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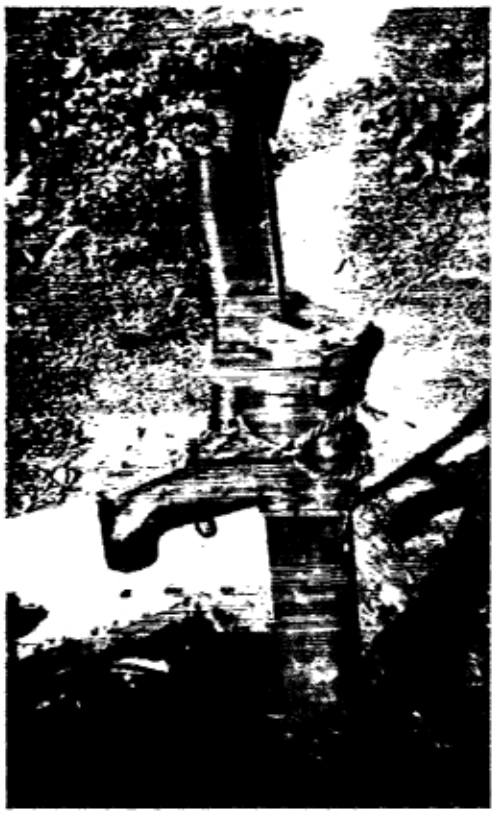
Community Handpumps in the Terai Region: Assessment of Operation and Maintenance



His Majesty's Government
of Nepal, Department of
Water Supply and Sewerage

Regional Water and Sanitation
Group - South Asia, UNDP-World Bank
Water & Sanitation Program

United Nations Children's Fund,
Nepal

Finnish International
Development Agency

JUNE 1995

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Regional Water and Sanitation Group - South Asia,
UNDP-World Bank Water & Sanitation Program

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LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

ADB/M	-	Asian Development Bank, Manila
ADB/N	-	Agricultural Development Bank of Nepal
CDO	-	Chief District Officer
DAO	-	District Administrative Office
DDC	-	District Development Committee
DiSvi	-	Movement for Development (International NGO)
DWSO	-	District Water Supply Office
DWSS	-	Department of Water Supply and Sewerage
FINNIDA	-	Finnish International Development Agency
HHP	-	Household Handpump
HMG/N	-	His Majesty's Government of Nepal
IDA	-	International Development Association
INGO	-	International Non-Government Organization
INo.6	-	Improved Nepal Number 6
JAKPAS	-	Janta Ko Khane Pani ra Safai Karyakram
MHPP	-	Ministry of Housing and Physical Planning
MLD	-	Ministry of Local Development
NEWAH	-	Nepal Water for Health (NGO)
NGO	-	Non-Government Organization
No.6	-	Nepal Number 6
NPC	-	National Planning Commission
NRCS	-	Nepal Red Cross Society
O&M	-	Operation and Maintenance
RWS	-	Rural Water Supply
RWSSP	-	Rural Water Supply and Sanitation Project
RWSG-SA	-	Regional Water and Sanitation Group-South Asia
SWC	-	Social Welfare Council
TTP	-	Terai Tube-well Program
UNICEF	-	United Nations Children's Fund
VDC	-	Village Development Committee
WDS	-	Women's Development Section
WES	-	Water and Environmental Sanitation

Executive Summary

Shallow well handpumps are used as household pumps (HHPs) and community handpumps in large numbers in the Terai region to meet domestic water supply needs. There have been differences of opinion among implementing agencies on the type of handpump most suited for community use. As no comprehensive field evaluation of the operation and maintenance status of handpumps was available to guide policy decisions, the DWSS initiated this study on operation and maintenance of shallow well handpumps in the Terai region. This study was funded by RWSG-SA and FINNIDA and supported by UNICEF. It includes assessment of the performance, operation and maintenance of No.4, No.6 and INo.6 handpumps with particular emphasis on the latter two, which are used as community handpumps.

The study area comprised 21 village development committees (VDCs) in Jhapa, Kailali and Kapilvastu districts in the Terai. The sample consisted of 721 handpumps comprising 100 HHPs, 311 No.6 and 310 INo.6 handpumps. Aspects investigated include usage, platform construction, operational status, reliability, maintainability, capital costs, O&M costs, users' satisfaction, water quality, community mobilization, effectiveness of present institutional set up, involvement of the private sector and the role of district/VDC level NGOs. A set of structured questionnaires was developed and fielded. Information was collected through in-depth interviews of various actors, observations in the field and review of reports and documents.

FINDINGS AND CONCLUSIONS

The main findings and conclusions of the study are:

(a) The No.6 handpump offers advantages such as lower capital costs and maintenance costs, and better reliability and maintainability. The maintainability of the INo.6 has been adversely affected by the non-availability of spare parts in the local markets. There is no justification for the continued promotion of the use of INo.6 handpump as it does not offer any specific advantage over No.6 handpumps.

(b) Many functional community handpumps (68 percent of No.6 and 52 percent of INo.6) were in fact inadequately repaired, using rope, wire, bamboo/wooden pieces in place of spare parts; with very little evidence of preventive maintenance. Although adequate local skills for maintenance of handpumps are available, maintenance occurs only in response to breakdowns, and even this is not satisfactory as the minimum number of spare parts are replaced to keep the repair costs low. As a result many handpumps need major repairs which users often find difficult to finance. Another reason for poor maintenance is that the caretaker does not have ready access to funds. The caretaker, invariably has to spend his/her money and then approach users for reimbursement. Ready access to maintenance funds can improve the situation.

(c) The supply of INo.6 spare parts at subsidized rates through non-market channels has suppressed market demand. Therefore, local retailers do not take an interest in stocking and sale of INo.6 spare parts. The private sector can meet the INo.6 spare parts demand through the existing marketing channels, if donor intervention in pricing and distribution is withdrawn. The development of a free market may however take some time.

(d) With the proposed withdrawal of donors from the supply of spare parts the availability of spare parts

is likely to suffer further, at least temporarily. The donors have the moral responsibility to ensure that users of handpumps installed under donor assisted programs continue to be able to operate them. Field modification of the INo.6 pumps - estimated to cost NRs. 150 per pump - to make them compatible with the No.6 spare parts is the preferred option for solving this problem.

(e) A large number of handpumps need frequent priming due to leakage in the foot valve. The foot valve is identified as a major design weakness in all the handpumps.

(f) Nearly 70 percent of HHPs do not have a platform. There is a need to create awareness among users about the water pollution risks of handpumps without platforms. Larger platforms for community pumps provide better working areas and thus improve the utility of community handpumps.

(g) Community participation is very effective during the implementation phase. Users' committees are formed for almost all handpumps. The committees are very active and able to create enthusiasm in the users to provide their share of the construction cost. Users are involved in the selection of sites. Communities contribute in the form of local materials and labour, and in many cases provide private land for handpump installation. In the maintenance phase, however, the users' committees become defunct or are ineffective. Almost all maintenance activities are performed by caretakers or users without any substantive support from these committees. Often caretakers provide their services voluntarily.

The users contribute significantly during construction as well as operation and maintenance. The collection of O&M funds on a regular basis is virtually non-existent. A contribution of NRs. 2 per household per month will be able to take care of O&M requirements. Regular collection of O&M funds is very important for the long term sustainabilty of the community handpumps.

(i) While women's representation on handpump committees was mandatory, their role in site selection and installation was negligible. Representation of women in users' committees of INo. 6 handpump was found significant in Jhapa district where 24% were female. In comparison only 4 percent and 5 percent women were in users' committees in Kapilvastu and Kailali respectively.

(j) Users are generally satisfied with the quality of handpump water. The users were conscious of water quality. Women felt that water related diseases were reduced after they began using handpump water. High iron content was a common concern in Jhapa district study area.

(k) With each HHP serving on an average 2.6 households or 17 users the water supply coverage appears to be much higher than the official estimates.

(l) The district/VDC level NGOs are not adequately equipped to undertake handpump programs. They will need external assistance for building capacity.

RECOMMENDATIONS

i. Implementing agencies/facilitating agencies should not insist on the use of INo.6 handpump in their programs. On the contrary, the use of No.6 handpump should be encouraged.

ii. The maintenance of handpumps is not satisfactory. The emphasis should be on regular contributions to an O&M fund (NRs. 2 per household per month). The maintenance funds deposited by users with the implementing agencies at the time of installation should be transferred to each users' committee when they are operational.

iii. The donors should stop subsidies on INo.6 spare parts. A free market should be allowed to develop. A non-interventionist approach is recommended for market development.

iv. A definitive and perhaps ideal solution for the non-availability of INo.6 spare parts is to modify all the existing INo.6 handpumps to make them compatible with No.6 spare parts.

v. In order to routinize collection of O&M funds and improve monitoring and record keeping it is necessary to consider institutional changes. One approach could be the merger of users' committee and sub-committees into ward level/sub-ward level committees with the active participation of the caretakers - who are the most important actors in O&M - and ward member who enjoys popular support. This is likely to offer the following benefits: (i) create a manageable unit close to users;

(ii) through ward member's participation provide a formal linkage with the VDC; and (iii) improve accountability and sustainability. It is therefore recommended that the present system of a users' committee at the VDC level and sub-committee at the handpump level may be replaced by the users' committee at the ward/sub-ward level.

vi. There is a need to improve the foot valve design.

vii. The construction of bigger platforms for community pumps should be encouraged to meet the needs of users. There is also a need to create awareness among HHP users that platforms reduce the risk of water pollution.

viii. Capacity building of NGOs at district/VDC level is a prerequisite to make their participation in handpump programs effective.

FOLLOW UP ACTION RECOMMENDED

i. It is critical to take decisions quickly on the recommendations made in this report. A meeting of decision makers should therefore be convened as soon as possible.

ii. In order to closely observe and monitor the transition from donor driven spare parts supply to market oriented distribution, a study should be initiated as soon as possible.

FOLLOW UP ACTION TAKEN

A meeting was held on 26 May, 1995 to discuss the findings, conclusion and recommendations of this report. The meeting was chaired by Mr. Dinesh Chandra Pyakurel, Director General, DWSS and attended by representatives of UNICEF, WHO, TAEC Consults P. Ltd., and RWSG-SA. The minutes of meeting are attached as Annexure 4.

Chapter 1

Introduction

BACKGROUND

Nepal's Terai region is endowed with shallow groundwater. Shallow tubewells are widely used in the region to abstract drinking water and are fitted with a suction handpump chosen from several available models. Handpumps are used by households and community groups. Individual households use local or Nepal No.2 or No.4 handpumps (referred to as HHP in the text). Local or Nepal No.6 (No.6) and Improved Nepal No.6 (INo.6) are generally used as community handpumps. A community participation approach is used to implement the community handpump program. The local costs of constructing a platform, drain and soakage pit are met by the community. The community also contributes to the maintenance fund and frequently provides land for the handpump installation. Support agencies organize training of handpump caretakers and health volunteers and provide materials such as the pump, pipes and cement. Users are expected to assume responsibility for the operation and maintenance of handpumps.

The sectoral lead agency responsible for implementing the community handpump program is the Department of Water Supply and Sewerage (DWSS). The Department receives bilateral and multilateral support from the United Nations Children's Fund (UNICEF), Finnish International Development Agency (FINNIDA) and the Asian Development Bank (ADB/M). The Ministry of Local Development (MLD) is involved in handpump programs in some Terai districts through its Women Development Section (WDS). District Development Committees (DDCs) provide support to Village Development Committees (VDCs) to install handpumps. The non government sector is active in the program, represented by WaterAid, Nepal Red Cross Society, DiSvi International and Lutheran World Service. The recently established Rural Development Bank also provides credit to individuals and communities for handpump installation. Through all the above initiatives, 28,139 community handpumps had been installed in the Terai by the end of fiscal year 1992/93. These are in addition to family handpumps, whose numbers run into several thousands.

In the past community handpump programs have been supply driven. This approach has not been very successful and now there is a growing consensus that water supply is a local function and central agencies should withdraw from direct implementation role and should only play the role of a facilitator. His Majesty's Government of Nepal (HMG/Nepal), with assistance from IDA, has been evolving and testing new approaches to sector issues through Janta Ko Khane Pani ra Safai Karyakram (JAKPAS) as part of the IDA-funded RWSS Project. Furthermore, with the proposed establishment of the Rural Water Supply and Sanitation Fund, the government is opening up a new channel for the demand-led decentralized implementation of RWS projects.

The Eighth Plan (1992/97) envisages greater participation of local governments in drinking water development. With the enactment of the VDC Act of 1992, the VDC is empowered to develop and manage drinking water systems within its jurisdiction. In pursuance of these policies the role of the DWSS is expected to shift, emphasizing facilitation and moving away from the traditional role of an implementor. From 1994/95, the UNICEF assisted shallow tubewell program will be implemented through NGOs, DDCs, the private sector and the credit scheme of the Rural Development Bank.

THE STUDY

In a 1980 UNICEF survey, it was reported that the Nepal No.6 handpump was not robust enough for community use. Subsequently a new handpump design was introduced – a modified version of the Bangladesh No.6 handpump known as Improved Nepal No.6 (INo.6) – and recommended for groups of up to 125 users. Several agencies including UNICEF, Water Aid, DiSvi and Nepal Red Cross Society use the INo.6 handpump. The No.6 handpump is generally used by government agencies in their programs. Another survey covering handpumps was conducted by FINNIDA. There were differences of opinion among the various implementing agencies on the type of handpump most suitable for community use.

No comprehensive field evaluation of the operation and maintenance status of handpumps was available to guide future policy decisions. This study, focussed on the operation and maintenance aspects of HHP, No.6 and INo.6 handpumps with particular emphasis on community handpumps, is an effort to fill this gap. Initiated at the request of the Department of Water Supply and Sewerage (DWSS), the study was funded by the UNDP/World Bank Water and Sanitation Group - South Asia (RWSG-SA) and Rural Water Supply and Sanitation Project (RWSSP)/FINNIDA and supported by UNICEF.

Objective of study

The objectives of the study included assessment of the performance, operation and maintenance of all three types of handpumps (HHP, No.6 and INo.6) in the Terai region, with particular emphasis on community handpumps. The study included the following activities:

- Collection of data on the field performance of these handpumps, including frequency of replacement of the main components such as cup seal, foot valve, fulcrum pins, handle, handpump rod, etc. This also included capital costs for handpumps, average number of users, average usage and common problems encountered in the field. Frequency of handpump priming was another important factor that was looked into carefully.
- Assessment of the users' acceptance of and preference for the three types of handpumps.
- Collection of data on the annual cost of maintenance by category of handpumps.
- Evaluation of the level of community involvement in the maintenance of the handpumps, the willingness of the community to pay for normal maintenance and the external support (government/donor) provided for the maintenance of these handpumps. Particular attention was paid to the role of women in implementation and not just as primary users;
- Study of the role played by the private sector in the supply of spare parts and maintenance of these handpumps and exploration of the possibility of increasing the role of the private sector;
- Ascertainment of the availability of spare parts, particularly the metric and BSW fasteners; and
- Assessment of the reasons for the substantial difference in price between the two types of handpumps (No.6 and INo.6) in relation to their quality, sturdiness and reliability.

Methodology

Study Design: The study was designed as an empirical investigation of the three types of handpumps currently in use in the Terai. An Information Coordination Matrix was designed to organize and manage information for the study. Relevant secondary materials were reviewed, following which a set of structured questionnaires was drafted. The primary questionnaire, intended for handpump users and caretakers, sought information on operation and maintenance, resource mobilization, status of spare parts availability etc. Questionnaires were also prepared for implementing and support agencies, NGOs, retailers and manufacturers. Pretesting of questionnaires was done in Jhapa district. After pretesting the questionnaires were modified and finalized for the full scale survey.

Inception Meeting: Prior to pretesting, the study methodology and survey instruments developed by the consultant were reviewed at an inception meeting attended by RWSG-SA, DWSS, UNICEF and FINNIDA. Suggestions from that meeting were incorporated into the research design.

Sampling Design: Key elements of the study were the selection of survey sites and sample size. Three districts, one each from eastern, central and western Terai were selected for survey. These were Jhapa, Kapilvastu and Kailali (see Annex 1). The objectives of including the three districts were to ensure socio-economic, cultural, operational and geographical representation. Twenty one VDCs in the three districts were selected randomly for the survey. First, the districts were divided into

southern and northern regions in relation to the East-West Highway. Consideration was given to include VDCs having a substantial number of community handpumps. From the selected VDCs, lists of HHPs, No.6 and INo.6 handpumps were prepared.

The samples of HHPs, No.6 and INo.6 handpumps were randomly drawn from the lists. Only functional handpumps were included in the sample. This was deliberate, since information on performance, operation and maintenance of the nonfunctional handpumps was difficult to obtain. However, a full census of pumps in the sample VDCs and the operational status, by type of pump, were included in the study and presented in Table 3. Since older handpumps were more likely to have faced problems in operation and maintenance, the minimum age of the sampled handpumps was fixed at two years. Also priority was given to include handpumps serving more than 50 users. Altogether 621 community handpumps (including 10 school handpumps) and 100 HHPs were included in the sample. The number of HHPs was restricted to 100 as the main purpose of including HHPs in the study was to understand the market oriented mechanism available for installation, operation and maintenance of HHPs and to examine whether some of the elements could be incorporated into community handpump program. The handpump samples by district, type and age categories are listed in Table 1.

