Self Governance and Nepali Farmer Managed Irrigation Systems

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Summary

Effective governance of natural resources is a key challenge facing many developing nations. There is general agreement that without effective institutions resources will be underprovided and overused. What is less certain, however, is what these institutions might be and who ought to provide them. Should governments take the lead in supplying institutions and organizing collective action, should this task be resolved through market forces, or should resource users of a "common pool resource" be encouraged to take the lead? This paper takes the view that it is difficult for external actors to design optimal institutions and enforce rules at low costs because solutions tend to be conditional and situation specific. Therefore, local resource users are better equipped to develop or be a major participant in developing institutional solutions.

Support for the above idea is drawn from empirical studies of irrigation systems undertaken in Nepal. Performance comparisons of farmer managed irrigation systems with agency managed irrigation systems show that the former consistently outperform over the latter on most performance measures. The paper offers two key insights - developing effective institutions are as important as developing physical infrastructure, and local resource users may be able to offer better institutional solutions under certain conditions than government agencies when resources are local in scale.

Key Words: Irrigation, Governance, Common-pool-resource, Collective action, Natural resource management.

Introduction

Effective governance of irrigation systems is crucial to Nepal because it is predominantly an agrarian economy which is dependent upon irrigated paddy cultivation to feed a growing population. Although agriculture contributes 38% to the gross domestic product (GDP) and provides employment to 75% of the labor force (Ministry of Finance, 2006), year round irrigation is available for less than 20% of the 2.2 million hectares of land area that can potentially be irrigated (Shah and Singh, 2001). While there is no dispute in recognizing the importance of irrigation there are intense disagreements over how irrigation infrastructure ought to be developed and governed. There are those who believe that governments are necessary to supply and organize collective action, and there are also those who believe that this task is best done by self governed resource users.

The Nepali State's involvement in the provision of irrigation infrastructure has been substantial. However, the performances of Agency Managed Irrigation Systems (AMIS) are reported to be unsatisfactory relative to the resources invested into the sector (National Planning Commission of Nepal, 1994). Failure to provide an assured supply of water, failure to reach water to farmers at the tail-end, and failure to achieve economies of scale in all spheres of construction, operation, and maintenance are among the most consistently cited problems. Interestingly, many of these problems observed in AMIS are a result of poorly designed institutions[2] rather than poorly designed infrastructures.

Farmer Managed Irrigation Systems (FMIS),

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[2] The use of the word institution in this paper connotes rules-in-use.

in contrast, are reported to perform relatively well (Lam 1998). In a systematic study Lam shows that FMIS outperform AMIS on most key parameters – agricultural yield, cropping intensities and ability to reach water to tail end. FMIS potential, no doubt, is substantial but not every FMIS is successful. There are some settings where appropriators are able to self-organize successfully and other settings where they are not. Since there are many variables that can jointly affect the benefits and costs of organization, predicting the emergence or lack of self-organization simply by looking at the presence or absence of a set of resource and resource user attributes is not a trivial task (Ostrom, 2001). This paper examines some of the attributes and resource settings in farmer managed irrigation systems of Nepal to understand how it has influenced the abilities of farm communities to self-organize. Such an understanding should allow for the design of policies that can strengthen institutional and governance capabilities of FMIS.

The paper is organized in five parts. Part I presents an overview of the irrigation sector and its performance in Nepal. Part II explores the incentive structures facing farmers in self-organized versus agency-managed systems and examines why farmers in the former systems may be better motivated than those in the latter. Performance comparisons between AMIS and FMIS are presented in part III. Part IV presents research results and explores how some of the attributes of resource users, attributes of physical resource, and resource setting can affect cooperation and performance in self-organized systems. The conclusions and lessons that can be learnt to improve irrigation performance are then presented at the end in Part V.

Irrigation Development and Planning in Nepal

The country has a total cultivated area of 2.6 million hectares. Though 85% of this area has potential for irrigated agriculture, only 1.1 million hectares is covered by irrigation infrastructure (NENCID 2007, Shah and Singh 2001). Surface-water is used to irrigate 900,000 ha and ground-water[3] 200,000 ha of land area. Round the year irrigation is available to only 38% of the irrigated areas. Most (75%) of the irrigated areas are serviced by farmer managed irrigation systems and the remaining (25%) by agency managed irrigation systems (NENCID, 2007)

A vast majority of the irrigation infrastructure developed until the mid 1950s was constructed and managed by farmers. During this period there was some State involvement (Chandra Nahar and Juddha Nahar[4] and a few "Raj Kulos"[5]) but it was limited (Shah and Singh, 2001). Even today farmer managed irrigation systems contribute three times more towards irrigated agriculture than agency managed irrigation systems. It was only after 1956 that planned modes of irrigation development were initiated by the government through its five year plans.

