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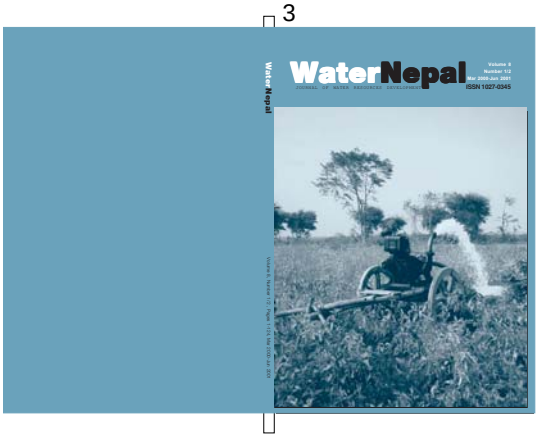
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Diesel Pump in operation, Bihar's Kosi command, by Dipak Gyawali

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EDITORIAL POLICY

Water Nepal is published two times a year by Nepal Water Conservation Foundation. *Water Nepal* is a publication for planners, engineers, scientists, policy makers, and administrators engaged in water development and management. Its aim is to function as a forum for sharing experiences in different aspects of water resource development. Each issue of *Water Nepal* includes summaries of new techniques, reflections on current approaches in water development, management, research findings, and case studies of innovative practices including field experience. As a matter of policy *Water Nepal* publishes articles not published elsewhere. But pieces that are of policy relevance for Nepal, that serve educational purposes, will be included.

Editorials, feature articles, and reports in *Water Nepal* will discuss water management problems, analysis of long term development needs and trends, dispute resolution, impact assessment and mitigation, overcoming weaknesses and ensuring institutional learning for sustainable water development; as well as balancing water development with social and environmental objectives at the micro, meso and macro levels by understanding the interdisciplinary relationship between water use and sustainability.

Each issue of *Water Nepal* includes

Editorial: Issue and Authors – an overview of the articles and authors in the issue.

Viewpoint – a column that offers views on contemporary water development issues and provides a connecting thread to the views presented in the articles of the particular volume.

Feature Articles – detailed presentations of theory and practices in water development. Members of Editorial Advisory Board and other peer reviewers review these.

Innovation from field – brief presentation of field experiences in water resource sector.

Reports on Gray Literature – reviews of past or contemporary public documents in Nepal and abroad.

Book Review – books selected by the editorial board and reviewed by experts in the appropriate field.

An Editorial Advisory Board of practitioners, scholars, and professionals involved in water development assists the editors in selecting materials included in *Water Nepal*.

Opinions expressed in the article rest with the author/s and do not reflect views of Nepal Water Conservation Foundation, advisors of the journal or its funders.

WATER NEPAL, VOL. 8, NO. 1/2, 2001, 1-3

Editorial: Issues and Authors

POLITICS AND WATER

'Lack of political will' is an oft-repeated excuse to explain failure to move ahead in water resource development and management. Those entrusted with implementing water projects lament, 'we would succeed if the political masters listened to technical suggestions'. Technical people beat their breasts over the lack of political consensus.' 'Political will' is said to be the *sine qua non* for resolving trans-boundary river water sharing issues or using water to reduce poverty. Its absence is blamed when planned objectives remain unmet. Politicians do not agree often because they represent different sections of society and thus differing over contradictory interests are pulled at from different directions. The 'political consensus' sought by many technocrats has remained an unachievable goal.

Technicians hope to get immediately into the implementation of projects without having society come in the way. Because the responsibility of developing and managing water, for much of last one hundred years, been technically guided, this aspiration is understandable. But, no matter how much technicians would like it to be, a society is not a clean slate and it does not take efforts at technical re-tooling lightly. Where water projects have been implemented under that naïve assumption, the social and environmental costs have been very high indeed.

Water, nature and society are linked in complex ways which are neither linear and nor easily predictable. The use of technology is an expression of power that allows for the control and manipulation of water in nature. Water technology has generally been used by nation-states with the objectives of meeting drinking water, irrigation and industrial needs, of obtaining revenue for the state, and of exercising political and administrative control. Revenue and control were the raison-d'etre for developing irrigation systems in South Asia during the Colonial period. In western United States, control over river water allowed uninhabited territories of the so-called Wild West to be colonised. In the former Soviet Union, Lenin's GOELRO Plan conceived hydropower as a means to achieve economic independence and growth. Though the stated goals of all three efforts were achieving regional development and improving access to water, the politics of bureaucratic control underlay the enerprises.

In many localities, access to water has improved as a result of past interventions. Many other societies of the developing world, however, face increasing stress due to resource degradation and diminished access to clean water. Earlier

efforts to manage water have produced losers and winners, and, the losers were the weak sections of society and the mute water-dependent life forms. The papers of this volume suggest that politics is embedded in many aspects of water management. The wise course of action for the technical community involved in water management activities is to assure a balance of power between the various sections of the society.

In the viewpoint, Ajaya Dixit suggests that debates over three water projects in South Asia created the impetus for forming the World Commission on Dams. He argues that the Commission and its report *Dams and Development* was an attempt by collective compromise to respond to emerging water management challenges. Social and natural uncertainties have, in the present context, rendered many tested tools of management outmoded; innovative approaches are needed. He argues that we need a new vision that would start by revising our image of water to make it a more inclusive constituent of nature and communities.

In the first feature article, Govinda Koirala reviews the problems facing groundwater irrigation using shallow pumpsets in Nepal. The article documents the economics of pump ownership and discusses the details of arrangement for subsidy. The author suggests that the objectives of Nepal's Agricultural Perspective Plan (APP) will not be met without significant structural changes. These include innovations in cropping patterns, pumpset technology, water markets, subsidies and loan availability for farmers with small land holdings. This article is based on the author's paper titled 'Clogs in Shallow Groundwater Use' published by Winrock International, Kathmandu in December 1998.

The second article also takes up the case of groundwater pumping and energy use. S. Janakarajan analyses the genesis of the politics of subsidies for groundwater pumping in Tamil Nadu. The issues raised bring home the point that politics is intrinsically embedded in resource management questions, forcing us to explore the linkage between politics, institutions and society. Janakarajan's insights and conclusions will be useful to students of institutional studies. Subsidies, the author argues, have led to fiscal haemorrhage but removing them will adversely affect small and marginal farmers.

The next article, by Binod Bhattarai discusses how Nepal's Supreme Court's decision on the Arun III project helped the cause of people's right to information about development projects. Such projects often raise economic and socio-environmental questions that the technical people either answer poorly or not at all. He discusses anti-Arun III activism and argues that such activism informs and educates people, and, in the end, brings about a more positive balance of power in society.

One undesirable aspect of modern development is river pollution. The fourth article is by Bart Scott, a student in Kathmandu in 2000, who completed an anthropological study focussing on the religious aspects of the Bagmati River. He questions why the river is polluted despite the sacredness attributed to it by Kathmanduites. He suggests that people are aware of the ill effects of pollution but they don't take remedial actions, and concludes that activism is needed to save the river. If people's belief in the Bagmati's divinity can be transformed into a social movement, changes can be wrought, argues Scott.

Ramesh C. Bohara discusses Rural Water Supply and Sanitation Project's (RWSSP) initiative in providing drinking water to Daugha VDC, Gulmi District, Lumbini Zone, using rainwater harvesting tanks. Each tank meets the drinking water needs of one family. He discusses multiple aspects involved in promotion of the rainwater harvesting technology in the hills of Nepal and shows how this has become an important innovation in Nepal's rural hinterlands. The author was affiliated with RWSSP from November 1991 to April 2001.

The section on 'gray literature' reviews two reports. The first is the 1987 Pokharel Commission Report and the second is Review and Evaluation of UNDP/ NWSC Management Project. Santosh Shrestha who reviewed the two reports suggests the need for a more critical analysis of the institutional context in any effort at reformulating the existing urban drinking water improvement strategy. The lesson of this review is to look for institutional innovation to manage water supply in Kathmandu.

Laxmi Narayan Chaudhari reviews the book 'The Dilemmas of Water Division', written by Lucas Horst. The reviewer, who is a lecturer at Nepal Engineering College, argues that South Asian engineering education is still technology-guided and responds poorly to the emerging challenge of managing irrigation water. Water education must be reoriented by introducing social, environmental and legal dimensions and not just focussing on technological ones.

How we as a society can respond to pollution, groundwater overdraft, unrealibility of supplies in irrigation, access to information and other issues is an important question. But the quest for solutions needs to heed the fact that this question involves politics. Answers must come from within the realms of social norms, specific context, and peculiarities of locations. The fundamental imperative is to recognise that power that is not contested can make hubris-ridden choices that will generate more problems in the future than the problems they purport to solve.

WATER NEPAL, VOL. 8, NO. 1/2, 2001, 13-37

SHALLOW GROUNDWATER IRRIGATION IN THE NEPAL TARAI: CONSTRAINTS AND OPPORTUNITIES

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ABSTRACT

Nepal's Agricultural Perspective Plan (APP) formulated in 1995 views groundwater development as the main engine for the country's economic growth. This paper argues that this objective is not being met well and that it is unlikely to be achieved without significant changes for the following four reasons. First, given current cropping patterns and poor selection of pumpsets, the efficiency of pump utilization is inherently low. This fact makes the purchase and use of pump equipment uneconomic. Second, water markets are unlikely to increase the efficiency of pump utilization because in the existing agricultural system potential buyers and sellers need water at the same time. Third, subsidies are too limited to encourage growth: they cover none of the operational costs of pumps (a factor which, among other things, limits the purchase of water by non-pump owners); and the funding available for subsidies is too little to cover the demand for pumps. The fourth factor is that loan requirements severely constrain access to subsidies for small landholders and farmers with fragmentary land holdings. This paper documents the economics of pump ownership and discusses the details of subsidy structures. Specific policy changes, including crop diversification which spreads irrigation demands over an entire year and more carefully targeted subsidy structures are essential if the objectives of the APP are to be realised.

INTRODUCTION

The objective of irrigation is to make an assured supply of water available at a reasonable cost and an appropriate time. When he/she has a reliable supply of water a farmer can plan agricultural activities in advance and thereby improve productivity. Water is seasonally plentiful in Nepal but there is often no supply of water to irrigate cultivated land and cropland[1]. Despite the heavy investment in surface irrigation in the past, access to water from the many canals built is unreliable. This has resulted in low, and even declining, agriculture production.

Since the early 1970's, when the government started supporting the use of shallow tubewells (STWs), groundwater has increasingly been used for irrigation in Nepal, especially in the Nepal Tarai, the region this article considers. By increasing the reliability of a water supply, STWs are used as insurance against potential failures in surface irrigation. Even within the command areas of surface irrigation systems

the use of pumpsets is now widespread. The government has led this trend in groundwater development as per the Agriculture Perspective Plan (APP), which aims for economic growth by expanding area in the Tarai under irrigation by using groundwater. The APP aims to double the annual rate at which tubewells are installed and to increase the area under groundwater irrigation by 612,000 ha by 2015, when the plan will come to an end. This programme includes support to subsidising the purchase of pumpsets. This focus assumes that, pumps, because they are in the private sector, are responsive to policy interventions.

How successful the objectives of the APP are being met in the Tarai, given the constraints to effective implementation of its groundwater development aim are not well known. Likewise, the pumpset's role in the context of this plan is poorly understood.

In order to address some of these questions, this paper explores the economics of the development of shallow groundwater irrigation in the Nepal Tarai. It evaluates the issues of ownership associated with individual and community managed shallow tubewells and with deep tubewells installed by the Agriculture Development Bank Nepal (ADBN). The paper also analyses the Bank's programme as it was implemented in six of the twenty Tarai districts (Kanchanpur, Banke, Rupandehi, Bara, Dhanusha and Morang) using well certification records maintained by the bank[2]. These districts are distributed across Nepal's five development regions, that is in Far-West, Mid-West, West, and Central and Eastern regions. Information were also collected from farmers, equipment dealers and suppliers, technicians (engineers, overseers and drillers), workshop owners, government officials, and others engaged in the business of groundwater development. The paper concludes by proposing measures for improving the development and management of groundwater based on the research findings.

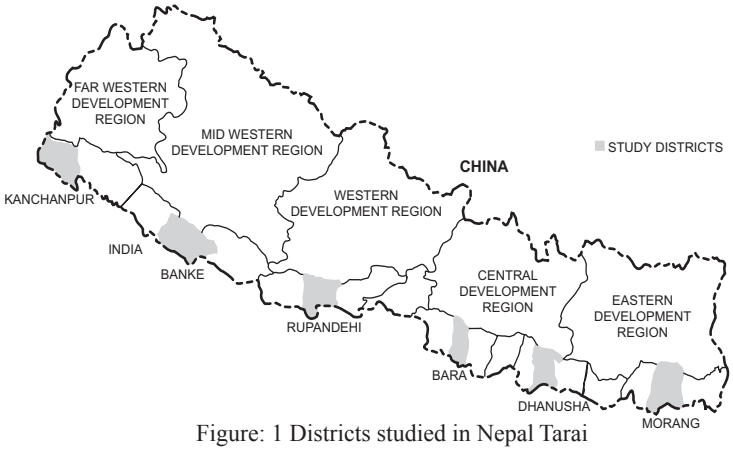

Figure: 1 Districts studied in Nepal Tarai

SHALLOW GROUNDWATER UTILISATION: STATUS AND TREND

Between the fiscal years of 1980/81 and 1996/97 the ADBN installed about 40,000 pumps. Then in 1998, the Bank financed the installation of about 3,000 shallow tubewells (STWs). Between 1990/91 and 1996/97 a total of 21,808 borings were installed in the 20 districts of the Tarai (Table 1). In addition to the ADBN programmes other programmes that promote groundwater development in Nepal Tarai include Bhairahawa Lumbini Groundwater Project (BLGWP) and the Agricultural Development Project Janakpur (ADPJ). Five thousand STWs have been installed within the project framework of ADPJ and Sagarmatha Integrated Rural Development Project (SIRDP). Furthermore, community managed deep and shallow tubewells are being promoted by the Irrigation Support Project and Irrigation Line of Credit (ISP and ILC) programmes supported by the World Bank and the Asian Development Bank, Manila (ADBM). The total number of STWs, which have been installed, is not known because no records of privately installed pumps are maintained. Also, the number of pumps installed does not reveal a trend. Assuming, though, that the prevalent subsidy arrangement precludes individual initiatives in installing private pumps, the ADBN record can be considered as an approximate minimum number of wells/pumps installed in the Tarai.

Of all the districts where STWs have been installed, Rupandehi has the highest number of borings (2,499) while the district of Dang has the lowest (198) (Table 1). The distribution of borings and pumpsets is most widespread in the Eastern Development Region followed by the Central, Far-Western, Western and the Mid-western regions in decreasing order. The pumpset-boring ratio was highest in Mahottari District (0.96) and lowest in Nawalparasi District (0.37). The depth of boring varied from an average of 40.1 feet in Kapilvastu District to as high as 137.2 feet in Mahottari District. The average pump discharge was highest in Rautahat (15.9 l/s) and lowest in Saptari (8.6 l/s) with the average discharge of all the pumps in all twenty districts being 13 l/s. At 7.6 ha, Kanchanpur has the largest average command area per pumpset and Bara, at 1.3 ha, the smallest. Per pump, the highest cost was Rs 34,240 in Dhanusha and the lowest Rs 12,520 in Nawalparasi. The average cost was Rs 22,162, a figure which includes the government subsidy. In Dhanusha District the high cost can be attributed to the use of a drilling machine.

This history, however, does not present a realistic picture of groundwater development in the region. Since 1992 there has been a decline in the number of pumps installed by an average of 500 units per year. The area irrigated by a pumpset is also on the decline; the command area has decreased at an average rate of 0.3

Table 1
Average features of pumpsets installed since 1989/90 by districts

District	Borings (No.) A	Pumpsets (No.) B	B/A	Depth (ft)	Discharge (l/s)	SWL (ft)	Command area (ha)	Cost (Rs)
Kanchanpur	1,336	955	0.71	57.9	11.7	13.9	7.58	16,200
Kailali	2,295	1,892	0.82	54.5	11.9	12.5	1.75	24,780
FW Region	3,631	2,847	0.78	55.8	11.8	13.0	3.9	21,623
Bardiya	765	386	0.50	58.5	11.9	13.2	1.59	16,610
Banke	1,205	903	0.75	54.2	12	11.6	1.89	21,250
Dang	198	135	0.68	41.1	13.3	12.6	4.82	17,900
MW Region	*2,168*	*1,424*	*0.66*	*54.5*	*12.1*	*12.3*	*2.1*	*19,307*
Kapilvastu	219	164	0.75	40.1	12.5	10.9	3.34	19,240
Rupandehi	2,499	2,021	0.81	50.6	12.9	10.5	1.31	24,350
Nawalparasi	391	145	0.37	51.3	13.3	11.4	1.39	12,520
Western Region	*3,109*	*2,330*	*0.75*	*49.9*	*12.9*	*10.6*	*1.5*	*22,502*
Chitwan	215	169	0.79	41.2	13.7	16.1	1.63	20,610
Parsa	240	220	0.92	65.6	12.1	11.7	2.01	29,580
Bara	1,195	857	0.72	56.9	10.9	13.5	1.26	20,280
Rautahat	862	653	0.76	63.2	15.9	12	1.98	23,250
Sarlahi	2,096	1,022	0.49	60.6	15.2	11.4	1.7	16,000
Mahottari	407	391	0.96	137.2	12	11.5	2.79	33,280
Dhanusha	712	598	0.84	79.3	11	11	3.08	34,240
Central Region	*5,727*	*3,910*	*0.68*	*67.5*	*13.5*	*12.1*	*1.9*	*22,222*
Siraha	1,056	972	0.92	55	11	12.6	3.45	29,930
Saptari	658	576	0.88	67.8	8.6	12.5	2.39	25,790
Morang	1,849	1,371	0.74	65.1	13.7	10.7	2.04	26,700
Sunsari	2,096	1,021	0.49	56.9	15.2	11.4	1.7	15,990
Jhapa	1,514	1,069	0.71	62.7	15.4	10.6	2.61	22,620
Eastern Region	*7,173*	*5,009*	*0.70*	*61.0*	*13.6*	*11.3*	*2.3*	*23,101*
Nepal	**2,1808**	**15,520**	**0.71**	**59.6**	**13.0**	**11.8**	**2.3**	**22,162**

hectares per year. In addition, the cost of a tubewell and of each unit of irrigated area has increased (Table 2). The cost of a tubewell is increasing at a rate of more than Rs 3,000 per year. The decrease in the number of pumps, coupled with the decline in area served, has resulted in an increase in the average cost of irrigation per hectare by about Rs 2,500 each year. Though the total government subsidy for pumps has been cut back by about 5 million rupees per year in recent years, the amount of a loan to install a single tubewell and pumpset has remained more or less static since 1992. These figures suggest that disbursement in real terms has declined.

The actual decline trend in the use of pumpsets contradicts the assumption made in the APP that the number will double annually. An analysis of the causes of the decline necessitates deeper investigations into both the supply and demand aspects of the groundwater development programme. The supply side is relevant because policies affect performances. The achievement in any year shows ADBN's latent execution potential under the given policy and subsidy framework[3]. Generally, the annual quota of pumpsets that is allocated to a branch office of ADBN is exhausted before the fiscal year ends. The bank entertains only those requests for loans that demonstrate eligibility for financing. The loan request form, however, is filled out only by those who will actually receive a loan. The total number requisitioned, therefore, does not present an accurate analysis of the actual demand. For boring and pump/engine purchases the bank initially provided a subsidy of 40 per cent for individually-owned pumpsets and of 75 per cent for community-owned units. In 1998, the subsidies were reduced to 30 per cent and 60 per cent respectively.

Demand is an important aspect. The loan eligibility criteria stipulate that to qualify for a standard 4-inch boring, a farmer must own a 1.5 *bigha* (or about 1 ha) plot of contiguous land. However, contiguity does not exist in the Tarai as land parcels are scattered to form a crazy quilt of land holding. The criteria, therefore, preclude small farmers from taking advantage of a loan. Also, farmers have tended to crowd the bank, demanding loans, during particular years; runs like these also affect demand. ADBN provides loans for installing pumps to groups of three small farmers with contiguous plots in the Small Farmers Development Programme (SFDP) areas. In non-SFDP areas, too, farmers can form a group and apply for a loan. The purpose of extending loans to areas not covered by the SFDP is to provide opportunities to farmers with small land holdings who are not included in the SFDP programme.

Table 2

Coverage and cost of ADBN funded shallow tubewell (1992 to 1997) (in Rs × 10^3)

Description	1992/93	1993/94	1994/95	1995/96	1996/97
No. of wells installed	5,164	4,716	3,604	3,074	2,631
Area coverage/STW (ha)	3.3	3.0	2.7	2.05	2.00
Bank loan	71,356	93,745	69,133	76,950	74,999
Government subsidy	64,111	59,579	44,842	39,429	38,203
Total	135,467	153,324	113,975	116,379	113,202
Cost per tube well	26.3	32.5	31.6	37.9	43.0
Cost per hectare	8.0	10.8	11.7	18.5	21.5

Source: Computation based on information furnished by ADBN

ADBN provides loans for installing pumps to groups of three small farmers with contiguous plots in the Small Farmers Development Programme (SFDP) areas. In non-SFDP areas, too, farmers can form a group and apply for a loan. The purpose of extending loans to areas not covered by the SFDP is to provide opportunities to farmers with small land holdings who are not included in the SFDP programme.

The lending process for community pumps is the same as that for an individual-owned pump. In some cases, an individual farmer secures a loan, and then divides it among three beneficiaries. The collateral put forward by each farmer is evaluated separately, the loan amount divided proportionally, and an individual repayment schedule prepared. The bank, however, considers this arrangement the same as an individual loan. Despite the higher subsidy, (60 per cent as compared to 30 per cent) the number of community pumps is small compared to the number of individually-owned pumps. ADBN's well certification records from 1987 to 1997 in the six districts of the Tarai this study examined shows that community pumps constituted only four per cent of the total number of pumpsets installed in those regions (Table 3).

ECONOMICS OF A PUMPSET

Installation cost

The cost of installing a pumpset depends upon the water table, the geology which determines the boring method, the bore diameter governed by the command area, the discharge potential of the well and the choice of water lifting device (the brand and capacity of the pumpset). The cost of installation is generally higher in the North

Table 3
Percentage of community pumpsets in the study districts

District	Total STWs	Community STWs	Percentage
Kanchanpur	1,336	15	1.12
Banke	1,203	71	5.90
Rupandehi	2,500	72	2.88
Bara	2,172	1	0.00
Dhanusha	712	41	5.76
Morang	1,781	127	7.13
Total	**8,728**	**327**	**3.75**

Source: ADBN well certification records (1987-1997)

Table 4
Installation cost of 4-inch diameter wells for 1996/97

S. No.	District	Cost of STW installation (Rs $\times 10^3$)	
		Northern VDCs	Southern VDCs
1	Kanchanpur	50	35
2.	Banke	36	34
3.	Rupandehi	38	32
4.	Bara	No wells	31
5.	Dhanusha	44	41
6.	Morang	39	34

Source: Well certification records, ADBN

Tarai than in the South, because the North has a deeper water table and mixed boulder geology (Table 4). The southern region, on the other hand, is made of alluvial deposits. In the northern Tarai, to men, drillers use mild steel pipes instead of high-density polythene pipes. Steel pipes are three times more expensive, though, and thereby jack up the cost of boring. To install a 60-feet deep 4-inch diameter borehole with a standard 8 horsepower (HP) pump/engine without a subsidy cost about Rs 42,000 at 1996 prices. When the 30 per cent subsidy is considered the farmer's share of the cost comes to about Rs 30,000. In general, the cost of pumpset installation is increasing annually. In 1995/96, for example, the average cost of an Indian pump was 20 per cent higher than it was in 1994/95. Costs can be brought down if Chinese pumps, which are cheaper than Indian brands, are used.

Multiple regression analysis of the data from more than 21,000 pumpsets shows a good fit between the dependent variable (cost) and the independent variables (engine horsepower, boring depth, pump age, and boring size)[4]. On average, the base cost of the system (Rs 22,467) increases with an increase in the capacity (HP) of the engine, as well as with the depth and size of the boring. Each unit increase in engine capacity raises the cost by more than Rs 1,000. Similarly, each additional foot of depth in a well costs Rs 100, and a one-inch increase in the diameter of the bore costs an additional Rs 1,350. The negative coefficient of the age variable implies that the older the system installed is the less it will cost. From the age coefficient, the average annual increase in the cost of a pumpset comes to about Rs 2,000.

Regression equation

$$\text{COST} = 22.647 + 1.077\ \text{HP} + 0.101\ \text{DEPTH} + 1.351\ \text{SIZE} - 1.901\ \text{AGE}$$
$$(46.38)^* \quad (27.06)^* \quad (46.20)^* \quad (11.09)^* \quad (-82.41)^*$$

Note: The figures in parentheses under the independent variables show respective T-statistics. $R^2 = 0.526$; Adjusted $R^2 = 0.525$

* The significance of the coefficients is to 95 per cent confidence level.

Cost of operation

The cost of operating a pumpset includes the interest on the capital employed, the depreciation of the equipment, the annual salary of an operator, if one is hired, and the cost of insurance, though none of the pumps were insured. These are indirect costs. Direct costs include fuel lubricants, as well as repair and maintenance. Direct costs are inversely proportional to the number of hours a pumpset is operated in a year; the higher the number, the lower the direct cost.

