

Paper 1: Impact Assessment of Irrigation Management Transfer in Selected Irrigation Systems in Nepal

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INTRODUCTION

The efforts of irrigation management transfer in Nepal started from 1992. This report presents the results of a study carried out in Nepal to assess the impacts of irrigation management transfer. Specifically, it assesses the impact of recent management changes on the performance of irrigation schemes. The analysis is based on data obtained from a surface irrigation scheme (West Gandak), and four groundwater irrigation schemes, which come under the Bhairahawa Lumbini Ground Water Development Project (BLGWP).

The report begins with an overview of the irrigation management transfer program in Nepal followed by the scope and objectives of the study. The next section outlines the methodology. The results of the analysis are presented next. The final section presents the principal findings of the study.

IRRIGATION MANAGEMENT TRANSFER POLICY AND PROCESS

In 1992, His majesty's Government of Nepal adopted a policy to transfer the responsibilities for the operation and maintenance of entire irrigation systems with command areas of less than 500 ha in the hills and 2,000 ha in the plains (terai) to water user associations (WUAs). Schemes with larger command areas were initially to be jointly managed by WUAs and the Department of Irrigation (DOI). At subsequent stages, WUAs were to be made increasingly responsible for the management of the schemes (Irrigation Policy 1992, and its first amendment 1997).

Up to now, the management of four surface irrigation systems, and about 60 tube well schemes have been transferred to WUAs. Under World Bank-supported "Irrigation Line of Credit", irrigation management of about 24 small irrigation systems have been devolved to WUAs. About 30 schemes are at various stages of joint management. At present the management of some 8 % of the area under government irrigation schemes have been fully or partially transferred to WUAs. Many more schemes will shortly be brought under irrigation management transfer program.

*Omission of Samad's name in previous print is regretted.

The process of irrigation management transfer (IMT), in general, begins with a government's support package of system rehabilitation/improvement and farmers' institutional development activities. Farmers are also required to share costs of such activities based on different criteria as outlined in policy, legal documents, and agreements between the support recipient WUAs and support provider DOI.

The IMT process takes off with joint irrigation management efforts in which both, farmers and DOI personnel, along with DOI-appointed consultants in some cases, jointly undertake related tasks and responsibilities inclusive of system operation, maintenance, rehabilitation, farmers' capacity build-up, resource mobilization, conflict management, monitoring and evaluation etc¹. Gradually, increased O&M responsibilities are given to farmers heading toward full management transfer. The government through its related agencies provides technical and other supports after full management transfer leaving farmers themselves as the day-to-day managers of the transferred irrigation systems.

OBJECTIVES AND HYPOTHESES

The overall objective of this study is to determine the effects management transfer has on the performance of irrigation management and irrigated agriculture.

The specific objectives are to determine:

- the effects of management transfer on the recurrent expenditures for irrigation
- changes in the cost of irrigation to farmers
- the impact of management transfer on maintenance of irrigation infrastructure
- changes in the quality of irrigation services irrigation schemes, and
- the effects of management transfer on agricultural productivity levels in the irrigation systems.

The principal hypotheses tested are:

1. IMT leads to a reduction in government's recurrent expenditures for irrigation.
2. IMT increases the share of irrigation costs borne by farmers.
3. IMT will improve the quality of irrigation service to farmers.
4. IMT results in improved maintenance of irrigation facilities.
5. There will be an improvement in agricultural productivity levels in schemes benefiting from IMT.

¹ For more details, please see Prasad et al (1997), Irrigation Service Fees in Nepal, and IIMI (1997), Study on Rehabilitation and Management Transfer, Nepal: Identification of Current Processes.

THE RESEARCH DESIGN

The research design for this study draws on procedures formulated by IWMI to assess the impact of irrigation management transfer². Evidences of impacts are based on a comparison of performances of systems with and without the effects of management transfer. For this study three minor canals in the West Gandak irrigation system and 4 pump systems under the Bhairahwa-Lumbini Ground Water Project (BLGWP) were selected for study.

In the West Gandak scheme, the Palhi minor was transferred to WUA management in May 1993. This canal was chosen to represent the "with IMT" situation. Manjhariya minor was among the last minor canals to be transferred to WUA in October 1996. For purposes of this study Manjhariya minor was considered to represent the "without IMT" case. In addition, Parsauni minor, which was transferred to WUA management in September 1994, was also selected for study.

In BLGWP, two non-transferred schemes (Tube Well no. 5 and 58) and two transferred schemes (Tube Well no. 13 and 48 both transferred in July 1995) were selected for study.

The Farmer Survey

The assessment of impacts was based primarily on a questionnaire survey conducted amongst a random sample of farmers from each of the locations selected for study. The objective of the survey was to obtain information from farmer about their perceptions of changes in selected performance attributes before and after transfer in the case of the IMT schemes. In the non-IMT systems farmers were asked to compare current performance with the levels realized five years ago.

A sample of 96, 76 and 80 farmers from Manjhariya, Palhi and Parsauni minors in the West Gandak scheme and 50 farmers from the four BLGWP schemes were selected by stratified random sampling. The sampling unit was a selected parcel of land in the irrigation scheme. The cultivators of the selected parcel were chosen as the survey respondent. The respondents were asked about changes in costs of irrigation, agricultural production, value of production, perceptions about the quality of irrigation service between pre- and post-transfer years (i.e., adequacy, timeliness and equity of water delivery, system maintenance and conflict resolution) and physical conditions of the canals before and after IMT.