Irrigation infrastructure development from 1956-1980 initially focused on the construction of medium and large scale projects. It then gradually moved towards the intensification of existing command areas through the expansion and rehabilitation of existing infrastructure. Program implementation during this period was very centralized. Irrigation officials assumed all planning, construction, operation and management, and maintenance responsibilities. Beneficiaries were not involved. Only after 1985 did the Government begin to take a more integrated approach to developing land and water resources and unlike earlier times more emphasis began to be placed on user involvement in the irrigation process (Angood et al 2002, Shah and Singh 2001).

The policy reforms undertaken by government to adopt a participatory approach to irrigation development are reflected in documents such as the Water Resources Act 1992, and the updated Irrigation Policy 2003. The policy sets out objectives and guidelines for irrigation interventions including FMIS development and management and transfer of Department of Irrigation (DOI) constructed systems to water user associations (WUA) (Water Aid Nepal, 2005). The irrigation policy which was initially adopted in 1992 has

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[3] Ground-water is used for irrigation mainly in the Terai

[4] Chandra Nahar was the first public sector irrigation project undertaken by the National Government in 1923. The Juddha Nahar was built in Rautahat district in the Terai in 1946.

[5] State budgets were allocated to construct and operate the "Raj Kulos" or royal canals. Regmi (1978) calls them state operated irrigation canals.

explicit provisions for supporting community efforts in irrigation development and encouraging more users' participation in Agency led irrigation development programs. The Water Resources Act 1992 also provides a legal basis for implementing participatory development programs as it recognizes the rights of WUAs. Another important document is the Government's 20-year (1995-2015) Agricultural Perspective Plan (APP, 1995). Irrigation is identified as the primary input to increasing agriculture productivity and FMIS are recognized as key vehicles to deliver the inputs.

Irrigation Performance

An estimated $1.2 billion has been spent in the irrigation sector from 1956-2000 (Shah and Singh 2001). Only 20% of this amount was funded through the Government's own resources. The remaining 80% in investments has been funded by external donors[6]. Nearly 60% of these funds have been spent on constructing new irrigation infrastructure. Despite a standing policy since the mid eighties to prioritize the rehabilitation and expansion of FMIS networks the DOI has invested only about 16% in this area (Shah and Singh 2001).

DOI investments in medium and large scale projects have been disappointing. Shah and Singh (2001) report that water volumes supplied by many large projects[7] are far below original plans and they consistently have capital cost over-runs. Some projects such as Bagmati and Babai are reported to have cost over $5000 per hectare to construct. The 1994 appraisal by the National Planning Commission's regarding irrigation development performance in the country was also negative. It reported that "irrigation development and operation in Nepal is performing dismally relative to the amount of resources poured into the sector" (NPC, 1994). There are many reasons for such poor performance but the ones that are more frequently reported are: a) weak governance framework and enforcement in attaining effective service delivery b) unrealistic productivity projections in assessing benefit-cost ratios, c) poor system management d) insufficient operation and management due to lack of user participation, and e) poor understanding of farmer priorities (ADB, 2001). The institutional arrangements to induce realistic project planning and effective system management are, obviously, weak.

Intervention by government agencies to improve farmer managed irrigation systems have also run into difficulties. Ostrom (1992, 2002) points out that these difficulties often arise because irrigation agencies fail to recognize the institutional aspect of irrigation systems and focus only on improving physical capital. To emphasize her point she cites the experience of the USAID funded Chiregad Irrigation Project in Dang as reported by Hilton (2002). A new irrigation system with permanent headworks and cement lined canals was constructed in an area that was previously irrigated by a network of five farmer managed irrigation systems. Making no efforts to understand how the pre-existing water associations were organized DOI appointed a new user committee. This committee, however, did not even include the water managers of the earlier five FMIS. The outcome of this intervention was that only three of the five "maujas" received water consistently. Prior to the intervention all five "maujas" used to receive adequate water. The effort to improve agricultural productivity through investments in physical capital alone thus resulted in reduction of the service area, unreliable water deliveries, nonfunctional WUA, and a weakened older WUA. Institutional structures stand on social capital developed over many years of learning through shared experiences and are as tangible as physical capital. Their neglect as we see in this example not only resulted in weakening of farmer organizations but also led to adverse outcomes.

