RESOURCE MOBILIZATION AND ORGANIZATIONAL SUPPORT IN IRRIGATION SYSTEM MANAGEMENT: EXPERIENCES FROM KULARIYA, JAMARA, AND RANI KULOS OF KAILALI DISTRICT

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INTRODUCTION

Irrigation organizations are formed to perform different sorio-technical functions for irrigation systems. These functions range from water acquisition, water allocation, water distribution, and drainage to the design, construction, maintenance of the system, resource mobilization and management,. However, the importance of the particular function differs from system to system on the basis of the nature and terrain of the system.

Kulariya, Jamara, and Rani Kulos of the eastern part of Kailali District joined together in 1986 in order to acquire water collectively from the Karnali river, one of the biggest river systems in Nepal. Hence, the East Kailali Irrigation System, formed by the consolidation of Kulariya, Jamara, and Rani Kulos, **is** one of the largest farmer-managed irrigation systems, commanding about 15,000 hectares (ha). Previously, these systems were separate and took water from the Karnali independently.

Gross area as measured from the 1:10,000 scale aerial photograph is about 20,000 ha. This large expanse of tarai plain gently slopes ***to*** the south. The western boundary of the command area is the Patharaiya River and the southern boundary is the Mohana river, which is also the border with India. The command area of the canals has expanded over a period of time due to the clearing **of** forests and settlement programs. The cadastral survey of 1964 indicated a command area **of** only 8,000 ha. According to a recent water resources inventory and estimates on the basis of aerial photography taken in 1987, the command area is about 15,000 ha. Table 1 gives the area irrigated in each panchayat in the command area as reported in 1985.

The discharge of the Karnali varies from season to season. According to the Karnali project report, the average water discharge is 1,340 cubic meters per second (m^3/s). The lowest discharge is between 250-300 m^3/s. The highest discharge is about 24,500 m^3/s, occurring during a high flood in 1984.

About one kilometer below Chisapani, the Karnali River divides into two channels. The left channel **is** called Gerwa and the right Karnali. In 1984 there was a large flood that caused major changes in the systems. The river course shifted so that in the dry season the Karnali channel dries up and more effort is required **of** the people of these irrigation systems to divert water from the Garwa to the Karnali channel (see map).

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Map of the Kulariya, Jamara and Rani Kulo Irrigation systems.

Because **of** the huge variations in discharge, annual repair of the intake and the canals near the Karnali river is a major operation. In order to meet this challenge the irrigators have to mobilize people and resources. Both money and natural resources such as branches, brush, and stones are needed. There are different tiers of organization in existence to mobilize these resources for the repair and maintenance **of** the system.

Table 1. List of panchayats and area irrigated in each panchayat in the command area.

Panchayats	Area Irrigated (ha)
1. Baliya	400
2. Pathaiya	1750
3. Janaki Nager	945
4. Duragauli	1130
5. Manuwa	1650
6. Tikapur	3710
7. Narayanpur	1760
8. Dhangsingpur	1755
9. Pratapur	300
TOTAL	14000

Source: Hydro-Engineering Service. Water resource inventory study of Kailali Districts of Seti zone. WECS, Kathmandu.

OBJECTIVES OF THE PAPER

The objectives of this paper are to identify:

1. The features of organizational support for internal and external resource mobilization for the operation and maintenance of the system.

2. The organizational structure and its implications on resource mobilization.

3. The adjustment and adaptation of the organizations to changes in the environment such as expansion of the command area and demographic changes within the command area.

4. The adaptation of different levels of organization in order to mobilize external resources.

METHODOLOGY

The study is divided into preparatory work and field work. In Kathmandu, preparatory work sought to identify a large farmer-managed irrigation system. Water resource inventory reports of Dang Deukhuri, Bardiya, and Kailali Districts were studied and vital information from these reports (Hydro-Engineering Service 1985) was collected. A reconnaissance report by Tahal Consulting Engineers was also reviewed (Tahal Consulting Engineers 1978).

Dr. Hari Man Shrestha and Mr. B.K. Pradhan of the Water and Energy Commission were also consulted before going to the field.

Reconnaissance was done by a team consisting of a social scientist, an agricultural economist, and an agronomist in November 1986 (see Shivakoti, et al.). Interviews were conducted with the farmers, officials of the irrigation system, and elites of the area. The physical features of the system were also observed.

