capacity in terms of planning and design is not sufficient.

3. Organization

3.1 DOI

As a main state agency, DOI has major responsibility towards the development of irrigation facilities and management in the country.

3.2 DOA

One of the prominent state agency for expansion and development of agriculture sector has not implemented agriculture development programs among completed irrigation projects. Agricultural agency has to take full ownership of agricultural output from all completed irrigation project.

3.3 WUA

Should focus on irrigation management by organizing farmers but,

- Deviate from core function of system management and more focus on construction
- Political interference during WUA executive committee formation
- Lack of continuation of expertise of office bearer of WUA members due to periodic turnover by election
- Lack of sufficient financial resources for MOM due to insufficient commercialization and diversification of crops as planned during project preparation
- DOI developed WUA seems as appendix of DOI, where as most of WUAs of FMIS are self -governing, self-regulating but lack of self-sustaining because of lack agri-commercialization and migration of labor force. So they are not able to collect sufficient ISF for MOM.

4. **Towards self-governing, self-regulating and self-supporting WUAs**

In principle WUAs should be self-governing, self-regulating and self-supporting. WUAs of FMIS show these features. In AMIS also this is possible if proper institutional development programs are designed and implemented, involvement of WUAs from beginning of the project and if infrastructures are developed as per their needs are the basic requirements toward these achievement.

Support to WUAs should be on their strategic plan in relation to water, asset and organization.

Formation of WUA should be based on local condition, planned infrastructures and overall bottom up approach should be applied.

5. **Irrigation institution and agriculture institution could work together for optimizations of resources**

Irrigation institution and agriculture institution could work together if we integrate irrigation project with

- Separate component of agricultural development programs
- Implementation of Integrated crop and water management programs
- Development of market access to agri- products
- Preparation of cropping pattern and irrigation scheduling jointly with irrigation officials, WUAs and agricultural officials
- Coordination and partnership of DOI and DOA by working procedure, programmes and regular meeting

In addition to this approach for year round irrigation with smooth implementation of projects with stakeholder's ownership and assured quality of service will bind two agencies together.
6. **Towards climate change impact resilience irrigated agriculture**

Climate change impact is a big issue for irrigated agriculture. To develop resilience irrigated agriculture some of the measures may be,

- Development of multipurpose storage and diversion project
- Promoting multi use of FMIS
- Promotion of Non Conventional Irrigation Technology
- Promotion of adaptive cropping pattern
Issue on Nexus Challenges in Irrigation Institutions

Masayoshi Satoh

The first thing to be noted is that the water in rivers and irrigation facilities are the assets of the society, but not by water users’ private one. It is because the training of rivers, water resource developments and irrigation developments are done by the governments using tax.

Every investment in irrigation development by governments has a clear target of increasing productivity and stability in agricultural production for a region or the nation. Therefore related irrigation institutions are responsible for achieving this target, which is a request from the national people, the tax payer). This responsibility goes also to the government. The government is responsible not to allow concerned people to do a silo irrigation management.

Silo management is attractive to a group or a part of group members. In such cases the water is inequitably controlled by limited people, who do not want to be watched and criticized from outside.)

The water management in silo has two kinds of problems; 1) the people in charge miss the opportunity to get information for better water management, 2) the government has no information on the water situation of the facilities, which the government should keep in a good condition.

The ultimate solution may be the introduction of information dissemination system together with democratic management procedures, in which everybody has an opportunity to express his opinion based on the given information. And the government should prepare a system to guarantee such a right of the members.

It inevitably requires a system of intervention from outside including governments to the institutions. It seems to be contradictory to the idea of IMT. However, we need to manage this issue. At the same time, this issue gives a serious and important question on the basic idea of PIM; Is a simple IMT effective to improve irrigation management?

Through the 300 year experience of irrigation management by water users in Japan the Japanese researchers and practitioners have common understanding that the simple water management by beneficiary farmers will not go smoothly because of internal conflicts among farmers or farmer groups. Individual farmers have their own goals, which are different from the goal of the government. We cannot expect the farmers to naturally behave to achieve the government goals. In this regard the government need to transfer irrigation management to the farmers and at the same

---

6 Emeritus Professor, University of Tsukuba, Japan
time to hold a measures to intervene the behavior of the farmers. The contradictory necessities in irrigation management is a challenge. Refer to the Japanese model (as mentioned in session TS05).

Irrigation management consists of three components of operation, maintenance and management of organization and finance. Operation (water distribution) is the most important among the three for successful management by farmers since good yields is the direct and eventual concern of farmers in irrigation. Good operation (equitable water distribution) will support both good maintenance and management. Equal and equitable water distribution provides a good relationship among farmers as well as better production in the whole irrigated area.

