Main System Management Mahakali Irrigation Project Kanchanpur

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1. Introduction

1.1 System Description

Mahakali Irrigation System (MIS) Stage I starts eastward from the western-most point in Kanchanpur district. It encompasses an area of 4600 ha just south of Bhabhar Zone. It is a compact, well laid out, perennial system, guaranteeing intensive irrigation throughout the year. The system extracts water from Mahakali River through the Sarada Barrage constructed by the British Indian government during early part of the current century.

The 1920 agreement stipulates that Nepal's share of water is 460 cusecs during Kharif, 15th May to 15th October, and 150 cusecs during Rabi, 15th October to 15th May. It lays down two more conditions; 1. that a maximum supply of water up to 1000 cusecs can be provided, if the supply is available and 2. that if the canal head, during Rabi season, is alternately closed and opened for 10 days at a time, the canal will run 300 cusecs whenever it is opened.

In the early seventies HMG - Department of Irrigation (DOI) - started designing and constructing a main canal that would have 1000 cusecs capacity to irrigate 5000 ha. By 1975 the main canal and some major secondaries were completed, but not more than 3400 ha could be irrigated due to water management problems. In order to update the system and layout an extensive command area, development networks with IDA credit was sought. A World Bank loan became effective from 1981. The system, known as Mahakali Stage I, has been operational since mid 1988. A network with 14 Km of long main canal, 10 distributaries and minors, and nearly two hundred tertiaries supplies water to the fields.

The command area is well connected, having gravel roads running through to canal banks and some off canal roads. North-south running principal drains, fed by tertiary drains, drain-out excess water from the command area.

A Pilot Farm has been set up for promoting the establishment of new irrigated farming methods. It demonstrates on-farm water management and provides in-service training for extension personnel and farmers.

The prevailing climatic pattern is monsoon. Of the 80% probable annual rainfall of 1422 mm, 88% falls from June to September; the rest occurs during the winter months. The mean daily temperature ranges from 14.7°C in January to 30.6°C in May.

The standard cropping pattern followed in the area is - monsoon paddy followed by wheat in winter. In the upland, maize is followed by oilseeds. About 100% of the area during Kharif and 92% of area during winter is cropped. The latest cropping intensity is 192.5%, exceeding the staff appraisal report (SAR) target of 165%. Besides the principal

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crops of rice, wheat, maize, and rape-seed, some vegetables are also grown. Sugarcane farming is another alternative crop.

More than 85% of the households belong to small landholders, owning less than 2.38 ha (3.5 bigha) of land, 70% of the households are big landholders, and about 12% of the owners have landholdings between 3.5 to 7.5 bighas. Excluding the few large landholders, the farmers till their land themselves.

The benefit of irrigation is slowly percolating down. The 1990/91 project evaluation puts the average farm household income at Rs. 26,343 per annum. The net benefit to the farm family for a small, medium, and large farm is believed to be Rs. 12,185, Rs. 33,414, and Rs. 70,549, respectively. The incremental benefit accrued to small and large farmers from 82/83 to 90/91 is more than five fold.

Figures on literacy and education similarly give an encouraging picture - 68% to 55% of the population has had formal schooling. Improved housing and possession of material goods such as bicycles, radios by individual farmers indicate a general degree of wealth in the command area.

The Project is administered by Mahakali Irrigation Development Board working under the Ministry of Water Resources. The Project authority, stationed at Mahendranagar in Kanchanpur district, is directly responsible for operation of the water distribution system down to the level of off-takes from the tertiary canals. The operation and maintenance (O&M) unit, consisting of a Senior Engineer, two Assistant Engineers, and four Overseers has been set up. Gate operators, inspectors, supervisors, and canal men (Dhalpas) work under the control of block overseers to operate and maintain the system.

1.2 User Group Formation

The Mahakali System is probably one of the more intricately designed Projects in current operation. Its success depends on proper observance of a rotational water supply schedule, and efficient utilization of on-farm irrigation - both factors depend exclusively on active participation by the farmers. Participatory management below the tertiary level has been initiated over the 3 years. Farmer participation at different levels has been institutionalized, and at field level, a measure of successful implementation of these methods has begun.