In the Tarai, however, low pump utilisation efficiency is the norm and is one of the factors affecting the lack of agricultural expansion in the area. On average, each household operated its pump for 162 hours a year, including the time for which pumps were rented out (Table 5). The hours of operation were highest in Morang (208 hours/year) and lowest in Banke (95 hours/year), but in both cases they were used for less than the potential use of over 1,200 hours/year. This means the pumps use time were less than their overall potential, even though they were not only used for irrigating paddy, but also for irrigating wheat and for threshing. Low use has a number of causes. First of all, pumps are used only to irrigate paddy and wheat, whose requirements are low and seasonal. For the rest of the year the set remains

Table 5
Annual pumpset use (hours)

Districts	Use in own farm	Rented out	Total	Time rented out (%)
Kanchanpur	70	44	114	38.6
Banke	49	46	95	48.4
Rupandehi	105	97	202	48.0
Bara	153	38	191	19.9
Morang	174	34	208	16.3
Overall	110	52	162	32.1

Source: Field Survey

Note: Dhanusha was excluded because of artesian conditions

idle. In addition plots are small and scattered, inputs such as fertilisers are low and extension services lacking. Not having cash to buy diesel also limits farmers' use of pumps. The loan package does not include provisions for owners to buy diesel or for purchasers to rent the set. Further constraints are imposed by technical factors related to operation and maintenance (Gautam and Shrestha, 1997). Since most repair workshops are located in towns, the users and the repair facilities are separated. The result is the postponement of repairs. Iron, also, is high because diesel is mixed with kerosene for repair and maintenance.

As long as a pump is used only to irrigate paddy and wheat, bringing more area under irrigation will not have a positive effect on agricultural productivity. Such expansion could, in fact, prove to be a hazard. Unless traditional cropping pattern are changed the rate of pumping during peak irrigation periods would increase, because communities follow similar cropping patterns. When large numbers of pumps in a given area are operated simultaneously the possibility of well interference increases.

Table 6
Average STW operation cost

Particulars	Kanchanpur	Banke	Rupandehi	Bara	Morang	Average
Boring cost (Rs)	4,500	9,240	6,290	2,417	13,019	7,093
Pumpset cost (Rs)	20,441	15,797	14,924	20,954	27,682	19,960
Total cost (Rs)	24,941	25,037	21,214	23,371	40,701	27,053
Fuel and lubricant	2,534	2,397	1,947	2,465	3,620	2,593
Repair and maintenance	3,136	1,135	1,375	1,587	2,139	1,874
Operator	0	0	0	0	0	0
Depreciation (@10% pa)	2,494	2,504	2,121	2,337	4,070	2,705
Interest @ 18% pa	4,489	4,507	3,819	4,207	7,326	4,870
Total op. cost (Rs)	12,653	10,542	9,262	10,596	17,155	12,042
Hours used	114	95	202	191	208	162
Cost/hour (Rs)	111	111	46	55	82	74
Discharge (l/s)	11.7	12	12.9	10.9	13.7	12
Cost/m^3	26.35	25.69	9.87	14.14	16.72	16.87
Total direct cost	5,670	3,532	3,322	4,052	5,759	4,467
Direct cost/hour	50	37	16	21	28	28
Total Indirect cost	6,983	7,010	5,940	6,544	11,396	7,575
Simulation						
At 500 hours use						
Cost/hour	63.70	51.20	28.33	34.30	50.48	42.72
Cost/m^3	15.12	11.85	6.10	8.74	10.24	9.70
At 1000 hours use						
Cost/hour	56.72	44.19	22.39	27.76	39.08	35.15
Cost /m^3	13.47	10.23	4.82	7.07	7.92	7.98

In the districts studied, the average cost of operation per hour for a 5 HP pumpset, based on 300 hours of operation yearly, is Rs 47.34 (Table 6). The cost could be lowered if the hours of use were increased. For example, at 500 instead of 300 hours of operation annually the simulated average cost of operation (see Table 6, bottom row) comes down to Rs 63.70 in Kanchanpur, Rs 51.20 in Banke, Rs 28.33 in Rupandehi, Rs 34.30 in Bara and Rs 50.48 in Morang. The average cost comes to Rs 42.72, about half of the current average cost.

Farmers believe that bigger is better and that notion has been effectively disseminated by everyone from equipment dealers to drillers, bank functionaries to other service providers in order to secure higher profits. To pump water at the current rate, 3-5 HP machines would suffice, but the modal capacity of the pumps purchased by farmers is 8 HP. Due to this capacity redundancy, the farmer loses Rs 18.55 every hour due to interest costs (Table 7). In fact, a farmer loses two ways. First, because the number of operational hours is low, the high capacity pump is redundant (Gautam and Shrestha, 1997). Second, investment is lost as blocked capital. A diesel pump with a capacity of 3 HP or less costs more than 8 HP pump but the cost of fuel and lubricants constitutes less than 22 per cent of the total operational cost. The only gain from investing in a high capacity pump is its use for threshing paddy and wheat, an activity lasting not more than five days. On an average, the cost of pumping one cubic meter of water is Rs 16.87 (Table 6). The simulation shows that the cost would come down by 57, 46, 62, 62 and 61 per cent in Kanchanpur, Banke, Rupandehi, Bara and Morang respectively, if pumpsets were used for 500 hours each year.

Table 7
Hourly difference in cost of operating 5 and 8 HP pumpsets

Cost items	8 HP	5 HP	Difference
Capital	30,412	26,622	3,790
Fuel (lit/hr)	2.5	1.5	1.0
Fuel and lubricant cost (Rs/hr)	37.5	22.5	15.0
Interest cost (Rs/hr)	18.25	15.97	2.28
Depreciation (Rs/hr)	10.14	8.87	1.27
Total operation cost (Rs/hr)	65.89	47.34	18.55

Note: The computation is based on 300 hours of operation of the pumpset in a year.

Pump rental

In addition to the direct costs of operation, a major factor affecting pumpset ownership is the extent to which surplus capacity can be utilised by renting out a pumpset by selling water. In the Nepal Tarai, pumps are rented out, but the buying and selling of groundwater is extremely limited. On average, a pump is rented out about 32 at about Rs 50 per hour, but the figures considerably vary across districts (Table 8). While rental time was nearly half of pump use in Banke and Rupandehi, it was only 16 per cent in Dhanusha and Morang districts. The high proportion of renting was due to the low use of pumps by the owners on their own farms.

In situations of low overall use and high operational cost farmers often prefer not to own their own pumps if pumps are available for renting. At the same time a privately owned pumpset is perceived as a means to access water and to gain control over the supply of water. This perception has stifled the emergence of a water market as water buyers feel that they have no control over supply. They feel

Table 8
Renting of STW and rental rates by season

District	Renting of boring and pumpset reported			Rent rate reports according to season			Rent rate reported (Rs/hr)		
	M	W	S	M	W	S	OB	OP	B
Kanchanpur									
Owners	-	28	16	35	39	39	6	27	39
Non-owners	-	86	74	38	38	38	6	29	38
Banke									
Owners	-	23	23	58	50	-	55	47	60
Non-owners	-	36	32	57	-	-	-	80	60
Rupandehi									
Owners	1	28	68	55	55	55	15	54	55
No-owners	-	44	84	54	53	56	13	50	53
Bara									
Owners	-	18	20	50	50	50	8	52	47
Non-owners	-	45	45	52	51	50	5	60	66
Dhanusha									
Owners	-	2	4	50	-	-	50	49	48
Non-owners	25	8	10	50	60	33	21	55	51
Morang									
Owners	30	2	2	50	-	-	8	36	41
Non-owners	29	75	56	48	50	-	5	42	47

Notes: M: monsoon; W: winter; S: spring; OB: Only boring; OP: Only pumpset; B: Both

powerless because all the farmers in a given community require irrigation water at the same time as most follow the same cropping pattern. The only potential water purchasers are those who cannot afford to buy or install their own pumps. These people face difficulties in mustering resources for purchasing water, and the ADBN does not provide loans for buying water. Limitations on the conveyance of water also limit the scope for establishing water markets. In addition, disputes among owners of contiguous plots can render buying and selling water difficult.

Although they are expensive, manual and small capacity pumps (up to 2 HP) are emerging as alternatives. With improved technology, the cost will come down, allowing non-owners to install small diameter borings and energise them. Chinese pumps, which are cheaper than Indian brands are used.

If the charge for renting a pumpset was fixed on the basis of its cost of operation, which is high, there would be little demand for waters and further constraint the emergence of a groundwater market. However, because farmers fail to take account of indirect costs, they sell pumpset service at a loss. In addition, by renting their pumps, farmers can subsidise the operational costs on their plots by covering the direct variable costs. If rental opportunities were absent, the pump would be operated for less time, further increasing the unit cost of operation.

Applications and benefits

Pumpsets are mostly used to irrigate paddy in the nursery stage prior to the onset of the monsoon in April-May (Table 9). In the later stages of the crop, use depends on the nature of the monsoon rains. In the winter, pumps are used to irrigate wheat, which requires two or three applications of water at critical stages. Other crops irrigated by pumpsets include pulses, sugarcane and vegetables. The use of pumps is highest in Bara and Banke districts.

In Bara District farmers generated net profits of Rs 99,958 from bitter gourd, Rs 75,253 from potato, Rs 73,858 from cucumber and Rs 154,146

Table 9
Crops for which STWs were used in the surveyed districts

District	Crops						
Kanchanpur	Paddy	Wheat	Maize	Oilseeds			
Banke	Paddy	Wheat	Maize	Oilseeds	Pulses		
Rupandehi	Paddy	Wheat	Maize	Oilseeds	Pulses	Sugarcane	
Bara	Paddy	Wheat		Oilseeds	Pulses	Sugarcane	Vegetables
Dhanusha	Paddy	Wheat			Pulses		

from cauliflower each grown over one hectare of land. These estimates of net profit were obtained after deducting all expenses, including the cost of family labour valued at the market wage rate. The share of irrigation in the total cost of production was 10.6 per cent for bitter gourd, 16.1 per cent for potato, 41.2 per cent for cucumber and 21.5 per cent for cauliflower. The cost of cultivating cucumber, at Rs 13,860 per hectare, was highest, that for cauliflower (Rs 5,292 per hectare) was lowest. The level of profit is much less when cereal is produced. For paddy and wheat, rotation pumpset operation would be profitable if cropping intensity was increased and fertilisers and other inputs applied on time. Thus increasing yields by 1.5 to 3 times. Irrigation expenses constitute about 20 per cent of the total cost, while inputs account for 15 per cent. Even if yields were increased by only 50 per cent pump operation would be profitable.

Maximising use of and returns on STWs

The farmers' choice of crops, cropping intensity, water charges, the cost of production and crop profitability govern the use of pumpsets though the economic returns on shallow tubewells is estimated to be 40 per cent when used independently and 20 per cent under conjunctive management (Irrigation Master Plan, 1987). The proportion of farmers who grow crops, which generate a lot of profit, was comparatively small; most grew paddy or wheat.

How can the time a pumpset is used be increased so that it's operation becomes profitable? To analyse how this could be achieved, two cropping patterns a paddy-wheat combination (CP-1) and a vegetable combination (cucumber, cauliflower and potato, CP-2) were selected in Bara District. For both types, the evapo-transpiration requirements for one hectare of land were computed by using coefficients for the water depth and spread for both crops. Rainfall for the district was obtained from the climatological records maintained at Parwanipur. When the requirement for a month thus estimated was subtracted from rainfall, the net water requirement was obtained (see figures 2 and 3).

The next step in the analysis was to estimate the hours for which a pumpset would have to be operated in a month to meet the requirements of the selected cropping pattern. Taking the average pump discharge to be 10 l/s, 47.5 mm water per hour is required for the selected crop. When the net water requirement is divided by the water required per hour, the number of pumping hours in a month is obtained. To cultivate a hectare of paddy-wheat the pump needs to

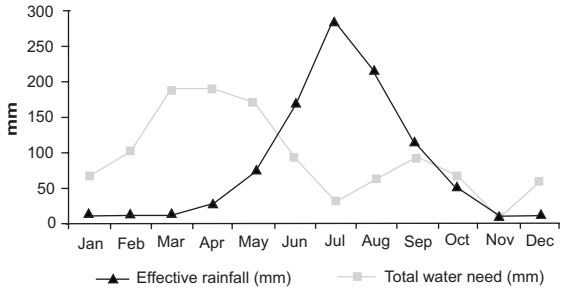

Figure: 2 Total water requirment for CP-1 and effective rainfall, Amritganj VDC, Bara

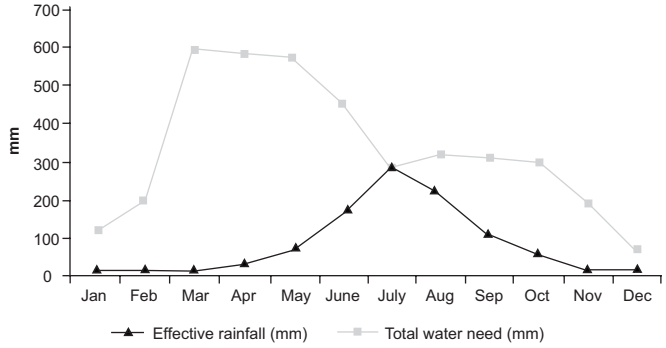

Figure: 3 Total water requirment for CP-2 and effective rainfall, Amritaganj VDC, Bara

be operated for 413 hours, spread over only four months; the pump remains idle for the remaining eight months, irrespective of the area irrigated. When vegetables are cultivated, the number of pumping hours increases to about 2,000 and is distributed over the entire year. Vegetable cultivation allows the full potential of the pump to be used even when only half a hectare is cultivated, and can thus improve the efficiency of pumpset use.

INSTITUTIONAL CONTEXT

Several actors are involved in groundwater development in the Nepal Tarai. The government is the major player in the sector. The government's aims are to achieve social welfare (employment, equity, etc) goals and to increase the country's gross domestic product. It provides subsidies on pumpsets. The Groundwater Development Board (GWDB) of His Majesty's Government (HMG) oversees

policies related to groundwater irrigation in the country. The Department of Irrigation (DOI) and ADPJ are other government agencies, which promote deep tubewells (DTWs). In the private sector, pump-drilling companies, which aim to maximise their profit, have emerged as major stakeholders. The ADBN's objective is to maximise its income from interest on loans while helping to provide social welfare. STWs and manual (rower and treadle) pumps are handled by ADBN, equipment suppliers, drillers and private enterprise like International Development Enterprise (IDE).

The role of the government

Though it has consistently failed to allocate sufficient budget to meet the demands for pumps, the government tends to seek the political advantages of the subsidies it provides. The government actually takes back 33.5 per cent of the subsidy in the form of tariffs the excise duty refund (10 per cent), import duty (15 per cent), and sales tax (8.5 per cent). The excise duty refund is obtained from the Government of India after importers of pumps fill out the Duty Refund Payment form (DRP). HMG, however, loses 15 per cent of the potential excise duty refund when equipment importers do not fill out the form which they see as an unnecessary burden. In 1998, the amount of subsidy was reduced, but the potential loss was compensated for by the removal of the duty on import. Leakage in targeting is evident and fringe gains are reaped by wealthy rural households, thereby countermanding the social justice goal. Also, 'rent seeking' propensities among the functionaries of the ADBN are common.

Agricultural Development Bank of Nepal

The ADBN's activities, which range from identifying and training local drillers to mobilising international donors for funding, began in 1969. The ADBN, together with consultants, formulated norms and procedures for financing pumpset loans, under the Fifth Agricultural Credit Project. The procedures are regularly revised by the bank's board and management on the basis of recommendations made by the Irrigation Unit under the Loan Division. The banks' financing policy does not clearly spell-out whether a minimum of contiguous land holding is a fixed requirement so field offices interpret and apply norms differently.

The decision behind financing a pump loan is guided by targets for areas to be brought under irrigation, set by the government. The bank discourages farmers who have already drilled bores on their land and who seek loans just to buy pumps or engines because such loans do not work towards achieving the command area

target. The bank demonstrates its lending priority by extending loans even when the subsidy quota is exhausted if the borrower pledges in writing that s/he will pay the cost in full if the loan cannot be adjusted in the subsequent year's quota. ADBN charges a minimum of three months' interest on a pumpset loan to cover the cost of its processing in case the loan is repaid within three months. The gross subsidy amount received is allocated to different field offices in the Tarai.

Earlier, loan disbursement was centralised by pre-qualifying equipment suppliers. Because this procedure created incentives for ADBN officials to influence farmers' choices of particular brands and in favour of certain dealers, the policy has recently been changed. In the present arrangement, the bank provides cash loans while farmers themselves select and buy the brand they want.

In the Ninth Plan (1997-2002), the bank was given the target of providing irrigation to 119,700 ha through groundwater and surface irrigation systems. This target is slightly less than the 161,143 ha target assigned to the Department of Irrigation (DOI) to achieve in the same period. The responsibility assigned to the bank, however, is not complemented by concomitant support in technological innovation, overhead financing, or other assistance. Even on the subsidy amount made available, the bank authorities claim that HMG has not met its commitment for the past several years. In the drought year of 1992, HMG asked ADBN to finance 50 per cent more pumps than would be permitted by the quota, assuring that funding for these subsidies would be made available. The bank has received no additional money.

Equipment suppliers

Equipment suppliers fall into two categories: those who supply pipes and screens and those who supply pumps and engines. The margin of a dealer's commission on the sale of pipes and screens is low and competition among dealers is high. As many as 25 brands of Indian pumpsets are sold in the Tarai. Suppliers have formed a cartel. Connivance between a particular dealer and ADBN functionaries also exists. Pump and engine suppliers are expected to provide on-farm maintenance service at least four times in the first year of sale. To ensure that they do, ADBN retains Rs 1,000 to be paid a year later upon receipt of a certificate of satisfaction that each buyer is expected to provide. Almost all dealers, however, successfully circumvent this requirement by persuading farmers to sign the certificate even if they do not make the stipulated visits. With classic myopia, farmers agree; when the system becomes dysfunctional, however, it is they who lose out.

Workshop owners

The owners provide operation and maintenance services. They are located in towns, because they claim that the business of repairing pumpsets is insufficient in villages and that other mechanical activities available only in towns sustain business. This presents such a hiccup in regular operation and maintenance that the performance not just of pumpset but of groundwater development as a whole is adversely affected.

Private drillers

There are two types of private drillers in the Tarai. The first type consists of those who carry out manual drilling of various forms. They either own or hire equipment for drilling. Estimated at about 1,200, these drillers are unorganised and not very skillful. In fact only about 40 per cent have received some training. Some work with pump dealers to promote a particular brand even though the profit margin is small. The farmers' choice of pumps with capacities greater than they need is influenced by drillers who seek to maximise their own commission. The second type of drillers is drilling companies, which are relatively new entrants into the pumpset trade.

Farmers

Farmers, who are the actual beneficiaries of groundwater development, are socio-economically stratified and form a heterogeneous unit. In many cases, rich farmers profit more than poor ones by cornering the benefits from the government subsidy. Poor farmers, deprived of both ownership and improved use of groundwater, lose out. The question of equity comes to centre stage.

OWNERSHIP AND OPERATION OF PUMPSET

Ownership decisions depend on several socio-economic factors. The size of a farmer's land holding is one constraint as farmers must meet the eligibility requirement set by the ADBN. In particular, the criterion of owning a contiguous irrigable plot of 1.5 *bigha* for a standard 4-inch bore is an obstacle though the dimension is relaxed for smaller diameter boring. Because contiguous plots of land do not exist the possibility of helping more landowners install pumps is limited. The other factors which determine ownership decisions are operational issues.

Private pumpsets

To install a pump, a farmer must either arrange for the drilling on his own or approach the bank with a request for a loan. Self-drilling is uncommon because the majority of farmers feel that they would be deprived of the benefits of the government subsidy. In addition, if they do not succeed in finding water they bear the full cost. If they install a pump on their own, farmers are not able to take advantage of the backup support that the bank and its functionaries provide. Only those who consider the excessive time and hassle involved in obtaining a subsidy and other services prefer self-drilling[5]. The distance the bank is and the way farmers reach it also affect to an extent, ownership decisions. Increasing the number of ADBN field offices in the areas of potential investment will bridge the distance and encourage more farmers to own a pumpset. Procedural hassles and 'rent seeking' behaviour, however, continues to be a constraint impeding the expansion of the area irrigated by pumps.

Because they do not want to forego the benefits of a subsidy, farmers buy a pumpset even if they do not want to own a pump. The bank's conditions for disbursing loans creates conditions suitable only for farmers who already own borings. The contradiction between this criteria and the farmers' understanding is due either to the low level of awareness among the farmers or to their intention never to own a pump. Generally, farmers who own pumpsets possess large land holdings and are economically stable and literate. The literacy gap between males and females is higher (48 per cent) among non-pumpset owners than among owners (34 per cent). Loans are usually taken by relatively wealthy and literate farmers.

In 47 per cent of cases, the desire to own a pumpset was a result of seeing a neighbour's facility. Another 29 per cent of the farmers said they were persuaded by ADBN and 30 per cent said they installed pump after they had seen pumps operated in India. Self-motivation was cited as a reason by only 15 per cent of the farmers. All pump owners had secured loans, and the amount borrowed per unit was on average Rs 20,367. Nearly half of the total loan amount has been paid back with interest; repayment of the other half is outstanding.

Community tube wells

To be eligible for a community tubewell, three households need to collectively own a minimum of six *bigha* of irrigable land: each must have 2 *bigha.* Despite the fact that a higher rate of subsidy is provided, community pumps make up less than four per cent of the total units installed under ADBN's programme. Sometimes

an individual farmer takes advantage of the higher subsidy by temporarily enlisting two other farmers to co-operate in securing a community pump loan than operating it alone. The result is a fake community pump system. In other cases, one member of a group, usually the richest, controls water allocation, giving rise to a dominated community system. The existence of a participatory community system, where all members comply with jointly formulated rules and regulations about the operation of their pumpset and the allocation of its water was rare in the districts studied.

The notion of 'community' has also lost meaning leading to a 'tragedy of common'. Due to difficulties with collective action, community pumps are used by individuals and other members take no part in allocation or management. Each member filled the engine with fuel, but none contributed to buying lubricants or spare parts and none undertook major repairs. The collection of funds is also difficult because members are averse to paying cash for repair and maintenance. Many of these nominal community pumps were located outside SFDP areas. Within SFDP regions, group management is better because farmers have been exposed to the concept of collective management. When a plot is located far from a pump the high conveyance loss from earthen canals increases the time needed for irrigation as well the consumption of fuel. Management committees are not strong and do not accord importance to maintenance, while users lack a positive attitude towards collective management (Gautam and Shrestha, 1997).

Land related disputes, are frequently a problem. The parcels of big and small farmers are often interspersed and exact borders are in question. Caste heterogeneity is other impediment to forming users groups for community pumps. Even if the difficulty in forming groups from stratified categories of farmers could be overcome, small landholders do not own contiguous irrigable plots. From the water control point of view, farmers prefer individual ownership to community ownership.

Operational constraints

Other constraints facing the use of pumpsets are related to discharge and well interference as well as to the problems of fuel, maintenance and lack of complementary inputs. Some of the specific problems were,

Discharge from wells: Nearly 31 per cent of the wells we surveyed showed decreasing discharge. If the decrease is due to the lowering of the water table, a borehole has to be sunk deeper thereby incurring extra cost. Only 0.4 per cent of the wells sampled reported an increase in discharge over time.

Well Interference: Well interference was seen in Amritgunj and Hariharpur VDCs of Bara District, where well density is high. About 31 per cent faced well interference in Kanchanpur, 8.3 per cent in Banke, and 52 per cent in Rautahat.

Fuel problems: Almost half of the sample households reported experiencing fuel-related problems. High cost, distance of supply depots poor quality and liquidity were the main elements that led to maintenance problems.

Maintenance: Mechanics do not visit farms as stipulated in the arrangement mutually agreed upon between suppliers and the ADBN. Dealers, however, claim that they provide regular services. Some dealers claim that the bank does not monitor whether mechanics visit farmsteads or not. In emergencies, owners themselves visit workshops. In districts where access to India is easy, farmers travel across the border for major repairs. One pump agency dealing in Morang claimed that it provides a free mobile servicing camp once a year for the pumpsets that it sells. A dealer in Banbasa India (bordering Kanchanpur District) claimed that he also provided services in Nepal. The ADBN, for its part maintains that farmers do not complain about shortcomings in supervision.

Inputs: Constraints on the supply and quality of inputs limit gains that could be derived from groundwater development. Without inputs fertilizers and quality seeds innovative farming techniques and access to markets, the availability of irrigation water increases crop productivity by only a small amount. As a result, just one-third of the total households interviewed were able to increase the time of pump operation and make greater profits. The dearth of complementary inputs was highest in Bara (77.6 per cent), followed by 64 per cent in Rupandehi, 30 per cent in Morang, 22 per cent in Kanchanpur, 16 per cent in Dhanusha and 10.4 per cent in Banke.

ISSUES AND LESSONS

The preceding analysis of the development of groundwater in the Nepal Tarai provides the following major lessons.