After the reconnaissance, a six-member team consisting of three engineers, one agricultural economist, and two social scientists went to the Kailali systems to identify the area for study. it was decided that, the stud? would be phased into two years due to its size. During the reconnaissance and subsequent trips, information was collected through interviews with the leaders of these systems. Their record books were also examined.

In the meantime, the study on resource mobilization and organizational interaction was initiated. Major resource mobilization activity takes place during February and March. An Asian Institute of Technology graduate student, as a part of his master's thesis research, was fielded in Chisapani to observe the operation of the organization and resource mobilization.

CONCEPTUAL FRAMEWORK ON RESOURCE MOBILIZATION

Resource mobilization is one of the major functions of farmer-managed irrigation organizations. The major share of manpower, materials, and money for the operation and maintenance of the system comes from within the system. There is a close relationship between the strength of the irrigation organization and the amount of resources the organization must mobilize. The greater the difficulty for the acquisition of water, the more resources require:?, the stronger the organization has to be.

One of the objectives of this paper is to show that the type of irrigators' organization that exists in a particular system is related to the nature of the resources the organization must mobilize. A change in the environment may force the organization to adapt its structure in order to respond to the changed environmental requirements. Examples from the East Kailali Irrigation System demonstrate the dynamic nature of these organizations.

Internal **Resource** Mobilization

Resource mobilization can be broadly categorized into internal and external mobilization.

Within the irrigation system itself there are a number of different resources which the community may have to organize, obtain, and utilize. Internal resource mobilization includes:

1. Labor mobilization.

2. Cash mobilization.

3. Acquisition of forest products such as tree trunks, brush, and branches (jhalapata).

4. Mobilization of bullock carts to bring jhalapata and stone for temporary diversion dam construction or to make the proportioning weirs,

5. Establishment of enterprises such as water mills by the irrigation organization.

6. Sale of water share, as in the Chherlung systems of Palpa district.

7. Utilization of any technical expertise which may exist among members of the community.

The common feature of resource mobilization for operation and maintenance (O&M) in farmer-managed systems is the labor and cash from within the command area and from among the water users. Other resources such as bullock carts and forest products are also used. In the kulariya system, each water user pays approximately US$ 0.50 (Rs 10) to get permission from the Forest Range Office to collect jhalapata to divert water and for construction of the bunds and temporary check dams. The assigned forest for the collection of these materials is far from the work site, so the bullock carts are needed to transport the jhalapata (Yoder, et al. 1987).

In some systems, in order to lessen the burden on labor mobilization, the irrigation organization has entered into the operation of water mills. The money collected from this enterprise is used for system maintenance.

In other systems, water is considered a salable product. Water is sold to expand the membership and finance improvement of the system. Water selling is also seen in some systems as the basis upon which resource mobilization for irrigation improvement is calculated (Martin 1986).

Utilization of the local people's knowledge is also important. The knowledge of local leaders about what can be done and how it can be done are significant resources existing within many systems. For example, the expertise of local tunnel makers was used in hill irrigation systems of Nepal.

Each irrigation organization must develop a structure and set of rules in which to operate so that resources can be effectively mobilized. During the time of labor mobilization, the norms, basis, customs, and amount of work t.o be done are considered and determined by the organization. The rules for the enforcement of labor mobilization are established by the irrigation organization. In the same way, the rules of punishment for members who do not fulfill their obligations to the organization are strictly supervised by the .irrigation organization.

Changes in the Kailali internal resource mobilization structure. The characteristics of resource mobilization change along with changes in the resource base such as water course changes, or expansion of the command area, or population growth resulting from migration into the system. In the irrigation system under study, all these factors of change have taken place. In the initial stage of irrigation development, the Kailali system had abundant land but there was a shortage of manpower. Every able body from each household had to contribute to the repair and maintenance of the system irrespective of the size of landholding in the command. With the migration of hill people to the area, lack of manpower is no longer a constraint. At present, labor contributions for O&M are determined by the size of individual landholdings. Hence, population changes within the command area resulted in an increase in the labor resource and prompted a change in the basis upon which labor

contributions are determined. The character of the organization cannot remain static but must adapt to these changing situations.

External Resource Mobilization

In some irrigation svstems the O&M requirements are greater than the capacity of the farmers to perform. In this case they must organize and seek outside help, usually from government or international donor agencies. In order to obtain external resources the irrigation organization may have to strengthen its leadership and adapt its structure. External resource mobilization encompasses a number of different activities:

1. Cash mobilization at the national, district, or village panchayat levels, or from voluntary or international organizations.