In Japan every irrigation systems after construction is principally transferred to a Land Improvement District (LID), a farmers autonomous institution. Land Improvement Act (1949) describes the establishment and management of LID and at the same time it prepares a frame and procedures for LID management in detail. The water management at the on-farm level is shouldered by LID. Therefore the government pays constant attention to on-farm irrigation management. Thus the government has a regular inspection on LID management, once in three years, whether it is properly managed in terms of money, organization and water. In this regard, Japanese water management is one of the Joint Water Management (JWM), while it seems to be a type of IMT.

Since the final target of irrigation management is good agricultural production, an irrigation institution needs strong cooperation with an agriculture institution in terms of water operation. The Japanese farmers are the members of LID and Agricultural Cooperative (JA in Japan) at the same time. Agricultural extension services are well contributing to water management by providing information on water requirements.

The inspection of LID are under the responsibility of other sector of sociologist and economist in the Ministry of Agriculture, Forestry and Fisheries, which includes the irrigation sector.
Development and Challenges of WUA in China

Ding Kunlun

1. WUA for the irrigation sector in China was introduced and pilot projects were established by the World Bank aided project in early 1990s. Up to 2018, over 83,000 WUAs were believed to exist in the whole country, established under domestic programs. The WUAs involved over 60 million families, and are managing about 30% of the irrigation areas. The chairman of the WUA is elected by “one family, one vote,” monitors the agency’s work on behalf of farmers, organizes “collective action” for O&M of the on-farm irrigation systems and water tanks. An irrigator appointed by the chairman measures the volume of “inflow” together with people from the agency and allocates water within the group. The water fee is paid directly to the irrigation agency and the farmers see what they pay and are happy to minimize water use.

2. In China, irrigation and drainage facilities are jointly managed by professionals and the general public. For large and medium sized irrigation and drainage projects, the government set up specialized regulatory bodies staffed with professionals in irrigation and drainage. These professionals are in charge of the daily operation and management of water delivery and distribution. The regulatory bodies are funded by public finance and agricultural water fees. On-farm and small irrigation and drainage projects are managed by the water users or farmers. Therefore, the current management organization of China’s irrigation and drainage sector is a combination of irrigation district authorities and rural water cooperation organizations.

3. For on-farm facilities of large- and medium-scaled irrigation schemes and small irrigation and drainage facilities, the management module of self-construction and self-management by farmers is promoted. Participatory irrigation management by farmers, mainly in the form of rural water cooperation organizations, is vigorously promoted by the Chinese government. Cooperation organizations are the managers of small irrigation and drainage projects. The cost of management is repaid in the form of water fees, and water pricing is subject to government guidance and consultation within the organization. To ensure the orderly development of rural water cooperation organizations, the government encourages pluralistic development that suits the local conditions. Large crop producers, family farms, farmer co-ops, water user associations are all encouraged to become the managers of small irrigation and drainage projects as long as the following results are achieved: the projects are managed efficiently; agricultural water use is optimized; water-saving agriculture is promoted; sustainable agricultural development is ensured through sustainable utilization of water resources; national food security and water security are guaranteed.

7 China Institute of Water Resources and Hydropower Research, Beijing, China
Chinese National Committee on Irrigation and Drainage, Beijing, China
4. Due to the very diverse social-economic conditions for different regions in this country, the performance of the WUAs is very different. As a result of field assessment on the WUAs, roughly one-third of the total WUAs have played well their role with strong capacity in terms of O&M for their irrigation facilities, legal status, financial sustainability, empowerment and organizational aspects; another one-third can play their role in terms of O&M but not as well as required and having weakness of financial sustainability or legal status etc.; while the rest one-third do not function in practice but only have the name and paper documents of the WUAs that are called “paper WUAs”. This results showed that WUA implemented was successful but not 100% successful due to the different local conditions and, also that it was easy to talk about the benefits of WUAs but quite difficult to achieved.