Subsidy

Subsides for energy and groundwater development are available on a lump sum basis through the ADBN and its field offices. Although ADBN is consulted, the allocation of budget is dictated by the funds available and is always less than the amount

requested by the bank. In none of the field offices was the subsidy quota sufficient; it was always exhausted before the end of the fiscal year. As its general policy, the bank encourages pumpset clients; it accepts requests for a loan even after the quota for the year is exhausted. It awards loans to farmers who formally accept in writing that they will bear the full cost of the set if it cannot be adjusted in the quota of the subsequent year.

Both DTWs installed by DOI and surface systems are subsidised. Farmers contribute little to any stage in the development of these units. In most cases, the water charge does not cover the cost of operation. In addition, the entire departmental overhead is subsidised. The subsidy offered for shallow pumpset through the ADB in contrast is lower. The government recovers a major share of its subsidies through import duty, sales tax and excise refund. The reduction of the subsidy for pumpsets would be fair only if a concomitant reduction were also applied to DOI transactions.

Rural electrification

In rural Tarai, the lack of access to a supply of electricity is another constraint. Precluding farmers from reaping the advantages that electrically operated pumps offer. The APP focuses on rural electrification, in part because of such advantages. An electrical pump is cheaper than a diesel pump and is more suitable for small landowners. The hourly savings in indirect (fixed) operational costs is about four-fifths of the total operating cost. Electrical engines are easy to start and operate and repair and maintenance costs are lower than those for their diesel counterparts. Another advantage is that the electricity tariff for irrigation, which is cross-subsidised is 50 per cent of the domestic tariff. The operating cost would thus be lower than it is for diesel. While diesel has to be bought cash down, farmers can pay electricity bills on a monthly basis in a sort of deferred arrangement. More than 65 per cent of farmers would prefer an electric engine if this option were made available. Farmers, however, also express a reluctance to switch over to electricity because of the uncertainty in its supply and the danger of shocks. Others feel that the investments they have made in diesel engines would be lost if they switched over to electrical pumps. While electrical pumps do offer advantages, the generation and distribution of electricity involves an administrative layer with high institutional inefficiency. The State Electricity Boards (SEBs) in India are cases in point (Also see paper by S. Janakrajan in this volume). The inefficiency and consequent unreliability of the supply of electricity in many Indian states have the created incentive for about 25 million farmers to switch to diesel pumps.

Groundwater legislation

Groundwater is linked to ownership of land. A user, by installing a high capacity pump, can extract water from aquifers below his/her land. When pumped without restriction, however, the water table gets lowered. As the water table lowers, the access of the landless and the poor to water decreases and equity problems increase. When the recharge rate is low, an aquifer is often mined. Legislation can tackle the problems of expansion and over extraction of groundwater while creating avenues for 'rent seeking'. Administrative measures alone will not solve the problem: the issues of rights, legislation and responsibility also emerge, which require more experimentation and analysis.

A major issue is related to legislation articulating the right to groundwater use. There are no restrictions on boring, inter-well spacing or on the rate of extraction of groundwater. The only control is exercised through the ADBN's financing procedure, which stipulates that there be a minimum of 200 meters between wells. While it is true that this rule cannot be enforced on private installations, there is no condoning the fact that borings installed under ADBN loans also is a breach of the norm. Legislation is required to define water rights and to streamline groundwater extraction. The GWDB is developing legislation for groundwater use.

Support mechanism

A major difficulty is the nebulous organisational mandate. The ADBN is drifting away from the technical aspects involved in groundwater development and focusing on financial management. Which agency will provide functions like the identification and training of drillers is unclear. There is also the unattended but important task of determining the number of active wells and pumping sets. No agency has the mandate to conduct this research. Once a loan is repaid, ADBN has no incentive to touch bases with the pumpset ones again. The problem is serious because the bank is not able to monitor or recover its outstanding loans. That the DOI has an organisational disincentive for overseeing groundwater development and management is evident in the formulation of the 1989 Master Plan for Irrigation (MPI).

The Irrigation Master Plan stated that STW development in the Tarai is a means of achieving rapid gains in food production before larger surface schemes can be implemented. In making such claims the designers reveal that shallow tubewells are to play only a transitory role. The MPI favours DTWs over shallow pumpsets even while accepting that economic returns on the former would be only about 20 per cent at the expected future level of yield. In contrast economic returns

on shallow tubewells at the current level of yields are 40 per cent and for conjunctive management 20 per cent. Without considering that aquifers are recharged, annually the Master Plan argued that aquifers would soon be exhausted, thereby homogenising the diversity of the physical resource base.

The role of the GWDB needs clarification; it must get a mandate including more autonomy and regulatory functions. Research and development (R&D) on groundwater has been largely ignored except for the aquifer investigations conducted while drilling test wells. This status quo needs to be changed by creating space for the critical analysis of issues governing groundwater development and management. How to evolve new mechanisms to achieve these objectives needs serious thoughts.

Conservation and recharge

Another important issue is related to groundwater recharge. The rivers that flow from the Chure recharge the Tarai's groundwater largely along the *bhabar* zone, which must be conserved to ensure that the character and quality of the resource base is not degraded. Conservation however, is easier said than done as the country's East-West Highway routed along the zone has resulted in expanding ribbon settlement. Allowing irrigation water to flow laterally along topographical contours could enhance recharge. This concept, however, needs greater analysis because contour canals impede drainage and exacerbate flooding. The substitution of technology and the reduction of costs are other areas of concern that require immediate attention in order to facilitate the innovative development and management of groundwater.

RECOMMENDATIONS

Groundwater development in the Nepal Tarai has not been utilised to its full potential and the constraints facing are significant. Increasing capital and operational costs, for example, have lowered the economy and performance of pumpsets. Improvement of units rather than numerical expansion should receive attention. To improve performance new policies should focus on the following goals:

- Reducing the minimum land area required to secure a loan for a pumpset. Changing criteria, however, might reduce efficiency if farmers select particular crops type. If farmers cultivate vegetable full ownership may be justified even for those who posses only half a hectare of land. Small landowners will thus be able to take advantage of groundwater development. Increasing the number of hours of pump operation can also enhance profitability.

- Allocating sufficient budget to meet the existing demand for pumpsets. At least a 50 per cent rise in the subsidy budget is recommended.
- Mobilising extension services to educate farmers about the expected gains accrued by owning a unit can improve performance.
- The northern Tarai belt has much potential for the expansion of pumpsets but training needs are also high.

If pumpsets are operated for a few hours, there is a loss of investment in terms of blocked capital. This handicap could be corrected by taking the following steps.

- Promoting cropping patterns that require net water all year round. Vegetable cultivation can make a substantial contribution to the profitable use of pumpset.
- Land consolidation measures need to be encouraged in order to achieve the goal of consolidation by exempting land exchanges from registration fees. Fragmented holdings with too many parcels limit the profitability of and constrain the maximum possible use of pumpsets.
- Higher use is also constrained by the lack of finances to buy fuel in the case of owners; and in the case of buyers, to rent pumps. Providing support to include these items, like any other production inputs, in the loan package appears logical.
- Constraints in the supply of complementary inputs and services should be resolved and periodic monitoring should address the issue of targeting.
- Avenues for the alternative usage of pumpsets must be explored. In India, for example, the pumpsets are used to pull carts. Alternative uses extend the numbers of hours of operation.
- Farmers need to be educated about selecting machines with the right capacity as well as to be trained in the basic skills needed to operate machines.
- Cluster development may address the constraint associated with the location of workshops for maintenance. In the northern Tarai belt, 'pumpset villages' with roads, electrification and fruit and vegetable cultivation could be conceptualised. The close proximity to the East-West Highway can also support access to markets.

CONCLUDING COMMENTS

The Nepal Tarai is endowed with groundwater in shallow, confined, unconfined, and deep aquifers. Only a small percentage of the potential offered by the resource has been used productively. Because of the possibility of controlled, reliable and year-round irrigation from groundwater development, the APP has recommended the large-scale expansion of shallow pumpset and DTWs in order to increase

agricultural growth and productivity. Half of Nepal's overall rural income comes from the agricultural sector and the emphasis on agriculture as the key to promoting the growth in the rural economy is logical. The lack of a timely input of fertilizer, unreliable irrigation, the lack of improved seeds, and poor access to markets is other barriers to agriculture growth.

The APP has set out a framework for addressing some of these constraints in order to achieve the objectives of the national five years plans. To meet groundwater development aims will require overcoming the constraints identified in the above analysis. Though the structure of land ownership to a large extent defines productivity as an issue and needs to be addressed, the institutional reform is perquisite for the effective implementation of the APP. The former issue is political in nature and may require major initiatives if it is to be resolved. Despite its encompassing framework and the fact that successive governments have endorsed its cross-sectoral approach, the social and institutional barriers that face the APP are real, and unless overcome, entail the risk that the plan's objectives might remain unachieved. If the barriers are overcome, however, opportunities do exist.

NOTES

1 See Gyawali (1989) and Dixit and Gyawali (1997)

2 For discussions on methodology and other details see Koirala (1998)

3 Loan for pumps peaked in 1992, when there was a drought, which increased the demand for STWs. On its part the government assured the ADB that the aggregate subsidy amount would be raised further thus sustaining demand.

4 To filter out boring-only cases, a floor cost of Rs 10,000 was defined. The number of observations used in the analysis was 10,416 (from BS 2044 to BS 2053 of ADBN)

5 One pump owner revealed that he had made as many as eight visits to the branch office of the bank to complete the processing of his loan. Fortunately, he lived close by and the visits did not cost him much though substantial time was lost.

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THE POLITICS OF POWER SUBSIDISATION: THE STATE OF THE POWER SECTOR IN TAMIL NADU

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ABSTRACT

Groundwater pumping contributes significantly to irrigated agriculture in many areas of India, including Tamil Nadu. Providing the electricity for pumping farmers free of cost has created a fiscal burden at the national as well as state levels. In addition, free electricity provides an incentive for the unhindered pumping of groundwater, which has led to a significant lowering of the groundwater table. For farmers with small land holdings the lowering of groundwater levels has added to the cost of pumping. New policies seek to introduce an electricity tariff for pumping in order to address both fiscal haemorrhage and groundwater depletion. Introducing a tariff is logical but it could seriously hurt small farmers, who would be unable to pay it. In this regard, the politics of equity becomes important and requires creative solutions.

INTRODUCTION

One disturbing feature of the agricultural system in India is the indiscriminate subsidies of various kinds provided to farmers by both the central and state governments. Subsidies in recent years were nearly twice the combined fiscal deficit of the centre and the states (Srivastava and Rao, undated). Subsidies include those for agricultural inputs such as chemical fertilisers, the purchase and provision of farm equipment, price support for agriculture output, irrigation water, and electricity for groundwater pumping. While many of these subsidies are centrally sponsored, the most important among state – sponsored ones are those related to the Public Distribution System (PDS), irrigation infrastructure and to electricity for pumping groundwater. The total value of subsidies extended during the fiscal year 1994-95 amounted to Rs 1,370 billion This amount represents 13.6 per cent of the country's GDP of that year at current price levels. One year later, in 1996-97, the total electricity subsidy extended to the agricultural sector for the country as a whole had increased to Rs 153,290 million. Six years earlier, in 1991-1992 the subsidy amount was, at Rs 59,380 million, almost three times less.

The bulk of subsidisation goes to irrigated agriculture. In the last 40 years, the Indian government has spent more than 600 billion rupees (at 1988-89 prices)

on building canal networks. This investment has created an irrigation potential of about 22 million hectares. Cost recovery from the systems built has, however, been very poor. Only a small fraction of the operation and maintenance costs is raised from the users of the irrigation systems, while capital cost is not recovered at all. Even the question of irrigation fees has been left largely unaddressed. The 1972 Irrigation Commission recommended that canal water charges be at least five and 12 per cent of the gross revenue from food and commercial crops respectively, but, in fact, recovery constitutes only about one per cent of the gross revenue (Pursell and Gulati, 1995). The Committee on Pricing of Irrigation Water (CPIW) in its 1992 report observed, 'The gross receipts of major and medium irrigation and multi-purpose projects fell short of their working expenses by about 168 million rupees per year on an average during 1974 to 1977; the gap rose to 2,775 million rupees per year during the period 1984-87. When interest on capital outlay was included the deficit over the same period (1984-87) rose from about Rs 1,737 million a year to Rs 9,867 million a year' (Planning Commission, 1992).

Irrigation water pricing has been a highly contentious issue dominating the interest of successive governments both at the centre and in the states. Hence, very little has been done to recover costs or to explore mechanisms for addressing the issue of pricing of irrigation water. Furthermore, state governments have resisted implementing the recommendations of the Irrigation Commission as well as those of the Committee on Pricing of Irrigation Water. One of the reasons is because charging for irrigation water is untenable in the populist politics of the states.

Not only irrigation water but also the electricity needed to operate agricultural pumpsets is subsidised. Furthermore, many State Electricity Boards (SEBs) have sought refuge in the subsidised power supply extended to agricultural pumpsets, in order to cover up their technical and administrative malfeasances. Consequently, SEBs incur substantial financial loss. Despite the fiscal incontinence of the subsidy regime for the agricultural sector as well as for surface and groundwater irrigation, the rates for surface irrigation and for electricity for pumping groundwater have not been revised. The politics of subsidised power for agriculture in Tamil Nadu clearly shows how competitive populism has ruined financial well-being of the state.

This paper explores the rationality of providing a free supply of electricity for groundwater pumping and presents an historical account of tariff politics for agriculture pumpsets in Tamil Nadu. The overall power scenario and the consumption pattern in Tamil Nadu is discussed along with the use of electricity by the agricultural sector and the subsidy regime of the state. It explores how different sections of farmers would be affected if the electricity subsidy

for agricultural pumpsets were removed and discusses the policy implications of this change.

TAMIL NADU: POWER SCENARIO AND ELECTRICITY CONSUMPTION PATTERN

The installed generation capacity in India increased from 1,400 MW in 1947 to 89,167 MW at the end of the fiscal year 1997-98 (GoI, 1999). Power generation in Tamil Nadu increased concomitantly (Table 1). During the first five-year plan period (1951-56) the installed capacity of the Tamil Nadu State Electricity Board (TNEB) was 256 MW. When electricity purchased from other states and from the central grid was included, a total of 1,058 million units of energy were available. Towards the end of the Eighth Plan (1992-97) the installed capacity under the command of TNEB had increased to 6,908 MW with a peak demand of 4,875 MW. However, there was a shortfall of 1,059 MW in 1998-99; this gap between availability and requirements is expected to be met by the end of the ninth five-year plan period. The peak demand at the end of the first plan period in contrast was only 172 MW.

Table 1
Installed capacity, peak demand and per capita power consumption in Tamil Nadu, 1950-51 to 1996-97

Plan period (end of)	Installed capacity (MW)	Peak demand (MW)	Gross power availability (generation+purchase) (10^6 kWh)	Per capita consumption (kWh)
Pre-plan March 1951	156	110	630	12
First Plan 1951-56	256	172	1058	21
Second Plan 1956-61	571	381	2243	60
Third Plan1961-66	1370	717	4041	92
Annual Plans 1966-69	1470	997	5260	116
Fourth Plan1969-74	2254	1287	6948	127
Fifth Plan 1974-78	2424	1641	9453	157
Annual Plans1978-80	2719	1710	10414	183
Sixth Plan 1980-85	3344	2154	13731	195
Seventh Plan 1985-90	5473	2929	18273	295
Annual Plan 1990-91	5744	3094	20794	332
Annual Plan 1991-92	6019	3501	21920	360
Eighth Plan 1992-1997	6908	4875	32700	420

Source: Tamil Nadu - An Economic Appraisal, 1996-97, Government of Tamil Nadu, Chennai.

During 1951-56 the per capita electricity consumption in Tamil Nadu was 21 units; in 1995 it had increased to 420 units the fifth highest rate in the country, after Punjab (786 units), Haryana (601 units), Gujarat (549 units) and Maharashtra (483 units). The lowest per capital consumption rates are in Bihar, West Bengal and Assam; they are 82, 87 and 90 units respectively. The all-India average per capita is 319 units. Apart from the top five states only Karnataka and Andhra Pradesh register a per capita consumption higher than the all-India average (CMIE, 1999).

Industry is the main consumer of electricity in Tamil Nadu, it consumed more than 40 percent of the total power used by the state in 1997. Rural electrification, which has been one of the most important infrastructure building programmes undertaken by the central government of India and by all state governments has received a boost from industrialization. Electrification and the widespread use of pumpsets for irrigation have also helped in rural industrialisation. The nation-wide spread of mechanised lift irrigation technology such as pumpsets is one of the reasons for the success of Green Revolution in India. By March 1998, 11.8 million pumpsets were being supplied with electricity.

Tamil Nadu was ahead of other Indian states in achieving rural electrification. The state achieved almost 100 per cent coverage in the early 1980s. This base helped promote the Green Revolution and made the agricultural sector a major consumer of electricity. In 1970-71, about one-fourth of the total power available in the state ($1{,}275 \times 10^6$ kWh) was consumed by agriculture to operate pumpsets. The power consumed by the sector increased to one-third of the total energy available in the state ($1{,}850 \times 10^6$ kWh) in 1974-75. Pumpsets continue to be a major consumer of electricity but their share of the total power used in the state has decreased steadily since 1975 (Table 2).

Table 2
Consumer category-wise energy consumption in Tamil Nadu, (10^6 kWh)

Year	Domestic	Commercial	Agriculture	Industries	Others
1970-71	336 (6.5)	411 (8.0)	1275 (24.8)	2931 (57.0)	193 (3.8)
1974-75	425 (7.6)	417 (7.5)	1850 (33.3)	2674 (51.4)	194 (3.5)
1979-80	777 (9.5)	650 (8.0)	2178 (26.8)	4187 (51.4)	350 (4.3)
1984-85	1405 (12.8)	890 (8.1)	2424 (22.3)	5779 (52.8)	457 (4.2)
1989-90	2649 (17.5)	1160 (7.7)	3233 (21.4)	7261 (48.1)	807 (5.3)
1995-96	4184 (16.5)	1734 (6.8)	6730 (26.6)	10981 (43.4)	1701 (6.7)
1996-97	4181 (16.2)	1776 (6.9)	6910 (26.8)	10617 (41.1)	2321 (9.0)

Source: CMIE, 1999

Note: Figures in parenthese are percentage

In 1989-90 the agricultural sector consumed 21.4 per cent of the total power available in Tamil Nadu. In the 1990s there was a dramatic increase in the power consumed by the sector. For example, in 1995-96, agriculture consumed 26.8 per cent of the electricity generated (from $3{,}233 \times 10^6$ kWh in 1989-90 to $6{,}730 \times 10^6$ kWh in 1995-96). During that five-year period, the electricity consumed by the sector doubled (Table 2). This increase can be attributed largely to the supply of free electricity provided to this sector by the state government.

Despite the increase in the quantum of power produced, the system is inefficient: transmission and distribution (T and D) losses are very high. In 1980, T and D losses were 20.6 per cent; the loss had increased to 22.4 per cent by the end of 1990, but came down to 21 per cent in 1995-96. The percentage of T and D loss is high compared to other Asian countries. In 1990 the losses in other countries were as follows: China, 7.1 per cent; Indonesia, 16.4 per cent; Korea, 5.6 per cent; Thailand, 10.9 per cent and Japan, 5.7 per cent (Masayasu and Takamasu, 1995). The Tata Energy Research Institute (TERI) estimated that the aggregate calculated T and D loss stood at 75 billion kWh in 1996-97. The Indian central government, through technical innovations and stricter enforcement of laws, aims to reduce the loss at the rate of one per cent per year, thus saving about 800 of MW electricity annually (TERI, 1999).

In 1996-97 almost 5,530 million units were lost in transmission and distribution in Tamil Nadu. Though lower than the all-India average, the aggregate loss was still 16.9 per cent of the supply. When the power used by agricultural pumpsets is added, the loss becomes much higher. In 1996-97, the amount of electricity consumed by the agricultural sector was about 27 per cent of amount available. That supply was free meant that it was un-metered. When un-metered consumption and T and D losses are put together, the total losses incurred by the state amounted to 12.5 billion units in 1996-97: this figure is more than two times T and D losses. In financial term, the loss is about 25 billion rupees.

The loss is even higher when cross subsidies provided by high and low tension consumers and other commercial categories are considered. In Tamil Nadu, a differential tariff is charged depending on the nature of the user. The price of electricity in 1997-98 was 192 paisa per kWh. Domestic users are charged (on average) 124 paisa and receive a subsidy of 69 paisa. Because nothing is charged for running pumpsets, the agriculture sector receives a hundred per cent subsidy. Commercial users, on the other hand, are charged 287 paisa of which 94 paisa is subsidised. Industries are charged (on average) 280 paisa and the industrial sector provides a cross subsidy of 87 paisa (TERI, 1998-99). Cross subsidies have

resulted in power deficits in all Indian states except Maharastra, Haryana and Himachal Pradesh, where deficits are comparatively less. Deficits, however, are increasing over time. State bureaucracies, including that of TNEB, argue that subsidising to the agriculture sector is the root cause of the high losses (Reddy and Sumithra, 1997). This claim needs deeper investigation because un-metered consumption, corruption and pilferage account for equally high levels of inefficiency.

The deficit in the supply of power has increased over time partly due to the practice of supplying free electricity to agricultural pumpsets. Because they pay no tariff, farmers use electricity without restraint and not only to energize their pumpsets. The balance between supply and demand is negative and increasing (Table 3).

Table 3
Power supply in Tamil Nadu since 1990-91

Year	Supply vs. demand
1990–91	-6.4
1991–91	-4.8
1992-93	-1.8
1993-94	-3.9
1994-95	-2.8
1995-96	10.9
1996-97	-13.8

Source: TERI, 1989-99

Note:+ surplus – deficit

SUBSIDY TO AGRICULTURAL PUMPSETS

It is worthwhile at this stage to compare the estimates of power to be consumed by the agricultural and industrial sectors with the actual consumption for 1994-95[1]. The comparison reveals that the agricultural sector consumed five per cent more power than the forecasted value whereas the electricity consumed by the industrial sector was ten per cent less. This situation does not augur well for plans to adding new power supply projects. According to TERI (1999), 'If this trend is not reversed, a major percentage of power generation from new power stations during the ninth Five Year Plan may well go towards meeting the requirements of losses, agricultural consumption and pilferage of electricity'.

The government has realised the seriousness of the situation. The former Finance Minister of the Government of Tamil Nadu V.R. Neduncgezhian in his budget speech in the state legislature in 1995-96, highlighted the losses incurred by TNEB and its serious implications. Said the minister,

> 'Even after revision of tariffs, the Tamil Nadu Electricity Board is confronted by a total resource shortfall of Rs 5223.2 million in 1995-96. Supply of free electricity to farm pumpsets causes major financial burden for TNEB too. The total cost was estimated at 11124 million rupees in 1994-95. This cost continues to rise, but the government cannot provide more than Rs 3500 million as a cash subsidy, and since other categories of consumers cannot be charged more, the situation has become quite complex. The Tenth Finance Commission has completely disallowed the provision of a cash subsidy to the TNEB to cover the cost of a free supply of electricity to farm pumpsets. A long-term solution will have to be found in due course'.

The total energy consumed by the agricultural sector, the number of electric pumpsets and the amount of electricity consumed per pumpset have all increased over the years (Table 4). An increase in the consumption of electricity per pumpset may be partly justified if the area irrigated per well also showed a corresponding increase. This has not, however, been the case. The data available indicates, in fact, that the area irrigated per well has increased only marginally in the last two decades. Not only does the increase in the consumption of electricity by pumpsets have implications for the amount of subsidisation that the state doles out, it also results in an externality in the form of a secular decline in the water table level as farmers resort to the competitive deepening of wells (Janakarajan, 1996 and 1997).

A positive relation between the electricity consumed per electrified well and the tariff prescribed by the state is evident. Whenever a tariff was first imposed or raised, consumption per pumpset declined or remained stable. When a flat rate was introduced or when the supply of electricity was made free, consumption increased rapidly (see figure 1) and there was a jump in the amount consumed. When there is no tariff, the farmers have no incentive to minimise misuse. The result is that scarce groundwater is extracted at a high rate and electricity use is inefficient. Not only is such a policy unsustainable, but also contributes to degradation of the common pool of groundwater because the extraction rate is unsustainable. .