Field Survey: The field survey was conducted by a team of research assistants and enumerators.. The survey team was trained in the use of survey instruments and acquainted with the contents and objective of each questionnaire item. Techniques used for information collection included a structured questionnaire-cum-checklist, on-site inspection and observation, and informal discussions and meetings.

Respondents: Group interviews were used to complete questionnaires for 621 users' groups. Caretakers played a formal role in 320 of these groups, and an additional section of the questionnaire was administered to them. For HHPs, the study gave a questionnaire to 100 heads of households. Structured interviews collected information from 6 manufacturers, 28 retailers, 12 local NGOs, and 7 VDCs and 3 DDCs. Interviews were also conducted with DWSS, UNICEF, DisVi, FINNIDA, Nepal Red Cross Society and Nepal Water for Health (NEWAH).

Supervision: In order to ensure reliability of the collected data, supervisors were deputed to work with the survey team in each district. Completed questionnaires were checked to clarify any ambiguity and to solicit additional information if required. Each supervisor spent 10 to 21 days in the field. Some members of the study team also visited the districts. The technology specialist from UNDP/World Bank, RWSG-SA visited Jhapa district to check the effectiveness of the data collection procedure.

Data Analysis: All the data collected through the census and in-depth interviews were coded and entered into a micro-computer. The data were analyzed by using the software Lotus and DBase.

ORGANIZATION OF THE REPORT

This report is divided into five Chapters. Chapter 1 includes the background, objectives and scope of the study, and methodology including instruments used, sampling design and description of respondents. Chapter 2 presents the main body of results including a technical description of the types of handpumps and data analysis concerning system performance. Performance assessment included usage, construction aspects, operational status, reliability, maintainability, capital and O&M costs, users' satisfaction, institutional aspects and community mobilization and contributions. The participation of the private sector and its potential role in the manufacture and distribution of handpumps and spare parts are discussed in Chapter 3. Chapter 4 covers the role of the NGOs in the handpump program. Conclusions and recommendations are presented in chapter 5.

Table 1: Number of Sampled Handpumps by Type and Age

District	Sampled VDCs (No.)	No.6				INo.6				HHP				School				Total			
		2 Yrs	3-7 Yrs	8-13 Yrs	Total	2 Yrs	3-7 Yrs	8-13 Yrs	Total	2 Yrs	3-7 Yrs	8-13 Yrs	Total	2 Yrs	3-7 Yrs	8-13 Yrs	Total	2 Yrs	3-7 Yrs	8-13 Yrs	Total
Jhapa	6	1	1	1	3	10	168	22	200	14	17	9	40	1	2	2	5	26	188	34	248
Kapilvastu	10	27	40	33	100	50	50	–	100	7	10	13	30	–	–	–	–	84	100	46	230
Kailali	5	48	139	21	208	–	–	–	–	8	22	–	30	–	3	2	5	56	164	23	243
Total	21	76	180	55	311	60	218	22	300	29	49	22	100	1	5	4	10	166	452	103	721

Chapter 2

Handpump System Performance

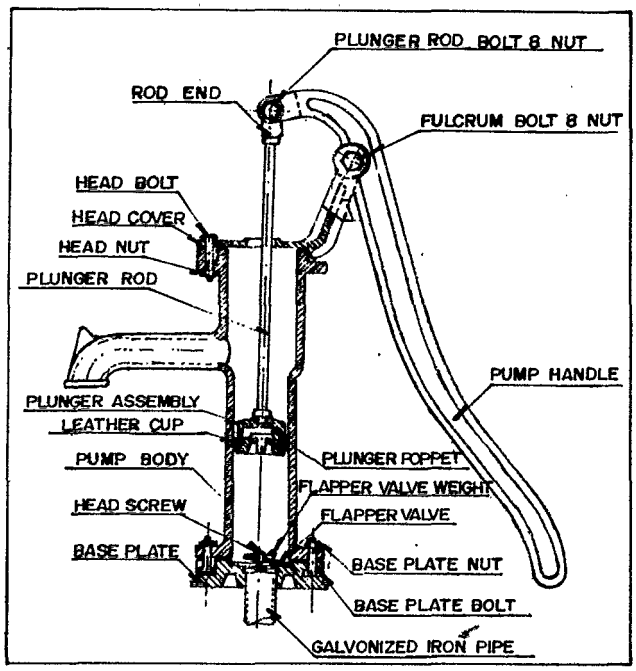
TYPES OF HANDPUMPS

Types: Of the various types of handpumps that are in use, No.2 and No.4 are smaller in size and commonly used as a household handpump. No.6 and INo.6 are larger in size and capacity and used at the community level. The INo.6 handpump was introduced in 1984 by UNICEF[1].

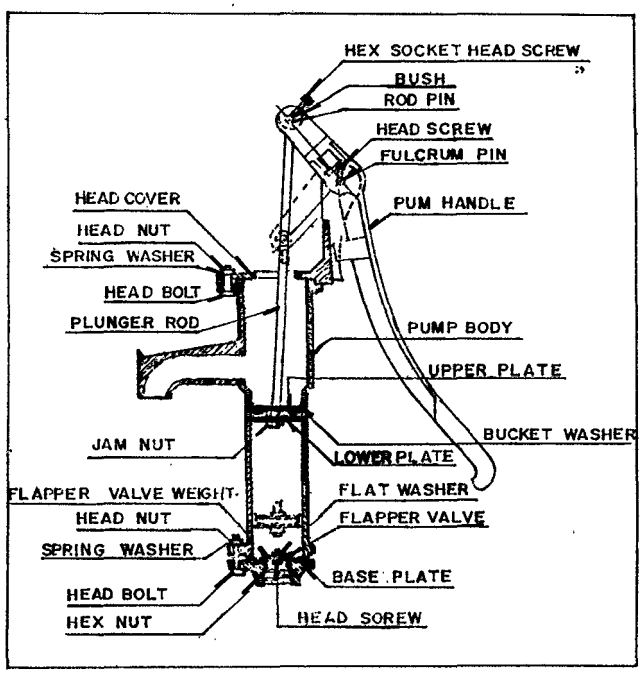
Description: The above four handpumps are all reciprocating suction pumps. Major constituent parts of the handpump are handpump body, head cover, handle, base plate and plunger assembly. Most of these components are made of cast iron. The No.4 is similar to the No.6 in terms of the shape of components and material of construction. But it is smaller in size, lighter in weight and delivers less water for the same number of strokes. The main design features of the INo.6 are similar to those of Bangladesh No.6 handpump. The technical features of the No.6 & INo.6 handpumps, which are the main focus of the study, are shown in sketches below.

USERS AND USAGE

Population and Household Served: The 611 handpumps in the sample serve a total of 42,026 people.



NO.6



I NO.6

Nomenclature of Handpump (Typical Cross Section)

1 An internal review of the performance of the community handpumps in 1982 by UNICEF was highly critical of the available variety. Consequently, the Bangladesh No.6 handpump was adopted with modifications. This is the Improved No.6 pump (INO6) currently in use, mostly in donor assisted projects.

Table 2: Technical Specification of handpumps

Particulars	No.4	No.6	INo.6
Barrel diameter (mm)	65	90	90
Body length (mm)	425	480	512
Rated discharge at 20 strokes (liters)	6.8	17	24
Length of stroke (mm)	–	175	220
Approximate Weight (kg)	15	22	37

The average number of households and the population served by a community handpump were 9 and 69 respectively.

Household handpumps are used by outsiders also. Of the 100 sampled HHPs, 50 percent served outsiders, benefitting 162 households, or an average of 4.2 user families per handpump. For all 100 handpumps, however, the average number of families and users benefitted by a HHP was 2.6 and 17 respectively.

Handpump Use: Handpumps were used to meet domestic water needs such as drinking, washing, cleaning, bathing, and livestock needs. Only a few households adjacent to the handpumps utilized the community handpumps for irrigating kitchen gardens. The HHPs were more widely used for this purpose.

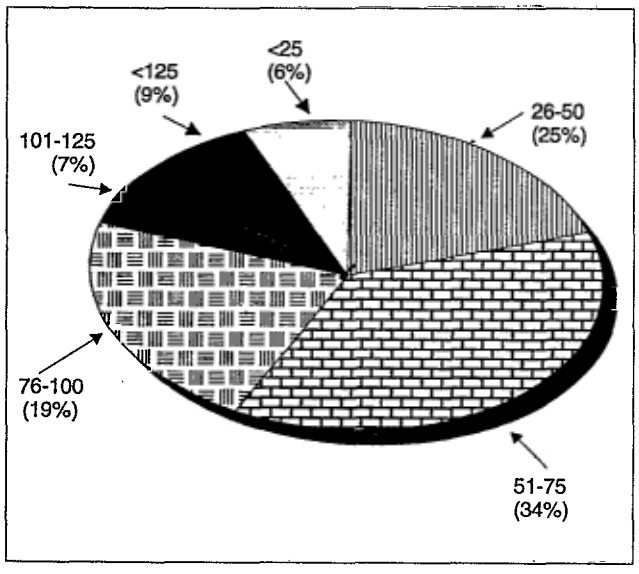


Figure 1. Pupulation served by community handpumps

Waiting Time: The community handpumps served a cluster of households in a VDC. Most of the handpumps (87%) were located within 200 meters of the farthest household in the cluster. It was observed that the users staggered the water collection time instead of queuing. In the morning and evening hours, washing and bathing were avoided to make fetching water for household use easy. For 81 percent of the users, the waiting time was less than 5 minutes. Differences between the two models in waiting time were minimal. Only one percent had to wait for more than 15 minutes.

Restriction of Use: An element of the study was investigation of caste discrimination in the use of the handpumps. Almost all respondents (99%) mentioned that there are no caste restrictions in the use of community handpumps.

Summary of Findings

a. The average number of household and population served by a community handpump were 9 and 69 respectively. While 50 percent of the HHPs served one household, the other half of the sample served an average of 4.2 households.

b. Handpumps are mostly used to meet domestic water needs. Accessibility to service was reasonable and the waiting time was less than 5 minutes for 81 percent of users.

c. Caste discrimination in the use of community handpump was almost non-existent.

d. The average number of households and population served by an HHP were 2.6 and 17 respectively. This means that a very large number of people were served by HHPs and water supply coverage was much higher than the official estimates.

CONSTRUCTION ASPECTS

Platform, Drain and Soakage Pit: A platform serves three important purposes. First, it provides space for collection of water, washing, cleaning of utensils and bathing. Second, it provides protection against possible groundwater contamination by preventing seepage of waste water into the aquifer. And third, while serving as the foundation, it prevents lateral movement of the handpump body which increases the life of the handpump. Among community handpumps, 88 percent were provided with a platform. This was not the case with HHPs, in which only 30 percent had platforms. A disposal channel was provided to drain off excess water and keep the platform surroundings dry. The disposal channel existed in 72 percent of HHPs and 85 percent of community handpumps. In a well constructed platform the disposal channel drains into a soakage pit, a pit dug at the end of the disposal channel and filled with gravel or broken bricks. It receives water coming

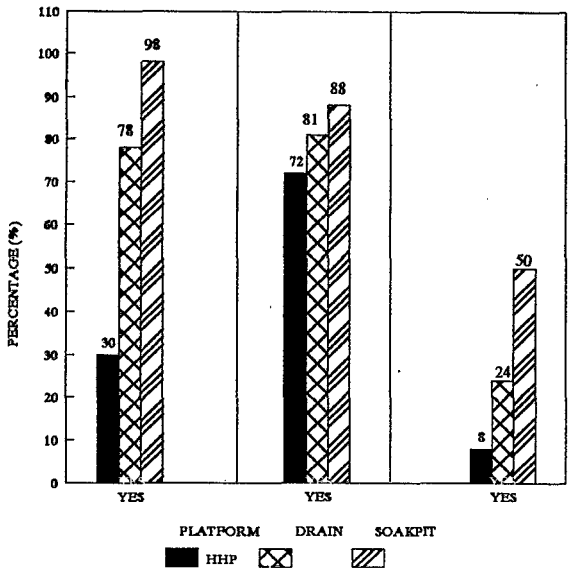


Figure 2. Existence of platform, drain and soakage pit

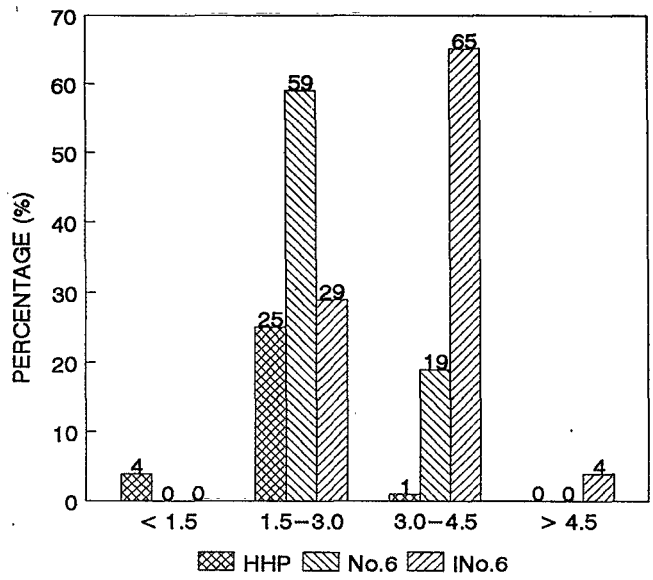


Figure 3. Platform size(m²)

through the disposal channel and keeps the handpump surroundings dry. The percentage of handpumps that had soakage pits were HHP (8%), No.6 (24%) and INo.6 (50%).

Platform Size: Platforms were of rectangular shape in all three districts. On average, in the community handpumps, the platform size varied from 1.5m² to slightly greater than 4.5m². The average platform area in No.6 and INo.6 handpumps were 2.5m² and 3.8m² respectively. In the HHPs the average area of the platform was 2.3m². However, in the RWSSP/FINNIDA - assisted program in Kapilvastu, comparatively large (5 to 7.5m²) platforms were found. Some of the platforms in this district were circular in shape with a diameter of almost 2.5m. Large platforms provide more work area and therefore increase the utility of the handpump in terms of greater frequency of bathing and washing. The users were appreciative of large platforms due to their better utility.

Construction Quality of Platforms: Construction quality of 96 and 76 percent of the platforms in INo.6 and No.6 community handpumps were assessed to be good; i.e., platforms were free of cracks or damage. Platforms in only 23 percent of the HHPs were considered satisfactory in terms of their construction quality.

Foundation Condition: In 95 percent of the INo.6 and 69 percent of the No.6 handpumps, the foundation was compact and prevented seepage of waste water into the aquifer. Nearly 66 percent of HHPs had a loose foundation. Besides reducing the effective life of the handpumps, a loose foundation can cause seepage of waste water in to the borewell which in turn can

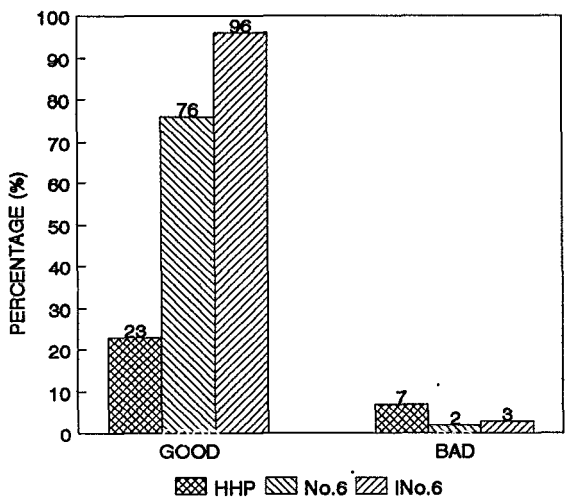


Figure 4. Construction quality of platform

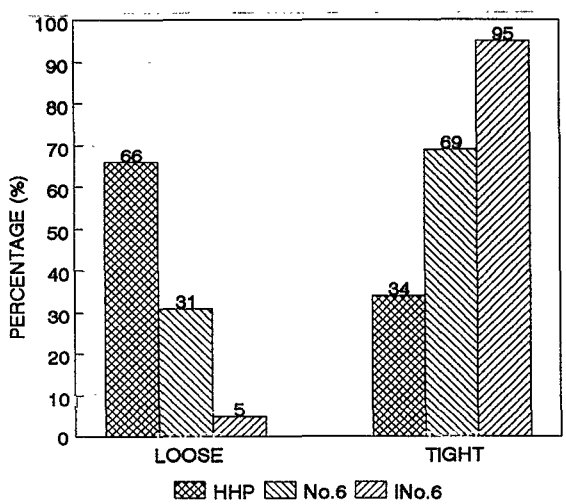


Figure 5. Condition of handpump foundation

contaminate the aquifer. Although the extent of health hazard brought about by groundwater contamination remains to be investigated, a few studies in Nepal have shown that contamination can occur. Therefore, health/ hygiene education activities need continued focus to eliminate such risk.