2. Material mobilization including gabion wire, cement, pipes, or food for work.

3. Dissemination of technological knowledge from outside sources.

4. Supervision by the technical people of work done by the local people. This could be from within the country, or from international agencies or from international voluntary organizations.

5. Machinery mobilization. Bulldozers or excavators are brought in during the time of desilting or repair of the canals.

6. Credit mobilization.

External resource mobilization in the Kailali systems. In 1984 a large flood caused a shift in the river course where the Karnali River divides into the Karnali and Gerwa channels. During the dry season, water no longer flows into the Karnali channel and farmers of Kulariya, Jamara, and Rani Kulos must make much larger investments of time, labor, and equipment to obtain water than before. They have therefore sought outside assistance.

Rani Kulo and Kulariya Kulo have mobilized some resources from Kailali district panchayat. However, the money was channeled through the village panchayat. These irrigation systems extend over nine village panchayats so giving money to only one village panchayat does not help the improvement of the system. However, the irrigation organization does not have a legal base so it has to align with local political units for external resource mobilization. As a result, nonbeneficiaries become involved in the leadership of the organization and the irrigation organization is pushed into the political arena where factors extraneous to the operation of the system may take control.

Previous to 1987, Kulariya, Jamara, and Rani Kulos each had its own irrigators' organization which functioned independently of each other. On 18 February 1987 a joint committee of the three irrigation systems was formed with the purpose of obtaining external support for the O&M of irrigation in the command area. The farmers felt that they needed the support of an influential person and obtained the cooperation of Mr. Khadga Bahadur Singh, a very prominent national politician, who was named chairman of the joint committee. Mr. Singh does not have land in these irrigation systems, so he is neither user nor beneficiary. However, the users felt that he would be useful in drawing government's attention to these irrigation systems.

In 1987, approximately US$ 3,196 (Rs 70,000) was granted by the Ministry of Agriculture and a bulldozer was assigned to help with the repair and maintenance of these systems. All the water users of the three canals worked together to divert water from the Karnali. According to the records, the Kulariya Kulo was responsible to send 963, Rani Kulo 353 and Jamara Kulo 740 laborers each day of work for a total of 2,056 persons. Table 2 gives the actual details of the labor-days contributed in the main canal diversion work. It shows that an average of 2124 person were working each day.

Money and bulldozers made available to the irrigation system this year were obtained through the Tikapur Development Board of Kailali established in 1971. Because the irrigators' organization has no legal standing, it cannot directly receive government funds. However, Mr. Khadga Bahadur Singh is the chairman of the Tikapur Development Board. Through his influence, money and equipment were made available to the Tikapur Development Board, which channeled the resources to the East Kailali system. Mr. Singh was also able to obtain the attention of His Majesty King Birendra, who, during his Far Western Nepal tour in 1987, issued a directive to make technical manpower and gabion wire available for the improvement of these systems.

Table 2. Details of labor days involved in the main canal diversion work.

Day	Number days	Canal Subsystem	Number of persons per day			Person days	
			Working	Supporting	Total	Working	Total
6-14	8	Rani Kulo	357	163	520		
		Jamara Kulo	449	220	669		
		Kulariya Kulo	632	270	902		
		Sub total	1438	635	2091	11,504	16,728
13-24	11	Rani Kulo	667	121	788		
		Jamara Kulo	648	154	802		
		Kulariya Kulo	519	152	671		
		Sub total	1834	427	2261	20,174	24,871
24-26	3	Rani Kulo	341	170	517		
		Jamara Kulo	448	204	652		
		Kulariya Kulo	329	214	543		
		Sub total	1124	588	1712	3,372	5,136
		Total	4396	1650	6064	35,050	46,735

Source: Khadka Giri field observation record. February 1987

HISTORY OF THE AREA'S IRRIGATED AGRICULTURAL DEVELOPMENT

Some time ago, Kailali belonged to Kalwapur Raja, who was also known as Chisapani Chautariya. About 60 years ago Colonel Dhundi Raj Sahi, Bada Hakim of Bardiya, got the zamindari of Tikapur. He initiated the canal

construction, Rani Kulo being the first built.. The chaudhary of Kulariya confirms this historical event. The old people of Tikapur could identify only a few villages in existence 40 years *ago.* They are Derawali, Belwa, Laxhmipur, Satti, and Bhagwanpur. The rest of the area was covered by thick forest,.