HISTORY OF THE SUBSIDY FOR PUMPSETS

Though the provision of free electricity in Tamil Nadu was introduced in 1991, its genesis can be traced to a militant farmers' movement in the state a few decades earlier. Indeed, the 1970's and 1980's were significant decades in the agrarian history

Table 4
Consumption and changes in agriculture tariff structure for electric pumpset in Tamil Nadu 1970-71 to 1996-97

Year	energy kWh × 10^6	Number of pumpsets	Energy consumed/pumpset	Area irrigated/ well (ha)	Tariff/pumpsets
1970-71	1,241.9	529,932	2342	0.63	Rs 0.08/unit
1971-72	1,269.9	594,169	2136	0.63	Rs 0.09/unit
1972-73	1,430	649,241	2203	0.66	Rs 0.011/unit
1973-74	1,576	681,205	2314	0.69	Rs 0.011/unit
1974-75	1,847	706,914	2613	0.63	Rs 0.011/unit
1975-76	1,675	742,745	2255	0.55	Rs 0.016/unit
1976-77	1,697	773,702	2193	0.52	Rs 0.016 /unit
1977-78	1,786	809,606	2206	0.60	Big farmers: Rs 0.016/unit Small: Rs 0.014 /unit
1978-79	2,104	840,557	2503	0.67	Big farmers: Rs 0.014/unit Small: Rs 0.012 /unit
1979-80	2,186	887,227	2464	0.69	Big farmers: Rs 0.014/unit Small: Rs 0.012 /unit
1980-81	2,299	919,162	2501	0.66	Big farmers: Rs 0.014/unit Small: Rs 0.012/unit
1981-82	2,354	945,520	2490	0.64	Big farmers: Rs 0.015/unit Small: Rs 0.012 /unit
1982-83	2,230	965,017	2311	0.50	Big farmers: Rs 0.015/unit Small: Rs 0.012 /unit
1983-84	2,200	982,606	2239	0.56	Big farmers: Rs 0.015/unit Small: Rs 0.012 /unit
1984-85	2,415	982,606	2,458	0.61	Big Farmers:Rs 75/HP/year Small: Rs. 50/HP Per year
1985-86	2,840	1,033,533	2,748	0.62	Big Farmers: Rs 75/HP/year Small: Rs. 50/HP/year
1986-87	3,114	1,074,184	2,899	0.60	Big Farmers: Rs 75/HP/year Small: Rs 50/HP/year
1987-88	3,136	1,116,177	2,810	0.66	Big Farmers: Rs 75/HP/year Small: Rs 50/HP/year
1988-89	3,524	1,184,450	2,975	0.65	Big Farmers: Rs 75/HP/year Small: Rs. 50/HP/year
1989-90	3,740	1,235,941	3,026	NA	Big Farmers: Rs 75/HP/year Small: Rs 50/HP/year
1990-91	3,974	1,318,671	3,014	0.63	Rs 50/HP/ annum for ≤ 10 HP and Rs 75/HP/annum for > 10 HP
1991-92	4,451	1,359,748	3,273	0.69	Free supply
1992-93	5,160	1,403,673	3,676	NA	
1993-94	5,618	1,445,951	3,885	0.77	
1994-95	6,228	1,488,469	4,184	0.80	
1995-96	6,626	1,528,807	4,334	NA	
1996-97	6,910	1,567,317	4,409	NA	

Source: TNEB: Tamil Nadu Electricity Board at a glance (various years) and season and crop reports, Government of Tamil Nadu (various years)

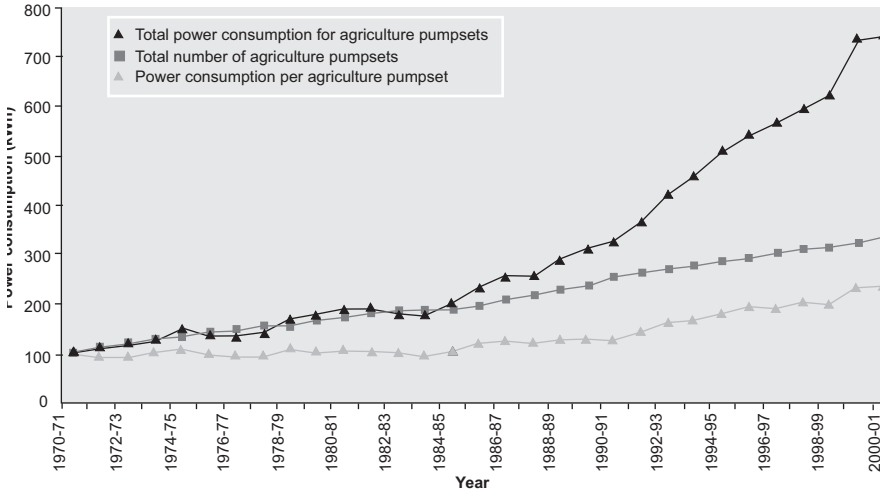

Figure 1: Power consumption per agriculture pumpset

of Tamil Nadu. The farmers' movement began in the dry tracts of Coimbatore, Erode, and Salem district, because irrigated agriculture in these districts depended almost entirely upon well water and gradually spread to other parts of the state. From 1965 to 1976 many parts of the state faced a series of droughts which decreased crop production. The farmers had invested heavily in wells, but in many places the groundwater table had already dropped significantly. Around the same time, the state government decided to raise the electricity tariff from eight to ten paisa per kWh (Table 4). This increase caused farmers to feel the pinch because it added to the cost of pumping and thus created the grounds for a movement. Farmers mobilised spontaneously and on a large-scale. The movement focused on two issues: the reduction of electricity tariffs and remission of loans obtained for digging and deepening wells.

The state government responded by using force, and several hundred agitators in Coimbatore District were arrested. The struggle by the farmers continued for about a month, at which point the government decided that the tariff would be reduced from ten to nine paisa per unit. In 1972, the Dravida Munetra Kazagham's (DMK) K. Karunanidhi was elected to head the government and he raised the tariff from nine to 12 paisa per unit. The farmers in turn, opposed the increase in price, and started an agitation that spread to many other districts of the state and received support from the opposition parties. The state police again took strong measures

to suppress the movement, and 15 people were killed. Subsequently, the DMK government held talks with farmer leaders and decided that the tariff would be reduced from 12 to 11 paisa per unit. During the emergency of 1976, when Tamil Nadu was under President's rule, the tariff was again raised, this time from 11 to 16 paisa per unit. Farmers were unable to protest because Indira Gandhi's state of emergency prohibited rallies. After the Emergency, All India Anna Dravida Munentra Kazagam (AIADMK) contested the state election in Tamil Nadu for the first time and swept the state election with the promise to reduce the tariff. After forming the government, the AIADMK failed to fulfil its electoral promises. The farmers felt betrayed and again began a series of protests, which intensified all over the state. Three people were killed by police fire in the violence that erupted in many places.

In response, the AIADMK government reduced the tariff from 16 to 14 paisa. From this time onwards, the political parties of Tamil Nadu have recognised the strength of the farmers' movement and began to use them as potential vote banks. Political parties of every shade began making populist promises in order to woo farmers. In 1980, the AIADMK ministry introduced differential electricity tariffs for large and small farmers, viz., 14 and 12 paisa respectively. Farmer leaders opposed this provision. Once again agitation started and picked up momentum. The state government arrested many farmers, disconnected electricity supplies and auctioned off the properties of defaulting farmers. In 1981, the farmers' movement split and weakened. When this happened, the state government raised the tariff again from 14 to 16 paisa per unit. A year later the Indian Farmer's and Toilers Party, a new political party, was launched. It contested the seats in a by-election, but was miserably defeated: it secured only around three per cent of the votes. The party contested the assembly elections a second time in 1984, but failed to secure any seats.

The weakening of the farmers' movement had created a political window for the state government to revise tariff arrangements. However, it responded in a regressive manner and instead introduced a flat tariff of Rs 75 per horsepower (HP) per annum. Some sections of the farmer community accepted this provision and their compliance further weakened the farmers' movement. Despite the flat rate, revenue collection did not improve, and in 1988 when the state was under the President's rule, the government did take certain measures to collect dues from defaulting farmers. The situation changed in 1989, when elections for the state assembly were held. Almost all the political parties contesting the elections promised that the dues would be waived. But the DMK went several steps ahead and promised

to introduce free electricity to all sections of the farming community. After it won the 1989 election, the DMK kept its promise and began supplying free electricity to farmers for pumpset operation.

It is ironic that the state, which had confronted the militant farmers' movement and even resorted to repressive measures to subjugate it, finally yielded cheaply. Even those at the helm of the farmers' movement were taken by surprise by the DMK's move (Lindberg, 1996). Subsequently, Tamil Nadu's political parties began 'competitive populism', the practice of providing free electricity for political expediency and ignored the serious economic and ecological consequences of their decisions.

PUMPSETS USE EVIDENCE FROM FIELD

The use of pumpsets has increased the reliability of irrigation and contributed significantly to increased agriculture production, but also depleted groundwater supplies. In many parts of India, the water table has fallen progressively in the post-Green Revolution period (Dhawan, 1991, Rao, 1993, Moench, 1992, Bhatia, 1992, Janakarajan, 1993 and 1997, Janakarajan and Vaidyanathan, 1997, Vaidyanathan, 1996). Tamil Nadu is no exception. A recent study compared the original and current depths of the water table in wells dug prior to 1975 in the villages of Nesal, Vinayagapuram and Veerasambanur of Tamil Nadu. The original depth refers to the actual depth to which the well was first commissioned while the current depth refers to the water depth recorded during the survey. In Veerasambanur, wells were shallow and operated with *kavalai* (bullock-driven) and *yetram* (human lift) methods until 1971. Subsequently, the use of electric pumpsets became widespread.

The study identified substantial difference between the original and current depths of the studied wells. The differences imply that there has been a decline in the level of the groundwater table over the last two decades. Wells dug after 1975 had become deeper (Janakarajan, 1997). The average original depth of the sample wells dug in this village before 1975 was 14 feet. The average current depth is 44 feet. Janakarajan (1999) found similar differences in the other two villages. In Vaigai Basin, an analysis of data collected from 1,200 wells distributed over 27 villages in different parts of the river basin showed similar results (Janakarajan and Vaidyanathan, 1997). The secular lowering of the water table is due to both the increase in the number of pumpsets and the higher rate at which groundwater is extracted. The pumps feed an intensive and expansive area under groundwater

irrigation. As the water level is lowered, farmers resort to the competitive deepening of wells in order to get higher water yield. Consequently, because the head is greater, the cost of pumping increases.

The competitive deepening of wells and the progressive lowering of the water table has led to an increase in the investment required in well digging, construction, water lifting and conveyance. The average amount invested (for all eight villages surveyed and considering only fixed costs), measured in terms of hectares of gross irrigated area (GIA) and net irrigation area (NIA) for the sample wells works out to be Rs 30,000 per hectare. Including not-in-use wells in the calculation, higher values of Rs 36,000 and Rs 59,000 per hectare of GIA and NIA respectively are obtained [2]. Across villages, the investment varies a great deal, as shown in table 5.

The cost per hectare is highest in Vaigai (Madurai and Ramanathapuram regions) and Noyyal (Coimbatore and Tiruppur regions). These regions are constituted of hard rock and receive low rainfall. In the Noyyal Basin, the average amount invested in wells (144 wells in use and 37 wells not in use spread over four villages) is Rs 104,000 and Rs 164,000 per hectare of GIA and NIA respectively (Janakarajan, ongoing). If not-in-use wells are also included in the calculations, the amount invested per hectare of GIA and NIA increases to Rs 120,000 and Rs 190,000 respectively. In the Vaigai Basin, the amount invested in wells is Rs 80,000 per hectare of NIA (Janakarajan and Vaidyanathan, 1997). This

Table 5
Investment in well irrigation calculated per ha of GIA and NIA by sample wells in Palar Basin, 1997-98

Name of the village	Number of sample wells		Investment/ha (Rs x 10^3)			
			wells in use		All wells	
	in use	not in use	GIA	NIA	GIA	NIA
Kathiavadi	34	6	54	75	59	81
Poondi	20	2	39	65	40	67
Gudimallur	13	6	36	72	42	84
Damal	36	13	20	22	24	26
Periavarigam	14	16	26	67	37	97
Solur	9	12	28	77	40	108
Ramanayakk Anpettai	26	16	36	98	49	135
Nariampattu	23	3	22	44	22	45
Total	**175**	**74**	**30**	**50**	**36**	**59**

Source: Survey, 1997-98

survey shows that the amount spent on creating the potential to irrigate one hectare with a well source is higher than the amount spend on surface irrigation[3].

How does the lowering of water levels impinge upon household levels? To answer this question we need to estimate the cost of irrigating a unit of land with well water using a pumpset. For that purpose, data relating to groundwater irrigation, the number of hours pumped, the area irrigated by wells, productivity, and the costs of cultivation were collected. Both the gross receipts from cultivation and the cost incurred for it were used to make a comparison. The amount was worked out including cost with and without electricity use. Such a comparison would reveal the impact of the progressive lowering of water table at the household levels (Table 6).

INTRODUCING TARIFF

What are the implications of introducing a tariff in the above context? The introduction of an electricity tariff needs to look at issues such as the ownership of wells by farmers of different land holding size, and economic classes, the competitive deepening of wells by farmers and the extent to which individual farmers have invested in well irrigation. Results presented in table 6 are based upon 53 sample wells (in use) randomly selected from the three villages. About 32 per cent of the sample wells are owned by farmers whose holdings are less than or equal to 2.50 acres. The GIA by these wells accounted for only 18 per cent of the total area irrigated by all the sample wells. Sixty-six per cent of the sample wells were owned by farmers whose holdings are less than or equal to 5 acres; these contribute to 43 per cent of the GIA. Around 21 per cent of the sample wells, which are owned by farmers with holdings more than 7.50 acres, comprise 39 per cent of the GIA.

The area irrigated per well is positively related to the land holding size of farmers. Larger landholders irrigate larger areas per well than smaller landholders do. This implies that the wells owned by farmers in larger size classes provide better yields of water. Given this reality, it is common sense that if an electricity tariff is introduced, it will affect farmers with small holdings more than it does those with large holdings. Let us consider the size class less than one acre. The GIA per well in this size class is 26 acres and the electricity cost per acre of GIA is Rs 955 (the energy consumed is 955 kWh assuming one rupee per unit as the input cost). The gross receipts and payments per acre of the GIA in this size class are Rs 3,929 and Rs 2,974 respectively.

Table 6

Gross receipts and net payments by well-owning farmers Nesal, Vinayagapuram and Veerasambanur 1995 (Rs)

A	B	C	D	E	F	G	H	I	J	K	L	M
1	2	3	4	5	6	7	8	9	10	11	12	13
<1.00	4	2.97	5.04	4	3,919	2,974	955	3,929	945	24.4	24.3	-10. 30
1.01-2.50	11	19.30	24.82	13	4,254	2,531	572	3,103	1,722	13.5	18.4	1,150.50
Sub-total	*15*	*22.27*	*29.86*	*17*	*4,197*	*2,606*	*637*	*3,243*	*1,591*	*15.2*	*19.6*	*954. 60*
2.5-5.00	14	50.02	40.79	18	4,926	2,272	621	2,894	2,654	12.6	21.5	2,032.85
5.01-7.50	5	30.06	30.00	7	5,261	2,283	281	2,664	2,878	5.3	10.5	2,597.46
Sub-total	*19*	*80.08*	*70.79*	*25*	*5,068*	*2,319*	*477*	*2,796*	*2,749*	*9.4*	*17.1*	*2,272.12*
7.51-10.00	4	34.15	39.20	8	4,703	3,026	919	3,945	1,677	19.6	23.3	757.78
10.01-15.00	0	0.00	0.00	0	0	0	0	0	0	0	0	0
Sub-total	*4*	*34.15*	*39.20*	*8*	*4,703*	*3,026*	*919*	*3,945*	*1,677*	*19.6*	*23.3*	*757.78*
15.01-20.00	1	19.50	24.50	3	22,549	4,730	673	5,403	17,819	3.0	12.5	17,145.73
>20.00	0	0.00	0.00	0	0	0	0	0	0	0	0	0
Sub-total	*1*	*19.50*	*24.50*	*3*	*22,549*	*4,730*	*673*	*5,403*	*17,819*	*3.0*	*12.5*	*17,145.73*
Grand Total	**39**	**156. 00**	**164. 35**	**53**	**7,429**	**2,899**	**641**	**3,540**	**4,530**	**8.6**	**18.1**	**3,888.79**

A- Size class (acres)
B- No. of sample farmers
C- Land owned (Std. acres) (A)
D- Gross area irrigated (GIA)
E- No. of wells in use
F- Gross receipts per acre of GIA (Rs) (B)
G Gross payments/acre of GIA (Rs) (C)
H- Imputed electric cost/acre of GIA (Rs) (D)
I- Total of all payments/acre of GIA (7+8) (Rs)
J- Gross receipts minus payments (6-7)
K- Electric cost as % of gross payments 8 as % of 6
L- Electric cost as % of total payments 8 as % of 9
M- Gross receipts minus total payments 6-9 (Rs)

Source: Survey, 1993-95

Notes to table-6

(a) ***Land owned in standard acres:*** Land owned by the sample farmers is differentiated into several categories such as plots of land which are solely irrigated by surface sources, those irrigated by surface and groundwater, those fed by well water and those dependent entirely on rainfall. According to the productivity of land, scores have been given to each of these types of plots in order to arrive at the standard acres owned by each sample farmer.

(b) ***Total receipts per acre:*** Total receipts include the gross value of yield, the market value of by-products, land rent received and water charges received selling groundwater.

(c) ***Total gross payments:*** Gross payments include all labour payments towards crop operations (cash and kind), the cost of physical inputs such as chemical fertilizers, pesticides, and farm yard manure, the cost of hiring farm equipment, land rent paid and water charges paid.

(d) ***Imputed electricity cost per acre:*** Data was collected for the number of wells in use, the number of electric pumpsets operated, the number of hours each pumpset was operated per day and in each season by the sample farmers. One HP motor would consume 0.75 unit per hour. The total energy consumed by the sample farmers who operate electric pumpsets was calculated using this information. A unit of energy consumed has been assumed to cost one rupee to arrive at the imputed electricity cost. The data may not be hundred per cent representative but gives an idea of the energy consumed by farmers.

This size class makes a profit of Rs 945 per acre of GIA only when the cost of electricity is not included. Otherwise, a loss of Rs 10.30 is incurred. In other words, the cost of electricity constitutes one fourth of the total receipts by a well obtained from one acre of GIA. The GIA per well in the second size class (1.01 to 2.50 ha) is 1.90 acres, which is slightly higher than the previous size class. The cost of electricity per acre of GIA for this size class is Rs 572; this size class makes a profit of Rs 1,150.50 per acre of GIA even if the cost of electricity is included in the gross payment. The cost of electricity constitutes only 13.5 per cent of the total receipts obtained by a well from one acre of GIA.

As size class increases the net profit derived from gross receipts after all payments (including the cost of electricity) are made increases. The cost of electricity is a small proportion of total receipts in the large size classes. How justified is the continuation of the present subsidy (one hundred per cent) to farmers? Should farmers be charged a tariff? If answer to the second question is yes, a related

question is, whether the tariff should be same for all categories of farmers or whether the rates should differ.

The answers to these questions also need to consider the type of crops farmers' plant. For example, paddy is a water-intensive crop, which depending upon soil type and rainfall, needs to be irrigated every two or three days. Commercial crops like oil seeds, cotton and vegetables, on the other hand, require wetting only once every ten days. Since they require less water, their cultivation consumes less electricity than does paddy cultivation. In other words, irrespective of size class, since paddy-cultivating farmers consume relatively more electricity than others, their profit margin would vary with any electricity tariff set. But there is a difference: while small landholders are prevented from growing multiple crops by limited land area, big landholders can allocate their land to different crops. Even if cultivating paddy becomes unprofitable (as it could if an electricity tariff were imposed), they can maintain an overall profit by cultivating less water-intensive commercial crops.

Despite the general notion that well irrigation is accessible only to farmers with large land holdings; small farmers indeed do own a large numbers of wells. The mere ownership of a well does not mean much, however, as wells owned by larger farmers yield more and better quality water. This is reflected in the fact that the area irrigated per well is much higher among large farmers than it is among small landholders. Therefore, the marginal cost of pumping is lower for large farmers than for small landholders. It is clearly erroneous to lump all well owners into a single category. Resource-rich farmers were the first ones to invest in well irrigation. Not only did they exploit groundwater early on, but they also mined aquifers and were responsible for lowering the groundwater table. Although they own wells in large numbers, small landholders began using groundwater much later.

Small and marginal landholders, who own two-thirds of all wells in the regions studied may not be able to bear the additional cost of tariff. They face two constraints. First, they stand to lose in competitive deepening because they are unable to meet the investment required. Second, the introduction of an electricity tariff would mean an additional burden. Not able to bear it, they might stop using pumps. Large land owners, on the other hand, can sustain tariff increases not only because are they are economically better off, but also because they use electricity to pump water, which they then sell to other farmers as well as to urban industrial consumers at a profit (Janakarajan, ongoing). Large farmers can withstand competitive deepening also.

POLICY QUESTIONS

The policy of the Tamil Nadu State Electricity Board to supply free electricity to operate pumpsets has created incentives for the misuse of electricity by farmers. For the state exchequer the financial consequences of continuing to provide subsidised electricity are dire. At the same time, misuse and overuse of groundwater has led to depletion, which adversely threatens small landholders, who continue to lose out in the competition for deepening. The question of reintroducing an electricity tariff, as a means of groundwater regulation needs, therefore, to be viewed in this context. There are no straightforward answers to this issue, which has complex, historical, social and political roots. The following issues emerge as important for policy reformulation.

First, the supply of free electricity to farm pumpsets constitutes about one-third of the power available for distribution in Tamil Nadu. The supply is not metered. About 17 per cent of the power available is lost in T and D. The total un-metered energy loss comes to about 12,472 million units, which is valued at Rs 24,940 million per annum (about Rs 25 billion). The 1998-99 Economic Survey published by the Ministry of Finance, Government of India, took a serious view of the T and D losses incurred by SEBs. To quote, 'The SEBs has continued to suffer from high transmission and distribution losses, which stood at 22.3 per cent in 1995-96, have increased to 23.4 per cent in 1996-97. The losses are high when compared with the average value of less than ten per cent for advanced countries. The high transmission and distribution losses are due to the sparsely distributed loads over large rural areas, substantial energy sold at low voltage levels, inadequate investment in distribution systems, improper billing and high pilferage' (Economic Survey, 1998-99). Many SEBs blame the T and D losses including inefficiencies and pilferage on the free supply of electricity for pumpsets. It needs to be substantiated whether subsidisation and other un-metered consumption are the root causes of the losses.

Second, as of 1994-95, all SEBs except for four in the states West Bengal, Kerala, Maharashtra and Himachal Pradesh, have incurred a loss to the tune of Rs 46,960 million. In 1990-91, the total loss was about half of this i.e. only Rs 27,190 million. The main reason for the increase in the loss has been the unhealthy financial condition and the poor management of the boards (Gurumurthy, 1997). Indeed, restoring the financial health of SEBs and improving their operational performance continue to remain the most serious challenges for the power sector. Section 59 of the Electricity Supply Act of 1948 requires that SEBs earn a minimum rate of return (RoR) of three per cent of their net fixed assets in service after providing

for depreciation and interest charges. This stipulation has not been met. The document 'Draft Approach Paper to Ninth Five Year Plan (1997-2002)' recognised this need as follows: 'The deteriorating financial health of the State Electricity Boards has been one of the most critical factors constraining power development in the country'[4].

There are several impediments to meeting the stipulation in reality. Some of them are low tariffs, politics, population increase and operating inefficiencies, both technical and managerial. The average RoR (with subsidy) for SEBs was as low as (minus) 12.1 per cent in 1996-97 and had dropped further to (minus) 17.6 per cent in 1997-98[5]. The restructuring of SEBs was initiated in some states with the aims of breaking up the monolith power system by separating generation, transmission and distribution. The change was aimed at increasing the competitiveness by allowing private participation in generation and distribution as well as maintaining a regulatory framework. Restructuring of Orissa SEB began on April, 1996, when corporations to look after generation and distribution were formed. The Haryana Electricity Reforms Bill became an act after receiving presidential assent. Rajasthan, Goa and Gujarat have also drafted restructuring bills and are in the process of finalising them. Andhra Pradesh Electricity Reforms Bill awaits presidential assent. The governments of Madhya Pradesh, Karnataka, Kerala, Uttar Pradesh, Maharashtra, Bihar and West Bengal are in various stages of reforming their respective SEBs.

In order to help the TNEB overcome its current fiscal and technical crisis, the government of India has suggested implementing certain policy measures. These include creating separate entities for hydro and for thermal power generation, establishing an independent tariff regulatory commission with judicial authority and creating new organisation for power distribution. Tamil Nadu has not responded positively.

TNEB employees have also resisted efforts at reforms. The state government engaged an independent consultant to carry up with a proposed for restructuring the TNEB with a view to decentralising its functions. All employees unions, however, refused to cooperate with the consultant appointed by the government and have not attendant any discussions when they were invited. The unions claimed that any new effort to dismantle the power sector with the aim of privatising it would be met with opposition[6]. The unions were upset when the state government in July 1999 designated TNEB as the State Transmission Utility (STU). The idea behind making this announcement was that the responsibility for power generation hitherto handled by TNEB would be transferred to a subsidiary organisation of TNEB. The

SEBs of Andhra Pradesh, Orissa and Karnataka were restructured along the same lines[7] . The boycott by TNEB employees has introduced a new constraint confronting power sector reform.

A third factor which hampers the functioning of SEBs is the interference of state governments in fixing electricity tariffs for various categories of users. In particular, considerable political mileage is achieved in supplying highly subsidised electricity to the agricultural sector. According to the government report 'Economic Survey of 1998-99', 'the gross subsidy associated with the provision of electricity to agriculture was Rs 5,938 crore (Rs 59.38 billion) in the year 1991-92. The subsidy rose to Rs 19,091 crore (Rs 190.91 billion) in 1997-98 and the estimated subsidies for the years 1998-99, and 1999-2000 were Rs 21,322 crore (Rs 213.22 billion) and Rs 23,847 crore (Rs 238.47 billion) respectively.' This trend is clearly unsustainable.

