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Performance Evaluation of Irrigation Projects - A Case Study of Lift Irrigation Scheme Sirsa Manjholi in Solan area of Shivalik Himalayas

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ABSTRACT: A Case study was made to assess the performance of irrigation water management of Lift Irrigation Scheme Sirsa Manjholi in Solan area of Shivalik Himalayas. The study was carried out from June 2010 to June 2011. The study has pointed out that the physical performance of lift irrigation scheme is poor. The construction of this scheme has not resulted in any change in cropping pattern of the command area. There are no permanent diversion head works to divert the river water. The water level of the river is going down day by day due to rampant mining of the river bed material. The Krishak Vikas Sangh is non-functional and there is little involvement of farmers in water management of the scheme. The water charges are a very low and that too are not being collected.

Keywords: Irrigation water management; Shivalik area; Sirsa Manjholi; Krishak Vikas Sangh.

INTRODUCTION

Irrigation is of major importance in many countries of the world. It is important in terms of agricultural production and food supply, the income of rural people and public investment for rural development. However there is wide spread dissatisfaction with the performance of irrigation projects in developing countries [1]. India has moved from the specter and actuality of food imports and periodic famines to self-sufficiency since early 1970s' food exports and
progressively more diversified production [2]. Despite their promise as engines of agricultural growth, irrigation projects typically perform far below their potential [4]. Head-tail problems, leaky canals and malfunctioning structures because of delayed maintenance leading to low water-use efficiency and low yields are some of the commonly expressed problems [4].

The economic performance of Indian agriculture has been closely related to changes in agriculture production [5]. Increases in agricultural productivity, in turn have been partly attributed to substantial increases in the irrigated area [6-9]. Agriculture accounts for 80% of consumptive use of water and is at times even recorded to be higher than 90% [10]. The rise in irrigated area came about with massive irrigation investments. These investments began in the 1960s and peaked in the 1980s, but in the early 1990s, public spending in agriculture slowed down and this translated into reduced spending in irrigation [7, 11, 12]. Gross capital formation in agriculture declined from an average of 54% in 1980-81 to 26% in 1999-2000 [13]. However there have been recent efforts to reverse this trend in investments in water related infrastructure, including irrigation [14-15].

Performance assessment is an essential component of performance management. The performance assessment system is seen as the information system which enables performance management process to function effectively and efficiently [16]. Performance assessment provides the information needed to assess extent to which an organization delivers value and achieves excellence [17].

In this study, the irrigation water management of Lift Irrigation Scheme Sirsa Manjholi in Shivalik hills of Himachal Pradesh was assessed with performance indicators such as farmer's satisfaction as well as

other physical and financial parameters.

Background: Irrigated agriculture is essential for food security but the performance of the irrigation sector is not consistent with the needs for future food security. As an endeavour, Lift Irrigation Scheme Sirsa Manjholi was one of the pilot schemes constructed under Himachal Pradesh State sector to improve the well-being of farmer's community. The Lift Irrigation scheme Sirsa Manjholi is located on the left bank of the Sirsa River, a tributary of Satluj River on Nalagarh- Ropar road at a distance of 7 kilometer from Tehsil head quarter of Nalagarh in District Solan. The command area is located at an elevation ranging between 300 to 304 metre above mean sea level (msl). The average slope of the topography in the command area varies between 1 and 3% [18].

The topography of the area is represented by moderate hills and plain valley. The valley comprises of sandstone largely micaceous with maroon and buff clays alternating one by one. The Nalagarh valley is 8-10 Km, wide and extends in NW-SE direction. It is flanked in northeast by the high Kasauli hills and in the southwest by low height Shivalik hills. This valley is drained by Sirsa River that enters Himachal Pradesh in the Solan District near Baddi and flows straightway to Punjab and finally meets Sutlej near Ropar. The topography of the area is characterized by seasonal nallas (streams) which used to erode the fertile land and sometimes spread sand and debris in the fields.