According to the statute of Nepal at that, time, under the section of new cultivation, certain districts including Bardiya, Banke, Kailali, and Kanchanpur were encouraged to cultivate new lands. Landlords who cultivated the land were given a 10-year land revenue holiday. New villages were settled and people brought in from other areas. These people were given shelter and food and were expected to work for the landlord. The agricultural laborers kept moving from place to place and productivity was very unstable.

At present, agricultural laborers are hired on the basis of a one-year contract known as kamaiya. They receive food plus remuneration, and credit when they need it. By and large, the Tharus, who compose the majority of the agricultural labor force in this area, prefer this kamaiya arrangement. However, the laborers under this contract have little incentive to increase agricultural production.

STRUCTURE OF THE IRRIGATION ORGANIZATION

The main functionaries of the irrigation organization of the three canals are the following:

Chaudhary. The chaudhary is the chief of the irrigation system. Previously, the local landlord himself would be the chaudhary. Now, ercept in Jamara, Tharus have become the chsudhary. The chaudhary calls the meeting of badghars or assistant chaudharys to resolve issues regarding irrigation and assumes the leading role in the resolution of conflicts. He determines the date when desawar (the farmers' assembly) is mobilized for repair and desilting of the main canal. The chaudhary must be present during all labor mobilization and maintenance work. The pan chirage reports to him on the condition of the canal and dams.

Pan Chirage or Desawar Chirage. He is the messenger of the irrigation system. The chaudhary communicates to the badghar through the pan chirage. His other major responsibility is to go to the intake every other day and supervise the system. If there is a major breach or break, he reports to the chaudhary and the chaudhary, with the help of the badghars, mobilizes people to repair the system.

Badghar. The badghar is the leader in the village. His cooperation is necessary to obtain the participation of the villagers. The badghar is responsible for the village irrigation canal, the village road, and other public works in the village. The badghar settles village conflicts. He also maintains the village water distribution schedule.

He is the chaudhary's contact to mobilize villagers for irrigation maintenance. He has to bring his quota of people during the annual repair of the canal. Each year, the badghar reports how many people are coming from his village to participate in the annual repair work. If he fails to bring that number of people, he is fined.

During maintenance and repair, he has to bring an ax to clear the trees on the canal route. Therefore, he is expected to walk in front of the group.

Nandnrwa. The nandarwa allocates the area to be desilted by each village. During desawar, he specifies what is he done, how it is to he done, and certifies that the work is completed. He carries a 10-foot stick called a nan. One person per 18 inches per day in easy areas, and two persons per 18 inches in difficult, rocky portions of the canal is the basis for work allocation. His allocation of work is final,and it is strictly supported by the kulo chaudhary and other leaders.

Pachuwa. The pachuwa assists the nandarwa and works in his absence.

Lekhandaran. The lekhandaran keeps all the records. He records the attendance of the farmers in the farmers' assembly. Those who are absent from the work are fined. He is accountable to the farmers' assembly.

Budhiya. Previously, fines collected in the system as well as any unspent funds were deposited in the care of the budhiya. Now however, this function is performed by local hanks. Funds collected in the system are deposited in the banks under the joint names of the chaudhary and lekhsndaran.

Desawar (Assembly of all the farmers). The desawar takes care of maintenance and repair of the system. Desawar also refers to the time when all the farmers of the system work collectively to do major maintenance of the canals.

The farmers elect the organization's leaders and during times of crises in decision-making, the desawar helps make the decisions.

When the fines imposed could not be collected, all the members (desawar) of the system go to the village of the defaulters, and force them to pay the fine. Different methods including physical assault or damage to property are used to collect the fines. The funds collected are used by the desawar for feasting.

DESAWAR IN ACTION

The pan chirage announces the date for mohilization for canal repair work at Chisapani according to the decision of the desawar. The irrigators have to he present at the work site and stay for five days.

When they come to Chisapani they make temporary sheds and set up a common kitchen for each village. Each village brings the following items to the work site: 1) 5 kg of rice; 2) cooking oil, salt, red pepper; 3) plates and drinking glasses; 4) quilts or blankets; 5) picks (pharwas), axes, and sickles; 6) round umbrellas of bamboo (local); 7) bankas (a kind of grass to make rope) or net weaving thread; and 8) cooking pots and water cans. The cooking pots are community property which are used only for desawar.

The nanderwa carries a 10-foot long stick and the people follow him. The name of the village and amount of the work to be done is called out by the lekhandaran out of the record hook, and measurement of the work to be done is designated. As soon as the work is assigned, the people start to dig the canal. The work must be completed within a fixed amount of time. The nandarwa assigns the width and depth of the excavation to be done. When the work assignments are being made another person walks ahead of the

nandarwa carrying a 10-foot ,stick with a white cloth hanging from the top. This man's job is to establish a target that the nandarwa can see above the press of the crowd of workers in order to be able to lay out. the canal in a straight line.