Summary of Findings

a. Ninety eight percent of INo.6, 78 percent No.6 handpumps and 30 percent of HHPs had platforms. Drains existed in 85 percent of the community handpumps and 72 percent of HHPs. Soakage pits existed in 50 percent of INo.6 and 24 percent of No. 6 handpumps. Only 8 percent of HHPs had soakage pits.

b. While the size of platform is independent of the type of handpump, it was observed that the platform area in 69 percent of the INo.6 and 19 percent of the No.6 handpumps was greater than $3m^2$. Greater prevalence of larger platforms in INo.6 handpump was probably due to increased users' participation in planning and installation of INo.6 handpumps. Only 1 percent of HHPs had a platform of this size.

c. The increase in platform area improves its utility and convenience to users. In the RWSSP/FINNIDA project where platform area is 5-7.5m^2, people were very appreciative due to its greater utility.

d. Overall construction quality of the platform has been assessed as good for 86 percent of the community handpumps. The foundation in 95 percent of INo.6 and 69 percent of No.6 handpumps were found adequately tight.

e. Over 70 percent of HHPs and 22 percent of No.6 handpumps did not have platforms. This increases the risk of aquifer contamination. Construction of larger platforms in community handpumps to suit users' needs should be encouraged.

OPERATIONAL STATUS

Nonfunctional Handpumps: Only functional handpumps were selected for investigation. The decision to

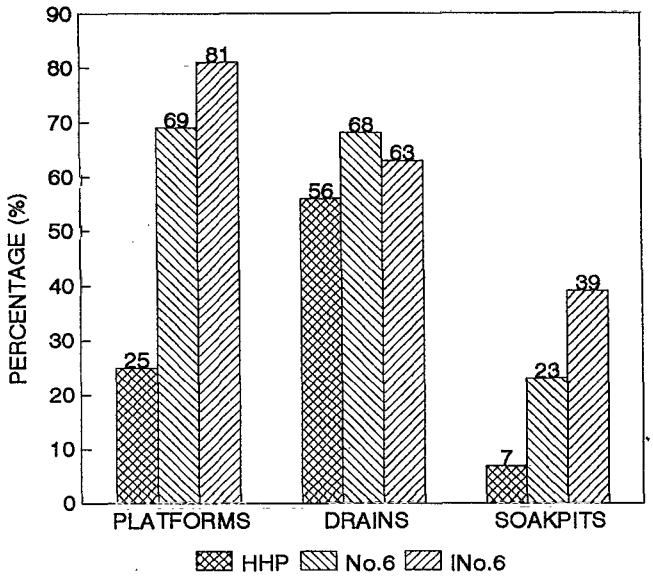


Figure 6. Maintenance of the platform, drain & soakage pit

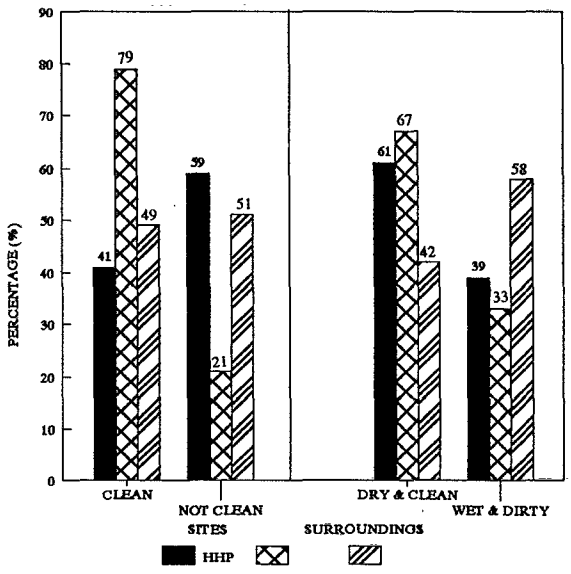


Figure 7. Cleanliness of sites and surroundings

Table 3: Number of community handpumps in the sampled VDCs and their functional status

District	Total No. of VVDCs Studied	Total No. of Community handpumps			Working Condition					
	No.6	INO6	Total		No.6		INO.6		Total	
					Working	Not working	Working	Not working	Working	Not working
Jhapa	6	-	456	456	-	-	331	125	331	125
Kapilvastu	10	148	184	332	126	22	182	2	308	24
Kailali	5	537	-	537	461	76	-	-	461	76
Total	21	685	640	1325	587	98	513	127	1100	225

include only working handpumps in the sample was deliberate, for the reason that the probability of collecting information on past performance was greater in functional handpumps rather than nonfunctional handpumps. However, to ascertain the percentage of working handpumps in the field, all community handpumps installed in the sampled VDCs were visited. Table 3 gives the functional status of handpumps. The percentage of nonfunctional handpumps was greater among INo.6 (20%) compared to No.6 (14.3%) handpumps (see Photos 3 - 6 in Appendix 2).

Maintenance of Platforms, Drains and Soakage Pits: Platforms were satisfactorily maintained in 75 percent of the community handpumps. Maintenance was good only in 25 percent of the HHPs. Waste water was drained in 65 percent of the community handpumps compared to 56 percent of the HHPs. The condition of 39 percent of soakage pits in INo.6 and 23 percent in No.6 was assessed as good while 7 percent of HHP had soakage pit in good condition.

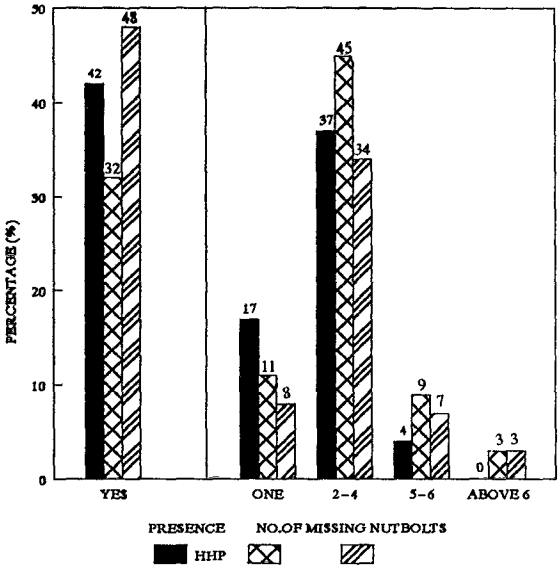


Figure 8. Presence of all nut-bolts & no. of missing nut-bolts

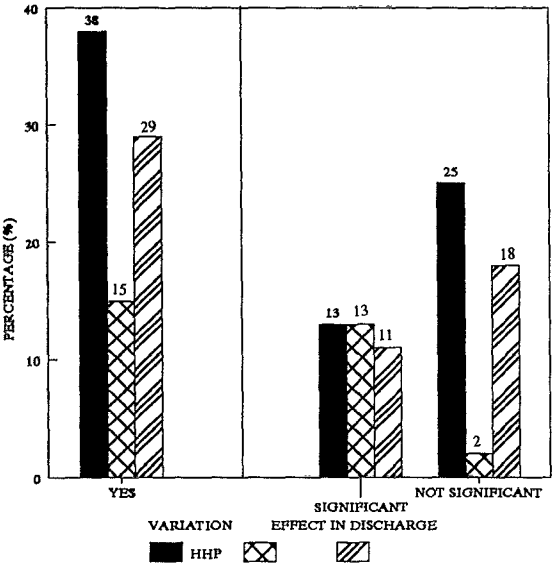


Figure 9. Variation in the water table and its effect in discharge

Cleanliness of platforms and surroundings: Cleanliness of the platform was assessed in terms of absence of algae and dirt. The cleanliness of surroundings was assessed in terms of surroundings being dry and free from trash. Community handpump platforms were cleaner compared to the HHPs. Only 41 percent of the HHP sites were maintained clean while 79 percent of the No.6 and 49 percent of INo.6 handpump platforms were clean. Poor handpump surroundings were due to absence of platforms. Handpump surroundings were clean in 61 percent of the HHPs, 67 percent of No.6 and 42 percent of INo.6 handpumps. Due to limited use, HHPs surroundings were fairly clean even in the absence of platforms.

Missing Nuts and Bolts and Their Replacement: Nuts and bolts were frequently missing, and lack of timely replacement was a common problem. In 60 percent of the community handpumps nuts and bolts were missing. Missing nuts and bolts was also a common problem among the HHPs (58%). Almost 40 percent of the community handpumps had two to four missing bolts and these were mostly from the cover plate. Absence of preventive maintenance and nonavailability of funds for the purchase of spare parts appeared to be the main causes for the non-replacement of bolts and nuts in time. The delay can cause damage to costly handpump components, making major replacements necessary at a later date. In 68 percent of No.6 and 52 percent of INo.6 handpumps the use of rope, wire, bamboo pieces and wooden handle was observed. This is a clear indication of inadequate maintenance.

Number of Idle Strokes: Another aspect investigated was the discharge characteristic of the handpumps. Almost 63 percent of the community handpumps delivered water in the first stroke. However, 16 percent of No.6 and 10 percent of INo.6 handpumps required two to four strokes for water delivery, and 9 percent of INo.6 delivered water after more than four strokes.

Discharge: In terms of discharge, the handpump performance was generally satisfactory. The average discharge per 20 strokes was measured as 13 liters for

HHP, 17 liters for No. 6 and 20 liters for INo. 6 handpumps. The average discharge in the case of HHPs was higher than the rated performance as given in Table 2 as 40 HHPs in Jhapa were of No. 6 type.

Seasonal variation in the water table is a general characteristic in the Terai. Some handpumps were affected by this variation. A higher proportion of HHPs (38%) were affected, probably due to shallow boring. Some INo.6 (29%) and No.6 (15%) handpumps were also affected by fluctuations in the water table. The percentages of HHPs, No.6 and INo.6, handpumps in which discharge was significantly affected by water table fluctuations were 13, 13 and 11 percent respectively.

Priming Requirements: Around 51 percent of the HHPs and 42 percent of the No.6 handpumps required priming. In the case of INo.6 handpumps, the percentage requiring priming was 39. Almost 15 to 20 percent of the sampled handpumps required priming before every use.

Physical Appearance and Iron Content: About two-thirds of the HHPs delivered clear water. Among community handpumps, physical appearance of the delivered water was clear in 87 percent of the handpumps. Iron content in 55 percent of all the handpumps was less than 2 ppm (parts per million). In Jhapa, 50 percent of handpumps delivered water in which iron content was more than 5 ppm. The iron content was lower in Kapilvastu (less than 2 ppm) for more than 90 percent of the HHPs and community handpumps. The presence of iron in water is a geological phenomenon and independent of the type of handpump.

Summary of Findings

a. Of the total community handpumps installed in the VDCs, about 86 percent of No.6 and 80 percent of INo.6 were functional.

b. Maintenance of platforms was satisfactory in 75 percent, drains in 65 percent and soakage pits in 32 percent of the community handpumps. Platforms in more than 60 percent and surroundings in 54 percent of community handpumps were kept clean.

c. Maintenance of the community handpumps was not satisfactory. Preventive maintenance was non-existent and was characterized by the non-replacement of nuts and bolts in many handpumps. In 68 percent of No.6 and 52 percent of INo.6 handpumps the use of rope, wire, bamboo pieces or wooden handle was observed. This is a clear indication of the poor maintenance. The photographs (1-6) at the end of this report depict the poor state of repairs of some of the community handpumps.

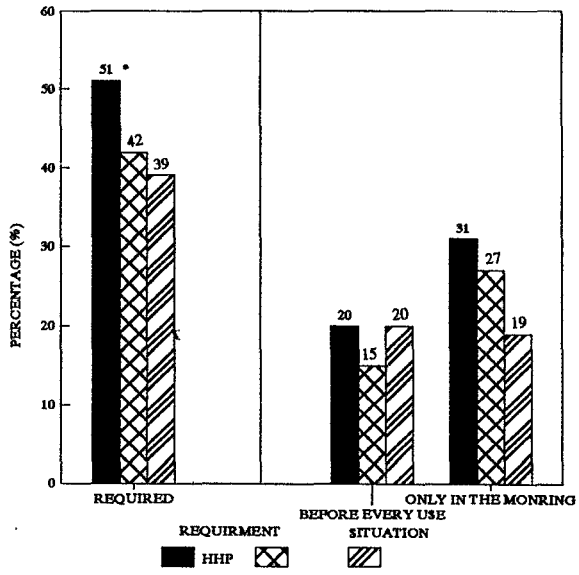


Figure 10. Printing requirement

d. More than 60 percent of the community handpumps, irrespective of their type, discharged water in the first stroke. The average water yield at 20 strokes for HHPs, No.6 and INo.6 handpumps were 13, 17 and 20 liters respectively. Although No.6 handpumps performed as rated, INo.6 handpumps' average was 4 liters below their rated discharge.

e. Physical appearance of water from more than 85 percent of the community handpumps was clear. About 34 percent of HHPs yielded turbid water. Iron content was less than 2 ppm in water samples from 60 percent of the community handpumps. In 50 percent of community handpumps in Jhapa, iron content was in excess of 5 ppm.

f. About 50 percent of HHPs, 42 percent of No.6 and 39 percent of INo.6 handpumps needed daily priming. In 15 percent of No.6 and 20 percent of INo.6 handpumps priming was required before every use.

RELIABILITY

Reliability was assessed in terms of durability, frequency of spare parts replacement and interruption in supply.

Durability: Major components replaced during the last one year are listed in Table 4. Among INo.6 handpumps, the handpump body and handle needed no replacement during this period implying that INo.6

is structurally more robust than the No.6.

Replacement of Spare Parts: Records of frequency of repair and cost incurred for maintenance were not maintained by users committees or caretakers. The information on spare parts replacement presented in this report is based on the recollection of the caretakers and users about the parts replaced in the last one year. The type of handpump, number of parts replaced and frequency of spare parts replaced during one year period are listed in Table 5. Frequency of replacement of spare parts was 6.55 for No.6 and 7.30 for INo.6 handpumps.

Table 4: Number of major components replaced during the last one year

Type of hand-pumps	Age of hand-pumps	No. of hand-pumps	No. of major component replaced During last 1.5 years							
			Body		Head cover		Handle		Plunger rod	
			Total	%	Total	%	Total	%	Total	%
No.6	6 years & less	210	2	0.95	5	2.30	25	11.90	88	41.90
	More than 6 years	101	4	3.96	12	11.88	23	22.77	53	52.48
INo.6	6 years & less	244	0	0.00	7	2.87	0	0.00	80	32.79
	More than 6 years	56	0	0.00	4	7.14	0	0.00	36	64.29

Table 5: Number of components replaced in the last one year with their frequencies

S.No.	Components	Jhapa	Kapilvastu		Kailali	Total		Frequency	
		INo.6	INo.6	No.6	No.6	No.6	INo.6	No.6	INo.6
1	Pump Body	–	–	1	5	6	–	0.02	–
2	Handle	–	–	6	42	48	–	0.16	–
3	Pump Head Cover	11	–	–	17	17	11	0.06	0.04
4	Head Bolt	72	16	25	153	178	88	0.58	0.29
5	Head Nut	76	21	25	157	182	97	0.59	0.32
6	Fulcrum Pin	49	17	–	–	–	66	–	0.22
7	Plunger Rod Pin	88	33	–	–	–	121	–	0.40
8	Socket Head Screw	78	40	–	–	–	88	–	0.29
9	Fulcrum Bolt and Nut	–	–	24	24	48	–	0.16	–
10	Plunger Rod Bolt and	–	–	29	27	56	–	0.18	–
11	Plunger Rod	91	25	25	116	141	116	0.46	0.39
12	Plunger Cage	–	–	20	22	42	–	0.14	–
13	Plunger Puppet Valve	–	–	–	15	15	–	0.05	–
14	Upper Plate	123	9	–	–	–	132	–	0.44
15	Spacer	36	2	–	–	–	38	–	0.13
16	Lower Plate	91	6	–	–	–	97	–	0.32
17	Lock Nut	127	5	–	–	–	132	–	0.44
18	Bucket Washer/Cup	553	240	240	581	821	793	2.67	2.64
19	Leather Flapper	244	27	163	177	340	271	1.10	0.90
20	Flapper Valve Weight	44	–	–	30	30	44	0.10	0.15
21	Bolt and Nut	40	–	3	2	5	40	0.02	0.13
22	Base Plate	3	–	–	2	2	3	0.01	0.01
23	Base Plate Bolt	22	1	10	22	32	23	0.10	0.08
24	Base Plate Nut	22	4	12	20	32	26	0.10	0.09
25	Spring Washer	2	1	–	–	–	3	–	0.01
26	Flat Washer	–	–	1	20	21	–	0.07	–
	Total	1,772	447	584	1,432	2,016	2,189	6.55	7.30

Supply Interruptions: Interruption of water supply was common in some of the handpumps, while it was not so for others. Interruption was faced in 39 percent of INo.6 handpumps after installation compared to 32 percent of the No.6 and 27 percent of the HHPs.

Table 6: Interruption in Water Supply

Response	Percent of Handpumps		
	HHP	No.6	INo.6
Interrupted	27	32	39
Not Interrupted	73	68	61
Total	**100**	**100**	**100**

The major factors leading to interruptions were dropping water table, lack of funds for repair and nonavailability of spare parts. In 20 percent of HHPs and 22 percent of No.6 handpumps, supply interruption was due to a combination of lack of repair and water table fluctuations. Nonavailability of spare parts was responsible for interruptions in 20 percent of INo.6 handpumps.