The users groups have been constituted at different levels in accordance with the Water Resources Act 2024 and Irrigation Regulations 2045. For this agency managed system, the said regulation envisages full control by user representatives in operation and maintenance below tertiary levels. A monetary incentive in the form of 25% of the total water tax collected within a particular tertiary command is to be retained by the concerned user group as a source of income apart from other resources they may be able to mobilize. The upper level user groups, elected from below, coordinate the lower group's activities. They help the agency in operation and maintenance of intake on the main and secondary canals.

2. Operation and Maintenance Procedures

2.1 Operations

Mahakali Irrigation System has to meet the irrigation needs of more than 11,000 ha. Presently, 4600 ha in the Stage I area gets a sufficient water supply, having less rotation, until the Stage II system is completed. The project prepared a rotational schedule based on the total command area of Stage I and II. Water availability in the main canal is variable; less than 1/3 of summer flow is available for rabi crops during

winter. A secondary canal rotation has been designed that takes into consideration the cropping patterns followed by the farmers in the command area.

The total command area in Stage I is divided into four rotational groupings of roughly equal size. The main canal runs continuously throughout the year, except when the Main Canal Head Regulator is closed for Headworks repair, which is usually timed during April for 3 to 4 weeks. During the summer, three rotational groups are "on" while one is "off", and during winter one group is "on" while 3 groups are "off". The design is for one irrigation period per week. The irrigation periods for critical rice seedlings and wheat cultivation are of 4 days duration; ie 12 days "on" and 4 days "off" during rice planting, and 4 days "on" and 12 days "off" during wheat season. These periods could be changed according to the farmers demand and practices.

To achieve water distribution management, the exact amount of water received in the main canal and the flow into different secondary groups according to the schedule must be known. To do this different control structures on the main canal and secondary canals have been calibrated. Rating curves and tables for each important structure have been prepared. At the head of the main canal, right at the Indo-Nepal border, a check weir has been constructed to measure the discharge coming into the system. Discharge is also measured at each head regulator of secondary canals, major escapes, and bridges though which canal flow runs.

The main operations in water distribution management are budgeting, issuing, monitoring, and adjusting. With the rotational system adopted, the gross amount of water to be discharged into each secondary head is 1.0 l/s/ha of command area plus an allowance for losses in the secondary. So far, observations give this loss coefficient as 10%. As the secondary operates at full supply level (FSL), there is only one discharge for that secondary. The budgeted discharge is translated into gate openings and heads over weir crest. In some secondaries this calibration has also been done on check drops.

A gate operator/supervisor is trained to read these levels on structures where levels are painted with the designed level. The discharge passing through the secondary head is monitored up to the tail of the secondary system, including its tertiaries. In blocks I and II, until the system is made compatible to Rotational Water Supply System (RWSS), each tertiary gate has to be opened and the discharge adjusted by gate operators. In blocks 3 and 4 the gates are welded; hence, all tertiary gates work as an orifice passing a particular discharge according to the designed FSL.

To measure actual flow passing through a tertiary, measuring weirs were built and calibrated in blocks 1 and 2. They were placed immediately after the tertiary regulators, where one can read the actual discharge passing through each canal. If the flow is more or less, the regulator gate is adjusted accordingly. In blocks 3 and 4 where tertiaries have the same discharge, the gate at the head has been adjusted to measure each tertiary canal flow by means of a fabricated measuring weir. Such flow measurements can be examined by the users.

Before blocks 1 and 2 are converted into RWSS, each tertiary will be adjusted to 1 l/s/ha by actually measuring the discharge passing through each of them. So, irrespective of the operational methodology in each block, the flow is monitored and adjusted accordingly. As evident from the above blocks 3 and 4 are easier to operate. Distribution from the outlet is adjusted by opening the outlet and closing the downstream flow in tertiary by a check gate, which is switched over to the outlet when flow in that particular chak is to be stopped.