If the assigned number of people from the village do not show up, the work is riot completed. The badghar or assistant chaudhary of that village is summoned by the chaudhary of the system. If the people from that village do not appear for work, the whole village is fined. Should the village be recalcitrant in payment of the fine, the desawar visits the village and obtains the fine by any means.

After the main canal desilting and intake repair work is completed, the desawar works on its distributory and field channels. Because of the flat terrain, check dams are needed at the offtake of distributories anti field channels.

Observations on Resource Mobilization for River Diversion in 1987

River diversion took 22 days of Desawar and 26 days of bulldozer work. The total number of people mobilized in 22 days was 46,000. The quantity of earthwork excavated during this period was about 30,000 cubic meters (m^3). Table 3 gives the details of the volume of excavation done by the farmers. The total volume of work done by bulldozer for river diversion was 13,936 m^3 plus the work in last year's diversion of 1,617 m^3 (Table 4).

Table 3. Volume of excavation (boulders, stones, gravel) done by farmers including support staff in the main canal diversion.

Date	Details of Work Done				Days Worked
	Length (m)	Width (m)	Height (m)	Quantity (m^3)	
6-14	785.9	20.0	1.0	15,718	8
13-24	620.4	13.5	1.30	10,888	11
24-26	208.0	20.6	0.84	3,599	3
Total	1614.3			30,205	

Source: Khadka Giri field observation. February 1987.

The total volume of boulders, gravel, and sand removed by people and machine to divert water from the Karnali into the canals is 45,500 m^3. (This is the description of only one part of the work they have completed in diverting the river. The quantity of work done by the desawar in individual canals and intakes has not been included here.)

The farmers, with support staff, were able to excavate 0.86 m^3/day (See Appendix 2). Analysis of' rates by His Majesty's Government, Nepal (HMGN) prescribes the quantity of work to be done per laborer to be 0.67 m^3/day. A comparison of the figures shows that the farmers were able to excavate more earth per day than government laborers.

Table 4. Volume of excavation (boulders, stones, gravel) done by bulldozer.

Measurement period	Length (m)	Average width (m)	Height (m)	Quantity (m^3)	Time (hr)	Output (m^3/hr)
1	34	19.0	0.54	348	5.5	63
2	300	24.8	0.43	3199	28.0	113
3	220	20.0	0.57	2508	40.0	63
Total	554			6055	73.5	82

Total hours work done by bulldozer = 156 hr
Total volume of work done on new canal: 156 hr x 82 m^3/hr = 12,800 m^3
Desilting work on old canal (4 days) = 1,617 m^3
Total volume of work done by bulldozer 14,417 m^3

Source: Khadka Giri field observation. February 1987.

The total cost incurred in mobilizing desawar at US$ 0.68/day/person (Rs 15/day) comes to US$ 32,010 (Rs 701,000). The unit cost of work done when the support labor is included comes to US$ 1.06/m^3 (Rs 23.221. This is almost exactly the government rate.

The cost per unit of work done by bulldozer comes to US$ 0.22/m^3. This does not include the costs of fuel and lubrication for the machine. depreciation, and food for the driver and helpers.

SUMMARY

Changes in the environment in which an irrigation system operates may compel the farmers in the system to use their internal resources differently. Such changes may also promote a need for the mobilization of resources external to the community. In order to adapt to the changing needs of the system, the irrigators' organization, its rules, leaders, and structure also adapt to accommodate new situations.

The example of the development of the three irrigation systems within the East Kailali command area demonstrates this dynamic principle. When the available labor force grew and the command area increased, the organization revised its basis for O&M labor contributions. The changed river course and the wide fluctuations of discharge in the Karnali required O&M resources beyond the capacity of the farmers. As a result, the farmers of Kulariya, Jamara, and Rani Kulos decided to join together to obtain external assistance. For this purpose a joint committee with representatives from each of the three systems was formed and an influential outsider was named chairman. Once again, the structure and leadership of the irrigators' organization adapted to the requirements for more extensive resource mobilization.

The structure of the irrigators' organization is closely related to the extent and type of resources it commands. Changes in resources produce an adaptive response in the organization which may go beyond the individual system level. In order to perform effectively, irrigators' organizations do not remain static. As the environment in which they operate changes, the organizations develop various mechanisms for response.