A fourth issue is related to the subsidy itself. Providing a subsidised supply of electricity creates incentives for farmers to misuse electricity and over-pump groundwater. Freely supplying electricity indirectly induces farmers to deepen their wells in a competitive manner even if the resultant yield of water is low and not commensurate with the marginal operating cost of pumping under normal circumstances. What measures would control misuse and over-pumping? The levying of electricity tariff is perceived as a tool for managing and regulating groundwater overdraft (Moench, 1999, Shah, 1993). Shah claims, 'it can even be argued that State Electricity Boards which are responsible for pricing and management of power have a more central, powerful and far-reaching influence on groundwater development than even the groundwater departments and corporations'.

In Vaigai and Noyyal river basins, the level of the water table has dropped a considerable extent over time and the yield of water per well is low. But farmers continue to pump. They even use new water extraction techniques. In the Vaigai Basin, for instance, in some water scarce villages, in order to cope with the dropping water tables contiguous landowners (three to five wells) jointly install a single pump for irrigation. This is practiced only when the water yield from an individual well is so low that irrigating a plot of land is no longer possible (Janakarajan and Vaidyanathan, 1997). Furthermore, in both Vaigai and Noyyal river basins, farmers commonly use two motors at different elevations in the same dug well and compressors in deep bores to surmount the problem of low water yields. In the Noyyal River Basin water pumped from a well or a deep bore is stored in a second dug well at a higher level and then is pumped to the surface for irrigation: thus,

the same water is pumped twice. Of the 146 wells in use spread over four villages in the Noyyal Basin, about 46 per cent are used to pump water twice (Janakarajan, ongoing). The energy consumed thus increases. Under normal circumstances, when a tariff is charged, farmers would hesitate to use so much energy.

A fifth issue is the fact that an electricity tariff adds to the cost of agriculture. It is argued that electricity constitutes only a small fraction of the total cost of all inputs employed in agriculture (Narayanamurthy, 1997) and that even if a pro-rata tariff were introduced, it would not make a major difference in lowering the consumption of electricity. Table 4 shows that this view is incorrect. There has been a steady increase in the amount of electricity consumed by pumpsets since 1960s. When electricity was made free in 1991, a significant jump in the per capita power consumption took place (Figure 1). In addition, as table 6 shows, the cost of electricity is about 18 per cent of the total cost of cultivation. This is not an insignificant proportion. Even if we assume that electricity is trivial for an individual farmer, however, the cumulative cost incurred is unsustainable because it imposes a heavy burden on the state.

Levying a tariff, however, would not reduce electricity consumption everywhere. For instance, in the low rainfall, hard rock regions of Tamil Nadu, such as Coimbatore, Erode, Salem, Dharmapuri, Ramanathapuram, Madurai and Vellore, the groundwater table has sunk very deep. This means the cost incurred by pumping will be high when tariff is levied. In other places, however, groundwater is shallow and introducing a tariff may have only limited impact on the pumping rate.

In deep groundwater areas, the cost of electricity as a proportion of the total cost of cultivation would be quite significant. Moreover, the proportion of the cost of pumping to the total cost of cultivation depends upon a wide variety of factors: the depth of the water table, sub-soil structure, the type of well and the type of water-lifting device used, the yield of water delivered per hour, the area irrigated per well, and the type of crop cultivated. For a farmer cultivating paddy, who has to irrigate at least three times a week, electricity consumption is high. In contrast, those who grow high value commercial crops such as banana, turmeric, cotton, flowers, and chilli peppers use less power since these crops need less wetting than paddy does. The question of electricity also has a political dimension to it. The imposition of an electricity tariff was the primary reason for one of the most militant farmers' movements in Tamil Nadu.

The sixth issue is technology. The introduction of agricultural and bio-chemical technologies has contributed to a rapid growth of well irrigation in Tamil Nadu as

well as in other parts of India. This has occurred at the expense of traditional irrigation systems based on surface sources. As surface systems are increasingly neglected, farmers resort to groundwater pumping for a reliable and assured supply. This causes water table to go down. As water levels go down, farmers are forced to deepen wells in a competitive manner so that access to water for irrigation remains assured, timely and reliable. Electricity allows farmers to employ technology (pump) as a means of accessing water. Technology has also allowed large farmers well endowed with resources to reach good aquifers, which they tap and sell on the market. Small landholders have also benefited from access to groundwater, but supplying electricity it freely fosters indiscriminate and unregulated pumping.

A large number of small and marginal farmers began using groundwater much later than large landholders did. They are at a disadvantage because the water table is already deeper and in the process of competitive deepening, they will probably be displaced. As groundwater is depleted, the pressure to quit pumping falls disproportionately on small and marginal farmers. Large operators can compensate for an additional investment in well deepening or wait out drought conditions (as occurred in the 1980s). For a small farmer, either of these two conditions would be an unbearable blow. They are constrained by the area that they can irrigate and unlike large farmers have no cushion.

Furthermore, the high incidence of joint well ownership (shared wells) complicates the situation. In all the river basins studied, 40 to 50 per cent of the wells are jointly owned. Because the incidence of joint well ownership is highest among small and marginal farmers, they would be most vulnerable if an electricity tariff is introduced. The tariff would be tantamount to an additional burden that might force them to stop pumping or sell their wells. The results could be loss of production, unemployment and impoverishment.

Successive governments of Tamil Nadu have used free electricity as a tool to create and to maintain rural vote banks. This indulgence has been short-sighted, as fiscal in continence has risen. Though governments in recent times have sought remedial measures to address the issue of electricity subsidies for agriculture pumpsets, simply repealing the subsidy and reintroducing a tariff is not a satisfactory solution given the convoluted political history of the subsidy in the state and the dynamics of equity involved. Small and marginal farmers, who account for more than 60 per cent of well owner would find operating pumpsets unviable if a tariff is introduced. The issue is closely related to a sense of fairness and politics, which the state cannot afford to overlook.

NOTES

[1] The report 'The Fifteenth Electric Power Survey of India' published by the Central Electricity Authority makes this estimate.

[2] A liberal definition of the extraction of groundwater – including the extraction of water from a sample well a single time in a year – has been taken into account in arriving at the area irrigated by wells. A survey of eight villages, in the Palar River Basin (the erstwhile North Arcot District) to discover the costs incurred by individual well owners for various activities such as well digging, construction, installation, water extracting and conveyance mechanisms, installation of vertical and horizontal bores and further deepening of wells and so on at current prices is in progress (Janakarajan, ongoing).

[3] 'The Report of the Working Group on Major and Medium Irrigation Programme for the Eighth Plan', Government of India (1989) mentions that during the seventh plan period (1985-1990) Rs 36,240 was spent per hectare of irrigation potential created.

[4] 'Draft Approach Paper to Ninth Five Year Plan 1997-2002', Planning Commission (reprint), CMIE Bombay.

[5] See the article 'Annual report of the working of the SEBs and Electricity Departments', quoted in the yearbook, 1998-99 Planning Commission, New Delhi.

[6] See *The Hindu*, September 9, 1999.

[7] On 25 April, 1998, the Indian government promulgated a new Electricity Regulatory Commissions Ordinance. After considerable debate, the Lok Sabha passed the bill with amendments to some of its provisions. The amendments reduced the rigour of the ordinance and made it optional for state governments to establish state electricity regulatory commissions. Moreover, the benchmark of 50 per cent of the average cost of supply of electricity for tariff fixation was dropped. The amended bill has received presidential approval.

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THE FIGHT TO BE INFORMED: A SEARCH FOR PROJECT FACTS IN NEPAL

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ABSTRACT

In May 1995 the World Bank pulled out of the 201 MW Arun III Hydroelectric Project. It had been on the anvil for over ten years, since 1985. Before then, very few details about the project, which was to cost the country one billion dollars, had been made public. In 1993, however, a group of non-governmental organisations (NGOs) organised a public hearing, setting off a process where by activists began pressuring the government to provide information about the project. The hearing was organised as planned but the government officials responsible for Arun III did not show up. Then human rights activists joined the cause to demand information about the project, which was said to be an environmental and economic blunder of sorts. The request for information was again ignored by the government. Eventually, the issue reached the country's Supreme Court, which not only ordered the government to make project documents public but also laid down guidelines for seeking information on issues of public interest. Nepal does not yet have a Right to Information Act, even though the democratic Constitution of 1990 guarantees citizens that freedom. The guidelines set in the ruling on Arun III thus provide the basis for seeking information on development projects. This paper will look into how the court's decision on the Arun-III project has helped the cause of seeking information about development projects, which more often than not leave many environmental and economic questions unanswered. This paper suggests that the Arun-III debate was not only about a lack of information but also about the government's attempt to misinform people about the implications of the project and about how determined voluntary activism could influence change. The activism was about a partnership among a handful of individuals, NGOs, media and experts united to inform and educate the people. The questions about foreign aid – bad loans – that the partnership raised, were in sharp contrast to the popular understanding of aid, especially so in a country where politicians openly measure their 'success' or the basis of the number of foreign loans and grants they are able to acquire. The paper interviews the members of the then Alliance for Energy and other individuals that were behind the initiative in order to learn about the dynamics of the successful activism. The paper also maps the media's growth in democratic Nepal – from mainstream press, radio and TV to alternative communication avenues, including wall-newspapers, audio towers and community radio. It discusses both the positive signs, especially in community-level communication efforts, as well as the negatives – mainly the ills of the mainstream media. It makes a brief assessment of the freedom of information situation in the absence of adequate legislation and the resulting information lacunae.

INTRODUCTION

Information is one of the most important variables in sustainable development planning. Sustainable development is about people participating, learning by doing, building self-confidence in the process, and taking ownership of the outcome. Such an approach can work only when the process is internalised, or understood and adapted, by all the people involved in the process of change. Information can facilitate internalisation. However, more often than not, this aspect of development planning is taken for granted, if not totally neglected. The role of information in sustainable development was recognised by the United Nations Conference on Environment and Development but in many countries of the developing world, it remains a commodity accessible only to governments.

Principle 10 of the 1992 Rio Declaration says: 'At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in the decision-making process. States shall facilitate and encourage public awareness and participation by making information widely available[1].' Additionally, Agenda 21, the consensus document for development adopted at the conference, upholds participation as the modus operandi for ensuring that development is both locally manageable and lasting. 'In sustainable development, everyone is a user and provider of information considered in the broad sense. That includes data, information, appropriately packaged experience and knowledge[2].'

It is easy to blame the governments of developing countries, especially authoritarian ones, for controlling information. However, even bilateral and multilateral development agencies that would have been forced to provide information in the North become inaccessible in the South. These agencies resort to using 'this is a government project, we're trying to help it do what it wants,' types of responses as alibis to protect themselves against inquisitive members of civil society, including the media. This is the context within which NGOs of the South function. These organisations are flexible and often build good contacts with Northern partners, which come handy for obtaining information on developments taking place in their locales.

The restoration of democracy in Nepal in 1990 triggered a new revolution: the growth of hundreds of NGOs, trade unions and informal alliances and associations. Exercising their new freedoms these groups began questioning public policy, something unheard in the past. The issues they raised ranged from

better working conditions and equal opportunities for minorities, to enforcement of environmental standards and good governance. Among the water resources-related issues that rose above the din were two government decisions. First, the Tanakpur Barrage on the Mahakali River involved the co-operative development and use of water resources with India and a constitutional provision that required parliamentary ratification of any pact on sharing of a natural resource. The other issue was Arun III, a hydroelectric project snowballed from relative obscurity into a controversy of a Himalayan scale. The ensuing Arun III debate not only dissected the project but also questioned the dominant developmental approach that Nepal had embraced[3].

This paper explores the events surrounding the Arun III project and the outcome – the institutionalisation of the right to information. It also demonstrates the focused efforts pursued by the media and NGOs to glean the facts, interpret the developmental jargon and take the information to those whom it most mattered – the people at large. The discussion includes records of the coverage of the debate in the mass media and of the battle for obtaining information that eventually reached the Supreme Court of Nepal, and the court's verdict. The paper is based on the available literature and on interviews with different players involved in the Arun III debate.

ARUN III HYDROELECTRIC PROJECT

Nepal is one of the world's poorest countries and hydropower is one of its major assets. The country's economic hydropower generation potential is estimated to be 42,000 megawatts[4], of which Nepal generated only 376 MW in 2000. Only about 18 per cent of Nepal's population have access to a supply of electricity from the central grid. The Nepal Electricity Authority (NEA) handles power generation, transmission and distribution. Even though new, private hydroelectricity generation projects are in operations, the NEA has a monopoly on transmission and distribution.

The Arun III hydroelectric project was to be built on the Arun River in Sankhuwasahba District, in the mid-mountain region east of Mt. Everest. The project was to be completed in 10 years. Locating hydropower generation on this river had been proposed in the mid-1980s and Arun III was one of many attractive alternatives. This project had been on the drawing board since 1985 and by 1990, US$15 million[5] had been spent on feasibility studies[6]. The project was initially designed to have an installed capacity of 402 megawatts (MW) but was scaled-

down to 201 MW. The scaled down version known as 'Baby Arun – was estimated to cost US$ 1.08 billion (US$ 5000/kW)[7]. A 120-km road to the site was to be implemented simultaneously. The project designers proposed extending air support using helicopters to ferry construction material and equipment into the Himalayan hinterlands in order to speed up the construction schedule.

The government of the day, the Nepali Congress Party, was keen to begin construction. The World Bank as the 'lead donor agency' was assisting Nepal in putting together the necessary financing[8]. The NEA was to put in US$290 million, His Majesty's Government of Nepal US$155 million, World Bank US$175 million, Asian Development Bank US$127.6 million, Kredittanstalt fuer Wiederaufbau (KfW Germany) US$124.4 million, France US$19 million, Sweden US$17 million, Finland US$10 million and Japan US$ 163 million (undetermined) to add up to US$1080 million[9]. This would have been the largest investment Nepal had ever made. The cost was alone estimated to be almost two times the size of the government's annual budget for development expenditures (US$ 640 million) for the fiscal year 1993-1994[10].

Despite its size and a 'ready-to-be-launched' status, there was little publicly available information on the project even after five years of preparatory work. The politicians spoke about the project in 'dream' bites. The Prime Minister of the interim government formed after the restoration of democracy, Krishna Prasad Bhattarai said in an election speech: 'the problems of trade deficit with India will be overcome with the Arun III hydroelectric project…'[11] . The interim rulers had inherited Arun III from the rulers of the party-less *panchayat* system and, not sure what to do with it, decided to take the advice of a committee made up of several ministers and top ministry officials. This committee recommended that the government approve Arun III implementation and proceed with construction 'since most financing agencies were committed to the project.' The committee also recommended that no thermal power plants be installed and that efforts be made to seek finances for the construction of intermediate projects to supply electricity before Arun III could come on line[12].

From its very inception, Arun III had many unanswered technical, economic and social questions which never featured in the official consideration of the project, either by the government of Nepal or by the World Bank.[13] Very few had a clear idea of what was going on and the mood of emerging activism was reflected in what Rajendra Dahal, a journalist specialising on reporting water resources had to say: 'The World Bank and the bureaucracy love to keep the information close to their chest. We will ultimately bring out all information on Arun

III, and the alternatives that are being neglected[14].' The information was not only unavailable to activists or to the public but even many top officials within the bank – apparently – knew little of what was going on[15].

One major criticism of the project was that the macro-economic risk of high investment in a single project would crowd out or leave little to be used for financing the social sectors. Issues relating to the development of local capabilities, the efficiency and accountability of the government's electricity generation and distribution monopoly and transparency were the other concerns. The exchange of allegations between the government, the bank and activists raged until 1995, when the World Bank cancelled the project in mid-August 1995, saying, 'the risks to Nepal were too great to justify proceeding with the project[16].'

IN PURSUIT OF INFORMATION

Even though Arun III had been proposed as the project ready to be built, only a handful of water resource experts, activists and journalists had some idea of the project and its design assumptions. These individuals – and many worked as groups – set out to seek more information by organising public consultations and by networking with like-minded organisations both within and outside the country. Others discussed the lack of information in the media and a human rights organisation went to court demanding the full disclosure of project documents.

Organised information seeking began in February 1993, with a public hearing organised by a group of eleven NGOs[17]. The hearing was the first of its kind in Nepal's developmental history. The organisers said 'maximum public support for projects such as the Arun III will only be possible when the informed public is satisfied that there has been sincere debate[18].' Accordingly, the group had invited representatives from concerned government agencies such as the National Planning Commission (NPC), the Ministry of Water Resources, the Ministry of Finance and the World Bank to share project information. Among the invited officials, only the managing director of the Nepal Electricity Authority and the Director-in-Charge of Arun-III attended the meeting. Two members of the cabinet, who had confirmed their participation, cancelled their commitment because of 'important work'. The NPC, which could have benefited immensely from the discussions, not only preferred to stay away but had also attempted to use its influence to get the hearing cancelled[19].

The meeting, however, did serve the purpose. In total 147 people – officials, NGO representatives and journalists – attended the meeting. The participants asked

twenty-three questions. While answering the questions, NEA officials confirmed that a World Bank-funded study carried out by the King Mahendra Trust for Nature Conservation (KMTNC), a Nepali NGO, was not an environmental impact assessment, which many had till then thought it to be. The KMTNC representative at the meeting said that as Bank contractors, the organisation could not divulge information from the study, without which many questions remained unanswered. Interestingly, upon discovering that 'Category A' projects such as Arun III require public hearings some government officials later claimed that the requirement had been fulfilled. The officials were counting the meetings that NEA was forced to organise in the district where the project was to be built only after the NGOs and media brought the issue into the realm of public discussion.

Perhaps prodded by the emerging activism the NEA, by June 1993, was already holding 'technical consultations' to inform 'the general public specifically the concerned NGOs, technical organisations, interested hydropower experts and to representatives of the media specifically publishing on water resources development in Nepal[20].' Another briefing on Arun III was organised by the government on December 10, 1993, the same day human rights activists registered their first request for information and for the disclosure of project documents. The NEA made technical presentations at the hearings which were largely informational. The concerns expressed at these hearings were that 'the project should be built, road alignment should pass through major settlements and locals should be employed in the construction[21].'

Questions about the technical, environmental and social aspects of the project, left unanswered at the NGO-organised hearing, spilled over into the media. Although the government's national news agency (RSS) carried a straightforward 'a-public-hearing-was-held' story, the private press was already beginning to ask tough questions. 'Officials Dodge Arun III hearing,' 'Donors Please Explain.' '*Nepal ko Thaplo ma Ujyalo ko Dhani Nasaknu Bhar*' (A debt load for brightness which Nepal cannot afford), 'Finance minister and water resources minister don't want to talk about Arun III,' and 'Electricity: Nepal is being taken for a ride,' etc. were the headlines of some post-hearing news reports[22].

The government's attitude was reflected by the stories carried by RSS in which, ministers said the government was committed to build Arun III and speculated on its future benefits. One story published in the government's *The Rising Nepal* newspaper (December 7, 1993) – a time where there were more questions about Arun III than answers – reflected the official stance. The front-page story by a 'staff reporter' was headlined 'Nepal Poised for a Great Leap Forward' and

ruminated on the project's positive aspects. The story featured representative officials of all major government ministries, the NPC and the World Bank. The report – apparently – was an attempt to counter issues being raised by activists, but fell far short of telling anything but the official side of the story. This report remains a classic example of how journalism should not be done – for the simple reason that it was oblivious to the activism that by this time, had become intense. It may never be known if the story was done by a journalist on his or her own or at the insistence of the government. The unnamed author of the fairly long, front-page write-up remains a mystery to date[23]. If that was one example of the government's position in public, a private communication (February 4, 1994) shows that officials were becoming more intolerant of the on-going activism. In a letter, the Secretary of Water Resources threatened to 'consider appropriate actions' against the Intermediate Technology Development Group's (a London-based charity), activities in Nepal'[24].

The basic document of the Arun III project, i.e. the World Bank's Public Information Document was released in January 1994. But that did not satisfy the activists. They said the document was incomplete even in terms of Bank policy, and that it lacked critical information about local and indigenous people from the project area, alternative projects, and sustainability, among other issues[25].

To follow-up on the NGO-organised public hearing, a group called the Alliance for Energy (AE) was formed. AE's mission was to seek and disseminate information on the project and associated energy policies and to educate the public. The group advocated an 'alternative approach' to hydropower development and suggested options. The group called for taking up projects that could be built within the country's existing financial, technical and economic capability. This approach, it said, could help nurture Nepal's capability to build projects such as Arun III in the long run. In the beginning the group was an informal association of about six people – an economist, a journalist, an electrical engineer, a management expert and two environmentalists, one of whom was a woman. Others interested in the cause joined hands later. The AE did not have a permanent secretariat. The members met at venues that were available and when needed, mainly to divide tasks on information seeking, advocacy and research. All AE members were unpaid volunteers. The group's main contact with the rest of society was a series of well-argued issues published in its newsletter[26].

The group stayed together throughout the period during which the controversy raged. The cohesiveness – apparently – resulted from the members' common interest and determination to work for a common cause. The AE members

are still around today but the AE as a group is more or less dormant. Individually, the members are still involved in the work they began as a group: they are either actively involved in the construction and promotion of small-and medium-scale hydroelectricity schemes or in analysing and participating in energy policy discussions with multilateral donors, banks and the government[27].

The Alliance was not opposed to the Arun III as such but questioned the paradigm and the associated uncertainties and risks – such as putting all Nepal's 'hydro' eggs in one basket–related to the economic and technical assumptions on which the project was based. Pandey and Bell articulate AE's philosophy, thus: 'Baby Arun's malignancy lies not in the dam itself, but in the context of its conceptualisation and realisation. You cannot leapfrog your way through the development maze. Arun's rotten core perpetuates the cycle of donor dependency and the stifling of indigenous capacity and creativity[28].'

PUBLIC INTEREST LITIGATION

The pursuit of information on Arun III escalated until it reached the Supreme Court of Nepal. Another group, INHURED International (International Institute for Human Rights, Environment and Development), began its campaign against the project by distributing pamphlets during a land acquisition meeting on December 1, 1993. Unlike the AE, this group questioned many specific issues related to the project – from resettlement and environmental concerns to the inadequacy of publicly available information on Arun III. Eventually, in what was to be Nepal's first public interest litigation demanding information about a development project, Gopal Siwakoti 'chintan', executive director of INHURED International and a member of the Arun Concerned Group, and Dr. Rajesh Gautam, a human rights activist, filed a petition in the Supreme Court on January 16, 1994, seeking the full disclosure of project information. On May 8, 1994, the Supreme Court ruled in favour of the petitioners, ordering the defendants to make all project documents available for inspection.[29] The petitioners had written to the defendants twice demanding documents before going to court. Their requests, also filed while the case was being heard, included demands for the disclosure of over two dozen-project reports, including tender documents.

The Arun III litigation was not the first public interest suit related to an environmental and developmental issue as such, but was the first that specifically sought environmental and developmental information on a project. The first public interest litigation on an environmental issue was filed in June 1989. The litigation

sought a court order for the closure of a marble quarry near Kathmandu. The court did not issue an order to close down quarrying but did instruct that mitigation measures be taken. Another litigation that specifically sought information on a matter of public importance – relating to a decision to fell a historic tree, believed to have been the one under the shades of which Lord Buddha was born – was filed in 1992. The court ruled this litigation was of public importance and that the plaintiff had reason to know what the reasons leading to the decision were[30]. This case, however, was decided only in 1996.

The verdict on the Arun III suit came in May 1994. It laid down the process for people to seek information on issues of public importance. The process spelled out by the Court decision remains in force 'until necessary rules and regulations are made' (or a Right to Information Act comes into force). The information seeking procedure is as follows:

1. The plaintiffs should ask for a list of documents related to different subjects from the defendants;
2. If the defendants provide that list within seven days, the plaintiffs should demand an arrangement for the inspection of the concerned documents;
3. Once a demand is made according to paragraph 2, the defendants should provide a notice to the plaintiffs specifying the time, date and place (for inspection) within three days;
4. Notes should be made after the inspection and if copies of the documents are to be made, a request should be made to the specified officer;
5. If rules are lacking for providing copies, certified copies should be provided after charging the real cost for making such copies;
6. If the defendants cannot permit the plaintiffs to inspect the documents, take notes from them and make copies of them, they should state the reasons and notify the plaintiffs within three days;
7. If the plaintiffs are denied access, they can file a petition in the Supreme Court if they are not satisfied with the reasons specified or for denial of access, and
8. The procedure for action on (the) petition shall be according to the Rules of the Supreme Court[31].

The verdict, by upholding the plaintiffs' demands to being provided information about the project, upholds the rights of citizens to demand information on similar initiatives or projects. The decision also clarifies that the '(c)ourt does not provide judicial resolution for all the disputes related to public interest. Such issues

can become an issue within the jurisdiction of the Court if they contain questions that require the interpretation of laws or the articles of the constitution[32].' That said the Court did not make a judgement on other controversies related to Arun III, such as the conditions attached to the loan, the rate of interest, the project's expenditure, its effect on the environment and resettlement, etc. The Court, however, was clear on the right of the plaintiffs to be informed about Arun III.

Despite the verdict, however, information on the project was not forthcoming. On October 31, 1994, the plaintiffs petitioned the Court, seeking an order for the 'immediate execution' of the May 1994 decision. They were back in court again on February 23, 1995, to file a petition charging the Arun III Project Office and NEA with contempt of court for their non-compliance with the Court's May 1994 decision. This court battle was overshadowed by fast-paced developments in the project and in Nepali politics. In-fighting in the ruling party ranks had led to Prime Minister Girija Prasad Koirala losing a crucial non confidence vote within the parliament in July 1994 and his calling for holding mid term elections on November 15, 1994.