The scheme is located in the agro-climatological zone I of Himachal Pradesh. The general climate in the area is sub-tropical with an annual rainfall varying between 750 and 1,500 mm and mean temperatures ranging from 15 to 29^0C. The rain gauge station is located at Nalagarh [19].

MATERIAL AND METHODS

Evaluation of the technical functioning and the practical management of Lift Irrigation Scheme Sirsa Manjholi with regard to sustainability was an important aspect of the methodology. The following procedure was adopted to generate the necessary data to accomplish the present case study.

- To understand the intricate and numerous relations and processes in a local situation requires spending time within the command area and with the irrigators' community. A combination of a variety of working methods helped to get access to the many aspects of the scheme's functioning. The methods used consisted mainly of direct field observations which were conducted during June 2010 to June 2011.
- The key-entry was to talk with a large number of stakeholders who were directly involved in the scheme such as farmers, members of the KVS, pump operator, Patwari (village level revenue official) Junior Engineer & agriculture extension officers. Such a practical, on-site, method helped to crosscheck the information gathered from various sources and to understand the practical hurdles as well as their possible solutions.
- To assess the adequacy and efficacy of existing infrastructure of this irrigation system, the water lifting capacities of pump sets installed at first stage was measured. To measure the discharge of each pump a duly calibrated 90° V notch was used at delivery tank of the first stage of irrigation system.
- The secondary data were collected from estimates, reports, and returns of Irrigation and Public Health Department, and other offices and Departments of Government.

1. Description of Lift Irrigation Scheme Sarsa Manjholi: The Lift Irrigation Scheme Sirsa Manjholi was completed and commissioned at an estimated cost of Rs.8.37 lacs during 1981. The main components of scheme are shown below in Table 1.

Table 1: Salient Features of Lift Irrigation Sirsa Manjholi.

Sr. No.	Components of Scheme	First Stage	Second Stage
1	Pumping Machinery	3 Nos Pump sets each of 50 H.P. (One stand by)	3 Nos Pump sets each of 25 H.P. (One stand by)
2	Total Head	37.5 m	52.00 m
3	Discharge of each pump	64.25 Litres per second (LPS)	16.27 Litres per second
4	Rising Mains	300 mm diameter Cast Iron pipes = 555 m	200 mm diameter Cast Iron pipes= 975 m
5	C.C.A.	141.89 hectares	41.52 hectares

Source: Irrigation and Public Health Department, 2011

The Scheme was constructed in two stages by diverting water from Sirsa River through a temporary earthen bund and 500 metres long unlined feeder channel. There was no permanent diversion structure The full discharge for CCA of both the stages is lifted at first stage. From the main delivery tank, the CCA of 141.89 is provided irrigation and balance quantity of water is conveyed through gravity constructed to divert the river water and the existing feeder channel is also temporary and unlined, which get damaged in every rainy season and reconstructed thereafter to provide irrigation. main cum distribution line of 300 mm diameter reinforced cement concrete pipes to an outlet (in village Manganpura) at RD 780 meter and there to sump well of second stage located at RD 1210 metre.

To improve the water use efficiency (performance) of this irrigation scheme, the chak development of the command area (or Command Area Development) was completed at the cost of Rs. 17.50 lacs in the year 1992. Thus water was further distributed through a network of 2350 metre main channels, 2400 metre long RCC pipes of 150 mm and 250 mm diameter, 8700 metre lined field channels, and 7800 metre unlined field channels. Each chak outlet was designed to serve approximately 6 to 8 hectare of land and feeder field channel for approximately 2.5 hectare of land. Sluice gates in the field channels were provided for control of the water supply to the beneficiaries on rotation basis which were missing at ground. The lay out plan of the scheme is shown in Fig 1.