Table 8: Duration of interruptions due to reasons other than lowering of water table

Duration	Percent (%)		
	HHP	No.6	INo.6
One Day	5	2	5
2-3 Days	5	13	5
More than 3 Days	9	5	22
Total	**19**	**20**	**32**

Supply interruption due to lack of interest to repair, lack of funds and nonavailability of spare parts lasted for more than 3 days in 22 percent of INo.6 handpumps. For No.6 and HHPs the comparable percentages were 5 and 9 respectively.

Table 7: Reasons for Interruption

Response	Percent of Handpumps		
	HHP	No.6	INo.6
Water Table Lowering	8	12	7
Lack of Interest	12	10	9
Lack of Fund	6	7	3
Spare Parts Unavailability	1	3	20
Total	**27**	**32**	**39**

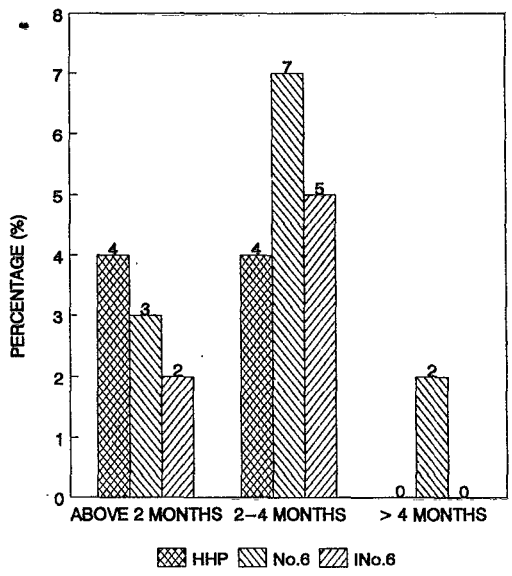


Figure 11. Interruptions caused by lowering of water table

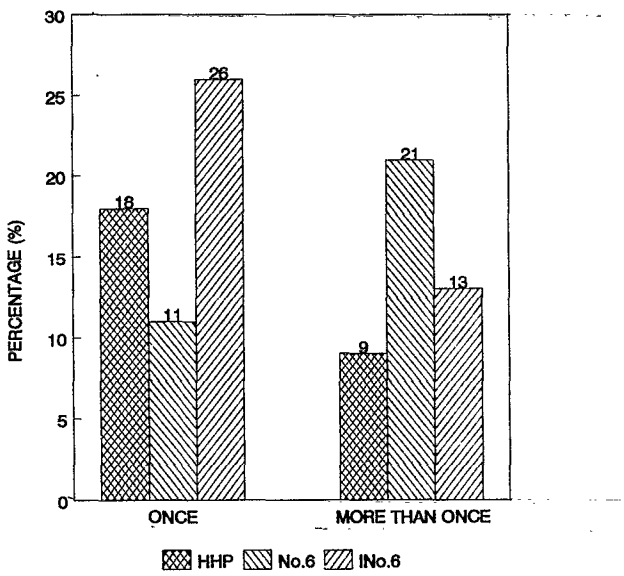


Figure 12. Occurence of interruption in last one year

The interruptions due to dropping of the water table lasted from less than two months to more than four months. Seven to twelve percent of the handpumps were affected by a falling water table.

In the previous one year, 26 percent of the INo.6, 11 percent of the No.6 and 18 percent of the HHPs recorded one interruption, while 13 percent of the INo.6, 21 percent of the No.6 and 9 percent of the HHPs had more than one interruption.

Summary of Findings

a. Annual frequency of replacement of spare parts averaged 6.55 for No.6 and 7.30 for INo.6

handpumps. Replacement of body and handle had not been necessary in INo.6 handpumps.

b. Supply interruption was slightly higher in INo.6 handpumps (39%) compared to No.6 handpumps (32%). The major cause of interruption in INo.6 handpump was nonavailability of spare parts, while in the case of HHPs and No.6 dropping of the water table and lack of funds for O&M coupled with low interest to repair were major reasons for supply interruptions.

c. Although no replacement of major components like handle and body was observed in INo.6 handpumps, the frequency of spare parts replacement was higher in INo.6 handpump. When judged on the basis of the number and duration of supply interruptions and frequency of spare parts replacements the No.6 handpump is more reliable.

MAINTAINABILITY OF HANDPUMPS

Maintainability has been assessed in terms of handpump design and ease of maintenance.

Design: The common design weakness observed in all categories of handpumps was the foot valve. A large percentage of handpumps needed priming daily and some of them before every use. In the case of INo.6, some design flaws/limitations were observed. These are briefly described below.

(a) *High Tensile Socket Head Screw*: These are used to secure fulcrum pins and rod pins in position. The internal threads made in the handle and head cover for fixing these screws get worn out rather quickly as screws — which have a much higher hardness than the cast iron components — have to be frequently removed for greasing. Once threads are damaged, the fulcrum pins and rod pins cannot be secured in position. Moreover, this type of screw needs a special tool known as an "allen key" for tightening or loosening. The allen key is also not usually available in hardware shops in small towns. Apart from this users are not familiar with the use of this special tool and therefore technical training of handpump caretakers becomes necessary.

The length of the allen screw is longer than required. Caretakers are unable to judge the portion of the screw that needs to be driven into the threaded hole. The tendency is to apply greater force than needed to tighten the screw. Consequently, the screw gets sheared at the point where allen head and threaded portion meet. The broken piece of the screw cannot be removed from the hole by caretakers.

(b) *Fulcrum Pins and Rod Pins*: The specially designed fulcrum pins and rod pins are not available in the local market. Once they are damaged or lost, makeshift replacements such as an under-sized bolt or a piece of wood is made by users. These replacements are not satisfactory, and can ultimately damage major components.

(c) *Fasteners*: High tensile metric nuts and bolts are used. These are not commonly available in villages.

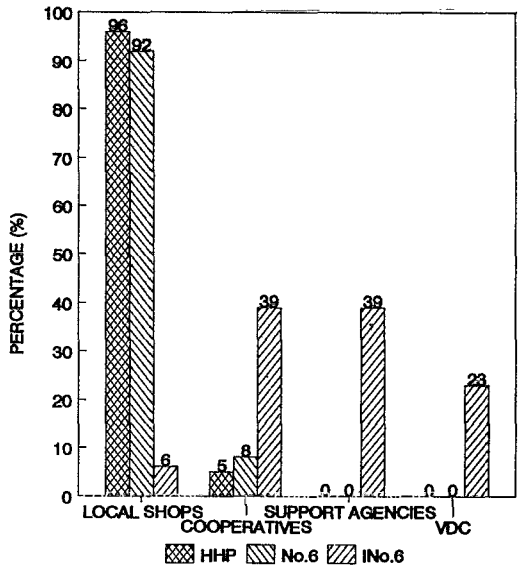


Figure 13. Source of Spare parts

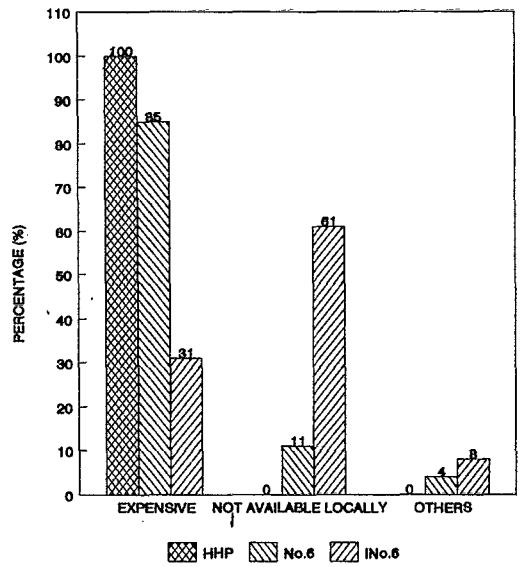


Figure 14. Spare parts problem

Table 9: Annual Maintenance Cost of No.6 and INo.6

S.No.	Name of spare parts	No.6				INo.6			
		Spare Parts Replaced		Average Unit Cost (Rs.)	Cost Per Hand-pump	Spare Parts Replaced		Averag Unit Cost (Rs.)	Cost per Hand-pump
		Total	Per Handpump			Total	Per Handpump		
1	Pump Body	6	0.02	595.00	11.90	–	–	650.00	–
2	Handle	48	0.16	110.00	17.60	–	–	312.00	–
3	Pump Head Cover	17	0.06	107.00	6.42	11	0.04	234.00	9.36
4	Head Bolt	178	0.58	4.00	2.32	88	0.29	10.35	3.00
5	Head Nut	182	0.59	3.85	2.27	97	0.32	3.40	1.09
6	Fulcrum Pin	–	–	–	–	66	0.22	25.95	5.71
7	Plunger Rod Pin	–	–	–	–	121	0.40	22.00	8.80
8	Socket Head Screw	–	–	–	–	88	0.29	8.75	2.54
9	Fulcrum Bolt & Nut	48	0.16	5.50	0.88	–	–	–	–
10	Plunger Rod Bolt & Nut	56	0.18	8.50	1.53	–	–	–	–
11	Plunger Rod	141	0.46	19.65	9.04	116	0.39	94.00	36.66
12	Plunger Cage Assembly	42	0.14	39.70	5.56	–	–	–	–
13	Plunger Puppet Valve	15	0.05	12.50	0.63	–	–	–	–
14	Upper Plate	–	–	–	–	132	0.44	26.00	11.44
15	Spacer Ring	–	–	–	–	38	0.13	7.35	0.96
16	Lower Plate	–	–	–	–	97	0.32	18.95	6.06
17	Lock Nut	–	–	–	–	132	0.44	6.55	2.88
18	Bucket Washer/Cup seal	821	2.67	13.50	36.01	793	2.64	17.85	47.12
19	Leather Flapper Valve	340	1.10	18.75	20.63	271	0.90	23.35	21.02
20	Flapper Valve Weight	30	0.10	5.50	0.55	44	0.15	9.35	1.40
21	Bolt Nut Securing Valve Weight	5	0.02	3.00	0.06	40	0.13	10.00	1.30
22	Base Plate	2	0.01	100.00	1.00	3	0.01	195.00	1.95
23	Base Plate Bolt	32	0.10	3.20	0.32	23	0.08	9.10	0.73
24	Base Plate Nut	32	0.10	2.00	0.20	26	0.09	3.25	0.29
25	Spring Washer	–	–	–	–	3	0.01	3.45	0.03
26	Flat Washer	21	0.07	4.50	0.32	–	–	–	–
	Total	**2016**	**6.55**	–	**117.24**	**2189**	**7.30**	–	**162.34**

If a nut or a bolt is lost or damaged both nut and bolt have to be replaced with local ones which do not have the same dimensions as the original fasteners. The loose-fit fasteners can cause damage to major handpump components.

Ease of Maintenance: This aspect was assessed in terms of (1) availability of spare parts and (2) local availability of appropriate skills.

(a) *Availability of Spare parts*: The sources of most of the spare parts were local markets (6%), cooperatives (38%), VDCs/DWSOs (23%), and support agencies like NRCS (33%). The local markets include both regular shops and weekly markets. More than 90 percent of HHP and No.6 users got the spares from local shops compared to only 6 percent of INo.6 users. The users in 34 percent of INo.6 pumps

reported that cup washers were available in local shops. The supply sources were located less than 8 km from the service areas and were easily accessible. Spare parts of No.6 and HHPs were easily available in the local market. In the case of INo.6, however, nonavailability of spare parts in local markets is one of the major factors adversely affecting its maintainability. All the HHP users and 85 percent of No.6 users reported that the spare parts were easily available but expensive. However, in the case of INo.6 handpumps 61 percent of users reported nonavailability of spare parts to be a problem.

(b) *Local Skills*: Almost 80 percent of INo.6 and 32 percent of No.6 caretakers had received formal training in O&M activities. Community handpumps of both types were maintained by users, caretakers and sevikas (women volunteers) selected from among the users by implementing agencies. Their duties included keeping the platform and handpump surroundings clean. The majority of HHPs (54 percent) were maintained by the owners and remaining 46 percent of HHP users hired mistries (local technicians) for maintenance. Appropriate skills for maintenance of handpumps was available locally.

Summary of Findings

a. The major design weakness in all the handpumps was the foot valve design. This is reflected in the large number of handpumps that needed priming.

b. Spare parts for HHPs and No.6 were available in the local market. In the case of INo.6, spare parts were not readily available. The non-interchangeability of components with locally available spare parts was considered a major design drawback adversely affecting maintainability.

c. Local skills available are sufficient for the maintenance of all types of handpumps.

d. The common problem observed in all the handpumps was priming. This appears to be a design issue. Maintainability of INo.6 suffered on account of (i) complex design features such as the use of allen screws and non-standard fasteners, and (ii) nonavailability of spare parts. The local skills available at the village level are adequate for the maintenance of handpumps subject to the availability of spare parts. The maintainability of the No.6 handpump is clearly better.

CAPITAL AND MAINTENANCE COSTS

Capital Cost: The capital cost of a handpump depends on its weight, the brand, quality of materials used and volume of production batches. The average cost of INo.6 handpump is NRs. 2,100[2] and that of No.6 is NRs. 900. The INo.6 handpump has a higher production cost due to small production batches, stringent quality requirements, higher weight of handpump and use of special fasteners.

O&M Cost: The annual operation and maintenance cost varies according to the type of handpumps. The annual O&M costs have been worked out in two ways. First, by asking users the amount spent on O&M during the last one year. Second, by asking the users the number of parts replaced during the last one year, and working out annual cost based on the open market prices. From the information provided by the users on amount spent on O&M, the average annual maintenance cost is NRs. 123 for HHP, NRs. 175 for No.6 and NRs. 103 for INo.6 handpumps. It may be noted that the O&M cost of INo.6 handpumps is influenced by the donors' subsidy on spare parts. The subsidy ranges from 10 to 90 percent depending on the type of components. Annual costs of spare parts calculated on the basis of frequency of replacement and market price of spare parts works out to NRs. 117 for No.6 and NRs. 162 for INo.6 handpumps (see Table 9). An average annual contribution of NRs. 13 to 18 by each household will cover the annual O&M costs.

Summary of Findings

a. The average capital cost of INo.6 handpump was NRs. 2,100[2] and that of No.6 was NRs. 900.

b. Average annual spare parts replacement costs for the maintenance of No.6 and INo.6 handpumps is estimated to be NRs. 117 and 162 respectively.

c. Small production batches, costly inputs, higher weight of handpump, use of special fasteners and stringent quality requirements make the INo.6 handpump more expensive.

d. The capital and O&M costs of INo.6 were found to be significantly higher when compared with No.6 handpump.

USER SATISFACTION

Satisfaction level of users has been assessed in terms of

2 Himal Iron and Steel Pvt. Ltd. and Local Shops.

preference, adequacy of discharge, water quality, location convenience and waiting time, platform area, downtime and women's satisfaction.

Preference for a particular type: Overall there was a high level of satisfaction among the users of handpumps. Most users seemed interested to continue using handpumps. Availability of spare parts, lower frequency of breakage, easy operation, easy maintenance and adequate discharge were the reasons given for users' satisfaction. Though some handpumps required priming, it was not considered to be a problem by most users because the need for water seemed to override the difficulties posed by the need for priming. However, nonavailability of spare parts was a major concern expressed by INo.6 users. The preference for HHPs was rather low at 63 per cent. The reasons reported for dislike were: low discharge, frequent priming and breakdown (18%); expensive maintenance (11%); and difficult to operate (8%).

Water Quality: The users were conscious of the water quality. High iron and its elimination were common concerns. In some cases, indigenous techniques were used to reduce the iron content. Filtering in two or three stages through sand layers in earthen vessels was a commonly adopted technique (see Photos 7 and 8 in Annex 2). Where access to alternate water sources existed, handpumps that delivered water with high iron (more than 5 ppm) were abandoned.

Locational convenience and Waiting time: Around 40 percent of the handpumps were located at a distance of less than 100 meters from all the households. For 50 percent of the handpumps, the farthest houses were located between 100 to 200 meters from the handpumps. The remaining 10 percent of the handpumps were installed more than 200 meters from the farthest household. Consequently around 80 percent of the users considered the location convenient. The maximum waiting time for 80 percent of the users was less than 5 minutes. In general, the location and waiting time was within the satisfaction level of the users.

Platform Area: Seventy four percent of the INo.6 users and 56 percent of No.6 users feel satisfied with the platform provided at the community handpumps. The higher level of user satisfaction may be probably due to increased users' participation in planning and installation of INo.6 handpumps. The 2.1m x 1.8m size was assessed to be adequate. Comparatively large platforms in the FINNIDA-supported RWSS project in Lumbini zone received greater appreciation from the users. It may be noted that the size of the platform is independent of the type of handpump.