Parallel to the court battle, on October 24, 1994, another organisation, called Arun Concerned Group (ACG), and two residents from the proposed project area petitioned the Bank's Inspection Panel, seeking an investigation of a wide range of issues surrounding the project. The ACG, organised on December 15, 1993, worked closely with INHURED International[33]. The ACG claim demanded an investigation by the Bank's Inspection Panel of alleged violations of International Development Association (IDA) policies and procedures relating to the adequate analysis of alternatives, information disclosure, environmental impact assessment, indigenous people and involuntary settlement (October 24, 1994). In a memorandum (December 16, 1994), the Panel requested the approval of the Bank's executive directors to carry out the inspection requested by the activists[34].

In February 1995 the Bank's executive directors agreed to have an Inspection Panel investigation to assess whether IDA policies had been observed with respect to environmental assessment, indigenous people and involuntary resettlement in terms of the consistency of the determination of the road alignment with Operational Directive (OD) 4.01 (Environmental Assessment); the consistency with the treatment of indigenous people, if any, with OD 4.20 (Indigenous people) and the consistency of arrangements for compensating seriously affected families for land acquired by Government with OD 4.30 (involuntary resettlement)[35].

This Bank decision fell short in terms of several issues that the activists wanted the independent panel to investigate. On February 22, 1995 ACG wrote to the Bank

requesting the Panel's mandate be broadened to include economic analysis, access to information and public participation. The AE also wrote to the Bank challenging the mandate of the independent panel, charging the Directors of 'putting a question mark on the credibility of the outcome of the investigation' especially by their acceptance that 'alternatives were sufficiently examined[36].' The Panel's mandate was not revised but an investigation did take place. Reporting its progress to the Bank, the Panel wrote: 'Management's agreement and efforts to take remedial actions, and the work now in progress on the areas where the investigation was authorised by the Executive Directors, seem to indicate Management's intention to observe, in substance, the requirements of the three operational policy directives in question[37].' The Inspection Panel submitted its report to the Bank on June 21, 1995. The report was said to have been critical of the Nepali government and of the Bank on resettlement issues and also on environmental mitigation and rehabilitation[38].

Records show another important letter that INHURED International wrote to the Bank (June 2, 1995). The letter welcoming the Bank's new President, summarised different issues surrounding the Arun III controversy, especially those the group felt were not adequately addressed by the Bank. In the letter INHURED concluded: '(w)e implore you and your organisation to stop the Arun III project as it is, from becoming a harsh and bitter reality[39].'

As the country prepared for mid-term elections, the leader of the main opposition, the Communist Party of Nepal (Unified Marxist & Leninist), wrote to the World Bank's President, saying the project was 'too big to be decided during a politically unclear situation.' In the letter, Madhav Kumar Nepal the General Secretary of the party added: '…the proposed project must be reviewed by the new government in light of the on-going controversies before Nepal makes any commitment to such projects[40].' The elections held in November returned a hung parliament and led to the formation of a minority government of the UML, the largest party in the Lower House. Soon after taking office, its new government sent the Water Resources Minister to Washington to discuss Arun III with Bank officials. Letters exchanged between the Bank and the government after the meeting show that by early 1995 the Bank's interest in Arun III was waning, while the government was prepared to take whatever came[41].

CONCLUSIONS

It is difficult to say what impact information – or the lack of it – and the information, which eventually did become public had on the Bank's decision to

cancel the loan for the Arun III project. But media reports on the activism for information and the new knowledge the activists managed to cull did fuel the public debate both nationally and internationally[42] . These debates may have influenced the Bank's decision. This conclusion is derived from the relationship that can be observed between the issues raised by activists and 'corresponding' responses in Bank and government policy shifts. In a December 1993 white paper, the AE for example, reports acknowledgement by the Bank of the need to study 'indigenous capacity and its growth potential for the development of hydropower in Nepal.' Local capacity building was one key issue advocated by the AE. Likewise, in June 1993, Nepal's National Development Council and the NPC announced a policy to develop small and medium scale hydroelectric projects[43]. The influence of information has been pervasive though it is difficult to isolate a cause-and-effect relationship.

Many issues advocated by activists, and widely reported in a section of the media, have also proved to be true. One example is the argument by activists about the availability of better, cheaper alternatives that could come on line faster than Arun III although the country was being told that Arun III was the best option available. The World Bank, in its three-year Country Assistance Strategy lists some of the alternatives that activists had said were more feasible than the Arun III[44].

The alternative projects that were prepared after the demise of Arun III were studied and designed by Nepali technicians. According to Dahal (1997), after withdrawing from Arun III the Bank also accepted the concept of the Power Development Fund, which the AE had advocated. He argues that AE was able to influence the shifts in the development approach because of certain 'powerful weapons' in its activism, i.e. 'positive thinking, positive approach and practical alternative solutions or options[45].' Nepal today is better off than it would have been if the Arun III project had been undertaken as was envisaged. More important than the outcome in measurable megawatts and elevated egos, the Arun III debate has added to the confidence of activists, and sensitised the government, donors and multinational institutions to the need to scrutinise projects more closely before attempting to sell them to supposed 'beneficiaries.' The outcome of the Arun III activism also validates the assumption of the sustainable development paradigm that broader debate can lead to better alternatives.

However, in terms of media reports and the Bank's decision to cancel Arun III, it is difficult to isolate a cause-and-effect relationship. Unlike the media coverage of the early 1990s, today Nepal's emerging print media is more capable and better equipped to facilitate debate on environment and developmental issues.

The independent media, especially the daily press, now has a reach that is comparable to, if not better than that of government newspapers. Journalists are also better trained and more committed to professionalism. Today Nepal is also ahead of the rest of South Asia in the independent radio movement, it has already licensed over 20 stations (by August 2002) and more are in the pipeline.

The first independent FM (frequency modulation) radio was set up by a group of NGOs, including some that had played a part in the Arun III debate. This station undertook a project to monitor and report air quality at different locations in Kathmandu Valley. The idea was to get people to start thinking and talking about air pollution in order to build social acceptance for the higher costs that clean technologies may require. The radio broadcasted air quality reports from different parts of the city everyday. It also aimed discussion programmes on the health implications of the air quality reports. Such an initiative was a new beginning, rare in public sector-funded media.

In a country where radio and television have been government monopolies used by rulers to talk to their people, the independent radio movement has provide citizens with the space needed to voice their concerns. Some of Nepal's independent FM radios are very local – owned and operated by VDCs, for example. These offer opportunities to discuss issues of local concern and to consider ways to improve the rural livelihood that can be best done through participatory approaches.

The decision on Arun III now makes it possible to implement the right to information, guaranteed by the Constitution. This is because the Court has established a process whereby anyone can obtain information, from the government on matters of public importance. The decision not only makes the information-seeking process easier for the media, but also better equips environmental activists working for the public good. Activists, who have filed different public interest suits have referred to the Court's decision. The Court verdict on Dahal vs. the government (1996) has further established this right. The plaintiff was seeking information on historical findings at Lumbini – the birthplace of Lord Buddha – after the government decided to cut down the *pipal* tree there and to transfer historical and cultural artefacts for safekeeping.

A number of public interest suits, on environment and consumer issues, have been filed since the Arun III issue was resolved, and many cases refer to the decision on the right to information, especially in situations where the government has not readily provided relevant documents. One even made the denial of information a major argument in a case seeking the cancellation of a government decision[46]. The Arun III verdict may be referred to again and again because it may take time for Nepali

rulers and the bureaucracy to accept the need for transparency and openness as a basic tenet of democracy. One government plan – eventually aborted – that was shielded effectively from public scrutiny before the Arun III verdict sought to incinerate dated pesticides, including mercury, in 1990. Despite protests by locals and demands for information by a section of the press, the government did not allow the distribution of information that would have answered the concerns. The government's actions were recorded in a report prepared by a foreign consultant hired to assist in the disposal of the useless but dangerous chemicals[47].

Nepal does not have a proper law to guarantee the right of the people to be informed on matters of public importance. Such a law would have to define what information is in the "public interest" and what is not, and state precisely the procedures for seeking information. Until such a law is in place, the Arun III verdict can serve the purpose. The definition of 'public interest' in the verdict is also broad enough to encompass many issues that may have direct or indirect bearings on the day-to-day lives of citizens.

NOTES

1 United Nations, 1992: Report of the United Nations Conference on Environment and Development, A/CONF.151/26 (Vol. I)

2 See United Nations, 1992: Report of the United Nations Conference on Environment and Development, A/CONF. 151/26 (Volume III) for programmatic recommendations.

3 The dominant development approach is discussed by Gyawali (1997), Pandey, B., (1995) (*Himal* July/Aug.) and Dahal R., (1997). Also see Pandey, (1998).

4 Dixit, A., explains hydro-facts in *Himal*, May/June 1991. This is the economically feasible generation potential, theoretically Nepal is said to have the capacity to generate 83,000 MW. 1000 kilowatts equals one megawatt.

5 Pandey Bikash, in an article in *Himal* July/Aug. 1995 argues that DM 23.5 was spent on engineering services.

6 Bhattarai, B., 1994: Nepal: Dam May be Major Election Issue, *Inter Press Service*.

7 See Pandey (1998) *op. cit.* for details.

8 Gyawali (1997) writes: 'in 1987, the Government of Nepal requested the World Bank to become a 'lead donor agency' in mobilizing resources for Arun III.' He adds '…for the first time in Nepal's development history, a ministry (thus) gave up its lead role to a foreign institution and authorized it to speak to other donors on its behalf.'

9 Gyawali (1997) in Pandey K., (1998) *op. cit.*

10 The social, economic and technical questions on Arun III, raised by human rights activists, are detailed in Siwakoti and Ma'anit, (1995).

11 In *Himal* May/June (1991) Dipak Gyawali quotes a speech where Mr. Bhattarai also said that if two other hydroelectric projects could be implemented 'Nepal will be developed like

Singapore.' Likewise, at another programme another senior Nepali Congress Party leader said that every Nepali could cook their rice and lentil staple (*daal-bhaat*) with electricity after the Arun III was built.

12 Shrestha (1991) explains the situation faced by the Interim government in hydropower development.

13 Gyawali, (1997) *op. cit.*

14 Bhattarai, B., 1993: Arun III, Nepal's Reluctant Narmada, *Himal* Mar./Apr. 1993

15 See transcript of the Environmental Defence Fund's (EDF) interview with Martin Kracher, Division Chief for Population and Human Resources, Country Department 1 in the South Asia Region at the World Bank (September 9,1994). Answering a question on the economic analysis of the project Kracher says: 'First of all it was difficult to get hold of the economic analysis until quite late in the project processing cycle. Somehow, that information was not being shared very readily. Then in January 1994, when we finally did get a copy of the draft Staff Appraisal Report for the project, I found many problems with the analysis.'

16 Bank's press release is found in Pandey (1998) *op. cit.*

17 The meeting was organised by a group of NGOs and informal associations namely the Environmental Camp for Conservation Awareness, Himal Associates, LEADERS Nepal, Nepal Forum of Environmental Journalists, Nepal Water Conservation Foundation, Parliamentarians Forum for Sustainable Development, Save Kathmandu Valley Environment Movement, Save the Environment Movement Nepal, Udaya-Himalaya Network and Youth in Environment,

18 Public Hearing of the Arun III Hydro Project (Report), Feb 12, 1993

19 See Dahal and Bhattarai, (1994).

20 See Record of Technical Presentation of Arun III HEP (in a Question-Answer format), June 20, 1993.

21 Based on recollections of journalist Rajendra Dahal who was present at the some of the hearings.

22 Dahal and Bhattarai, (1994) *op. cit.*

23 The writer had interviewed the key Arun III decision-makers and planners: Dr. Binayak Bhadra, member, National Planning Commission; Dr. Thakur Nath Pant, Finance Secretary; Surya Nath Upadhyay, Water Resources Secretary; Dr. Janak Lal Karmacharya, chief, Arun III project; and Dr. Joe Manickavasagam, Resident Representative of the World Bank.

24 From a letter signed by Surya Nath Upadhyay, Secretary of the Water Resources Ministry – who believed that the London-based Intermediate Technology Development Group (ITDG) was backing the AE – wrote to its Chairman. Another letter was addressed to Bikas Pandey, an ITDG employee in Nepal and a member of AE charging him of seeking 'foreign collaboration with a view to obstructing the development' of the project.

25 See Siwakoti G and Ma'anit A, (1995) for the activists' point of view about the lapses

26 The following headlines from several issues of Alliance News provide an idea of the issues AE advocated:

'Arun Teen ko Tender Kholiyo' (Arun III tenders have been opened), Vol. 1. No.2 Aug. 15, 1993

'How Arun Crowds Out Smaller Schemes' and 'Pitfalls of WB Lending System', Vol. 1. No 3, Aug. 31, 1993

'Baby Arun Debate: Options for Nepal', Vol. 1. No. 4, Sep. 30, 1993

'Donors Propose 45% Hike in Electricity Tariffs', Vol. 1. No. 5. Sept 30, 1993

[27] Based on discussions with Rajendra Dahal, the journalist member of AE, who edits a fortnightly and specialises on reporting on hydroelectricity and economic policy

[28] Pandey B., and Bell J., 1993: 'Look Before You Leap', *Himal* Mar./Apr.

[29] The defendants were the Nepal Electricity Authority, Arun III Hydroelectric Project Office, Ministry of Water Resources and the Ministry of Finance. The presiding judges were Hara Govinda Singh Pradhan and Keshav Prasad Upadhyaya.

[30] See Supreme Court decision dated 2053-7-31 (November 7, 1996) Kashi Dahal (petitioner) vs. Council of Ministers and other government departments.

[31] Siwakoti G and Ma'anit A, 1995: The World Bank & Nepal's Arun III Project: A Case of Anti-Social Development – Urgent Action Appeal, Kathmandu.

[32] Ibid.

[33] See Siwakoti G and Ma'anit A, 1995 for a chronology of events on Arun III

[34] The World Bank's International Bank for Reconstruction and Development (IBRD) and the International Development Association (IDA) provide loans to borrower governments.

[35] World Bank press release, February 2, 1995

[36] See Pandey B, February 27, 1995, letter to Lewis T. Preston, (the then) President of the World Bank

[37] See Siwakoti G and Ma'anit A, 1995 for other details. The use of phrases such as 'remedial actions' and 'work in progress' indicate that some aspects of the project did leave more to be desired.

[38] See Pandey, B. (1995), *Himal* July/ Aug.

[39] See INHURED International's letter to James D. Wolfensohn, June 2, 1995

[40] See letter of the CPN (UML) General Secretary Madhav Kumar Nepal to Lewis T. Preston, President, The World Bank, dated October 18, 1994. In this letter, Nepal also counter's the official (and Bank's) claim that the project was sufficiently debated in parliament by saying: '…any formal and meaningful discussion about the proposed project with the availability of basic project documents and information in advance has not yet taken place in the Parliament.'

[41] Following are some excerpts of letters (dated March 2, March 5 and March 8, 1995) exchanged between the Bharat Mohan Adhikari, Finance Minister and D. Joseph Wood, Vice President, South Asia Region of the World Bank. The government had proposed building an alternative road instead of the one in the original plan. Saying this risked 'considerable delay' in commissioning Arun III Mr. Wood wrote: '…we recommend that your Government intensify its efforts to facilitate private investment in smaller hydro projects and that it also move ahead expeditiously with the Kali Gandaki project. IDA stands ready to support these efforts.' (March 2). On March 5, Mr. Adhikari wrote back: '…in view of your explanation that the Basic Procurement Guidelines does not allow separation of the road from other

components of the project and would delay Arun III by two years more, His Majesty's Government of Nepal agrees to the construction of road along the route as already negotiated and agreed in June 1994.'

[42] Among the international publications, there was an editorial signed by Derek Denniston in World Watch (January/February 1995) that said, among others: 'If the World Bank is serious about eradicating poverty and protecting the environment, it will cancel Arun-III. And even more important, it will never again allow one of its projects to build such unchecked momentum, while fully ignoring such clear evidence that the project will be a monumental mistake.' Another example of the international debate on Arun III is the article – headlined 'Monster of the Himalayas: The World Bank's misconceived Mega-Project in the Heart of Nepal'– by Korinna Horta, an economist for the Environmental Defence Fund, in the Washington Post (November 6, 1994).

[43] See Alliance for Energy, 1993: 'Nepal is Capable: What Has Been Accomplished?', White Paper No. 2

[44] See The World Bank, (1998): Country Assistance Strategy (Nepal), 1999-2001.

[45] Dahal, R., (1997): (Unpublished), 'Don't Just Criticise–Provide Alternatives' (Lessons of fighting a project in Nepal)

[46] See 'List of cases filed and pleaded by Pro Public.' This issue was raised in 1994 litigation where Pro Public petitioned the Court seeking annulment of a government decision to lease forest land for the construction of a medical college complex. There the plaintiffs had charged that they were not provided information contained in the lease document. In the end, the court ordered cancellation of the government's decision.

[47] See story by Mainali M., (September 1998), *Lakhaun Kharcha Garda Pani Thanko Lagna Nasaka Bisadiharu* (Pesticides that have not been taken care of despite spending millions), *Gorkhapatra*.

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PROFANING THE SACRED WATERS: THE BAGMATI RIVER AND THE KATHMANDU VALLEY

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ABSTRACT

Bagmati River is polluted regardless of its sacredness. Kathmanduites understand that the river is highly polluted but do not demonstrate a sense of ownership in reducing pollution. People's belief in Bagmati's divinity need to be transformed into a social movement for bringing changes and cleaning the river.

INTRODUCTION

The Bagmati River emerges from a sculpted tiger's mouth at Shivapuri, in the north of Kathmandu Valley and meanders through farmed fields, chaotic suburbs, and the filth of Nepal's capital city before, blackened and polluted, it exits the valley at the Chovar Gorge in the south on its way toward meeting the holy Ganga in India. Although life in the water is dying, humanity is thriving along its banks. Walking along the banks of the Bagmati, I met many different kinds of people. A 25-year-old woman has been living in a rest house downstream of the *ghat* (cremation platform) of Pashupatinath. Her family has been relying on the generosity of the temple complex for 17 years, purportedly until they find a home of their own. However, she had given no thought to moving out. Nor did think it strange that her parents had spent a good deal of money on her wedding a year ago rather than on housing.

A few meters upstream, I met a little boy standing in the fetid river and splashing its darkish water and silt onto the steps between the *ghats*. When I asked him what he was doing, he replied that he was looking for gold. Apparently the gold coins that mourners sometimes put into the mouths of their dead loved ones find their way to the river bottom with the ashes.

Little girls near Boudha were excited to talk to me as a friend. They said they would wait while I conducted a few more interviews because they wanted to show me their family's pigs. They waited, and the pigs, though cute, smelled worse than the river.

('The Bagmati River? How dirty!'). Some interviewees mentioned the stench, others the death of the fish or the diseases that afflicted the monkeys. No one I spoke with thought the river was clean. My observation fits the more methodological findings of Dixit (1998), who found that 90 per cent of Kathmanduites are aware that the river is polluted.

Not only do people know that the river is dirty, they seem to know why it is dirty. The experts I interviewed identified the same causes of pollution, generally in the same order of importance, as local people did. Two causes emerged as paramount. First, most of the river's water is drawn at Sundarijal, in the Shivapuri hills to fill the pipes of city dwellers, leaving the riverbed almost dry during the post monsoon period. The dry river is then filled by the sewers of urban people, whose growth has outpaced Kathmandu's ability to provide sanitation services. Particularly at Chabahil and Boudha, where residents dump their untreated sewage directly into the Bagmati. The river is peppered with pipes and, as it flows, it acquires a distinctive odour. By the time the river reaches Pashupatinath, it is little more than an open sewer. The side pools are black and viscous and rank bubbles give the appearance of rain.

Other causes of pollution surfaced periodically in both the official literature and in my conversations. One is the dumping of solid waste directly into the river. Perhaps due to the traditional belief that running water can wash away whatever filth one puts in it, people throw their garbage directly into the Bagmati River. Plastic bags and bicycle wheels litter its bed, and banks of trash compete with the little remaining sand. Sand-mining tips the balance in the trash's favour. I saw many people carrying sand away from the river in baskets and even in trucks and realised that the sand is used to build the concrete houses that have become popular in the capital. The erosion of stretches of the Bagmati's banks threatens ancient structures like *ghats* and temples. In the early '90s a major bridge at the Bagmati River collapsed due to extensive sand mining. A third factor people blame for the river's pollution is carpet factories, whose dyes flow freely into the Bagmati. While carpet factories have been the object of much criticism, it seems unlikely they can do more harm to what is already a sewer.

Drinking water, sewage and solid waste disposal, sand mining, and carpet-making are the major factors directly responsible for river pollution. All have become problems because they are the results of a single macroscopic issue: overpopulation. The increasing population of the Kathmandu Valley has outstripped the river's ability to support it. To meet the city's needs, the Bagmati has been destroyed. The people I talked to seemed aware of the problem of overpopulation.

style mansions outside the city's bounds, undermining the significance of the *mandala* and opening the way for future growth that would disregard the rivers.

The old regimes also fostered a culture with strict rules that forced people to respect the Bagmati as one would a national flag. The conduct of polluting activities near the river was to be kept to a minimum. No one was allowed to urinate within sight of river, and people had to walk away from the river before cleaning themselves. As with present-day swimming pools, a person had to cleanse himself before bathing in the Bagmati's waters. He/she had to wash his/her feet and gargle, being careful not to spit his *jutho* back into the river. Some rules make more ecological sense, such as the prohibition of taking soap in the river. Women had to carry water home to do laundry (BBWMS, 1994). In addition to protecting the water, the culture kept an eye on the sand. Certain practices continue to present times. For instance, one man said that as long as his father lives, he will not let his family build a concrete house because he is worried that such a waste of sand will debase the river. A river-venerating practice that still survives is the movement of the right hand from chest to head and back again that make when crossing any river by bridge. I often noticed that on a crowded bus, generally two or three passengers would respect rivers with this gesture.

Even as these rules faded (and there's no way of telling how conscientiously they were ever followed), the river remained a vibrant and central part of valley life. Most people I talked to who had grown up in Kathmandu, ranging in age from sixteen to eighty, had similar memories of the days when they were small and the river was cleaner than it is now. People once readily bathed and swam in it and recalled peaceful family outings to the Bagmati's crystal clear waters and golden sands. Clothes washed in the river would come out clean. They would drink its waters straight, and it tasted good. One man told me how as a boy he would put the fish he caught in the river into a bottle to carry them home. The Bagmati was a community center for the entire city, not just for those too poor to exercise other options.

RIVER AND RELIGION

Hindu attitudes toward nature

The river is a keystone for Hindu religious life. Religious texts expound on the divine status of the natural world and encourage humans to live in harmony with all beings. However, as with any belief that can be called Hindu, not all Hindus believe it. Even

crete suggestions for living. The *Chadogyo Upanishad* speaks of the purificatory powers of water and warns against polluting them, as once people disturb the waters around them, they will find themselves in great trouble. It is said that during his lifetime every Hindu in life should plant at least ten trees to maintain nature. There are historical documents from the fifth or sixth century which document that a king leaves his lands to his daughter but warns her not to cut any of the pine trees in a particular grove because waters run through it. He apparently knew of the dangers of erosion. At the temple of Changunarayan on the outskirts of the valley, a wall plaque forbids not only the felling of trees, but also the removal of fallen leaves as even they, in their decomposition, are essential to the ecology of the area. The record reveals that Hinduism has a strong spirit of respecting nature and not interfering with the delicate interconnections that keep it healthy. For the Hindu, nature's health is linked irrevocably to humanity's, as 'for you to be happy, your surroundings must be happy'.

Hindu attitudes toward water

All of nature is sacred in Hinduism, but water is even more sacred than the rest of the natural world. Water is in fact the ground on which all of nature and all the gods rest. In some accounts of creation, Brahma the creator sits on a lotus flower that springs from the navel of Vishnu, the ground of his being. Vishnu, in turn, reclines upon the gigantic serpent Sesa Naga, and the Naga on the infinitely vast primordial waters. Vishnu creates everything in the universe except the snake and the water, which create Him. The waters are 'the remainder that is the ultimate source or support of the universe' (Bajracharya, 1978).

Perhaps because water is the only substance with power that exceeds their own, gods seek it out. Our earthly liquid 'is a divine, life-giving, and life-maintaining substance, the counterpart on earth of *amrita*, the immortalising elixir of the gods' (Slusser, 1982). It nourishes the gods in heaven, and does the same for us in its earthly manifestation. Naturally, when gods come to earth, just as they seek out green places, they seek out wet ones. They 'always play where rivers have for their bracelets the sounds of the flight of curlews and the voice of swans for their speech, water as their garment, carp for their zones, the flowering of trees on their banks as their earrings, the confluence as their hips, raised banks as their breasts, and the plumage of swans their mantle' (BBWMS, 1994). One of the gods, Ganga, even became an earthly river, sharing her divinity not only with the river Ganga but with all running water.