Motivation to Self-organize - FMIS vs. AMIS

A self-organized system can be structurally superior in generating positive incentives than externally organized systems. In a self-organized system such as the FMIS it is the farmers themselves who act collectively to construct and govern their systems. They make decisions on delin-

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[6] The Asian Development Bank, World Bank and the Saudi Development Fund account for 60% of the investment and bilateral donors 20%.

[7] Large irrigation projects such as Sunsari-Morang, Bagmati, Bhairawa-Lumbini Groundwater, Narayani etc.

eating service areas, determining water allocation rules and assigning maintenance responsibilities. However, in externally designed systems such as the AMIS it is someone other than the farmers who design the physical system and assume responsibility for making rules and enforcing them. Government officials who are tasked with managing these systems, however, have to govern on shoe string budgets and with limited manpower. Without much incentive to develop long term working relationships with the farmers and faced with resource constraints many try to develop simple uniform allocation rules across the board and often neglect to enforce rules. Given the farmers' diverse cropping schedules and needs such uniform rules are mostly inadequate and without enforcement the stage is set for breaking rules. When "official rules" do not match local needs then conflicts break out, canals are breached, and physical capital is destroyed (Lam, 1998; Shivakoti and Ostrom, 2002).

In more recent times irrigation policy does encourage "turnover" and "joint management" of AMIS to formal water user groups to overcome perverse incentives. However, very little attention tends to be paid in forming these groups and they are often seen as arrangements to obtain a community's cooperation. Little is done to either encourage or develop the governing function of these organizations. Officials (professional engineers) who oversee this process are not motivated[8] and often not skilled[9] to serve the needs of the farmers. The farmers too are not confident about the transfer process and are unwilling to invest their time in operating the system. Incentives to shirk on the part of the officials and incentives to free-ride on the part of the farmers often result in the poor performance of AMIS.

Farmers in successful FMIS tend to overcome their collective action problems by crafting their own rules. The conditions that are necessary to initiate collective action, however, do not arise spontaneously. Unless farmers have a common shared understanding of the costs and benefits of engaging in collective action, unless a secure property regime makes it possible for them to reap the benefits of their efforts in the long run, and unless they are confident that external authorities will not interfere in their rule-making, rule following and rule-enforcement activities farmers will not invest their efforts in organizing for the long term. Simply turning over systems to the farmers and expecting viable organizations to take root is expecting too much. To craft rules that suit a particular environment there has to be an understanding of the interrelationships between the combination of rules with the physical, social, and cultural environment.

Comparing FMIS and AMIS Performance

There are many individual case study reports by authors who assert that FMIS in Nepal perform better than AMIS. Lam (1998) who undertook a systematic and comprehensive study of 127 Nepali irrigation systems also reaches the same conclusion. In the following sections I review his results and those of a few others to underscore Ostrom's (1990) idea that self-organized resource users may be better able to resolve cooperation dilemmas (or be a major part in their resolution) when resources are local in scale. In other words, external actors may face more difficulties than local resource users in designing optimal institutional solutions and enforcing rules at lower costs.

Lam uses three measures of irrigation performance - Agricultural Productivity[10], Water Delivery[11], and Physical Condition[12] - to compare

[8] Engineers do not regard the O&M operation highly. They are much more interested in the construction part of the process. Also promotions in the civil service are based on seniority which to a large extent discourages initiative and creativity. Promotions and transfers are strongly associated with political patronage and not to keeping an irrigation system in good condition.

[9] Institutional aspects of irrigation system design are often not a strong component of engineering training.

[10] Agriculture Productivity consists of three variables viz. agricultural yield measured in metric tons per hectare per year, cropping intensity at head-end, and cropping intensity at tail-end. One crop per year on a plot of land equals a cropping intensity of 100%, two crops mean 200%, and three crops mean 300%.

[11] Water Delivery includes three variables i.e. water adequacy, equity and reliability. Water adequacy refers to whether a system is able to make enough water to meet farmer needs. Equity refers to fairness in distributing water between head and tail end. Reliability refers to the predictability and timeliness of water delivery.