5. *What policy instruments would help break the solo approach in irrigation institutions performance improvement?* Firstly, policy should be made to encourage, support WUA in terms of legal status and financial arrangement. The regulations and rules related to WUAs need to be established at the national level. Service-centered or users-centered in the rehabilitation and modernization of irrigation and drainage systems should be kept through the involvement of WUAs. For example, the Chinese Government forwarded Guidelines on Establishing New Mechanism for Constructing Irrigation and Drainage Systems in 2005, encouraging and supporting the development of water user associations and bringing into full play their role in project construction, operation and maintenance, and water fee collection, and issued the Guidelines on Strengthening the Development of Water User Associations, clearly defining the nature, rights, obligations, procedure of establishment, daily operation and capacity building of water user associations. Secondly, pilot projects with WUAs need to be established to demonstrate and learn lessons and experiences, to extend with improving as doing strategy. Thirdly, training activities are necessary for WUAs on their institutional and capacity building (ICB), including mobilization, awareness raising, empowering, technical skills, etc. For this purpose, proper training materials acceptable to the framers should be developed and training of trainers may be required for the large area of demonstration. Some lessons learned are that, there are some universal guidelines can be adopted to assist WUAs’ establishment and operation, but more important are to consider the site-specific social-economic conditions and the local users requirements.

6. *How should irrigation institutions be promoted with features of self-governing, self-regulating and self-supporting?* To make WUAs strong or stronger organizationally and financially for self-dependant and sustainable, it should be allowed and encouraged to explore that WUAs for irrigation management could be combined with other rural/farmer organizations, such as the organizations of fruits, vegetables or any other crops and cash crops, rural water supply, and any kind of post-harvesting activities. This would normally make the WUAs financially stronger and more efficient to manage their own all issues rather than irrigation alone, and internal subsidies may be adopted by the institution
among their different farming activities to make their production profitable and sustain their life. This kind of integrate or comprehensive organizations could target at expanding the services of their parent organizations and combined with agricultural production process and other business co-ops, this type of organizations provide members with a variety of services in which economic benefits would drive the farmers to be involved.

7. *How can irrigation institutions and agriculture institutions work together to ensure food security?* Where it is possible, it could be encouraged WUAs to be part of, or supported by, agricultural service institutions/station to deal with farmers’ issues of irrigation management, seed, fertilizers, marketing and post-harvesting processing. The capabilities of these farmers or village organizations could be strengthened by providing with technical training and information access to stabilize and/or increase the crop production and income.

8. *How can external and internal factors of irrigation institutions be integrated to meet the growing impact of climate change?* It may be indicated that, for the WUAs, only the farmers or water users are the internal factors and all others, including governments and technical staff, are the external factors. The farmers would be more sensitive to the climate changes to induce extreme dry or wet conditions, if there is any. Some of the technologies for adaptation of climate change include water-saving irrigation technologies; new crop varieties, like flood rice, dry land rice and “sea water” rice, which is a rice variety of high tolerance to brackish water; increase of water storage capacity.
Nexus Challenges to Irrigation Institutions

Ashwin B. Pandya

1. Context of Challenge

Nexus is defined as link, connection and various nexuses exist in the society, which influence the policies and decisions in respect of societal resources.

Water is a core resource for all aspects of economic activities and hence has strong linkages with the livelihoods and economic aspirations of the communities thereby attracting the attention from various areas like politics, strategy at sub-national and national level, resource reservation for future, community aspirations

Irrigation being the largest consumer of the water, the institutions managing irrigation also by design or implication land up managing the overall water resources.

2. Nexus Categories

2.1 External

• Political
• Financial and economic
• Advocacy for / against development agenda

2.2 Internal: Water-Food-Energy

In order to implement irrigation and/or operate the system, the institutions have to negotiate with every one of them.

3. Challenges Posed by External Nexuses

The institutions managing the water have to face the challenges from the other interest groups which are essentially challenges of:

• Development plans,
• Financial and logistical resources allocation,
• Constraints over the development proposals, and
• Optimal allocations versus beneficiary priorities.

---

8 Secretary General of International Commission on Irrigation and Drainage, India.
4. **Challenges of Development Plans**

- **Planning Approach challenges**
  - Utilization of ephemeral waters without storage support,
  - Non-optimal site selection to avoid hard decisions/ negotiations,
  - Developmental plans without adequate financial resources,
  - Time challenges for adequate investigations and planning, and
  - Inadequate financial and technological resource allocation for field investigations and planning.

- **Financial due diligence**
  - Plan and source assurance for financial inflows in the given time line,
  - Non-adherence to financial targets due to un-expected situations, and
  - Inadequate returns planning for debt servicing.

- **Logistic issues**
  - Interference of the distribution networks with other networks (roads, railways, power lines, etc.),
  - Environmental concerns and remediation measures,
  - Community willingness for land acquisition and rehabilitation policies,
  - Inter-departmental coordination for implementation of the development goals

- **Beneficiary priorities**
  - Changes in inter-se priorities of benefits
  - Planned and implemented cropping patterns,
  - Market accessibility and economic returns,
  - Downstream value addition measures,
  - Adaptation of new technologies and approaches and
  - Operational challenges of integrating and setting up a participatory regime at societal level.