Down Time: The users considered that the "down time" could be minimized if the users and support agencies cooperated. The feelings varied according to access to alternative water sources. Those who had access to alternative sources appeared less concerned about the "down time" and felt no need to minimize or rectify the problem. Those who felt so also considered that reducing "down time" was the responsibility of the implementing agencies or the caretakers, but not theirs. However, "down time" affects users who have no access

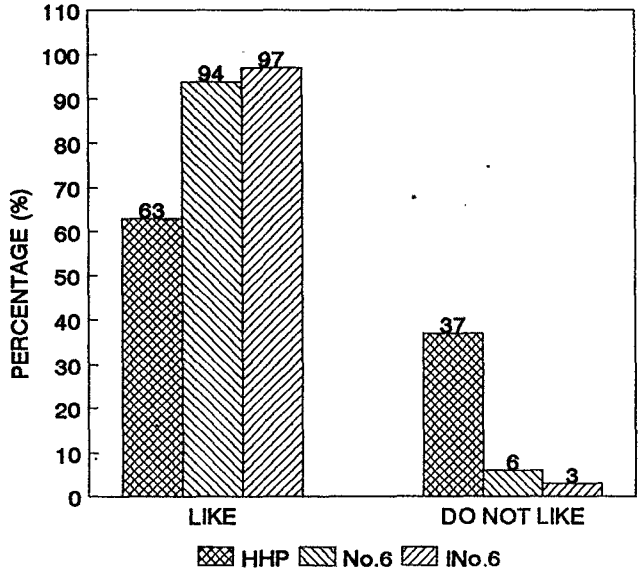


Figure 15. Preference of handpumps

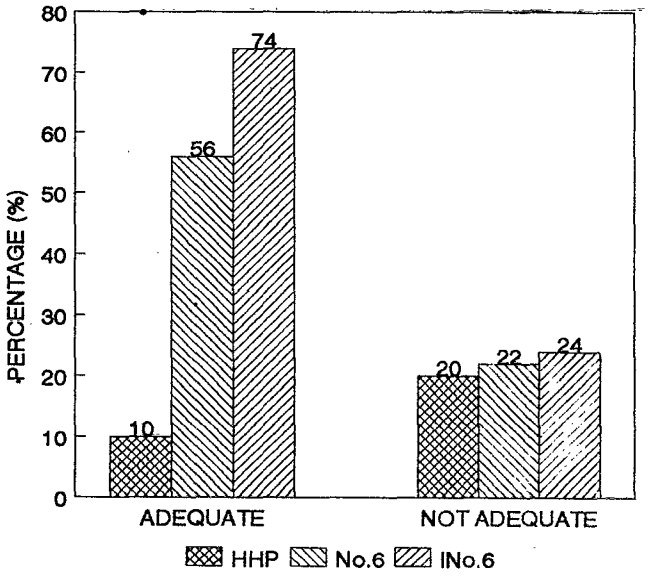


Figure 16. Adequacy of platform area

to alternate source. They were more eager to rectify the problem and work with the caretaker as a common responsibility. "Down time" occurred more among INo.6 handpumps (32%) compared to 20 percent and 19 percent among No.6 and HHPs respectively (see Table 8).

Women's Satisfaction: The traditional gender based division of labour in the villages in the sense that drinking water is women's business is pervasive in the study districts. However, women's role in selection of sites, in installation etc., was negligible, although women's representation in the handpump committee was made mandatory. Women users in general appeared satisfied with the community handpumps because of discharge of adequate water, ease of operation and convenience compared to dug wells. A platform is one of the attractive parts of the community handpump as it seems to allow interaction with others while cleaning utensils, washing clothes, etc. Even women from the households with HHPs appeared to prefer the use of the community handpumps for this reason.

Women felt that water related diseases were reduced after they started using handpump water. It was also noted that both women and children started to bathe more frequently. Time saved, although not significant, was reported to be used for household activities, such as child care and rest. The major dissatisfaction was nonavailability of INo.6 spare parts which tended to increase the "down time" of handpumps. In all cases the women seemed to dislike water with high iron content. In such cases preference for dug wells was high.

Summary of Findings

a. More than 90 percent of the community handpump users and 63 percent of the HHP users liked the type of handpump that they were using at present. The reasons for dislike of HHPs were low discharge, frequent priming and breakdown (18%), expensive maintenance (11%) and difficult to operate (8%).

b. Nonavailability of spare parts for the INo.6 handpumps was a major problem for repairs.

c. Users were generally satisfied with the quality of handpump water. However, when the iron content was high (more than 5 ppm), users tended to abandon handpumps as soon as they had access to an alternative source, usually a dug well. Where no alternative source was available, people used indigenous techniques to reduce iron content.

d. The location of the community handpumps was considered convenient by 80 percent of the users. Waiting time was less than 5 minutes at majority of handpumps.

e. Seventy four percent of the INo.6 users and 56 percent of the No.6 users were satisfied with the existing size of the platform. Although a platform of 2.1m x 1.8m size appears to be adequate, the increase in platform area to 5 - 7m^2 increases the handpump utility significantly.

f. "Down time" was more common and of longer duration among INo.6 handpumps compared to No.6.

g. Overall users were generally satisfied with the type of community handpump they use, their location and waiting time. Although most of the users were satisfied with the existing size of the platform, the users' appreciation of a large platform (5-7m^2) as in FINNIDA-assisted RWWSP was very high as this improved the handpump's utility. The "down time" was much higher in INo.6 handpumps, primarily due nonavailability of spare parts.

INSTITUTIONAL ARRANGEMENTS

The agencies involved in handpump programs can be categorized as support agency and implementing agency. Those in the first category provide financial, material and technical support. Some also provide spare parts at subsidized rates. UNICEF, FINNIDA and DiSvi fall into this category. Those in the second category include agencies responsible for overall implementation who provide manpower support, select the service area, etc. These include DWSS, NRCS, and Nepal Water for Health (NEWAH). District Development Committees, District Offices of Implementing Agencies (DWSO, NRCS, Local NGOs etc.), Users' Committees, Subcommittees (Handpump Committees), caretakers and users are involved in the installation, operation and maintenance of handpumps. The roles and responsibilities of the DDC, DWSO, Users' Committee, Subcommittee and Caretaker are given in the Water Supply Project Construction and Management Directive, of His Majesty's Government of Nepal, known as MHPP Directive, 1991. These are summarized as follows:

District Development Committee (DDC): Selects

VDCs based on predetermined priority criteria for Handpump Program implementation.

District Water Supply Office: Identifies potential handpump sites; conducts feasibility studies at each site; negotiates with the sub-committees; procures and provides standard handpumps and prescribed construction materials; installs handpumps in cooperation with users' committees and sub-committees; provides handpump ownership certificate to sub-committees and restores maintenance fund collected earlier to the caretaker; trains caretaker for pump O & M and provides a set of tools; arranges for local availability of spare parts; participates in Users' Committee meetings for O & M evaluation; maintains records of handpumps within the district; and provides major maintenance assistance (supply of head cover, handle, body of the handpump, and rehabilitation of the tubewell).

Users' Committees are formed under the chairmanship of the VDC chairman and include one representative from each handpump committee. The Users' Committees have the responsibility to mediate between the DWSO and subcommittees (handpump committees); convene a meeting four or more times a year to monitor and evaluate handpump O & M of handpumps in their jurisdiction; store and manage construction materials; reorganize handpump committees if necessary and report to the DWSO; ensure availability of spare parts within the village; and assist in promotion of improved environmental hygiene and of health education.

Subcommittees (Handpump Committee) are formed from among the handpump users and consist of three members. One member of the committee serves as Chairman and caretaker, and represents the group as a member of the VDC level Users' Committee. The subcommittee has responsibility to collect the maintenance fund required prior to handpump installation; provide all local inputs during installation, including platform construction; store and manage construction materials; operate and maintain the handpump; and manage the maintenance fund (returned after handpump installation), including maintaining the fund by collecting regular installments from users to replenish funds spent on O & M.

Caretakers, who are also the subcommittee chairmen and representative to the Users' Committees, are expected to carry out all preventive maintenance and keep the Users' Committee informed of any problems.

Existing Implementing Actors:

The work of the various levels of the existing institutional framework and their effectiveness are discussed below.

Support Agencies: Most of the community handpump programs are donor supported and the support agencies play an important role in their implementation. The programs are primarily implemented through DWSS, NRCS and NEWAH. In handpump programs supported by UNICEF, Disvi and WaterAid, the support agency's inputs include training

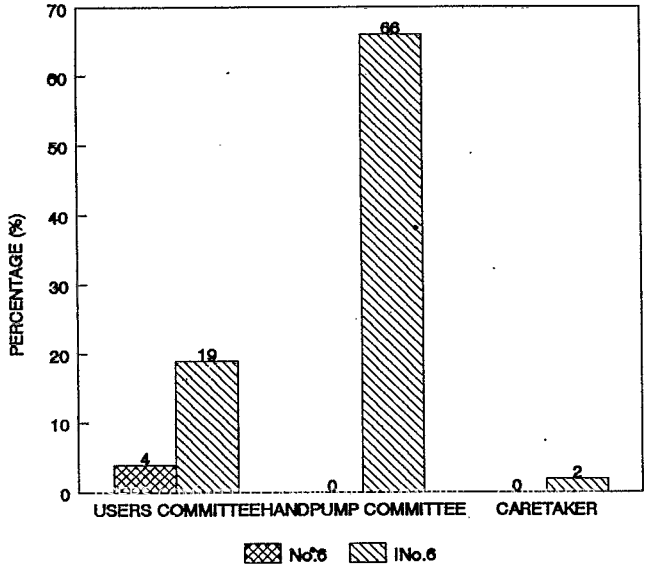


Figure 17 Percentage of female members in the users committee and handpump committee, and as caretakers

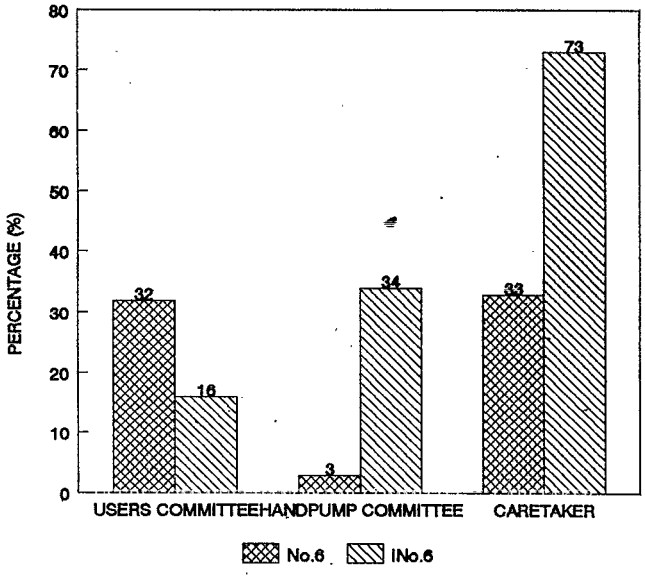


Figure 18. Existence of users committee, handpump committee and caretaker

of caretakers, supply of a tool box to the caretaker and supply of INo.6 spare parts at subsidized rates. In addition, monitoring support is frequently provided. For example, as per agreement reached, DWSO monitors the performance of UNICEF assisted INo.6 handpumps in Jhapa. It is interesting to note that other community handpumps in Jhapa are not monitored by DWSO. The performance of 63 percent of INo.6 handpumps was monitored by the support agencies. Fifty-one percent were monitored annually, and 12 percent were monitored every eight months. More INo.6 handpumps were monitored in Kapilvastu (91%) than in Jhapa (40%). Only 13 percent of No.6 handpumps were monitored. No monitoring takes place apart from donor supported efforts.

Users' Committees: Users' committees existed only for 32 percent of No.6 and 16 percent of INo.6 handpumps. The composition of the users' committees was not gender balanced as in most cases the members were male. The representation of women was higher (19%) for the INo.6 compared to 4 percent for No.6 handpumps. The higher percentage of women members in INo.6 handpump may be due to better community involvement in the planning and implementation stages and the insistence of the support agencies that women should be represented on the users' committees. Representation of women in the User's Committees of the INo.6 was found only in Jhapa district, where out of 212 users' committee members 51 (24%) were female. In the case of No.6 groups out of the total of 340 users committee members in Kapilvastu district 14 (4%) were women, and in Kailali there were eight (5%) women among the 166 members. The large number of females in the Jhapa users' committees is probably due to the insistence of UNICEF (main support agency) on including two female members in each users' committee. While the users' committees were very effective during the construction stage, this was not true of the post construction phase.

Sub-committees (handpump committees): Sub-committees existed in three percent of No.6 and 34 percent of INo.6 handpumps. There were no female representatives in sub-committees of the No.6, while women comprised 66 percent of INo.6 handpump sub-committee members. The higher female representation in INo.6 handpumps appears to be due to a mandatory requirement of donor agencies to include two female members in the sub-committee. The sub-committees were very active at the time of installation of the handpump, but thereafter, did not appear to take any responsibility for the maintenance of the community handpumps. For example, there was very little evidence of sub-committees collecting O&M funds. These committees, being informal in nature, cannot force the users to pay O&M charges.

Caretaker: Formal caretaking arrangements existed in 33 percent of No.6 and 73 percent of INo.6 handpumps. Only two percent of the INo.6 handpumps had female caretakers. In addition to a handpump caretaker it is mandatory to appoint two sevikas for each community handpump. However, sevikas were active only with INo.6 handpumps in Jhapa - a predominantly UNICEF-

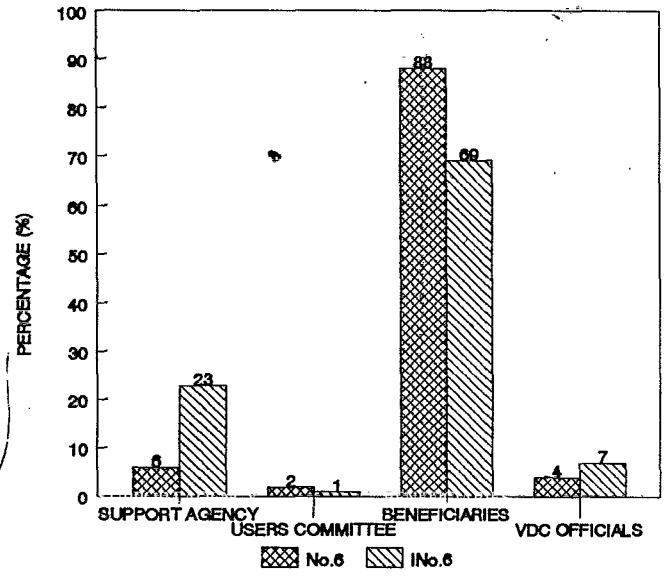


Figure 19. Parties involved in the selection of caretaker

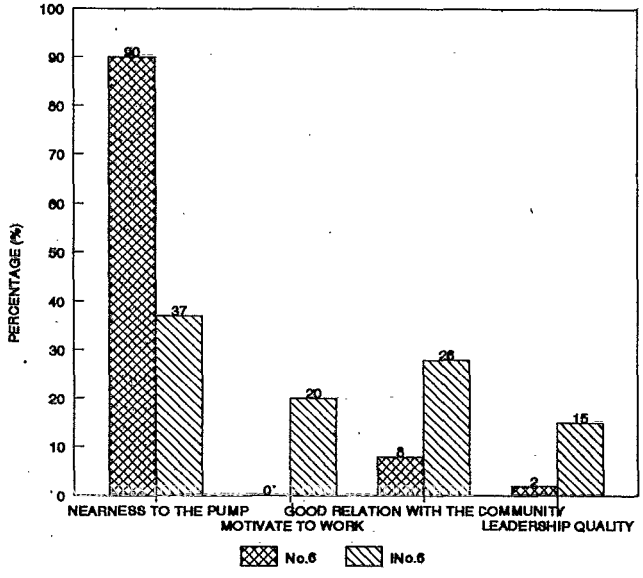


Figure 20. Criteria for the selection of caretaker

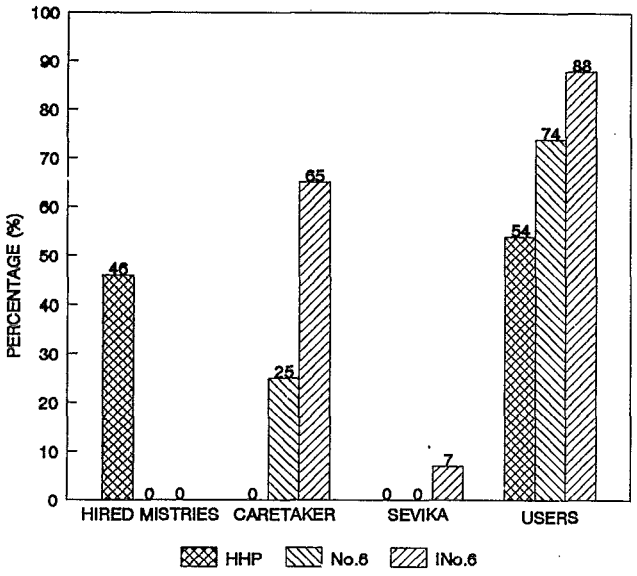


Figure 21. Parties involved in maintenance

assisted district. Sevika's main responsibility is to keep the platform and its surroundings clean. The survey findings also revealed that 7 percent of sevikas repaired INo.6 handpumps.

Almost 80 percent of the caretakers were selected by the users. Some caretakers were selected with the help of the supporting agency during the installation of the handpumps. To the extent possible, selection of caretakers was kept free of political influence as observed from the low involvement of VDC officials in their selection. The selection of caretakers seemed to depend on several criteria.

Those living close to the handpump site, showing motivation to work as caretaker, having good relations with community members and leadership quality were selected as caretakers. "Nearness to the handpump site" and "good relations with community members" appeared to be the main consideration.