> The *nagarajas* moved to follow the water, but Manjushri positioned himself at the new exit, knowing that without the *nagarajas* human civilisation could never prosper in the valley. First, Tatsaka and his large family came to the opening. Manjushri stopped him, saying, 'Oh Nagaraja, why are you going out? Please stay here for the good fortune and fertility of Nepal Valley.' Tatsaka became very angry with Manjushri and questioned him, 'How can I stay here in this Valley, the pure, clear water having been let out? You have destroyed my home I cannot remain here I will go to live in the Great Ocean.' Then Manjushri let him go. Next, Kulika Nagaraja and his large family came to the gorge. Manjushri stopped him and promised that if he stayed in the valley, he and his family would have a place where they could live in peace. Kulika accepted the *bodhisattva*'s offer, thinking that some day Manjushri would leave the valley, and the *nagarajas* would be able to stop up the gorge so that the waters again filled the valley[2]. One by one, all of the *nagarajas* came to Manjushri and one by one he convinced them all to stay with promises of peaceful, quiet waters where they could build their palaces and with assurances that the valley was still their kingdom and still belonged to them (adapted from Bajracharya, 1978).

This story tells of a world of water and snakes invaded and changed by humans and their allies. And it is told, at least in Bajracharya's translation, as to take to evoke sympathy for the *nagas*, a noble race whose home was stolen. The Kathmandu valley is the rightful place of the *nagas*, not of humans, and we, as imposing guests, should do what we can to respect them. The story also indicates an understanding of the delicate balance of ecology. For humans to live in the valley, the *nagas* must be displaced and nature tamed. But if the *nagas* leave the valley or if nature becomes imbalanced, then civilisation will perish. Nepal must walk this line carefully and keep the *nagarajas* content even in their displacement.

Other stories are of the creation of the Bagmati itself after the days of the lake. The following common Hindu story appears in the *Nepal-Mahatmya*. Prahlada, the king of the demi-gods, one day went up into the mountains and practised penance for one thousand years. Satisfied with Prahlada, Shiva laughed out loud. Then a river was born out of the laughter of Shiva, and came out of a cave in the mountain, white with the garlands of the foam and waves and with pure and clean water' (Acharya, 1992). The river came to be known as the Vakmati, as it was born of the *vak*, or voice, of Shiva. Other etymologists have interpreted '*bag*' to be a Newari word for

temple would be bathed with 108 jars of the river water. One man remembered how, as a little boy, he would go to the Bagmati with a jar, fill it, and hand it to the priest who would use it in the temple. Even today walking near the river gains religious merit, and a *pandit* recounted how in the past he walked along the banks from a point downstream to Bagdwar as an act of devotion.

Changes in religion to accommodate pollution

Because of the pollution, people today think of the Bagmati and its sacredness differently than did people a hundred years ago. To understand why today's Nepalis are not cleaning the river, we need to examine their scaled-back religious practices and weakened beliefs.

With the river water now mostly sewage, people do not use it for religious purposes. They don't want it to be their final taste of life. Nowadays, people die in hospitals more often than lying on an *argajal*. In my time at Pashupatinath, I saw only one woman laid out, feet in the river a grieving man at her head. People also tend to use water from the public tap nearby for the ritual needs that once were met by the river water. Watching cremations, I asked the men standing next to me if the water the mourners were pouring in corpses' mouths was from the river and would generally receive a chuckle with the reply. It seems general practice has turned to the tap. It also seems that mourners never bathe in the river. Some place a drop of river water on their head. All meet most of the ritual demand for purification at the tap or once they get home.

While people still wash the ashes of their loved ones into the Bagmati, many protest putting their parents in an open sewer. Padma P. Devkota wrote an impassioned article in a daily newspaper *The Kathmandu Post* (May 14, 1998) about his experience cremating his mother. He said his 'first instinct was to fly from there because of the stench of a dead river… [and the] scum on the surface of a thick, black, semi-liquid.' When the time came to put his mother's ashes in the water, he couldn't bear to do it himself and had the priest step in. While conventional belief has it that the dead person's *pretatma* (spirit) stays on earth for thirteen days after its last rites, soothed by the holy waters, Devkota thinks that now the *pretatma*, trapped in the flow of feces, will curse 'all who contribute to thirteen days of man-induced torture.' He announces that he does not want to be buried under that 'holy sewage' and calls for the city to shift from the traditional *ghats* to electric furnaces to cremate the dead, challenging 'the conservative Hindu who wrongly believes that the sacred laws are as eternal as God is.' Practice cannot be static when the world is not.

he didn't believe in the *nagas* because they're just in it for the money. I then shifted my questions to asking about *nags*, the word that in spoken Nepali refers to the snake gods. People generally told me that the Bagmati *nag* had gone elsewhere but would return when the river was cleaned. A few people told me it was dead long ago. No one seemed particularly concerned about its fate. After a while, I began to suspect that *nag* referred not only to snake gods, but to a type of snake that is larger and blacker than ordinary *sarpas*. One woman told me that she had seen several in her life, but none recently. So, people may believe that the Bagmati's snake god has relocated or died, or they may believe that the snakes that once lived in the river no longer do so.

No one agreed with my suggestion that because the valley has been polluted, Shiva and the other *devtas* (gods) might decide to leave. Responses ranged from the confused looks of the uneducated people I spoke with along the river to the smug laughter of the Pashupatinath Area Development Trust staff, the two ends of the 'Of course the gods would never leave' spectrum. It seems that the old priest is in a small minority. With one man, I shifted the terms of the question and asked him whether God will stop looking after people if they continue to pollute the river (*Bhagwaan uniharulaai her bichaar garnuhunna*?*)*. He said that God would cease to look after the city's people, but that the thought did not sadden him.

EFFORTS AT BAGMATI ACTIVISM

In my exploration of people's inaction, I do not want to give the impression that no one is trying to save the Bagmati. Many different people have made many kinds of efforts. In fact, during my three weeks of research, I never stopped hearing about new actions being taken. Here are a few.

The municipal government wants of repeat what it's already begun on the shores of the Vishnumati, sister river the Bagmati. City scientists have devised a system where river water is piped through the roots of plants, leaching out organic pollutants and leaving the water non-potable but biologically sound. There have been proposals to establish a United Nations park on the historical stretch from Thapathali to Teku. The water would not be treated, and the river's course might be altered to flow through Kathmandu proper. The park would feature shops and maybe even an amusement park. The idea has met with disapproval by people concerned that it would benefit only the rich and by those worried its commercialism might endanger the preservation of area *ghats*.

GAP SEPARATING BELIEF FROM ACTION

The people of the valley know that they are polluting the Bagmati. They have some sense that they are part of a cultural tradition that holds up this river as a god and the soul of their country. How is it that the love they profess the river can coexist with their disregard for it? How can a man condemn flush toilets and their effects on his beloved Bagmati one minute and go flush his own the next? What allows for this hypocrisy? When I asked people, they gave me a range of answers, some more persuasive than others.

Many told me that in Nepal's rush to modernise the old value of caring for the river had been supplanted by values imported from the West. Most of the people I talked to said that others pollute the river because they only look out for their own interests and disregard community values. They mine sand because it's profitable and throw trash in the river because it's the cheapest place. One man identified this 'money value' as an import that has emerged in Nepal only in the last twenty years. While the claim is doubtless exaggerated, the political liberalisation this century has seen probably does allow for more capitalistic, selfish action than old regimes would have tolerated.

Other interviewees pointed to Nepal's failure to differentiate between imports necessary for development like Western medicine and gratuitous introductions like sit-down toilets. The latter, with their twelve litres per flush, have done plenty to dirty water in the valley. Western media, I was further told, has replaced old stories and values for the new generation. As the old values fade, so does the Bagmati's special status.

Even individuals who do claim the Bagmati is sacred generally sit back passively. In my conversations with this group, I sensed that, for them the pollution in the river is a huge problem beyond their control. Fatalistically they withdraw from the problem. They complain, hoping that a larger power, like the government will take action, and meanwhile shrugging off their woes with a '*ke garne*?'. Some people probably don't have any options. One day, while I was sitting at a *ghat* in Teku, a woman purposefully walked up to the water, a plastic bag of trash in her left hand and a child holding her right. She tossed the sack into the river and just as purposefully walked away. I shouted after her to see why she had done it, and she shouted back that she had no where else to put her garbage. She was probably right. People with options, however, also subscribe to fatalism. One wealthy man lamented the decline of the Bagmati and Nepali civilisation and then suggested that the decline was inevitable because the world

make a convenient scapegoat for valley natives who want to avoid responsibility for the Bagmati's demise. It also points to a nasty, xenophobic potential in bio-regionalism an ideology currently popular among environmentalists in the West. If a person becomes too wedded to a watershed or bio-region, she/he doesn't want people from other bio-regions coming along to spoil it. The xenophobia also hints at the Nepal's transition from a small country based in the Kathmandu Valley to one that embraces Gurungs, Tamangs, Sherpas, and many other groups in a multicultural and polyglot nation. The Bagmati, once a unifying symbol for all Nepalis is now a small river in a small (though important) section of the country. It may have to change status again and surrender its position as the soul of Nepal. In any case, valley residents need to find a way to maintain their river as Kathmandu changes from a regional town to a cosmopolitan city.

To do so, it makes sense for them to give new birth to old practices and beliefs if those beliefs still move people. If they don't, it would help explain why people pollute the river although they profess its sanctity. A Limbu man who had been living in Kathmandu for ten years told me that, in his opinion, Hindus say the river is sacred but don't actually believe it. If they did, they would keep their trash and sewage out of it. Another man gave me a different perspective on how belief in the river operates. I had asked him about *nags*, and he told me that of course he believed in them as he's Hindu and so has to believe (*bishwaas garnuparchha*). His is not the kind of soul-staking faith that has led people to become medieval martyrs or join Earthfirst and chain themselves to trees. Beliefs, traditions, and sacred texts snowball into the unwieldy large entity known as Hinduism, and people follow it because they think they should. In a frequently told story, a Brahmin tries to conduct a ceremony that happens only once every ten years, but his cat keeps getting in the way, so he ties it to a tree. Ten years later, the cat and the old Brahmin have both died and passed the ritual on to the man's son. The young Brahmin prepares for his responsibility by buying a new cat and tying it to the tree because he doesn't realise it's not part of the ritual. He, like many Hindus, follows the practises of his ancestors blindly and passively.

This passivity feeds the fatalism and apathy that are killing the Bagmati. People know that the river is dirty, but as it isn't their river and they aren't the ones who declared it sacred, they don't feel the need to take responsibility for it. To motivate the majority of Nepalis to save the river, someone needs to transform the belief in its divinity from a dusty and lifeless statement to a movement that can compete or even fuse with the appeal of Western culture. Otherwise, Kathmandu will continue to choke the divine mother that gave it life.

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INNOVATION FROM FIELD

RAINWATER HARVESTING PROGRAMME IN THE HILLS OF LUMBINI ZONE, NEPAL

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INTRODUCTION

With the International Decade of Drinking Water Supply and Sanitation (IDDWSS) [1981-1990] Nepal started a long-term programme of extending water supply services to its citizens. In the hills, gravity flow water supply systems were built, while in the Tarai tubewells were installed. Today, gravity flow systems and tubewells do serve many communities but a large number of people are still without adequate level of drinking water services. This condition is especially serious in settlements where suitable water sources that could be tapped to develop a gravity water supply system do not exist.

A review of water supply situations in Lumbini Zone of south west Nepal in 1992 showed that almost 14 per cent of the Zone's population faced serious water shortages. The situation was critical in the hill districts where no water sources suitable for the construction of a gravity water supply scheme were available. To provide drinking water to such communities the Rural Water Supply and Sanitation Project (RWSSP) proposed using rainwater harvesting tanks, each of which would meet drinking water need of a single family. This initiative pilot began in Daugha VDC, of Gulmi District, which is one of the three hill districts of Lumbini Zone.

RWSSP's Initiative

The RWSSP is funded jointly by the governments of Nepal and Finland. It is implemented in six districts of Lumbini Zone. In 1992-1993, the project collected information on access to drinking water in all villages of the districts in the zone. The objective of the study was to determine the relative hardships that families faced in getting drinking water at the Village Development Committee (VDC) and

Table 1
Criteria used for determining supply service levels

Requirement to be met (the poorest characteristic decides the service level)						
Service level		Quality	Quantity (l/day/person)	Accessibility (minutes)	Reliability (month/year)	Continuity (hours/day)
Good	1	Protected source	>45	<15	12	>6
Acceptable	2	Acceptable source	>25	<30	>11	>5
Poor	3	Any source	>15	<60	>10	>4
Very Poor	4	All other water supplies				

ward levels. The extent of hardship was determined on the basis of quality, quantity, accessibility, reliability of the source and its continued availability: the resultant levels of service are shown in table 1.

The main criterion used in selecting the area prioritised by the RWSSP for building water supply systems was actual need. This criterion helped avoid possible bias in selecting the communities to be served. The overall hardship ranking was calculated weighting the individual hardship scores. To provide drinking water services to the households that faced most hardship, the RWSSP study team (Hans Van Kampen and Ramesh C. Bohara) had visited Daugha VDC in Gulmi District. The VDC was ranked as having the highest hardship. The hardship assessment and feasibility study was completed in January 1996. The team explored all options to supply drinking water. After evaluating those options, rainwater harvesting was identified as the most practical and cost effective method. The people of Daugha and the RWSSP agreed to introduce rainwater harvesting system at the household level as a pilot activity.

Design and technology

Individual households were selected for introducing the rainwater technology. The systems included 2000-litre ferro-cement jars that collected rainwater from roofs through gutters. To meet a daily water need of 100 litres per capita, for four months a household with 6 members would need a capacity of 12,000 litres or six jars.

Cost sharing

To build the six jars a household needed to invest about Rs. 4,500 per capita. RWSSP provided the cost of two jars at Rs 1,500 per capita. The investment for any additional capacity needed was the responsibility of the household. With this

approach the programme was expected to become self-reliant as almost two-thirds of the required investment would be generated by the community. The investment level of Rs 1,500 per capita was arrived at according to the following breakdown of cash and materials. The users demonstrated their commitments by contributing the cost of building the tanks. The RWSSP made contribution a prerequisite for selecting a scheme for implementation. The contribution had to be made before the implementation phase. Cash contributions were as follows:

- Rs 300 per capita by the VDC
- Rs 50 per capita by beneficiary household
- Rs 1,150 per capita from the district water supply and sanitation fund. The governments of Nepal and Finland contribute 50 per cent each to the fund.

Users were responsible for collection and transportation of local materials. Users transported construction materials from the nearest road head to sites. Users were also made responsible to manage unskilled labour for constructing the rainwater collection system.

Steps of construction

The steps involved in the development of the rainwater harvesting systems were as follows:

1. Design of the collection system
2. Testing of pilot project and demonstration sites
3. Feasibility studies (technical, social, health and hygiene)
4. Formation and registration of Water Users' Committees
5. Training to Water Users' Committee on managerial aspects
6. Training of local people in order to build the system
7. Establishment of revolving fund
8. Initiation of sanitation related activities

Issues and lesson

Multiple aspects and issues are involved in the implementation of rainwater harvesting technology. To promote the technology local resources (finances, materials and manpower) were mobilised, local people were trained to build the system, partnerships were established with private sector organisations and a

revolving fund at the community level were established. As of the end of January 1999, 1,500 units of 2000-litre ferro-cement tanks had been built in more than 1000 households of the twenty VDCs of Gulmi, Arghakhanchi and Palpa districts. The experience from the pilot scheme of Daugha VDC highlights the following key issues:

Information base: At the VDC and district levels a database is helpful as it can be used to assess the degree of hardship faced by communities. This information helped free scheme selection and prioritisation from political influences.

Step-by-step procedure: RWSSP designed a flow chart that showed a step-by-step procedure for implementing a drinking water scheme. The flow chart was designed incorporating gender balance and environmental concerns. This chart could be applied in rainwater programme too.

Community participation: Community participation is key to sustainability. Willingness of the beneficiaries to participate in the programme is to be taken as the main criteria. This commitment was judged by considering contributions in both cash and kind. In addition to labour, people contributed money and locally available materials.

Involvement of civil society groups: Local NGOs and CBOs and the private sector were involved because these institutions were considered important for and useful in assisting in the implementation of the programme. Involving was aimed at institutionalising the programme rather than at achieving specific targets. Many locally based NGOs and CBOs were partners in the programme. By becoming involved in the process the local NGOs and WUCs shared the responsibility and learned together. Involved NGOs and WUCs developed managerial and technical skills in water harvesting techniques.

Capacity building: Capacity building at the local level is central to ensuring sustainability of a new water supply system. The priority was accorded to training local people in the technical and managerial aspects of the water harvesting programme while developing it.

Rainwater from thatched roofs: Many families because of its low quality did not accept rainwater collected from a thatched roof. To get good quality water, it was

agreed that RWSSP would provide households having thatched roofs with 180 ft^2 of Corrugated Galvanised Iron (CGI) sheet and that the household would make one jar of 2000 litre capacity. It was agreed that households with CGI sheet roofs would build two jars.

Revolving fund: A revolving fund was established so that households could borrow cash and build additional jars. Revolving funds were established in each wards of the VDC so that the Water Users' Committee could loan cash to families. This concept was initiated in Daugha VDC of Gulmi as a joint venture of the RWSSP, Gulmi Arghakhachi Rural Development Project (GARDP), Daugha VDC and the users group.

CONCLUSIONS

In the three districts many communities now use rainwater harvesting as a primary method of drinking water supply. The technology is replicable. The following should be kept in mind in promoting the rainwater harvesting method (s):

- The programme should start small and evolve gradually. Technical designs must be improved and strategies of implementation refined as the programme unfolds.
- A programme in which local people contribute fund and labour and are involved in decision-making has a greater chance of success than one which is externally imposed.

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GRAY LITERATURE REVIEW

WATER SUPPLY AND SEWERAGE SERVICE SITUATION IN KATHMANDU: A REVIEW OF TWO REPORTS

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INTRODUCTION

Managing the water supply system in Kathmandu has preoccupied both the institutional and the financial resources of succession of governments of Nepal. The capital's piped water supply was built more than a century ago, and since then substantial investments have been made in constructing infrastructure as well as in improving the capacity of the parastatal agency the Nepal Water Supply Corporation (NWSC) and its former forms, the Water Supply and Sewerage Corporation (WSSC) and the Water Supply and Sewerage Board (WSSB). Various donor agencies such as the World Bank, United Nation Development Programme (UNDP), along with the Japanese and the Norwegian governments have helped to expand and improve water supply services since the early 1970's. Despite these efforts neither the quality nor quantity of drinking water supply services has improved. The government and the NWSC argue that improving services necessitates augmentation of water supply. In contrast a limited number of social auditors point the systemic and institutional shortcomings as the main reasons for the poor level of service. They emphasise that the level of service could be improved if water management became the culture of the parastatal.

In the past three decades, many studies have reviewed the management practices of the WSSB, the WSSC and the NWSC. Of these studies, perhaps the most important was the Pokharel Commission Report. The commission was formed in 1987 by the government[1] to review the policy, managerial, operational and financial deficiencies of World Bank-funded urban drinking water supply projects in Nepal. The three-member commission included a member of the Rastriya Panchayat, social anthropologist and a resource economist. The report argued that World Bank-funded projects needed to steer away from its focus on construction and move towards water management. When it came out, the report was not

received with open arms either by the government or the funding agency because as one member of the commission suggested, 'it laid bare the rot within and questioned the appropriateness of new supply projects to address problems and management' (Gyawali, 2000).

The following analysis reviews the salient features of the Pokharel Commission Report. It then juxtaposes its findings with those of another report, one completed in 1995 which also reviewed the issues with a critical perspective. This paper draws lessons of a general nature that will be relevant as the quest for the best institutional mechanism for managing water supply in urban Kathmandu continues.

THE POKHAREL COMMISSION

In 1987, a three-member Water Supply and Sanitation Service Situation Study Committee was formed by His Majesty's Government of Nepal (HMGN) under the chairmanship of Birendra Keshari Pokhrel, then a member of the Rashtriya Panchayat. The other members were Bihari Krishna Shrestha and Dipak Gyawali. Together they published their findings in a report called the 'Pokharel Commission Report'. The background against which this committee was constituted was as follows:

1. HMG was aware of the widely held public perception that neither the functioning nor the services provided by, the Water Supply and Sewerage Corporation (WSSC) were satisfactory.
2. HMG was apprehensive about the defects in the implementation of World Bank loan-funded projects and the paralysing impact of institutional and personnel management problems as well as about the political implications of an unproductive financial burden from long-term public debt.
3. The financing agency (World Bank) was also uneasy about the performance of the WSSC. The remedy it proposed was mainly a massive tariff increase, but HMG, being more in tune with the actual administrative problems and public sentiment, felt that this measure was one that should be promulgated only with great caution.

The committee conducted a rigorous examination of the achievements of the three projects implemented by the WSSC with loan assistance from the World Bank. It assessed the water supply and sewerage services actually received by the people as opposed to what had been envisaged or promised. The report recommended

improvements in the services to the public, commented on the effectiveness of the loans taken from the Bank, and identified deficiencies in the management of the implementation of these projects. The committee had the following specific objectives:

- compare the targets specified in the 1st, 2nd and 3rd water supply and sewerage project agreements with their actual physical achievements.
- examine water leakage and loss in the distribution system and the progress of project works.
- conduct a comparative review of the actual improved services to the people and the expenditures on consultancy services, vehicles, study tours and administrative overheads.
- compare the services expected from the project with those provided in reality.
- evaluate the quality of services provided with the tariff for the same.
- provide recommendations with respect to the above-mentioned problems and issues.

The committee began its work on February 1, 1987, and for the next three months examined relevant documents, visited outposts and interviewed concerned parties at the grass roots and local government levels. The committee also held consultations with local WSSC officials, central WSSC officials and WSSC board members. The committee submitted its report on April 24, 1987. The main report was prepared in Nepali and a summary in English was attached. The report consisted of four sections.

The first section discusses the historical background of the urban water supply sector in the kingdom against which the three projects aims to improve the existing situation. It also presents the targets and achievements of the three World Bank-funded water supply and sanitation projects.

The second section outlines the challenges and problems in the water supply sector. They include defects in the conceptual framework of the World Bank-funded projects, leakage and wastage from production plants and distribution networks, depleting groundwater levels and declining community participation as well as policy, managerial, operational and financial deficiencies in the NWSC.

The third section presents an overall analysis of the conditions as they prevail in 1987 and the salient conclusions that can be drawn from them.

Finally, the fourth section summarises the recommendations of the committee, reviews tariff, improvements in management efficiency, options against new supply, and presents in-house analysis of aid efficacy

The three projects

An important aspect of the study was its review of the World Bank-funded projects. The review compared the physical targets and actual achievements of these projects as well as the financial performance of the NWSC.

The first and second water supply and sanitation projects were conceived in 1974 under a study entitled 'Master Plan for Water Supply and Sanitation for Greater Kathmandu'. The World Bank appraised both the projects between 1971 and 1973. The loans for the first and second projects were sanctioned in April 1974 and April 1977 respectively. The third project was a continuation of the first and the second projects and was implemented despite their obvious shortcomings. This project was in progress during the study and was originally scheduled for completion by FY 1985.

The first loan was aimed at upgrading the drinking water supply and sanitation systems in Kathmandu, Lalitpur and Pokhara. In addition, Birganj and Biratnagar in second project and six more towns (Nepalganj, Butwal, Bhairawhaa, Hetauda, Janakpur and Dharan) in the third project were included in the service area of the WSSB. The objectives of these water supply and sanitation projects were to

- provide a safe and uninterrupted supply of drinking water to the residents,
- provide a sewage system for the core areas of Kathmandu and Lalitpur, and sewage treatment plants to reduce pollution in the Bagmati River and
- help the WSSB improve its institutional framework.

The estimated and actual project costs and project periods of the three projects (Table 1) indicates that the first and second projects were delayed by 65 months (5 year and 5 months) and 28 months (2 years and 4 months) respectively. The third project, which was in progress when the study was done, was delayed by 10 months. Under the principle that *benefit delayed is cost increased*, the three projects were termed costly in term of overruns. Other components that increased the cost were the high cost of consultancy, the purchasing of a large number of vehicles and high administrative expenses.

Table 1
Project period and project cost

Projects	Started on	Project period (month)		Total project cost Rs × 10^5					
		Estimated	Actual	Estimated			Actual		
				HMG	WB	Total	HMG	WB	Total
First	June1974	42	109	540	1,520	2,060	588	1,317	1,905
Second	March1978	48	76	412	999	1,411	301	1,040	1,341
Third *	June1981	60	70 *	1,140	4,860	6,000	974	3,342	4,917

Source: HMG/N, 1987

* On going project till study period

The costs of the consultancy services to the three projects were 10.6, 11.2 and 8.7 per cent of the total project cost. The report highlighted that the consultancy services cost was increased by extending the expatriate consultant's terms to correct their own design faults and including the direct cost of supporting a large cadre of local under-employed or assignment less engineers in WSSB/WSSC. According to the report the vehicle and administrative costs of these projects were 1.5 and 7.9, 1.9 and 6.3 and 0.9 and 7.6 per cent of the cost of the first, second and third projects respectively.