[12] Physical condition reflects the collective maintenance efforts as well as the degree of social organization of the group. It comprises two variables viz. condition of infrastructure and the degree of perceived economic efficiency in maintaining the infrastructure.

performances between FMIS and AMIS. All of his measures are composite indices that consist of multiple variables. Agricultural productivity attempts to capture the productive potential of a group resulting from their collective action efforts. Water delivery measures the ability of a system to deliver water adequately, reliably, and equitably. And, the variable physical condition is a measure of how well an irrigation system is being maintained. Comparing FMIS and AMIS along each of these three dimensions he finds that FMIS on average have higher levels of agricultural productivity, maintain their infrastructures better, and deliver water more effectively than AMIS. He finds these differences to be statistically significant.

Two other relevant results that he reports in his study are that - rule following among appropriators is significantly greater in FMIS than AMIS, and levels of mutual trust is higher in FMIS than in AMIS. More than 50% of the FMIS are characterized by high levels of rule following whereas this is only 20% in case of AMIS; rule infractions in 9 out of 10 FMIS systems are of a minor nature compared to 1 in 2 in AMIS; and farmers trust fellow farmers nearly twice in FMIS than AMIS. The reason why FMIS are able to perform better than AMIS is probably because the rules adopted by the former are better able to distribute the benefits and costs more equitably among the users than the latter. This is reflected in the higher levels of trust and greater rule following behavior observed in FMIS than in AMIS.

Another large N study by Ostrom and Gardner (1993) also suggests that FMIS are better able to deliver water to their tail ends than AMIS. Water is generally most abundant in river courses during the monsoon season. In the spring and winter seasons, however, it tends to be scarcer. Water is the most critical agricultural input for Nepali farmlands and crop yields and cropping intensities are mostly a function of its availability. Therefore, the ability of irrigation systems to deliver water to their tail ends across the seasons is a strong indicator of irrigation performance. Comparing FMIS and AMIS on this measure Ostrom and Gardner (1993) find that FMIS consistently outperform AMIS across the seasons. Their results show that three times more FMIS are able to provide abundant water to their tail ends than AMIS during the winter and spring seasons.

Studies of 160 FMIS in Tanahu by Poudel et al (1994) and 88 FMIS in Chitwan by Shukla et al (1993) also indicate that FMIS are able to produce more spring paddy (4 mt/ha/yr and 4.6 mt/ha/yr) than the national average (2.28 mt/ha/yr).

The above results indicate that farmers in self-organized irrigation systems are capable of performing better than their counterparts in systems that are managed by external actors. This, however, does not mean that farmers are always successful at self organization. There is general agreement that appropriators who are dependent on a resource, intend to use their resources over a long period of time, have achieved certain levels of trust, and possess some level of autonomy to make their own rules are more likely to self-organize. Whether they are actually able to do so, however, depends on how attributes of the resource and attributes of the resource users interact in specific field settings to affect the perceived costs and benefits of organizing (Ostrom 1999). In the following sections I examine how some of the resource attributes and resource user attributes may influence performance of FMIS in specific resource settings.

FMIS Performance in Chitwan - Research Results

This section draws heavily on a study undertaken by Regmi of 74 farmer managed irrigation systems in Chitwan, Nepal (Regmi 2007). In Chitwan, there are two distinct types of river systems; north-south flowing rivers (N-S) and east-west flowing rivers (E-W). Rivers that flow N-S originates from the Mahabharat hills and passes through changing terrain from hills to plains. These rivers are characterized by steep gradients, seasonal flows, changing river course, low discharge volumes, and difficult terrain (Pradhan, 1989). Irrigation systems drawing water from these rivers tend to have longer canals, pass through landslide zones, and require frequent maintenance of diversion structures. E-W rivers on the other hand are characterized by flat terrain, mild gradients, perennial flows, and high discharge volumes. Irrigation systems on these rivers enjoy an advantage over the other systems in terms of ease with which appropriators can access resource units. The N-S and E-W groupings reflect distinct resource settings. Apart from this, system variations also occur with respect to group size, ethnic compositions, exit options, in-group income differences and many other variables. It is within such a context that local resource users have to organize and craft rules that allow them to maintain their resources as well as ensure equitable resource distribution.