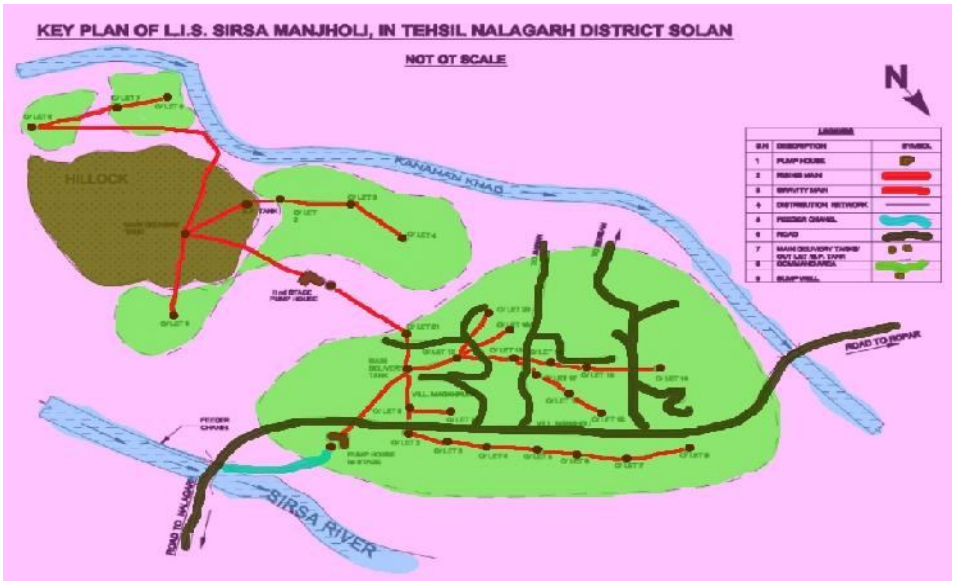

Fig. 1: Key Plan of Lift Irrigation Scheme Sarsa Manjholi.

2. Operation and Maintenance:

For management of irrigation water and minor repair beyond the outlets, Kisan Vikas Sangh (KVS) have been constituted and registered under society Act 1961. The Kisan Vikas Sangh has been formed separately for each stage of the scheme, during 1992. The KVS was entrusted the responsibility to distribute the water and to resolve the disputes, if any. For distribution of water, the Chairman of the KVS would sign the requisition slip mentioning the name of the beneficiary, and the allocated time. The requisition slip then has to be handed over to the pump operator for making entries in the log-book and release of water. In addition to the distribution of water, the repair and maintenance of field channels was the responsibility of KVS.

Table 2: Monthly Pumping Hours

Sr No.	Month	Pumping Hours									Designed Pumping Hours
		1989	**1990**	**1991**	**1999**	**2000**	**2001**	**2009**	**2010**	**2011**	
1	January	45	87	186	220	134	61	168	70	0	**375.34**
2	February	102	71	200	320	81	132	142	160	8	**340.21**
3	March	188	187	129	142	228	221	260	243	198	**473.56**
4	April	120	106	147	151	87	35	7	69	0	**474.87**
5	May	58	46	86	44	64	85	33	18	0	**267.45**
6	June	123	183	173	150	109	112	104	0	0	**285.74**
7	July	64	37	98	28	70	77	56	0	0	**0**
8	August	71	160	47	32	0	54	0	0	0	**0**
9	September	203	200	225	264	245	507	437	428	369	**0**
10	October	201	414	248	220	289	362	418	431	383	**479.00**
11	November	212	648	478	466	482	578	449	487	464	**462.39**
12	December	268	547	494	417	468	562	434	499	395	**410.35**
13	Total	1655	2686	2511	2454	2257	2786	2508	2405	1817	**3568.91**

Source: Irrigation and Public Health Department

However, the Irrigation and Public Health Department had to maintain the scheme up to the outlets. Both stages of this irrigation scheme worked satisfactorily till 2002. However, the first stage of the scheme was in operation intermittently as evident from the monthly pumping hours given Table-2.
Table-2 also indicated that scheme ran close to the designed hours only in the months of November & December of rabi crop seasons. In the remaining months of the year, the running of pumps was far less than the required (designed) hours. Similarly, it was observed from the log books of second stage of this scheme that pumps run for 370 hours, 506 hours, and 636 hours during the year 1999, 2000 and 2001 respectively. It became nonfunctional after 2001, following heavy damages to rising mains & gravity mains due to road construction from village Jhiran to Lakhanpur.