Caretakers were given three days of training in identifying faults, making minor repairs and handpump installation. Caretakers for 58 percent of the INo.6 handpumps were trained, while for No.6 only 10 percent of the caretakers were trained. Training of caretakers was obligatory in INo.6 handpumps. As such the number of trained caretakers for INo.6 handpumps is greater than for No.6 handpumps.

The caretaker's services are voluntary. Some caretakers were found to use even their personal resources to buy spare parts and repair the handpumps to prevent interruptions. In some cases, caretakers' wives took on caretaking responsibility when their husbands were away from home (e.g. Kechana VDC). Generally, the performance of hill migrant women caretakers was found to be better than that of other women caretakers (e.g. Dharmpur, Jhapa).

Though some caretakers played a passive role, most of the users appreciated their contributions for smooth functioning of the handpumps. In relative terms, the percentage of users who value the caretakers' work was greater in INo.6 handpump groups compared to No.6 handpump groups, indicating perhaps the beneficial effect of training inputs. Some users considered selection of an appropriate person to be the main reason for good performance.

Involvement of Various Actors in O&M: Maintenance of the HHPs was mostly done by the owners (54%) followed by hired mistries (skilled workers) (46%). In the case of No.6, maintenance was done by users (74%) followed by caretakers (25%). In the case of INo.6 repairs were carried out by caretakers (65%) and users (28%). Sevikas (female volunteers) also repaired seven percent of INo.6 and one percent of No.6 handpumps.

Record Keeping Practice: The users were asked about the system of keeping maintenance and financial records. The majority of the users (98%) mentioned that no record keeping system exists. The caretakers and some users felt that it was a burden. Almost all users' committees collected funds for repair only after breakdowns occurred.

Summary of Findings

a. Support agencies (UNICEF, NRCS, DiSvi) provide a tool box to the caretaker. They also provide spare parts for INo.6 handpumps to users through village cooperatives at subsidized rates.

b. No regular monitoring system exists to cover all the community handpumps. The handpumps were monitored by implementing agencies at donors' insistence. Sixty three percent of INo.6 handpumps were reportedly monitored as compared to 11 percent of the No.6 handpumps.

c. Users' committees existed only for 16 percent of INo.6 and 32 percent of No.6 handpumps, while sub-committees existed for 3 percent of the No.6 and 34 percent of the INo.6 handpumps. Seventy three percent of the INo.6 and 33 percent of the No.6 handpumps had caretakers.

d. The users/handpump committees were effective during the construction phase and thereafter they

did not serve the intended purpose. They tended to loose their initial enthusiasm seen during the construction phase.

e. Female representation in users' committees and sub-committees of INo.6 handpumps was nineteen percent and 66 percent respectively compared to four and zero percent in No.6 handpumps.

f. In almost 80 percent of all cases, caretakers were selected by the users. About 51 percent of the caretakers of INo.6 handpumps had received training while only 8 percent of the caretakers of No.6 were trained. This indicates that even without training adequate technical skills are available locally to undertake repairs of the No.6 handpumps.

g. Almost all maintenance activities have been performed by the users and caretakers. The caretaker is the most effective level in the present institutional arrangement.

h. Record keeping for maintenance and finance did not exist.

i. Many community handpumps did not have users' committees or sub-committees. These committees wherever available were not very effective in O&M. Keeping in view the sectoral changes and especially the decentralized planning and implementation in which users, local institutions, community based organizations and private sector take a lead role, it is necessary to test new approaches which will improve overall institutional effectiveness, i.e., routinize collection of O&M funds and improve monitoring and record keeping. The caretaker is the most important and effective level of the present institutional arrangement for O&M.

COMMUNITY MOBILIZATION/ CONTRIBUTION

Community mobilization and contribution is assessed in terms of selection of sites, users' contribution to capital and O&M costs, willingness to pay, affordability and users' role in maintenance.

Selection of sites: The INo.6 handpump sites were selected by community (64%), support agency (30%), local leaders (3%) and users' committee (3%). In the case of No.6 handpump, sites were selected by local leaders (50%), community (22%), support agency (20%) and users' committee (8%). Around 90 percent of the INo.6 handpump sites in Jhapa were selected by the community, while in Kapilvastu 83 percent were selected by the support agencies. The intervention of the support agencies to select the sites mostly occurred in those areas where there were some technical complexities or the villagers were unable to reach a decision because of conflicts. Kailali was different regarding the type of site selector. In this district, most of the No.6 handpumps sites were selected by the local leaders.

Contributions to Capital and O&M Costs: Whenever suitable public land was not available or there was a need, users provided land for handpump installation. In 75 percent of the cases land for handpump installation was provided by the users. During implementation they provided inputs like local materials and labor. For operation and maintenance users contributed cash, albeit irregularly. Among 70 percent of INo.6 handpumps the annual contribution for O&M was less than NRs. 30 per household. It averaged more than NRs.

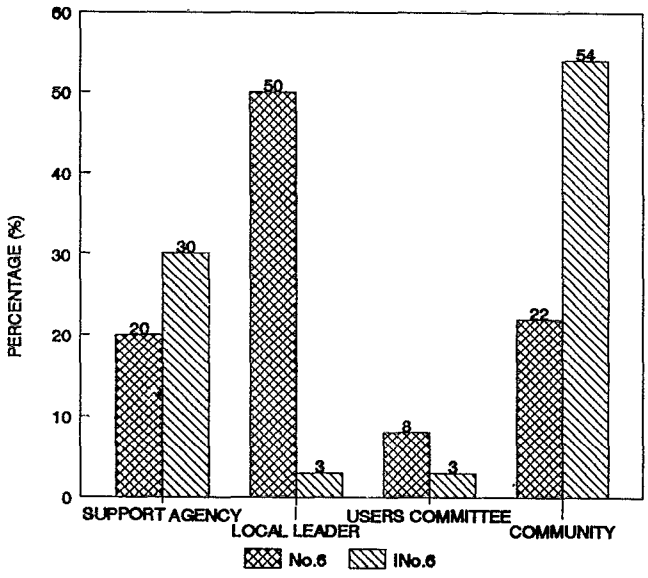


Figure 22. Selection of site by type of handpump

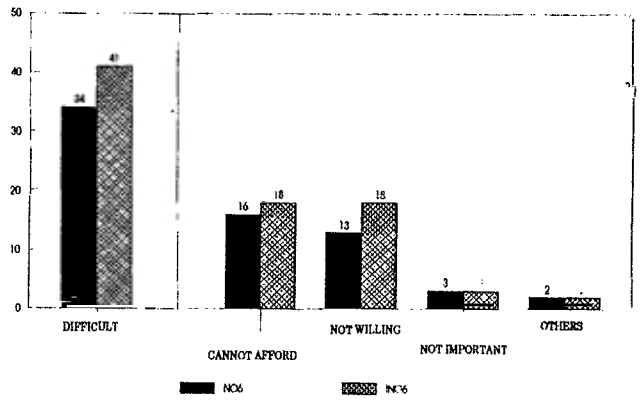


Figure 23. Difficulties in the collection of O&M funds

40 per household in No.6 handpumps. The contribution rates varied between the districts. In Jhapa, all users paid less than NRs. 30 per year, while in Kailali the users paid NRs. 40. These contributions were repair event based.

Payment for Spare Parts: The event based collection of funds for repairs were mostly used to replace the spare parts. More than 95 percent of the spare parts were procured by the community with the exception of a few spare parts for No. 6 provided by the support agencies.

Willingness to pay: About 90 percent of the community handpump users expressed their willingness to contribute more than what they are currently contributing if the need arises.

Users' Role in the Maintenance: Almost all community handpumps had been maintained by users and caretakers. The services offered by the caretakers were voluntary. In many cases caretakers had to use their personal funds to repair the handpumps which were later reimbursed by users. In the case of HHPs, local mistries have been hired in 46 percent of the cases.

Maintenance Fund: To prepare the users to pay for the operation and maintenance costs some agencies required the users to deposit a total sum of NRs. 200 to 350 before the handpump was installed. Nearly 40 percent of the INo.6 and 60 percent of the No.6 handpump users reported that they had deposited such funds with implementing agencies. However, the maintenance funds had not been utilized as there were procedural problems in the transfer of funds from implementing agencies to the users. The transfer issue is a major problem. This may have contributed to the difficulty of establishing a regular collection contribution for O&M funds. In almost all cases funds were collected for repair only after breakdown occurred.

Difficulties in the Collection of O&M Fund: Sixty six percent of the No.6 and 59 percent of INo.6 handpump users/caretakers/committees members did not report any difficulty in collection. Others cited various difficulties in the collection of O&M funds. Though most of the users did not refuse to pay, payment was irregular.

Summary of Findings

a. Users were involved in the selection of sites for 64 percent of the INo.6 handpumps while 50 percent of No.6 sites have been selected by the local leaders.

b. The communities contributed in the form of local materials and labor. In 75% of the cases land for installation of a handpump was provided by a community member.

c. The entire O&M cost was borne by the users in a majority of the cases. Annual contribution towards O&M was about NRs. 30 - 40 per handpump per household. However, the collection was repair event based and therefore funds were not readily available for preventive maintenance.

d. Currently the deposition of a maintenance fund is compulsory prior to installation of a handpump. Deposited maintenance funds have not been handed over to communities and cannot be used by the community. In more than 50 percent of the sample handpumps, maintenance funds ranging from NRs. 200 to 350 had been deposited with the implementing agencies before handpump installation.

e. More than 60 percent of all users felt that collection of O&M funds is not difficult. Though users were willing to contribute to the cost of maintenance it was not regularly collected. This appears to be due the absence of an effective institutional structure at the village level for collection and use of O&M funds. The caretaker's role, although very important, is informal and he/she cannot demand regular contributions from users.

f. Caretakers were not paid for services rendered.

g. All community handpumps were maintained by the users or caretakers. They are the most important actors in O&M of handpumps.

h. Users' participation is significant in the planning, implementation and O&M. Users' do contribute to O&M costs and are willing to pay more than the present maintenance charges. However, due to ineffectiveness of committees the O&M funds were not collected regularly. The nonavailability of ready funds has introduced an ad hoc approach to maintenance with virtually no preventive maintenance. Transfer of maintenance funds to users is likely to encourage users to collect O&M funds regularly.

Chapter 3

Private Sector Participation

ROLE OF PRIVATE SECTOR

The private sector plays a significant role in the handpump program. This includes construction of boreholes and installation of handpumps, supply of spare parts, repair of handpumps, and manufacture of handpumps and spare parts.

Construction of Borehole & Installation Of Handpump: The HHP and community handpumps surveyed were mostly installed by the private sector. This includes construction of borehole and installation of handpumps.

Spare Parts Supply: The private sector also provides a smooth flow of spare parts through efficient market channels and spare parts for No.4 and No.6 handpumps were even available in the weekly bazaars held in villages. However, in the case of INo.6, the demand for spare parts is satisfied primarily by the supply of INo.6 spare parts by donors through VDCs and NGOs at subsidized rates. The private retail outlets, therefore, do not stock these spare parts. This supply driven distribution strategy is not conducive for the development of a market oriented spare parts supply system.

Repair Services: The private sector also provides services for the repair of handpumps. The accessibility to handpump mistries for handpump repairs in the communities surveyed was excellent.

Local Manufacture: The manufacture of handpumps and spares is another area where the private sector is active. The two major manufacturers of the handpumps in Nepal are Ratna Iron Industries Private Limited and Himal Iron and Steel Private Limited. These two companies have several years of handpump production experience and have a combined annual production capacity of over 7500 handpumps (see Table 10).

Table 10: Annual Handpump Production Capacity of Major Local Manufacturing Units in Nepal

Types of the Handpumps	Nos. Produced	
	Ratna Iron	Himal Iron & Steel
No.4	3000	--
No.6	400	--
INo.6	60	4200

Source: Field Survey, 1994

Production of the No.4 and No.6 handpumps is based on market demand. The market is largely for HHPs and is usually strong for both complete handpump units as well as spare parts. Community handpumps, and especially the INo.6 are manufactured only after the receipt of purchase orders from support agencies. Many of these purchase orders are for a small number of handpumps. The tendency, therefore, is to wait to receive purchase orders for a sizeable quantity of handpumps before taking up a batch for production.

PRIVATE SECTOR PARTICIPATION: CONSTRAINTS

There are a number of constraints which impede expanding the role of the private sector.

Lack of Demand: The lack of demand for INo.6 handpumps and its spare parts is primarily due to donor policies and practices which have limited the growth of the free market forces. It was learnt that local

manufacturers are discouraged to sell INo.6 handpumps to private retail outlets. Moreover, INo.6 spare parts are supplied by donors through Village Cooperatives, DWSOs, VDCs and NGOs at subsidized rates. This has suppressed the market demand for INo.6 handpumps and spare parts. The majority of the traders were reluctant to stock INo.6 spare parts as there was hardly any demand. Moreover, one can not expect the private sector to compete with donors when the spare parts are supplied at subsidized prices.

Competition from Imported Handpumps and Spare Parts: The local manufacturers have to compete with imported handpumps and spare parts which are substantially cheaper. Local retailers, therefore, prefer to import No.6 handpumps and spares for economic reasons. The government's fiscal, industrial and procurement policies may need adjustment to encourage the growth of local industry but this aspect requires more study before specific recommendations can be made.

Raw Material Availability: The availability of raw materials like pig iron and BP coke is very uncertain. As these need to be imported from India under a quota system, they are not freely available in the market. This creates a lot of uncertainty in production planning. Government intervention can be helpful in improving the availability of raw materials.

Donor Procurement Policies: The procurement practice in some of the externally assisted projects has also adversely affected the local production and distribution of handpumps and spare parts, which in turn discourages capacity building for local production.

Steps by UNICEF to Correct Market Distortion: With the recent changes in the implementation strategy of the RWS program in Nepal, which calls for greater involvement of community in planning, construction and O&M of water supply facilities, the donors propose to discontinue supply of handpumps and spare parts. However, to ensure a market supply of INo.6 spare parts, UNICEF has recently initiated action to motivate small scale industries in the eastern region to manufacture INo.6 spare parts. Dealers have also been established for the sale of the INo.6 spare parts in three districts (Jhapa, Morang and Sunsari) out of 21 districts in the Terai region. A meeting of UNICEF, DWSOs, and approved manufacturers and retailers held in February 1994, came to the following agreement:

(1) spare parts supply through VDCs and cooperatives will be discontinued;

(2) spare parts will be supplied to users through approved retailers at agreed-upon prices;

(3) retailers will purchase spare parts only from the approved manufacturers;

(4) addition of new manufacturers and retailers will be subject to approval;

(5) the selling prices of spare parts shall be reviewed periodically; and

(6) manufacturers and retailers will be reimbursed by UNICEF for unsold parts.

This agreement was intended to facilitate continued production and distribution with some leverage on prices and quality. However, it is not clear, to what extent the intervention in market forces will either restrict an open market or artificially sustain a weak market. This transformation of the donor/VDC controlled spare parts system into a market oriented system is complex especially when there is external intervention/support. The process of transition therefore, needs to be monitored closely. This will help UNICEF and DWSS to make mid-course corrections in the strategy for this transformation.

Summary of Findings

a. HHPs, No.6, and INo.6 handpumps are manufactured by the private sector in limited quantities. The demand is largely met by imports from India for economic reasons and uncertain delivery schedules of local manufacturers.

b. While the production of No.4 and No.6 handpumps and their spare parts is geared to meet the market demand, the manufacture of INo.6 is dependent on purchase orders from donor agencies and NGOs.

c. Donors' policies and practices, such as continuing to supply spare parts to users at subsidized rates, have suppressed the market demand for INo.6 spare parts. The retailers therefore, did not find sale of INo.6 spare parts financially attractive.

d. UNICEF has begun to establish a market oriented spare parts supply system, yet one that remains controlled and sustained by licensing and donor price guarantees. Given the complexity arising out

of external intervention, the process of transition needs to be closely monitored.

e. The marketing channels for the spare parts of No.4 and No.6 handpumps are well developed. As there is a continuing demand, these spare parts are easily available in the local market. Should a strong demand exist for INo.6 spare parts, there is no reason why the same marketing channels could not take care of the supply of INo.6 spare parts.

f. Obtaining Pig Iron and BP Coke is difficult. This is a major problem faced by local manufacturers.

g. The lack of market demand is the main reason for the nonavailability of INo.6 handpumps and spare parts in the open market. Appropriate donor policies would help in building a strong local market for spare parts. The private sector is very active in the manufacture and supply of handpumps and could respond to the INo.6 spare parts demand either through imports or local production. The government's industrial and fiscal policies may be constraining the growth of local industries.

Chapter 4

Handpump Program Implementation: Role of NGOs

Handpumps installed by the government in the past have encountered problems shortly after installation due to the lack of community support and maintenance. Even though the handpump program emphasizes a community participation approach, problems remain. One of the factors for ineffectiveness of the program has been a centralized approach to implementation. The central agencies have been unable to respond to variations in grassroots needs as their program implementation loop is long. Non-governmental organizations' involvement in the delivery of services has often produced better results. Closeness to the grassroots have made local NGOs more sensitive to specific local needs, which results in a comparative advantage in designing and implementing projects.