Performance of an FMIS in Chitwan tends to be strongly associated with the orientation of the river system from which it draws its waters. As pointed out in the earlier paragraph, the characteristics of a river system have a direct bearing on the amount of efforts required to operate and maintain a system and the volume of resource units available to it. This is reflected in the ability of E-W irrigation systems to access water for more number of months in a year, maintain their infrastructures better, and enjoy higher cropping intensities. Whereas all E-W irrigation systems are able to access water from the rivers for more than 9 months only 1 out of 4 N-S systems are able to do this. Also, agricultural productivity and infrastructure in E-W systems are better than those in N-S systems by factors of 1.25 and 1.18, respectively.

The above results, however, do not necessarily mean that E-W systems are better governed than N-S systems. In fact, higher levels of rule following behavior are observed in N-S systems than in E-W systems and the differences are significant (Chi^2 = 3.185, p=0.074). This suggests that less endowed resource systems (N-S) may be more rigorous at fine tuning operational rules and following them than their better endowed counterparts. The larger implication of this result, though, is associated with self-organization. Resource users, even in the absence of a conducive environment, may be able to self organize and develop effective agreements when benefits of organizing are commonly understood.

Irrigation performance was also found to be influenced by the willingness of individuals in groups to assume leadership or entrepreneurial activities, and a group's history of prior organizational experiences. One in five E-W systems report weak leadership roles versus three in five in N-S systems. Similarly, some history of cooperation in activities other than irrigation is reported in 8 of 10 E-W systems versus 3 in 10 N-S systems. The differences in leadership and organizational activities also associate positively and significantly with irrigation performance. Unless individuals are willing to invest substantial amounts of their personal time and energy to coordinate activities of the many users it may not be possible to craft workable institutions. Making, testing, fine tuning, interpreting, and monitoring and enforcing rules to structure irrigation activities is a continuous process and it requires substantial amounts time and energy. Ternstorm (2002) also reports a significant relationship between leadership abilities and performance in her study of irrigation systems. Any type of prior organizational history is also important. Familiarity with various rules and strategies used to achieve various forms of regulations make the task of organization a bit easier as users are more likely to agree upon rules whose operation they understand from prior experience.

Results from Chitwan also indicate that there is no correlation between socio-cultural differences as reflected by a group's ethnic composition and irrigation performance; negative correlation between income variation and performance; and no correlation between size of an irrigation system as measured by its command area and performance. The results suggest that variations in incomes within groups may be a greater impediment to self organization than the number of ethnicities that comprise a group. In regards to the socio-cultural variable the result is in line with the studies of Fujita et al (2000), Gautam (2002) and Somanathan (2002). They too do not find any association between their measures of socio-cultural heterogeneity and collective action. Regarding income variation and size the results are similar to those of Tang (1992), Lam (1998), and Ternstorm (2002). All of these studies too find a negative correlation between income inequality and collective action, and no correlation between size and collective activity. One might expect better coordination and collective action when system size is small but this appears not to be the case.

The effects of engineering infrastructure i.e. the type of headwork or canal lining on irrigation performance appears not to be uniform. The presence of a sturdier and more permanent type of headwork on a system appears to be negatively correlated with performance. A sturdier cement lined canal, on the other hand, is positively correlated to system performance. Though the results are not statistically significant their implications very much are. A truly permanent headwork, ironically, generates negative incentives for head-enders not to want to cooperate with tail-enders in system maintenance (Lam 1998). Partial or complete cement lining on the other hand appears to improve performance by minimizing system water losses thereby enabling water to reach the tail ends. The policy implications of such results are that improvements in engineering infrastructure alone may not necessarily translate into improved system performance. Unless users are able to craft and enforce rules that can cope with the asymmetries generated by improvements in irrigation infrastructure the positive effects may well be cancelled out by the negative effects.

Conclusion

Irrigation systems face a variety of challenges. The terrain can be difficult, rivers can be unruly, group members may belong to diverse cultural backgrounds, group sizes can vary, asset endowments may differ, and interests may differ within groups. Given these constraints an irrigation system has to be able to solve the fundamental problems of provisioning and appropriation associated with common pool resources. Intakes and canals have to be constructed and maintained on a periodic basis and working rules have to be crafted to reflect appropriation rights and responsibilities. This paper argues that such activities, which consume lots of energy and require the mobilization of significant resources, might be undertaken more effectively by self-governed groups rather than by centralized government agencies.