RESULTS AND DISCUSSION

It has been noticed that although the KVS were registered but they were nonfunctional for all practical purposes. In absence of any schedule of rotation of water, it was common for farmers to divert water to their fields and take water for much longer than is due to them. The underground pipes were cut by the farmers at many locations to create leakages which were used for irrigation. The quantity of water as well as its timeliness was a major issue for the farmers of second stage as the farmers of first stage use more water, more frequently than their share. The inadequacy and non-timeliness of irrigation water has given rise the need of private irrigation systems in the form of bore wells. More number of private tube wells has been observed in the area where there was problem in availability of water. And in the command of this scheme there were 35 private tube wells which were well maintained and water was sold also to the farmers who did not own a tube well. The village wise numbers of tube wells are as given in Table 3.

Table 3: Village wise Tube Wells in the Command Area

Sr. No.	Name of village	Number of Tube wells
1	Manjholi	8
2	Maisatibba	7
3	Busan	8
4	Maganpura	6
5	Saini Majra	5
6	Lakhanpura	1
7	Total	35

Source: Survey data

Since the establishment costs and operation and maintenance (O & M) expenditures are borne by the State Government and farmers have to pay a very low water charge of Rs**.** 25.10 per hectare per crop [20]. Therefore despite having their own tube wells, farmers continued to get water from the Government owned irrigation scheme because of highly subsidized water rates which were also not collected for the last many years by the Irrigation & Public Health Department. Perry (2001) argued that if "charges are low or not collected at all, the direct beneficiaries of irrigation receive the services at the expense of economy in general" [21]. It means such arrangements affect the economy of the State adversely. The argument of Government against irrigation management by the farmers is that users have a lackadaisical approach in the management of public resources, which effects the functioning of the system. Even though the Government operated Lift Irrigation System is financially stable, it lacks effective management and timely maintenance. The main reason is that the Government system causes a time lag in the essential repair and maintenance and the current needs deferred repeatedly. In addition, commencements of new projects ignore the existing schemes and resources for up keep of old schemes are further delayed.
It has been observed that cereal crops are dominantly grown in the CCA of this scheme. For the sake of comparison cropping pattern observed at an interval of a decade e.g. in the year 1990 i.e. before carrying out command area development, in the year 2000 i.e. after completion of command area development, and in the year 2010 is presented in Table 4.

It has been noticed that Lift Irrigation Sirsa Manjholi envisaged providing irrigation for 183.41 hectare, and scheme provided irrigation to the targeted beneficiaries for twenty years from the day of its commissioning to 2002. After 2002, the second stage of this scheme covering CCA of 41.81 hectare, i.e 22.6% of total area, became non-functional primarily due to damage of gravity main cum distribution RCC pipe line of 300 mm diameter from delivery tank of first stage to outlet No. 7 and from there to sump well of second stage and neglecting the essential repair and maintenance of distribution network and other allied components.

Table 4: Cropping Pattern after an Interval of a Decade

Crop	Rabi (Area in Hectare)			Kharif (Area in Hectare)			Off season (Zaid) (Area in Hectare)		
	During 1990	During 2000	During 2010	During 1990	During 2000	During 2010	During 1990	During 2000	During 2010
Wheat	145.00	115.90	119.45	-	-	-	-	-	-
Pulses	9.00	1.50	0.10	-	-	-	-	-	-
Fodder	20.00	23.50	29.76	-	-	-	-	9.50	14.67
Vegetables	9.00	5.00	0.32	7.00	3.50	0.85	-	2.00	-
Maize	-	-		110.00	129.00	131.67	-	-	-
Paddy	-	-		44.00	43.50	45.80	-	-	-
Pulses	-	-		20.00	1.50	0.21	-	-	-
Total	183.00	183.00	149.63	181.00	177.50	178.53	0	11.50	14.67

Data Source: Irrigation and Public Health Department, Survey Data, 2011

Also the rising main of second stage has been damaged during construction of link road to village Lakhanpura. The deferred repair and maintenance led to apathy among the farmers towards agriculture which is highly detrimental to the sustainability of the irrigation systems in particular and to the State or country in general.