The NGOs in Nepal are active in many sectors such as environment and conservation, population and health, women in development, non-formal education, poverty alleviation, water and sanitation, etc. The NGOs include International NGOs (INGOs) and National NGOs.

INGOs

The operation of international NGOs in Nepal started in the 1970s. Their numbers and funding levels have gradually increased over the years. By 1991, the INGOs provided about 8 percent of the total external aid. The 61 INGOs active in Nepal include those supported by governments (e.g., SNV & VSO), churches (e.g. Lutheran World Service, United Mission to Nepal) and secular INGOs (e.g. Action Aid and Water Aid).

Table 11: Number of INGOs, by Type

Type	Numbers
Donor Government Supported	10
Church Based	18
Secular	33
Total	61

Source: East Consult, 1991

The majority of these (52%) are registered with the Social Welfare Council (SWC) while the rest work with the ministries. Among these, 19 INGOs are involved in the drinking water supply sector. The INGOs follow different modes of operation. Some directly implement the programs, while others support local NGOs to implement programs in partnership. Whichever approach is followed, the objective of the program is to enhance community capacity for sustained operation and maintenance.

NATIONAL NGOs

National NGOs undertake a wide range of activities, at local and national levels. Local NGOs include informal organizations such as Guthi and Dhikur. Guthi adheres to a the traditional, paternalistic and religious orientation. Dhikur is a credit association formed by members committed to entrepreneurship development.

The government has recognized the importance of NGOs and they are encouraged to participate in development activities. Though active since the 1970s, most NGOs emerged in the early 1990s. While there were only two hundred registered NGOs in the 1990, today the number has reached almost six thousand. Only a few NGOs are directly involved in the drinking water sector. Nepal Red Cross Society is the national

NGO most widely involved in the water sector and especially the handpump program.

Both the government and the donors advocate assigning a greater role to NGOs in the drinking water program. The Eighth Five Year Plan (1992-1997) aims to meet 60 percent of the water and sanitation targets through NGOs and private sector. It is committed to creating a conducive environment for the NGOs to work freely and independently. The INGOs and local NGOs account for nearly 11 percent of the sector coverage (ADM/M Third Water Supply Sector Project, 1994).

NGOs IN THE THREE STUDY DISTRICTS

A survey of existing registered NGOs in three study districts was conducted to identify areas of operation, willingness to work in the water sector, NGO strengths and weaknesses and assistance needed for capacity building. Altogether 231 NGOs are registered in the three study districts. Most of the NGOs showed an interest in the water sector but emphasized the need for capacity building to make their participation effective. Based on the nature of their operation NGOs are categorized as follows.

Table 12: Registered NGOs in Jhapa, Kapilvastu and Kailali Districts

Types	Jhapa	Kapilvastu	Kailali	Total
Social	38	6	10	54
Women Welfare	15	-	1	16
Development Oriented	25	12	23	60
Religious	18	1	3	22
Ethnic	6	-	-	6
Others	44	22	7	73
Total	**146**	**41**	**44**	**231**

Strengths and weaknesses: NGOs have strengths as well as weaknesses which have significant bearing on their selection for partnership and enhancement of institutional capacity. The reported strengths of most of the NGOs are:

- ability to understand the local problems,
- ability to build on trust of the local community,
- commitment to and experience in a specific sector(s),
- democratic working style,
- team spirit,
- ability to make rapid decisions,
- concern with the emerging issues (e.g. related to women and poor), and
- innovative approach to development.

The NGOs also identified the following weaknesses:

- project led nature of the working style; depending on the availability of project, the focus changes from one sector to another
- lack of specific commitment to the drinking water sector
- lack of trained manpower to supervise drinking water activities

Improving the effectiveness of NGOs:

To be effective, most of the local NGOs need the following support from both government and INGOs to build capacity.

- Identification of NGOs specializing in the drinking water sector and potential NGOs with interest in this sector is necessary. Institutional development of the NGOs identified should be supported.
- It is important that the government should devise a clear policy which would facilitate involvement of NGOs in the process of drinking water sector development. The role of various types of NGOs should be defined with clear and objective criteria.
- At present, most NGOs are working on the basis of their direct access to central level support agencies (INGOs, other donor agencies or government). At the district level, very little is known about their activities. This leads to problems for the coordination of local activities. This kind of problem could be solved if their activities are coordinated as a supplement to activities covered under the district development plan. The role of the DDC in this regard should be to facilitate the NGOs by resolving conflicts of interest (if any) between them and the support agency. DDC should mediate, not direct. The NGOs should be allowed to work independently and to build on their comparative advantages.
- The support provided by INGOs should aim at overall development of local NGOs and longterm replication of capacity building rather than mere expansion of size and activities of the local NGOs.
- Programs providing reorientation to line agency and NGO staff are needed. Training programs and workshops to share experiences and issues related to handpump drinking water supply should be organized.

Chapter 5

Conclusions And Recommendations

In the past, the community handpump program was supply driven. With the proposed changes in sector policy the emphasis will be on greater participation by users, responsiveness to demand, and decentralized implementation involving local institutions, NGOs and the private sector. The proposed establishment of the RWSS Fund by the Government with assistance from IDA will strengthen the channel for innovative implementation approaches developed by the JAKPAS[3] pilot project. These approaches are demand responsive and improve sustainability of water supply facilities. The conclusions and recommendations below take into account these sectoral changes.

CHOICE OF HANDPUMP

Table 13 compares No.6 and INo.6 handpump performance. The performance of No.6 and INo.6 handpumps in terms of rated discharge, frequency of spare parts replacement, local skills required for repairs, priming requirements and users' preference is similar. However, when compared on the basis of indicators like percentage of functional handpumps, idle strokes, frequency of interruption, spare parts availability, design, capital costs and O&M costs, and downtime, the No.6 handpump performs better. Overall, the No.6 handpump offers advantages like lower capital and maintenance costs, and better maintainability and reliability. It is therefore not justifiable for any implementing agency to insist on the use of INo.6 handpump.

Recommendation:

1. Implementing/facilitating agencies should not insist on the use of INo.6 in the community handpump program. On the contrary, use of the No.6 handpump should be encouraged.

SPARE PARTS AVAILABILITY

A large number of INo.6 handpumps are nonfunctional due to the nonavailability of spare parts in the local market. This is primarily because the distribution channels developed by donors utilized village cooperatives, VDCs and NGOs rather than open markets, which were further discouraged by the subsidized prices of spare parts distributed through village cooperatives, VDCs and NGOs. A change in donor policies to facilitate generation of market demand and availability of spare parts through local retailers is therefore necessary.

The availability of spare parts is an important criterion for the selection of a handpump. Keeping in view that in future the users will take a lead role in the

3 A pilot project implemented by RWSG-SA, Nepal.

Table 13: Comparison of Relevant Factors

Pump Type	Operational Status (% of handpump)				Reliability				Maintainability			Cost (NRs./pump)		User's satisfaction	
	Functional handpumps	Missing nut/ bolts	Ideal Strokes	Priming Reqd.	Discharge (ltr./29 strokes)	Robust-ness	Frequency of Interruption (% of handpumps)	Spare parts replacement/ handpump/ yr.	Design	spare parts availability	Local skill	Capital	Mainte-nance per annum	like (% of users)	downtime (% of handpumps)
No.6	80	52	40	39	20	more robust	39	7.3	some limitation	difficult	available	2100	162	97	32 (high)
No.6	86	68	34	43	17	less	32	6.55	appropriate	easy	available	900	117	94	20 (low)

planning and implementation of handpump programs and O&M of community handpumps in Nepal, the availability of spare parts through local retailers becomes critical. It is better for a user to select a less robust handpump whose spare parts are easily available than a robust handpump whose spare parts are not easily available from retailers.

With the proposed discontinuation of the supply of handpumps and spare parts by donor agencies, the availability of INo.6 spare parts is likely to worsen unless effective steps are taken immediately. The donors have the moral responsibility to ensure that the users of INo.6 handpumps installed under donor assisted programs continue to have access to spare parts. There are two possible solutions to address the problem of nonavailability of INo.6 spare parts. These are discussed below.

(a) *Improving Availability of Spare Parts Through Private Retail Outlets*: Currently efforts are being made to make the INo.6 spare parts available through private retail outlets. UNICEF has taken the initiative to identify local industries and private retailers and motivate them to manufacture and market INo.6 spare parts in 3 out of 21 districts in the Terai Region. This transition of a donor/VDC/NGO controlled spare parts distribution system to a market oriented spare parts supply system is complex especially as it involves external intervention. The transition process needs to be monitored closely. Monitoring will also help UNICEF in making mid-course changes in the implementation strategy, if necessary.

(b) *Modifying Existing INo.6 To Suit Spare Parts Available in Local Markets*: This strategy has been successfully adopted by the FINNIDA-assisted RWSS Project in Lumbini district. Some components of the INo.6 have been modified (see drawing no. 1 and part nos. 1 to 4 in Annex 3) so that the No.6 spare parts available in local markets can be used for the repair of INo.6 handpumps. For example, the piston assembly has been modified so as to facilitate the use of either INo.6 cup washer or No.6 leather cup washer.

For the first option the following considerations are relevant:

- The INo.6 handpump does not provide any specific advantage which justifies the extra capital costs.
- Due to higher capital and O&M costs, it is very probable that the demand for INo.6 in the future will remain very limited. This will provide a real barrier to market development which cannot be removed by external intervention.
- The true strength of the market will not become apparent until donor supported controls on manufacturing and retail sales in the current transitional stage are discontinued. This extends the uncertainty over the long-term viability of an open market strategy.

For the second option the following considerations are relevant:

- The number of the existing INo.6 handpumps is known and work involved in the modification can be assessed, planned and completed within a stipulated time.
- The conversion costs are marginal and its benefits are manifold.
- The conversion of the INo.6 handpumps has already been tried successfully in the FINNIDA-assisted RWSS project and therefore, there is no need for a pilot testing before taking up the large scale conversion of the existing INo.6 handpumps. This, however, will require careful planning of logistics to complete conversion of all INo.6 handpumps early.

Details of Modifications: The following steps are involved in the modification of INo.6 handpumps to make them compatible with the locally available No.6 spare parts. For technical details of modifications (see attached drawing no. 1 and part no. 1 to 4 in Annex 3).

- Replace fulcrum pin, and rod pin by 5/8" bolts (part nos. 1 and 2 in Annex 3) and nuts. Use of allen screws is not necessary.
- Reduce the plunger rod length (part no. 3 Annex 3) from 554 to 486 mm and cut 1/2" BSW threads to a length of 32 mm.
- Supply an adapter (required only when INo.6 plunger elements are used) as per details given in the drawing of part no. 4 in Annex 3.

The cost of the above modifications will be less than NRs. 150 per handpump.

Recommendations:

1. The donors should immediately stop subsidies on INo.6 spare parts. This will provide a level playing field for the private sector participation. As the open market mechanism develop the supply through village cooperatives, VDCs, DWSOs and NGOs may be withdrawn. The donors should consider changes in policies and practices to facilitate easier availability of spare parts through the open market in the shortest possible time.
2. A non-interventionist approach is recommended for the development of market supplies of INo.6 spare parts. However, if, for any reason, the transformation of a donor/government supported spare parts distribution system to an open market spare parts supply system with donor intervention is pursued, it will be necessary to monitor the transition process closely.
3. A definitive and perhaps the ideal solution is to modify all the existing INo.6 handpumps as done in the FINNIDA-assisted RWSSP so that the locally available spare parts from the No.6 handpump could be used for maintenance.

DESIGN IMPROVEMENTS

A large number of handpumps need priming. This has emerged as a common major design weakness in all the handpumps. The foot valve design, therefore, needs closer scrutiny.

Recommendations:

1. The foot valve design needs closer scrutiny.

CONSTRUCTION ASPECTS

Platforms of almost all the INo.6 handpumps and a large percentage of No.6 handpumps are assessed as satisfactory. A majority of the household handpumps (70%) are without platforms and this poses a risk of aquifer pollution due to seepage of wastewater around the handpump into the well.

While most users have indicated satisfaction with the existing size of the platform, experience from the RWSSP/FINNIDA project shows that users were very appreciative of large platforms (area 5-7 m^2) due to their better utility.

Recommendations:

1. Health and hygiene education, should be targeted at HHP/No.6/ INo.6 users, through the mass media, about the risk of aquifer pollution in handpumps without platforms. In the existing HHPs and community handpumps without platforms, users should be encouraged to build platforms.
2. The construction of larger platforms (area 5-7m^2) (that better suit users' needs) should be promoted as an option.

INSTITUTIONAL ARRANGEMENT

The provisions made in the MHPP Directive 1991 regarding the role and responsibilities of DDC, DWSO, User's Committees, sub-committees and caretakers, although detailed, are not followed. Many communities did not have users' committees or sub-committees. The users' committees and sub-committees were very effective during the construction phase but much less effective in the post-construction phase. The committees neither met regularly nor provided support to caretakers/users in O&M. This is evident from the fact that O&M funds were rarely collected regularly and records keeping were non-existent. The most important and effective actor in the institutional structure is the 'caretaker'. Due to the failure of the existing institutional structure, handpump O&M has been ad-hoc rather than preventive, and ultimately costlier.

The collection of O&M funds was based on repair events. Since funds are not collected regularly the caretaker does not have ready access to funds for the purchase of spares. In many cases, the caretakers have to spend personal funds which are reimbursed later by users. This has resulted in a tendency to change the barest minimum of spare parts to keep the handpump functional. It is common to see wooden handles, pins made from bamboo,and ropes being used in place of appropriate spare parts. This practice can eventually damage key handpump components, necessitating major repairs and expenses which the community may find difficult to finance. Encouraging preventive maintenance will reduce down time and lower maintenance costs.

In the Terai region, there is often good access to other water sources like HHP and dugwells. This could be another reason for the passive attitude of sub-committees and users. With each HHP serving on an average 2.6 households the water supply coverage is much higher than government estimates.

The users' committees and sub-committees in the present form are not effective in the O&M of handpumps.

Keeping and managing a bank account for each handpump separately is not considered feasible. It is therefore necessary to test alternate institutional approaches such as merging users' committees and sub-committees into a user's committee at the ward or sub-ward level with a functionary of the VDC taking active part. The number of users' committees will depend on the service area, population, settlement pattern and number of handpumps. More than one committee can be formed in one VDC for example, one committee for every 5-10 handpumps. Caretakers from each handpump should be members of the user's committee. The ward member should be the ex-officio member of the user' committee. Since a ward member has a legal status and commands popular support his/her membership will improve the users' committee's accountability and sustainability. The chairperson of the committee may be elected by the committee members.

Keeping in view that (i) users will play a lead role in the planning, implementation and O&M of handpumps, (ii) the role of implementing/supporting agencies will be that of a facilitator, and (iii) the VDC Act of 1992 assigns the responsibility of development and management of water supply systems to VDCs, the following is recommended.

Recommendations:

1. The present system of a users' committee at the VDC level and sub-committee at handpump level may be replaced by the "Users' Committees at the ward/sub-ward level."
2. The Chairperson of the Users' Committee should submit an annual report in a prescribed format on the status of handpumps in his/her ward to the VDC.
3. O&M funds collected prior to handpump installation should be released to each committee once a system has been established.
4. O&M funds (NRs. 2 per household per month) should be collected regularly, such as every two months, and deposited in a bank. Users' committee chairman should be responsible for the collection as well as financial record keeping.
5. Future handpump programs should be demand driven so as to avoid inadvertent promotion of unsustainable interventions.

PRIVATE SECTOR PARTICIPATION

The private sector has played a very important role in the handpump program and has the potential to play an expanded role in the local manufacture and supply of handpumps and spare parts. It has to be recognized that local manufacturers work in an unfavorable environment characterized by uncertainty about the availability of raw materials, high raw materials costs, and low production volumes which make local products expensive when compared with imports. The private sector is very effective in supplying spare parts for No.2, No.4 and No.6 handpumps. In the case of INo.6, spare parts are not easily available on the open market. This is largely due to the lack of demand which can be attributed to the manner in which donor agencies established a separate distribution network and subsidized the cost of INo.6 spare parts. If there is a demand for INo.6 handpumps and spare parts, the existing open market channels can meet the demand either through imports or local production.

Recommendations:

1. The private sector should be encouraged to expand its role in handpump production and distribution of spare parts.
2. If there is a demand for INo.6 handpumps and spare parts, the existing marketing channels will be able to meet the demand either through local production or imports.
3. Government assistance in improving the availability of imported raw materials like pig iron and coke will be helpful to local industry.

ROLE OF NGO's

NGOs have an important role to play in the handpump program. Most of the NGOs working in the three study districts are not active in water supply and lack capacity for the implementation of handpump programs, especially the construction aspects. However, they can be very effective in mobilizing the community, and therefore can play an important role of the intermediatory between the funding agencies and communities. If the district/VDC level NGOs are to play a meaningful role, capacity building of NGOs at the grassroots level is a must. The formation of an NGOs' Association with a well organized, experienced and resourceful NGO

working as "Mother NGO" will improve accessibility of grassroots level NGOs to the expertise that they need.

Recommendations:

(1) Local NGOs active in the water sector and also the NGOs planning to work in the water sector should be identified at various levels.