5. **Tackling the Challenges**

Negotiating Path to Approvals Often, the institutions have to convey and get acceptance from divergent nexuses. Technological strengths have to be leveraged for inter-nexus negotiations. Sound arguments for and against have to be generated

Building inter-disciplinary capacities is the key to success of irrigation institutions in negotiating path through various nexuses. Institutes have to be agile to absorb
new challenges arising out of a dynamic society and pro-active solutions. Institutes have to follow an evolutionary path by continually re-orienting the personnel and capacities to meet the challenges as they arise.

Institutes have also to battle internal issues that may develop by personnel orienting themselves to fixed approaches and skill sets. Keeping the personnel motivated towards the goal is a big challenge, especially in the governmental institutions. Skill sets have to be developed at relatively short notices.

6. **Internal Nexus of Water-Food-Energy**

- Irrigation institutions have to essentially react to the needs of the other two nodes of the nexus at every step in planning and operating irrigation systems.

- Change management is an important aspect as the food and energy demands vary over periods of time but the water being resource node remains nearly constant.

- Irrigation infrastructure that is put in place also serves other ancillary demands of drinking and industrial supplies as well as supplies to energy generation. Infrastructure once put in place has to serve over generations. The changes in demands have to be responded by the institutions through alternative strategies.

- Energy node acts as a resource as well as a consumer in respect of water. Large energy demands arise for improving field applications through efficient irrigation delivery and application techniques. Especially consumptive nature of thermal and nuclear power has to be accounted for. Many a times, hydropower generation has to change the generation policies for meeting irrigation demands.

- Changes in food preferences and returns generated from various crops affects the irrigation management significantly. Water saving and efficiency improvement measures are required to be adopted.

- Irrigation institutions have to maintain a constant vigil over the changes taking place and modify their policies of operation and management at regular intervals. For this purpose, the inter-disciplinary approach is a must.

- Compartmentalization of planning and development aspects needs to avoided so that the institution is capable of providing single window solutions.
7. Reflection

• Maintaining the water support to the other two nodes of the nexus in view of climate change
• Leveraging newer technologies and solutions to meet the transformation needs - evaluation and surveillance of associated fields for innovations

8. Conclusion

• Institutions will have to face increasing challenges from unexpected fields.
• Continued transformation of the institutions is the key to meet the challenges.
• Leveraging multiple disciplines for the solution has to be the focus for providing single window solutions.
Overall View of the Symposium

Irrigation is a combination of socio-technical and institutional aspects in order to be productive, hence, it operates within socio-ecological system consisting of hydrology, hydraulic, civil engineering, soil science, agronomy, institutions and human organizations and marketing. So, irrigation institutions have to break silo approach.

In this context, this plenary was organized by Farmer Managed Irrigation System Promotion Trust (FMIST) and facilitated by Dr. Prachanda Pradhan. It had a keynote session followed by panel discussion. During the keynote session, Prof. Asit Biswas, Dr. Douglas Merrey, and Mr. Devesh Belbase shared their thoughts on nexus challenges in irrigation institutions.

The video keynote speech by Dr. Asit Biswas emphasized that a new approach is to be taken and go beyond the boundary of traditional approach in meeting the food requirement to the growing population. Example of India and China suggests that despite the limited land and water, food production can be increased by adopting new technology and approaches including expansion of connectivity by bringing food from surplus area. However, the presentation suggests to look for new institutional arrangements where Dr. Douglas Merrey presented his keynote speech by stating whether 21ST Century Water Users Associations will do better than in 20TH century. He emphasized that the new approach is needed to support farmer-led collective management of irrigation. Following these two keynote speeches, Mr. Devesh Belbase presented case study on Irrigation and Hydropower Trade-off which suggests that, due to fast growing water related infrastructures of irrigation and hydropower, there is now need of catchment management and basin planning for water allocation and management to strike a win-win situation between irrigation and hydropower.

A panel discussion followed the three presentations. Five learned panel members namely Dr. Hafied Gany (Indonesia), Mr. Susheel Acharya (Nepal), Dr. Masayoshi Satoh (Japan), Dr. Ding Kunlin (China) and Mr. A. B. Pandya, Secretary General of ICID (India) deliberated on the issues identified and provided insights from their
vast experiences in the field of irrigation institutions. The panel discussion focused on following key issues;

- What policy instrument would help break the silo approach in irrigation institutions performance improvement?
- How should irrigation institutions be promoted with features of self-governing, self-regulating and self-supporting?
- How can irrigation and agriculture institutions work together to ensure food security?
- How can external and internal factors of irrigation institutions be integrated to meet the growing impact of climate change?