The arguments for government interventions are often based on the premise that flimsy infrastructures employed by farmers results in waste, group differences within a community prevent farmers from self organizing, increasing group sizes and command areas make it more difficult for farmers to reach effective agreements among themselves, and larger integrated systems result in economies of scale. Empirical results from the field, however, suggest otherwise. Despite considerable group heterogeneity farmers are able to organize; even with flimsy infrastructures they are able to outperform agency managed systems with superior infrastructure; and they are able to reach agreements even when group sizes or command areas are significantly large. These results underscore Ostrom's (2002, 2005) observation that there is a strong institutional aspect to irrigation systems and focusing alone only on improving physical capital may not result in improved irrigation performance.

Though FMIS potential may be substantial, the paper also recognizes that not every FMIS is successful. Some resource settings tend to be more conducive for self-organization than others. Systems with difficult topography, N-S systems, face far more organizational challenges than systems with favorable topography. However, the abilities of groups to craft rules and their willingness to monitor and enforce them can to a great extent overcome the problems associated with initial resource endowments. The lack of leadership abilities or prior organizational history, in fact, can turn out to be more a more detrimental factor to self-organization and irrigation performance than initial resource endowments, ethnic differences, or even the presence of permanent irrigation infrastructure. Understanding how different variables interact in different settings can help in designing policies that can strengthen institutional and governance capabilities of FMIS

There are many dimensions to the basis for cooperation among individuals. Individual common-pool resource users are likely to contribute and cooperate only if they perceive that they will be able to reap the long-term benefits of engaging in collective action. They are also more likely to cooperate if they are aware of their interdependence and see mutual benefits resulting from working together. The presence of a set of credible, commonly understood, well-enforced and agreed-upon rules further helps in generating a positive incentive system for villagers to engage in collective action. Without creating the right environment, bureaucracies cannot assume that cooperation among resource users will develop naturally once an irrigation system has been handed over to the users. Creating a right environment is going to require the bureaucracy to emphasize institution building, engage local resource users in all aspects of irrigation development, and ensure their legal standing. Common-pool resource systems are co-production processes that perform best when both the oversight agencies and resource users cooperate in making the system work.

Farmers in Chitwan have been able to overcome collective action problems and are fairly successful at managing water resources in their unique settings. This implies that, even though it is difficult, it is possible that resource users with a supportive political system can locally overcome what are assumed to be severe collective action problems. If external assistance is geared towards supporting the farmers' efforts to develop their own institutions this could potentially result in enhanced water security and improved irrigation performance.

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NEPAL: DISCUSSION

Question: While 15% of the irrigation area in Nepal is managed by the FMIS, this would be a cause of concern if the Nepali society is developing and the agricultural concern is declining in its importance. How is the present situation in Nepal? What strategies are in the pipeline to fill up the gap if FMIS are disintegrating?.

Answer: There are certain pockets where the development of the local economy has impacted the operation of FMIS by providing farmers with an exit option via jobs and other opportunities. However, most of Nepal still remains rural and cultivating crops for livelihood is still a major concern. There are plenty of scope to actually improve the management and operation of the irrigation systems.

Question: From your experience in case studies, the literature from the scholars in Nepal studies, could you please explain more or give more information on the linkages between high level institutions (formal rules/policies/laws) and the lower level institutions (rules-in use) in large - scale irrigation systems?

Answer: Formally legislations have been enacted to recognize the rights of water users associations. In principle they have the right to assert themselves. Departments have enacted policies to support farmer activities. However, there still remains a big gap between enacting laws and putting it to practice.

Question: Could you please give more information on the incentives from the Government Irrigation Agencies and local authorities/decision makers in the process of irrigation management transfer in Nepal.

Answer: The incentive structures facing irrigation officers in agency managed systems does not give incentive does not encourage the staff to cater to the needs of the farmer. The transfer/promotions are not tied to ones abilities to serve the farmer. Hence there is a general lack of initiatives on the part of the staff, resulting in the application of uniform rules across the board. The lack of shoestring budget of the department aggravates the problem further.

Question: There are several factors that affect technical efficiency of water users such as group size, social and eco-heterogeneity, farm size, incidence of terror, urban access, leadership, nonfarm income, social capital. Do you think these factors are also important in Nepal?

Answer: There are many individual factors that are important and can affect the performance of irrigation systems. What is more important, however is to understand the inter-linkages between these factors and how they affect the benefits and costs perceived by the resource users or those who are in the position to change the status quo. If the benefits are perceived to be greater than the cost then there is a likelihood of cooperation and self-governance to emerge. Otherwise, the possibility of self-governance becomes remote. Thus this lack of budget of the government further aggravates the problem.