(2) Substantial efforts are required to build/improve the implementation capacity of grassroots NGOs through training programs and exchange of experience.

(3) A formal linkage between a strong and resourceful NGO and grass root NGOs is recommended to improve the accessibility of grassroots NGOs to the expertise they need.

FOLLOW UP ACTION RECOMMENDED

(1) It is critical to take decisions quickly on the recommendations made in this report. However, to make the decisions effective it is necessary to develop consensus on important issues like choice of handpump, option to be followed to tackle INo.6 spare parts supply problems and new institutional approaches. It is therefore strongly recommended that a Decision Maker's Meeting involving government, donors and NGOs be convened as soon as possible to ensure a smooth transition and to minimize disruptions to users of INo.6 handpumps.

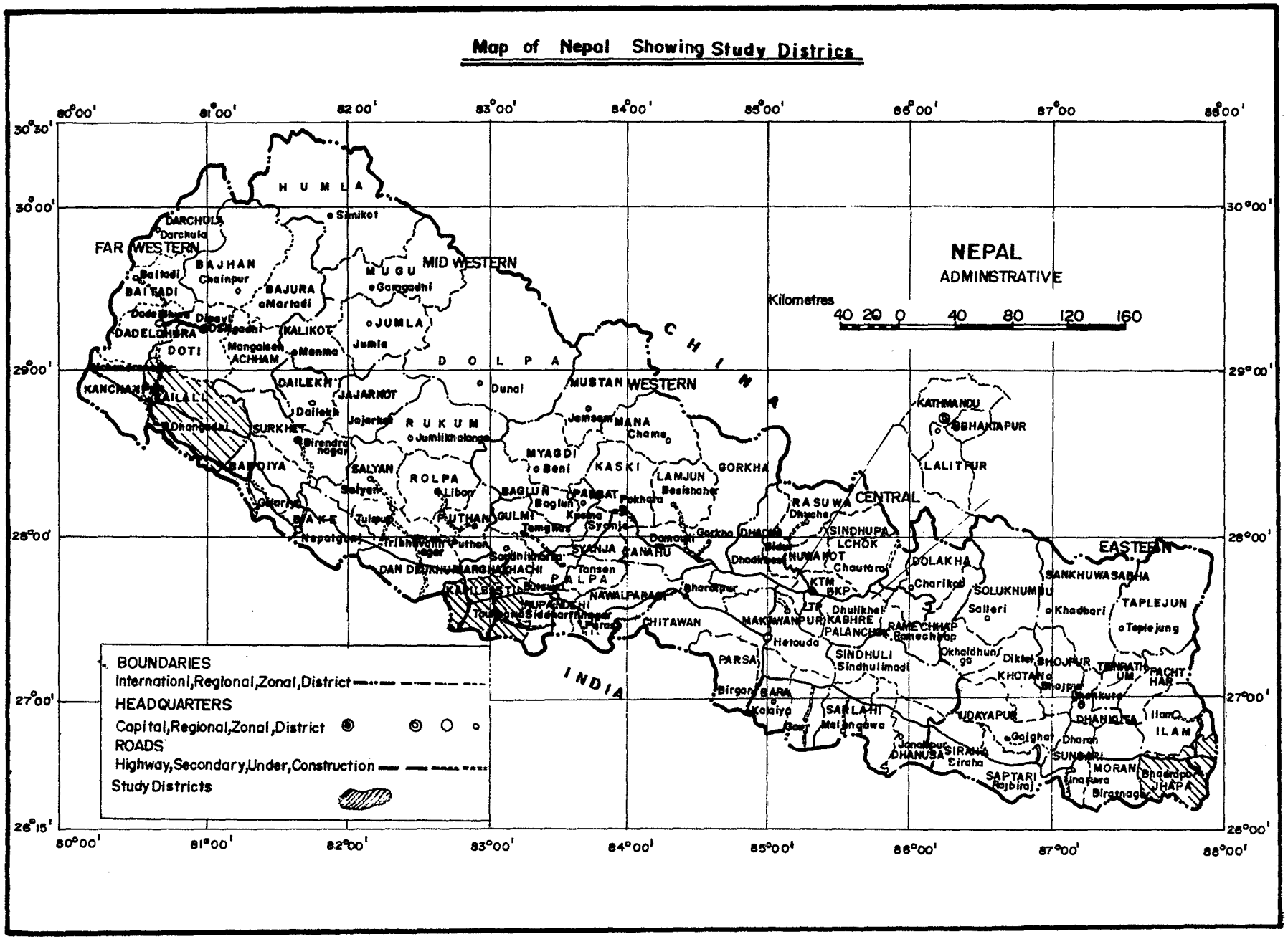
(2) In order to closely observe and monitor the transition from donor driven to market distribution of spare parts, a study should be undertaken as soon as possible. RWSG-SA will be happy to assist in conducting this study as a part of its initiatives for systematic learning.

FOLLOW UP ACTION TAKEN

A meeting was held on 26 May, 1995 to discuss the findings, conclusion and recommendations of this report. The meeting was chaired by Mr. Dinesh Chandra Pyakurel, Director General, DWSS and attended by representatives of UNICEF, WHO, TAEC Consults P. Ltd., and RWSG-SA. The minutes of meeting are attached as Annexure 4.

APPENDICES

Map of Nepal Showing Study Districs



APPENDIX-2

PHOTOGRAPHS

◀ *A well maintained I.No. 6 Pump with Platform having Women Caretaker – Dharampur (Jhapa)*

◀ *Poorly maintained No.6 handpump:*

- *With broken cover held by a rope*
- *Iron rods used in place of fulcrum & rod pins*
- *Cracked body covered with polyethylene sheet*

Damaged Headcover and use of Ordinary Iron Rod in Place of Pins (I.No.6) – Kechana (Jhapa) ▶

◀ *I.No.6 Handpump whose broken Headcover is held in position with the help of ropes*

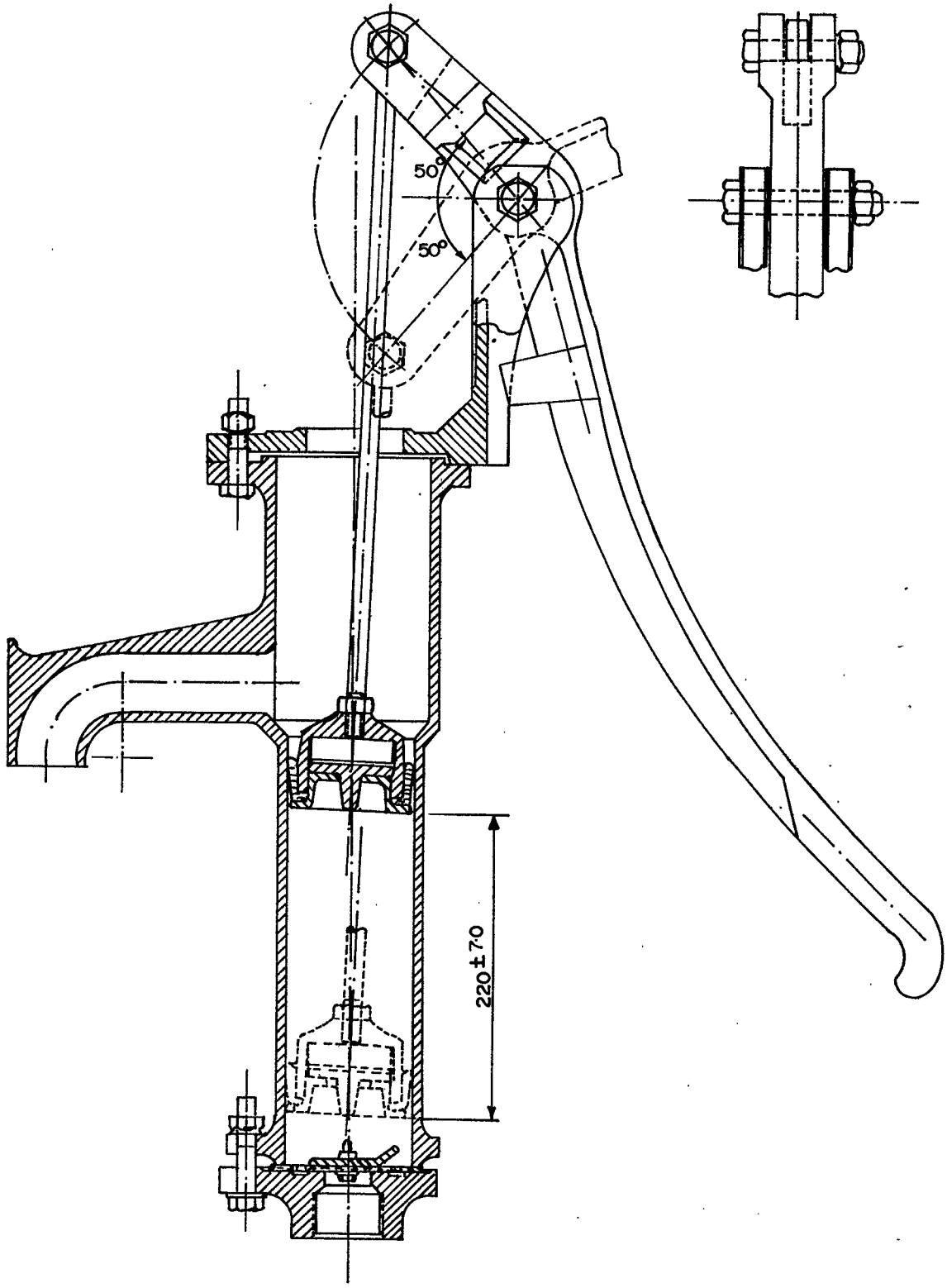
Poorly maintained No.6 Handpump – Hasuliya (Kailali) ▶

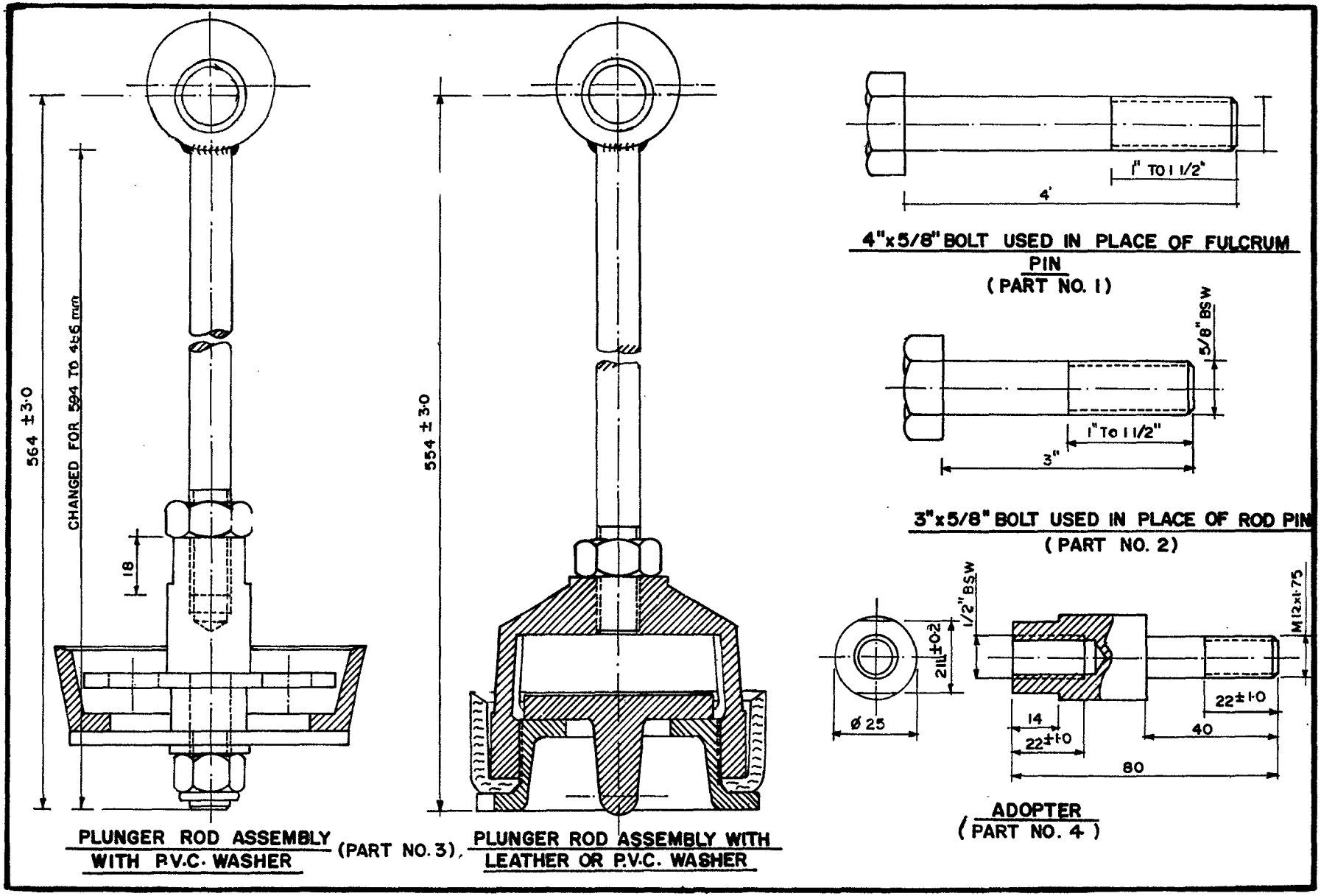
◀ *Poorly maintained No.6 Handpump – Masuriya (Kailali)*

▲
Local Filtration Technique adopted in an HHP to reduce Iron content in water ▶

APPENDIX-3

INo.6 HANDPUMP MODIFICATION





PLUNGER ROD ASSEMBLY WITH P.V.C. WASHER (PART NO. 3), PLUNGER ROD ASSEMBLY WITH LEATHER OR P.V.C. WASHER

4"x5/8" BOLT USED IN PLACE OF FULCRUM PIN (PART NO. 1)

3"x5/8" BOLT USED IN PLACE OF ROD PIN (PART NO. 2)

ADOPTER (PART NO. 4)

APPENDIX-4

MINUTES OF MEETING

A review meeting was held to discuss the final draft report "Community Handpump in the Terai Region: Assessment of Operation and Maintenance" on 26th May 1995 at the meetinghall in the Department of Water Supply and Sewerage. The following persons attended the meeting.

1.	Dinesh Chandra Pyakurel	:	Director General, DWSS
2.	Vasu Dev Raj Joshi	:	Regional Director, DWSS, Central Dev. Region
3.	Murari L. Choudhary	:	Regional Director, DWSS, Eastern Dev. Region
4.	R.S. Manandhar	:	Senior Divisional Engineer, DWSS
5.	Yves Faugere	:	Chief, WES, UNICEF
6.	Prakash Tuladhar	:	Project Officer, WES, UNICEF
7.	Arun Pyakurel	:	Project Officer, WES, UNICEF
8.	Arun K. Mudgal	:	Technology Specialist, RWSG-SA
9.	Rekha Dayal	:	Regional Program Advisor, RWSG-SA
10.	Jon Speets	:	Sanitary Engineer, WHO
11.	Kari Leminen	:	Project Coordinator, RWSSP/FINNIDA
12.	P. N. Nepal	:	Team Leader, TAEC Consult P. Ltd.
13.	B. R. Joshi	:	Technical Expert, TAEC Consult P. Ltd.
14.	M. P. Neupane	:	Consultant, TAEC Consult P. Ltd.

The meeting was chaired by the Director General, DWSS, Mr. D. C. Pyakurel. Mr. P. N. Nepal (Team Leader of the Study Team) explained the major findings of the study. In addition, he responded to the comments made by DWSS, UNICEF and FINNIDA. All the participants appreciated the report. There was open discussion on the issues which will be likely to come while implementing the recommendations of the report. After the deliberations on various issues, the following decisions were made unanimously.

Decisions:

1. Since the use of INo.6 handpump incurred higher capital and O&M costs compared to No.6 without appreciable specific advantage (except sturdiness/roubustness) to justify the extra cost and also keeping in view the changed roles of implementing agencies as facilitator of the development, the use of No.6 handpumps needs to be promoted.

2. The supply of handpumps and spare parts should be governed by the free market mechanism.
3. Existing Improved No. 6 handpump should be modified as suggested in the report so that spare parts available in the market can be used.
4. This report can be published in the present form with the following improvements.
   a. Executive summary of the report should be elaborated to include more findings on social aspects as necessary.
   b. This minutes of meeting will be an annex to the report.
5. To carry out follow up actions on the recommendations, the following four groups will be formed. The DWSS willl take initiative in this regard.
   a. *Technical Group*:

      The group will develop the methodology for the modification of the already installed Improved No.6 Handpumps. The group will also recommended some measures to improve the efficiency of foot-valve.

   b. *WUC/O&M Group*:

      The group will further explore institutional changes required to improve the effectiveness of community based O&M system.

   c. *Implementation Group*:

      The group will prepare an action plan to phase out subsidy on handpumps and spare parts provided by the implementing and donor agencies.

   d. *Market Survey Group*:

      The group will monitor the progress during the transition period.

At the end of the meeting, Mr. Pyakurel thanked all the participants for their contributions to the discussion. He made special mention of the efforts put by the consultant to the study.