PROBLEMS AND CHALLENGES IN WATER SUPPLY SECTOR

The report highlights the challenges faced by the NWSC in its policy, managerial, operational and financial sectors. The quality of service is poor because of high population growth, rapid urbanisation, depleting groundwater levels, water supply systems with high leakage rates and inadequate capacity and overall poor management of physical assets. The report points out following reasons for the deterioration of the drinking water supply

Leakage and wastage

Leakage and wastage was identified as a major challenge for the drinking water supply systems of most of the urban area but it receives very little attention. In the context of a situation characterised by the use of all the water sources in the valley itself, an unreliable groundwater source and, the high cost of outer source schemes, it is necessary to take proper measures to control wastage water and leakage. The official figure of leakage and wastage is 40 per cent of the total supply, but this figure could be higher in reality[2]. Because of high losses in transmission lines and distribution

systems as well as wasteful use, only of half of the supply fed into the system is actually available for consumption. Estimates of unaccounted for water are uncertain and variable. The estimated figures for leakage and wastage are different in different past studies[3]. The committee suggested that the managing organisation was not organically built to keep proper accounts of its water production and sales. The estimate of loss is uncertain because figure of bulk water use is not metered; in the official discourse, however, 40 per cent is accepted.

Lack of data

Lack of data related to production, distribution, consumption, and leakage is another problem that impedes the management of water supply and the ability to estimate unaccounted for water. Data includes the amount of water that comes to the reservoir, is produced in treatment plants, distributed from production points, leakage and wastage both in distribution networks and at production units. There has been organisational resistance to installing bulk meters and those installed do not function. It was officially announced that half of the consumer meters installed in Kathmandu did not function. The committee found that in the core areas of Lalitpur only 45 meters functioned. In regions deemed 'good service areas,' only 25 per cent of taps were metered.

The combination of an increasing water need due to population growth and the inadequacies of the current municipal system create a shortage which is difficult to calculate. Accurate data relating to the NWSC is unavailable and since official statistics are questionable in most cases, it is hard to gain a clear picture of the actual supply.

Conceptual Framework

The conceptual framework of the projects is another problem mentioned in the report. They focused on new construction activities and procurement rather than on water management. Though leakage and wastage control should have been a priority, neither the World Bank nor the NWSC accord priority to that area. This means that the level of service in the capital is deficient not only during the dry season but also during the monsoon when the supply is augmented by rainfall. The report mentions that ignoring management is a fundamental weakness of the conceptual framework of these projects.

The report highlighted that the policy of these projects to let expatriate-consultants carry out planning, design and supervision of construction led to

negligence during construction supervision, poor management and high project costs. Furthermore, this arrangement resulted in the loss of opportunities for in-country capacity building.

The consulting services of these projects are controversial despite the high financial outlay for them. The fees for consulting exceed 70 millions (Rs) and averaged 10 per cent of the total project cost. This was much higher than the cost of local consultancies for large civil engineering works – ranging only 1 to 3 per cent of the total project cost. Such donor policies have been, to a large extent, instrumental in bringing about institutional distortions in Nepal.

Since the very inception of the WSSB/WSSC all three projects have been constructed under the overall design and supervision of expatriate consulting firms. The presence and functioning of expatriate consultants made the design and planning cells of WSSC irrelevant to the management, which accepted all designs from expatriates without a process of review by its own staff. Many design faults were initially questioned by WSSB/WSSC engineers, but their objections were ignored[4]. After the completion of the first project, WSSB Board members decided that only one resident expatriate would be required for general supervision and that Nepali engineer could do much of the engineering tasks. The report mentions that the World Bank, in opposition, refused to promote the use of local engineering skills. The disenfranchisement of Nepalis, it argued, is one of the root causes behind poor project performance.

Engineering supervision by consultants was also less than satisfactory. In outside-valley towns the contractors met consultants only once every two months, when running bills were paid. Local WSSC offices had been told to supervise the works, but they were staffed by only one engineer who was also the local office chief and was too preoccupied with day-to-day distribution management and consumer complaints to do justice to the job. There were no formal commissioning procedures for newly constructed works in the WSSC. The engineering consultant also failed to provide standard CPM (Critical Path Method) charts for project management for two consecutive years. The charts prepared earlier did not acknowledge that tenders had been called and contracts awarded even before land had been acquired. Failures to follow proper management practices caused project delays up to four years.

Lack of community participation

The biggest problem in the organizational structure was the lack of community participation. Since, the project was directly linked to the community, beneficiaries

should have been put at the centre stage of the projects. The provision to include a member from the public, however, was pending since the very beginning of these projects. A request for association by the Nagar Panchayat[5] in 1979 was approved by the 87th board meeting.[6] But the decision was never implemented.

Poor organization management

Poor management was a crucial reason behind the deterioration of the drinking water supply situation in major urban areas. There were many defects in the management of the NWSC including project planning, project operations, the financial sector, tariffs and organisation of the Board. The problems in management mentioned in the review were as follows:

- The organisational culture of the NWSC is person-centred rather than job-oriented. The distribution of the work-load is uneven, regular staff meetings are not held regularly. When they are held, they dissolve into protracted disagreements over non-substantive issues. Interdepartmental dialogue and a procedure for vetting are virtually non-existed.
- The financial administration section controls all the other sections. The boundaries of the financial administration, the internal audit and the procurement sections should be separated to ensure mutual checks and balances in the fundamental rules of good management. These divides were ill-defined and NWSC does not have proper knowledge of its assets.
- Some important sections such as planning and designing, human resource, leakage and wastage control and metre maintenance were useless and other important sections such as legal, ground water and drainage (sanitation) were missing altogether. As mentioned above, planning and design section were irrelevant because of the imposed donor policies of hiring expatriate consulting firms at high cost for design and supervision and the NWSC acceptance of all designs without any process for reviewing by local staff. Similarly, the training section was generally assigned to whoever happened to be abroad for further studies. Groundwater supply and sanitation facilities are the main programmes of these projects, but there were no independent sections for these programmes; their poor performance was a direct result. There was no legal section, but an outside lawyer who had been retained after several disputes with contractors, dismissed personnel and litigating residents.
- The store management is unsuitable for the NWSC structure. Store accounts had not been kept for the last decade. Similarly, the central laboratory which

examined the water quality of all towns was not able to cope with the work of Kathmandu valley alone due to the lack of organisation, trained human resources and required material

Financial review

The committee reviewed the financial condition of the WSSC and termed the performance of the WSSC as 'sick'. The balance sheet for the FY 1987/88 showed that the organisation's expenditures were more than double the revenue collected during the same period. The report highlights that internal weakness, like distributing without metering, not billing even after six months of metering, not repairing, non-functioning meters and charging minimum tariffs to non-metered consumers for many months, and not taking action against defaulters are the cause of poor revenue collection.

RECOMMENDATIONS

The report recommended overall changes in the management of the organisation, general policies and specific programmes activities. They included decentralising to municipalities, public participation in decision-making, concentrating on loss reduction and improving fiscal continence. The recommendations were as follows.

- A water supply and sewerage organisation be formed for the urban areas of Nepal incorporating the principles of decentralisation and local participation in decision-making in issues of local concern.
- Leakage control is equivalent of adding a new source but is cheaper. Such thinking and policy is foreign to the present set-up. A study of leakage and wastage control, both in distribution networks and at production points, should receive priority. Bulk meters should be installed at major production and distribution points and the utility's performance should be measured by the efficiency of its water use rather than by the speed of financial disbursement.
- The *aid-mentality* resulted in the faulty design of the WSSB/WSSC projects. Neither the WSSC/WSSB, nor the Department of Water Supply and Sewerage (DWSS), National Planning Commission (NPC), Ministry of Water Resources (MWR) conducted the necessary analysis to see if the loan would be repayable. The analyses of banks and expatriate consultants could have built-in vested interests and should not be accepted without in-house studies by Nepali organisations.

- Each district town must have its own WS&S board which should have as members, the mayor representatives from the local health unit, the local chamber of commerce and relevant HMG offices. Members should be chosen keeping in mind local necessities and practicalities.
- The study and revision of tariffs should be conducted by the 'Public Utility Commission' (PUC) annually.
- Standposts must be entrusted to municipalities (nagar-panchayat), who should pay tariffs, HMG subsidies in this regard should to go the municipalities.
- Depending upon the availability of water resources and the cost of exploiting them each town must have different tariffs. If necessary, cities could be zoned into good, medium and bad water supply areas and increased tariffs levied accordingly.
- All future engineering work should be initiated and designed at least to a preliminary level by local staff or consultants before expatriate expertise is brought for special advice.
- Sewer systems should be connected to municipal drains.

THE 1995 DIAGNOSTIC REVIEW

Many of the above recommendations were not implemented and a few years later in 1990 the political system changed when multi party democracy was reinstated. A number of initiatives, including the formulation of a fifteen-year plan, were prepared in 1990. One was taken in 1993, when the NWSC was twinned with the Water Supply Company South Staffordshire of the United Kingdom. Halfway through the twinning, an independent review was conducted towards the end of 1994 and its report submitted in 1995. The review was undertaken by Dipak Gyawali and Ajaya Dixit. The objectives of this review were to take stock of the progress and failures of UNDP-supported Management Support Project (MSP) designed to assist the NWSC improve its managerial capacity.

The review looked at the problems from the perspectives of four policy actors: Nepal Water Supply Corporation, His Majesty's Government of Nepal, donors/consultants and the urban public. The report provided critical observations about these actors as follow:

Nepal Water Supply Corporation (NWSC)

- A sense Esprit de Corps for the organisation, as a whole does not exist. The result is a sinister and pathological working environment.

- Professional self-confidence and pride among the professionals at the NWSC is at rock bottom. Although awareness of the problems and knowledge about possible solutions to them are well known.
- The efforts of dedicated professional staffs to propose plans for improvements have been negligible.
- The tariff system has collapsed since the ill thought out introduction of the self-billing system.

His Majesty's Government of Nepal (HMGN)

- The structural inconsistencies generated by the World Bank's first, second and third projects still exist and the leadership/vision expected from the government to address the burgeoning problems of urban drinking water supply management in the country are not forthcoming even in this fifth year into democracy
- HMG has so far shown itself to be insensitive to the challenges posed by all the diagnostic work in the last decade and its leadership has been limited to expediency and cosmetic changes.
- The Ministry of Housing and Physical Planning and the Department of water supply and sewerage (DWSS), the moral leader of urban water supply, have been rather mute.
- The 1989 Act limits the authority of the board to provide leadership because it is obliged to accept HGM's instructions, which are generally welfare- or charity-oriented as far as drinking water is concerned. Although it is designed as a semi-autonomous body to be run on a commercial basis, in practice the NWSC functions as a department of the government. Its objective is new construction but with few stringent audit obligation.
- The NWSC board is ineffective due to poor leadership. It has mostly confined itself to addressing procurement issues rather than addressing the policy and operational anomalies identified in the many diagnostic reports.
- HMG and the NWSC have repeatedly failed to honour their covenants as regards the terms and conditions of loans from the World Bank. The failure to implement even a fraction of the recommendations and meet the covenants has lead to loss of credibility of the government in eyes of the municipality, donors, NWSC management and the public.

Donors/consultants

- Donors and the consultants have intervened with development initiatives having 'killer assumptions' that ignored past diagnostic studies. The MSP has also

proceeded with such assumptions, the result is that the project was in a sense, designed to fail.

- The expediency of day-to-day operational concerns prevented the larger picture from achieving salience. There were efforts to forcibly apply tools in the prevailing context that may further exacerbate the problems.
- The charges of corruption made in past reports have not been refuted institutionally by the NWSC management; in fact an acting manager effectively admitted to the veracity of these charges under provocation by a local journalist.
- Although the projects started with a twinning objective, there were no NWSC twins working together with South Staffordshire experts, with the result that the exercise degenerated into a simple consultancy mode, which was bound to fail as have many such consultancies in the past decade.
- The twinning objectives of the MSP, which might have rescued NWSC's professionalism, were lost.
- There were structural conflicts between expatriates that fed into the NWSC personnel miasma.
- The sharing of overall programme responsibilities between two top contenders, Chief Technical Advisors (CTA) and twinning consultants, resentment within the NWSC senior management, and the overall setting of NWSC has contributed to figure-pointing and a reluctance all around to own the problems so as to solve them.

The urban public

- Nowhere the public involved in any level of the organisation at present and its mostly negative feeling get vented only in esoteric programmes on national television. As NWSC has by itself lost its tangible entry point to the customer through the introduction of 'self billing', a solution is elusive.

The review provided a sketch of possible institutional modes for improved management as well as a matrix (Table 2) highlighting the pros and cons of the identified institutional modes.

CONCLUSION

The two reports, reviewed namely the Pokharel Commission Report and the Diagnostic Review reveal the problems underlying the management of urban water supply systems in Nepal. The reports identify institutional failure as the major cause for the problems, which remain unresolved even today. The recommendations of the reports for dealing with some of the obstacles are, to a large extent are, as

Table 2
Matrix of options

No.	Options	Positive implications	Negative implications
1.	Dissolve NWSC as Clause 24.2 of NWSC Act	a. Recognition of reality b. Provision of 'clean slate'	a. Fundamental question still: What then? b. Political flack could lable action as adventures or escapist c. Could lead to sever conflicts in all Nepali municipalities
2.	Handover to municipalities	a. Short decision loop with local management b. Better coordination with other sectors such as roads, telephones etc. c. Synergy with local needs and aspirations d. Revenue source for municipality e. Opportunity for local capacity building	a. Many municipalities as yet without management capability or skills in this sector b. Added burden to existing municipal functions c. Needs handing over in at least same if not better condition than what existed pre-nationalisation d. Possible local politicisation e. Qualified Kathmandu-based technicians refuse to go to OTV utilities for fear of professional stagnation
3.	Hand over to users' committees (UC)	a. Localised focus and self management b. Local resource mobilisation c. Better sense of accountability d. Shorter decision loop e. Public participation opportunities	a. Good leadership crucial, often rare b. Priorities of UC may change over time after initial crisis is over c. Local conflicts especially over water rights may predominate d. Politicisation
4.	Decentralised town committees	a. Local control b. Shorter decision loop c. Public participation d. Mobilisation of other municipal resources for water and sewerage e. Policy and coordination inter-linkages with other functions	a. Career dead-ends for national level technical cadres b. Subjective elements of local politics

5. Regional groupings	a. Local control for operation and development b. Decision loop localised within a closer and smaller geographical block which become the operations units c. Reconstituted NWSC can graduate to becoming a national water supply authority dealing only with national policy issues and not operations d. Personnel transfers within and between regions prevents career dead-ends and entrenc hment of corruption e. Organisation sense of identity f. DWSS managed urban systems too can be brought under one policy umbrella	a. Danger of creating more bureaucracy through one more layer b. Less rigid than current national framework but more rigid than more local options
6. Private management	a. Efficiency through profit motive b. Traiff close to cost of production and supply c. Felife to overburdened government d. Creative mobilisation of blocked private capital	a. 'Natural monopoly' problems without oversight bodies, especially for tariff b. Lack of local political backing could kill it c. Managerial skill and technical competence not yet available in private sector to required degree d. High up-front capital requirements with long and uncertain gestation period
7. Management contract of whole or parts of utility's functions	a. Intermediate between complete privatisation and state delivery b. Benefits from both profit-oriented efficiency and state patronage security	a. No past experience with such measures b. Lack of managerial especially legal and financial) skills in dealing with many contractual obligations
8. 'Business as usual'	a. Explosion may not occur now but in someone else's beat	a. More degeneration b. Service level deteriorates c. Low staff morale becomes more fatalistic d. Intractability of problems gets worse e. Will show poorly on Kathmandu's hence Nepal's image

Source: Gyawali and Dixit, 1995

valid today as they were when the reviews were made. The underlying themes of both these reports recommending corrections were similar; they were beginning to move in an intuitional path which would focus on the management and delivery of water supply and sanitation services. Unfortunately these recommendations did not get translated into institutional changes which would improve the services and brought the confidence of citizens by providing better quality of service. Improving the quality of water supply in urban regions is a major challenge as both push and pull factors lead to a rapid increase in the number of people living in these regions. The conceptual foci of the two reports reviewed within these pages underscore the notions that institutional checks and balances are a central feature of successful water supply delivery regimes.

NOTES

1 Rashtriya Panchayat was the parliament of the erstwhile Panchayati system.

2 Forty per cent appears to be the politically correct figure but the actual figure is higher. See Dixit (1992) for discussions. Another leak detection study concluded similarly, See IDA(1995).

3 Binnie and Partner (1965) reported the leakage to be 75 per cent of the total production. The German aid agency, GTZ's study of leak detection in Kathmandu Valley's water supply system estimated the average leakage and wastage at more than 70 per cent and that some sections lost as much as 84 per cent. Binnie (1989) suggested that of the total water used in 1987 in Greater Kathmandu consumers wasted by 9.95 MLD after the meters recorded use. In another study (Binnie, 1988) estimated that the loss was as high as 65 per cent of the supply. CES (1992) estimated the loss to be between 40 to 50 per cent while JICA (1992) indicated that losses were perhaps only 30 per cent of the daily production.

4 The 85th WSSB Board meeting decided that enough experience had been gained by the WSSB engineers and sufficient technology transferred. It was decided that only one resident expatriate would be required for general supervision and that much of engineering could be done by local engineers. In a letter dated Jan. 24, 1978, the World Bank informed HMG that such an arrangement without in-depth supervision by expatriate consultants was not acceptable to it. Such a refusal by the World Bank to promote the use of local engineering skills to the utmost is one of the root causes behind poor project performance.

5 During the Panchayat system a municipality was referred as Nagar Panchayat.

6 The decision was that there are many Nagar Panchayats in the project served area and the number must be increased in future. On the grounds that it was not the only Nagar Panchayat served by the WSSB, and that the inclusion of all would be impractical. Thus a project implementation cooperation sub-committee with Nagar Panchayat participation in each Nagar Panchayat will be formed.

7 Clause 24.2 states: In case HMG decides that the NWSC has already completed the functions to be performed or has not complied with the functions, duties or orders or directions to be

performed by it or if HMG deems it unnecessary to retain the corporation, HMG may at any time dissolve the NWSC.

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BOOK REVIEW

THE DILEMMAS OF WATER DIVISION

by Lucas Horst
Pages 120
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Reviewed by **Laxmi N. Chaudhari**

If irrigation water management is to be improved, the requirements of operation and maintenance must be considered during the design stage. *The Dilemmas of Water Division* by Lucas Horst analyses the design and operation aspects of an irrigation system. The book reviews the design processes and the choices of technology in relation to irrigation management.

In an irrigation system water must be divided from higher to lower order canals and finally to fields. The task of water delivery involves both technology and institutions. Technology comprises structural components for distributing water, while institutions are concerned with the norms, practices and perceptions of farmers in terms of the allocation and distribution of water. Designers of irrigation systems are generally guided more by technical considerations and accord less attention to institutional issues. However, both are important because of the interface between technology and farmers at water division structures.

A successful irrigation system should meet farmers' needs. To fulfil this objective distribution technology must suit local conditions of operation. Needless to say, the technology itself must be within the capacity of beneficiary farmers to operate and maintain. The majority of irrigation systems, however, face challenges on this count because irrigation was considered only a technical matter of division structures. Consequently, systems are poorly operated and maintained, and returns on investments are low. Irrigation systems do not meet the expectations of designers, irrigation departments or farmers.

In the last two decades, many researchers have attempted to explain these issues as they affect irrigation. These studies have focused on the performance of irrigation systems, farmers' organisations, and water rights. The studies suggest that irrigation is not only a technical artefact but also has human and institutional dimensions Policy tools like farmers' participation and transfers of irrigation management to users were

introduced. These efforts attempted to reduce the discrepancy between design and operation by improving the management environment, the designing of irrigation systems, and the underlying operational principles. But the design aspects of systems were not analysed sufficiently to see if designs attracted or repelled participation. Although the management responsibility of irrigation systems is being transferred to users, their compatibility vis-à-vis farmer capacity has not been well analysed.

The Dilemmas of Water Division has thirteen chapters in four parts. The first part of two chapters reviews the historical development of irrigation design methods and management since the early 20th century. It also highlights the needs for re-conceptualising irrigation design and management in the context of technological changes. The second part has two chapters, which examine the general principles of irrigation and water division structures. Different types of irrigation systems – their boundary conditions, layout and components – are discussed. Commonly used water division structures are presented with their hydraulic and operational characteristics.

The third section discusses water delivery schedules (WDS) in five different chapters. These schedules follow the conventional way of deriving WDS and analysis of various possible types of delivery systems. Specific details of the conventional structures along with their operational consequences, shortcomings, assumptions and results are presented. At the end of the section the author concludes that paying little attention to operational aspects leads to discrepancies between design and performance.

In the last section, the author presents remedies for solving the problems, and suggests changes in design, management and technology that can be a way forward. The simplification of water delivery and technology, the potential role of intermediate storage, and broader perspectives on design and management are recommended.

Distribution technology must match the underlying principles of water allocation. The type and characteristics of the technology used largely determine the style of management: centralised or decentralised. Of the various types of irrigation technology, the book concentrates on water control or distribution structures, which have a direct bearing on management. The author identifies five types of delivery systems on the basis of water delivery schedules and examines them in terms of hydraulic behaviour, operational aspects and human dimensions. They are proportion division-traditional (system 1); proportion division-Punjab type (system 2); central scheduling-variable flow (system 3); central scheduling-intermittent flows (system 4); and responsive scheduling – automatic delivery (system 5). Each system has its own capacities and water division structures**.** The systems are further categorised into three types based on water distribution

technologies: simplified technology (systems 1 and 2), adjustable technology (systems 3 and 4) and automated technology (system 5). Each system has a possible choice of division arrangements and operational consequences in terms of flexibility, procedures, requirements for operational staff, transparency, corruptibility, social acceptance and possible management by farmers.

Operational flexibility is an important determinant in the successful management of irrigation system. The type of system determines operational procedures, the need for measurements, staff requirements, and effectiveness of management by farmers. The greater the operational flexibility, the better the chances of matching demands with supply and thereby improving performance. This logic, Horst argues, might appear tenable on paper. In practice, however, this approach often leads to sophistication because structures are cumbersome and contain complicated procedures leading to operational difficulties. Additional individuals are required to monitor the operation which in turn increases the possibilities of mismanagement and disputes.

Furthermore, the current approach to irrigation aims to bring farmers to the centre stage of management not only to make the system function better but also to overcome the problems of inadequate funding for operation and maintenance. The initiatives involving farmers as the central actors are evident in the management turnover of agency-built irrigation system as well as of farmer-built system rehabilitated by state agencies or with support from funding agencies. For any irrigation system to perform satisfactorily, the water distribution technology must be simple, understandable and appropriate for users.

Among the three-distribution technologies, adjustable technology is more flexible but less transparent than others. Its use can lead to mismanagement and disputes. Discrepancies between design and operation are evident in systems 3 and 4. Systems with varying flows regulated manually or mechanically with gradually adjustable structures (systems 3 and 4) show operational problems. These systems are less suitable for farmer-managed irrigation system than proportional (system 1 and 2) and automatic systems. The author focuses his discussion on these four systems.

An analysis of the interrelationship among design assumptions, water delivery schedules, and operational realities show that designs are incompatible with the socio-institutional environment if assumptions are limited by agronomic, engineering and economic parameters, without considering institutional and human aspects. For compatibility, all aspects should be explicitly considered in the design. The author recommends four additional design criteria: operability, operational procedures, staff requirements and human dimensions.

The quest to improve the performance of irrigated agriculture has focused on the management of systems and only superficially touched upon the issues of technology. The author argues that most remedies to improve management will remain cosmetic if the fundamental problem – complex irrigation schedules that require sophisticated water division structures – are not addressed. Both result in difficulties in operations, shortages of skilled staff, and different perceptions of water distribution objectives between field operations and the farmers on the one hand and the official irrigation schedule on the other (pp. 90).

The author suggests that simplified technology – proportional division and on-off structures – is best suited for farmers because it is simple to operate. Although automatic control measures will require fewer persons to operate the system, operators must be skilled. Moreover, such a system cannot be adopted for run-of-the river projects or for projects with restricted storage capacities. Simplified technology and intermediate storage are suitable methods. A distribution technology can perform satisfactorily only if the beneficiary farmers accept it.

In Nepal various types of water distribution technology are used. They are both locally based indigenous and modern. After 1950 irrigation development was taken by the state as one sector for intervention. Many development interventions were bilaterally funded and western consultants employed. The consultants introduced new approaches to planning, design and supervision. In many irrigation systems technology was introduced irrespective of its compatibility with the physical, socio-economic and institutional context. This leads to a discrepancy between design and operational reality.

The choice of technology is guided by the preference of the promoters and has political-economic dimensions. Part of the challenge is also to reorient water education. In South Asia the development of modern irrigation has its roots in the technology that was developed during the British colonial period. This development was guided by the incentives of revenue generation and administrative control. To achieve these objectives, centralised agencies were created and they had low level of interaction with farmers. To successfully respond to the emerging challenges of managing irrigation system, water education must be reoriented by bringing social, environmental and legal aspects into engineering education. In South Asia engineering education is still dominantly technically guided. Since human and institutional aspects of irrigation management equally also important, education must aim to synthesize these elements with the technical. *The Dilemmas of Water Division* provides designers a basis for making informed decisions about selecting water delivery methods.

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Chapter in edited book: Upadhyay, M., 1997: *Bhattedanda Milkway: Making Markets Accessible to Marginalised Farmers* in Ropeways in Nepal, Gyawali D. and Dixit A. (ed.) Upayukta Prabidhi Prakashan, Kathmandu.

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