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APPENDIX 1

CLASSIFICATION OF FARMERS FOR THE PURPOSE OF LABOR MOBILIZATION EXAMPLES FROM RANI KULO SYSTEM

Farmers of the area have defined specific rules to assure that labor assignments are shared equitably. The irrigatiot. organization classifies the farmers according to the amount of land each owns, and work assignments are apportioned according to this classification. The following examples are taken from the minutes of the Rani Kulo organization's 1985 meeting.

Sadriya. Those farmers who own .03 ha or less are called Sadriya. They are exempted from work and pay only US$ 0.68 (Rs 15) for the whole season.

Kodriya. Small farmers with less than **3** ha and only one pair of oxen need to contribute five days labor per turn.

Kisan. Farmers holding more than 3.0 ha and owning two pairs of oxen are expected to provide labor throughout the time work is in progress. Each member of his household needs to work for five days in turn.

From all categories, women are exempted from irrigation work.

In March, 1985, the Rani Kulo committee consisting of leaders of three panchayats and irrigation organization leaders made the following decisions.

1. A fee of US$ 0.68/0.03 ha (Rs 15/.0.03 ha = Rs 500/ha) is charged to farmers owning 0.15–0.30 ha

2. Farmers who own a plow are assessed an additional fee of US$ 19.22 (Rs 420).

3. Farmers who own two plows must contribute labor every day that work is in progress, **plus** pay a fee of US5 38.45 (Rs 840)

4. Farmers who do not fulfill their obligations to provide labor will be summoned for repair and maintenance work and fined for the days **of** absence at the rate of US$ 0.68 (Rs 15) per day through the badghar. If the badghar does not obtain cooperation, the case is reported to the panchayat. Finally, if results are not achieved through the panchayat, desawar makes the final decision, and the entire assembly of farmers will force the defaulter to comply.

5. Funds held by the organization are used for the following: a) to pay annual allowances to the chaudhary (US$ 27.40 [Rs 60011, nandarwa (US$ 21.92 [Rs 480]), lekhandaran (US$ 16.44 [Rs 360]), and pachuwa (US$ 5.48 [Rs 120]); b) to organize the feast for desawar; and finally, c) the surplus is deposited in the bank.

6. The committee meets and decides the main **issues** before desawar.

7. Accounts of the organization are settled at a meeting at which the pradhan panch (panchayat leader), chaudhary, badghar, and kisans are present.

APPENDIX 2

EXAMPLES OF THE RESOURCE MOBILIZATION IN 1987

Field measurements were taken during resource mobilization in 1986/87 for main canal diversion wrrks. The comparative figures of work performance in man-days and volume of the earthwork done is indicated in Table 5.

Table 5. Analysis of work output per person.

Excavation (including support persons):

30,205 m^3/46,735 person days = 0.65 m^3/person/day

Excavation (without support persons):

30,205 m^3/35,050 person days = 0.86 m^3/person/day

Table 2 indicates that the total person days employed in the main canal diversion was 46,735 with actual work done (not including the supporting persons) amounting to 35,050 person days. Performance of the laborers in excavation work per day as seen from Table 5 is 0.86 m^3/day. The quantity of such works assigned per person in the analysis of rates (9) suggested by HMGN for the purpose of labor requirement estimations is about 0.67 m^3. The farmers were able to excavate more earth per day than government laborers. Being more motivated to complete the job, the farmers may have worked more hours per day.

At the same time a bulldozer was mobilized for 26 days to remove the mixed deposit of sand, gravel, and boulders. The total quantity of deposits removed by the bulldozer was estimated to be 13,936 m^3 with additional desilting work of 1,617.0 m^3.

The total cost incurred in mobilizing desawar at the rate of US$ 0.68 (Rs 15.0) per man-day is US$ 32,010 (Rs 701,000) and the per unit cost of work done comes to US$ 1.06/m^3 (Rs 23.22). This rate is almost exactly the same as the government rate which is US$ 1.05/m^3 (Rs 23). However, if the supporting work for food, etc., is not included as it would not be in the government rate, then the per unit cost of work is US$ 0.79/m^3 (Rs 17.30).

Resides depreciation on capital cost, the total amount of money assigned for bulldozer by the government was US$ 3,425 (Rs 75,000). The cost per unit of work done by bulldozer at this amount is US$ 0.22/m^3 (Rs 4.82). In addition, the beneficiaries also paid fuel and lubricants for the machine and food for the driver and helpers.