Operation of the system below tertiary head is carried out by the WUG - the tertiary committees which have been functional for some time in the project. There are two rotations to run. One is between different outlets and another between different farmers within one outlet. If a certain secondary system is 'on' for 7 days, each outlet in

a seven outlet tertiary will have twenty four irrigation times, and each farm within that outlet will have to take their turn and time in proportion to their land within a total of 24 hrs. Unless a uniform system of field channels are made, dividing total land within one outlet into basins of consistent size (MIP suggests basin size as 0.1 ha), irrigation for each plot is not possible.

MIP has been insisting that the farmers learn to accomplish on-farm irrigation development. Tertiary Committee (TC) members, who are outlet leaders, are slowly becoming aware of this need, and they are persuading users to construct their field channels. In most outlets at least one principal field channel has been constructed by the farmers. Because the System goes into full rotation after Stage II is operational, the actual significance of rotational water supply has not been felt by the users.

Unlike other irrigation systems, Mahakali Project has its own Agricultural Pilot farm with several officers and an expert consultant agronomist. These people have been training the command area farmers to adopt new farming practices, introducing improved seeds, pesticides, fertilizers, and etc. The agriculture farm and Farmers Organization Division have been eliciting the farmer's ideas regarding a calendar of irrigation supply, adequacy, and efficiency. Now, that the farmer's organizations have developed, its views will be solicited.

2.2 Maintenance

Maintenance consists of regular activities such as; desilting of beds, keeping canal bank in proper level, slope maintenance, clearing of weeds, and oiling or greasing of gates. Emergency maintenance operations might occur due to a serious malfunction - like bank breaches and blocking or overtopping drainages.

Before preparing a yearly maintenance schedule, a block-wise field visit is made. The visiting team includes the Project Manager, O&M Chief, concerned block Engineer and Overseers, the Project Consultant, and the Farmer Organization Division Coordinator, who works as an institutional development consultant. The team meets with the farmers and their respective organizational representative at the site. Engineers, Project Consultants, and farmers discuss different problems faced by the beneficiaries, their likely solutions and measures to be adopted. This information is collected from every site visit and entered into the computer. After processing, the year's total maintenance schedule is prepared, and prioritized. Block Overseers and Engineers then carry out a field survey, taking measurements to prepare a detailed design estimate and technical report. Before the work is approved, the beneficiaries agree to the maintenance operations through their representatives. The steps taken to involve the beneficiaries in system management, aim to clarify official procedures.

To convert blocks 1 and 2 into RWSS more outlets are added, outlet commands are adjusted, gates are replaced, and turnouts are repaired and adjusted to pass only calculated quantities of water into the fields. These operations are taken up as a part of regular yearly maintenance. For this, a team consisting of members from the water management unit, design section, O&M division, and Farmer Organization make a joint visit with the concerned water user's committee members at each tertiary. This team visits the tertiary command and meets the user groups to explain what is being proposed. They fix outlets to be retained or added to allow the designed flow through the outlets, make inventories of any other works like drainage and road crossings to be made, and look to see if erosion control measures need to be added. Designs and estimates are prepared and after approval from the project management, construction work is carried out.

2.3 Roles and Responsibilities

The current irrigation regulations applied to the agency managed system clearly divides operation and maintenance responsibilities between agency and beneficiaries by canal category. Primary and secondary canals are under the agency's control, and tertiary systems downward belong to the users. Participation in management is rewarded by sharing a water tax levied at a 3:1 proportion between Government and Water Users Association, with the proviso that TCs help collect the water cess. Users that participate in the agency's management of the main canal system, are advisory. Water User Associations derive strength from the efficient workings of their respective tertiary committees. They must know their rights and responsibilities in administering the canal system. The beneficiaries operate, maintain, and run the system.

In a rotational system, the TC has to rotate irrigation schedules between different outlets within the allotted time. Conflict resolution between outlets have to be sorted out. Within one outlet command, the outlet leader, who is a TC member, has to rotate irrigation between different farmers. For efficient management, on-farm irrigation has to be followed according to crop design and staggered plantings may be needed.

The land holders should agree to sacrifice their land for laying out field channel networks. This is the responsibility of the users themselves. TC members are requested to educate and convince the individual users to divide their land into small basins to maximize irrigation benefits. Attention should be paid to layout, maintaining the tertiary drain so that excess water can be drained off from each outlet command into a permanent drain. The Mahakali Project is now, extending this concept from the design phase to Stage II areas that are under construction.