It has been noticed that the first stage of the scheme remain operational for a few months in a year and as evident from the details of pumping hours (Table 2). The monthly pumping hours reveal that first stage was working & supplying the irrigation water to the beneficiaries during the rabi crop seasons only. This situation is the result of improper physical layout of the feeder channel, gravity mains, distribution network, field channels, outlets, non-construction of permanent diversion head works, and long non-repair of various components.

It has also been observed that the command area of this scheme was threatened by nallas (streams) which used to erode the fertile land and sometimes spread sand and debris in the fields. The topography of the command area accentuated the gully formations into the fields. The excessive soil erosion from RD 500 to RD 590 metre due to khad Kanahan has damaged the gravity main cum distribution pipe line of second stage from village Jhiran to village Lakhanpur.

It has been noticed that animal husbandry and dairying is one of the primary means of livelihood. The livestock population in these villages at times exceeded the human population. This results in heavy pressure on the commons land (grazing pastures) in spite of stall feeding being taken up, especially in the case of buffalo rearing.

Above all, the success of a system is strongly related to user participation in managerial affairs. Since farmer participation in management of the scheme is lacking, water distribution network is in dilapidated condition. It has been revealed by the field staff of this scheme as well as by the farmers and other local elites that the watercourse of Sirsa River has been changing. They attribute the change in water course mainly due to unscientific rampant mining of sand, gravel and stone from the river bed. They also divulged that sand mining in the riverbed has lowered bed level appreciably and resultantly lowering in water level which makes it difficult to pump water during non-monsoon season. Thus water lifting was not sufficient, especially during the winter and summer months i.e. January to June every year. And consequently farmers of the command area did not opt high yield varieties crops or cash crops which

deprived them from better farm income.
It has also been observed that non construction of permanent diversion structure to divert the river water and unlined feeder channel need avoidable recurring expenditure in raising the diversion bund and desilting the unlined feeder channel after every rainy season for restoration of scheme.

CONCLUSION

In the present study the following conclusions can be drawn. The construction of this scheme has not induced any change neither in cropped area nor in the cropping pattern of the command area. Thus the irrigation system has yielded the low returns and the performance of lift irrigation scheme was not satisfactory. There were no permanent diversion head works of the scheme. The water course of the river Sirsa, which is source for this scheme, is changing frequently and its bed level is going down year after year due to rampant mining of sand, gravel and stone as there is heavy construction activity in the near vicinity. The study has shown that the involvement of the farmers in planning and management of scheme is minimal as the KVS is non-functional. The 22.6% of CCA is not getting any water from the scheme.
The remaining area i.e 141.81 hectare is getting water only in July to December months because the water level in river goes down in other months and it is not possible to lift water for the scheme. The cropping intensity was found 198.90%, 203.28% and 187.34% during 1990 (almost after a decade of construction of irrigation scheme), 2000 and 2010 respectively. This mix change was due to installation of number of private tube wells in the command area of the scheme. It was also noticed that the water tariff rates being charged in Himachal Pradesh are very low and that too are not being collected by the Government.

RECOMMENDATIONS

On the basis of study the following recommendations can be made. On technical and economic grounds, it is suggested that the command area of any lift irrigation schemes should be determined on the basis of topographic features. Further, an undulating land demands a small irrigation set-up for effective performance.
To overcome problem of lowering of Sirsa River bed level to non-lifting level of water at the water-pumping site from January to June it is suggested that suitable permanent diversion structure be constructed and feeder channel be lined. There should be enforcement of Mining Act to check rampant mining of river bed material. To tackle the problem of soil erosion and gully formations in the command area of this scheme, the construction of small check dams and other vegetative treatments need to be taken up. For the economic well-being of a majority of the farmers, the intensification and diversification of agriculture is required which can be achieved through farmer's participation and imparting extension services by Irrigation and Public Health Department and Agriculture Department.

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