The power of sanctions for maintenance and operation of tertiary systems and below rests with the tertiary level committees. They are empowered to make rules to control stray cattle within their areas, make their own cleaning and desilting schedules, and impose fines and penalties for the defaulters. Some of the TCs have already started exerting their full rights and sanctions. The agency has been seeking the higher committee's help to generate people's willingness to protect secondary and main canals from being cut and breached. Acceptance of the rules by all users is better than threat of coercion.

3. Impact of Main System Management

The ease of operation with a fixed quantity of water in the main canal enables MIS to provide equitable distribution of water to the field. When blocks 1 and 2 of the system are converted to RWSS, full rotational schedules can provide equitable distribution of water up to the tertiary head all season. From the tertiary head below, efficient and equitable distribution will depend upon the outlet and tertiary groups. However, to achieve equitable distribution of water at the farm level, on-farm irrigation methods need full development. The system offers an adequate supply of water most of time. The only time it is likely to be under pressure is in December and again in March. Staggered sowing of wheat or adoption of non-traditional cropping patterns, using pulses and oilseeds would ease water demands at all times.

The productivity reached in food grain cultivation show that the average yield of most crops have increased substantially over the years. For the principal crops as much as three times the pre-project figures were reached (192.5%).

4. Conclusions

4.1 Problems and Issues Encountered

Operation, maintenance, and supervision of canal networks in a well developed command area system by a centralized agency, even if it is strongly staffed, is quite a herculean task. Observing kilometers of canals, scores of smaller structures, and supervising water distribution spread out over thousands of hectares is such a complex task that the Government rightly decided to hand the job over to the beneficiaries. This eliminates inefficiencies that are generally associated with the bureaucracy, and gives the beneficiaries a sense of ownership and pride in running their own system according to their needs.

The experience at MIS has not turned out as expected. It took a long time to elect outlet leaders and set up tertiary committees; even in blocks where the distribution system was running smoothly. Individual farmers are still reluctant to let their land be utilized to construct field channels, and wherever field channel construction posed a problem, farmers wanted to have their separate outlets.

The farmers are not aware of basin irrigation. Field to field irrigation takes more time, so the farmers are never sure that the designed flow in the canal and the time allotted for irrigation is sufficient. Also, land that was not leveled reduced the benefits of irrigation. The concept of chaks with 4 ha could have been suitable, had there been fewer owners.

The success of participatory management programme would depend upon attitudes of agency managers and Engineers. They have to be sympathetic to the farmer's problems, listen to their complaints, and be responsive to their needs. Apart from their own vocation, they have to learn to listen to the farmers and practice some Social Engineering. Few officials of proper calibre measure up to this requirement amongst DOI's present breed of middle and lower order management. Availability of sufficiently motivated manpower to run the programme is likely to be a major constraint.

Apart from these issues, prevalent in any irrigation system is the general attitude of farmer's towards the system. The farmers acceptance of participatory management and his desire to benefit from the system is paramount. The agriculture extension programme, availability of agricultural inputs, and access to the market for the farmers output would determine the success of any programme targeted to the farmers.

This particular system has been able to change the quality of life for the command area inhabitants over the years. But, strangely, the general public does not appreciate this fact. It could be either that changes have been too fast and the system is too sophisticated, or that people are not able to understand correctly how to take the full benefit. There is such a deep sense of apathy toward the government's projects, that people refuse to fully comprehend a system basically built for their benefit, making them hesitant to take over operation of the lower canal system.

4.2 Lessons Learned

The participatory system of management has just started to work. Inter-beneficiary conflicts occur less often for the administering authority and people by and large have started clearing their canals. Farmers now approach their own association before erecting field channel networks or making improvements in the system.

Communication has begun between the farmers and agency, but they still have not developed full trust and confidence in each other. What is needed is to continue to run the programme patiently and try to sustain it with new means where it has started to take root. We have quickly introduced new policies, but quicker still to abandon them

without giving them a reasonable chance of success. It is imperative at this point in time that this experiment has a fair trial. Although there have been pitfalls, participation by the beneficiaries in System Management is transmitting encouraging signals.

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