In addition, information about government expenditure for irrigation was collected from secondary sources.

² Vermillion et al (1996), A Standard Methodology to Assess the Impacts of Irrigation Management Turnover, IIMI, duplicated.

Performance Assessment

In this study performance is assessed both in quantitative and qualitative terms. Quantitative assessment is limited to the comparison of the current cost of irrigation to farmers and agricultural productivity levels in the schemes with IMT and without IMT. Qualitative assessment is based the comparison of farmer perceptions of changes in selected performance indicators before and after IMT in the transferred systems. In the non-transferred systems farmers were asked to compare current performance with the performance levels five years before. Table 1 gives the set of indicators used in this study.

Table 1: Performance Indicators and Data Sources

Performance Indicators	Data Source
<i>Financial Performance Indicators</i>	
Irrigation cash costs per hectare to farmers	Farmer survey
Family labor contributions for canal maintenance	Farmer survey
<i>Operational Performance Indicators</i>	
Farmer perceptions about adequacy, timelines and equity of water supply	Farmer survey
Perceptions on seeking the assistance of agency staff	Farmer survey
<i>Maintenance Performance Indicators</i>	
Farmer perceptions about canal/pump conditions before and after transfer (IMT schemes)	Farmer survey
Farmer perceptions about the present condition of canal/pump compared to 5 years before (Non-IMT schemes)	Farmer survey
<i>Agricultural Performance Indicators</i>	
Yield of major crops by season	Farmer survey
Farmer perceptions about changes in agricultural production	Farmer survey

RESULTS OF MANAGEMENT TRANSFER

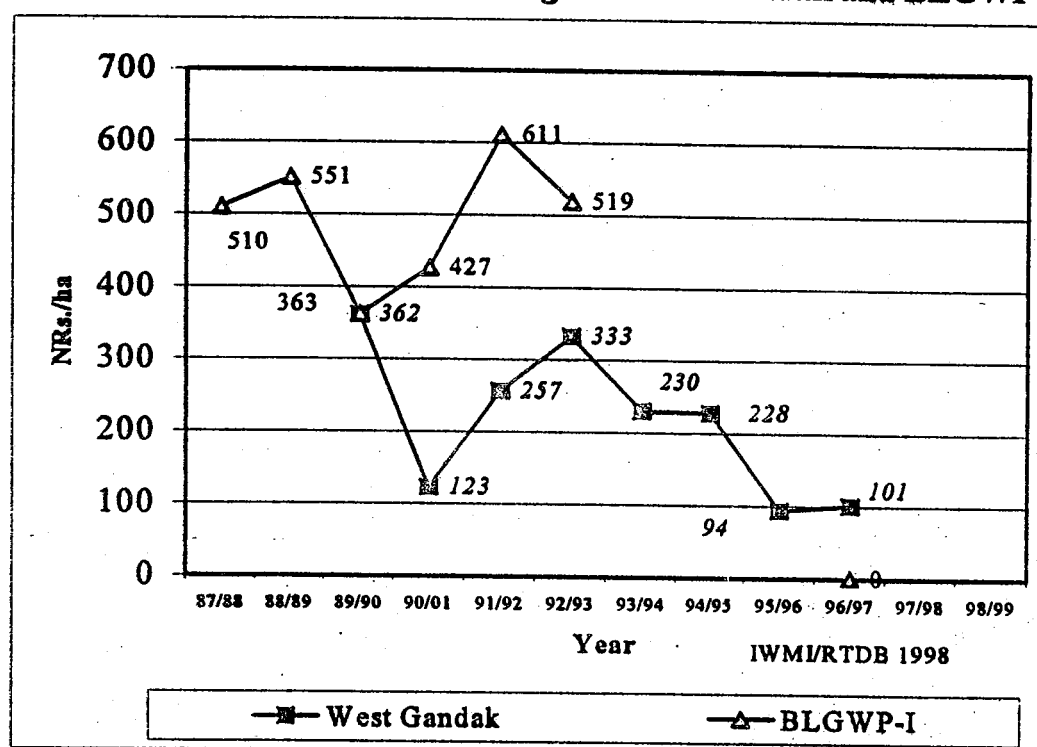
This part of the report presents the type of analysis carried out and related results and findings about the impact of irrigation management transfer. The results and findings are mostly confined to the BLGWP and West Gandak for the reasons discussed before. In presenting the results, we state the hypotheses and present the indicators used to test the hypotheses. Where possible we present the results of the hypotheses testing as well.

Hypothesis 1: IMT leads to a reduction in government expenditure for O&M.

Indicator	Data Sources
Annual O&M cost per hectare to government	Secondary data – Agency records

The average O&M cost to the government per ha in non-transferred schemes of the BLGWP over the last six years has been NRs. 497/ha. This has reduced to ZERO after the IMT (IWMI and RTDB, Performance Assessment Study, 1998). With regard to West Gandak, no conclusion can be drawn as minor-wise government's O&M expenses are not available. However, overall O&M budget allocation for the entire system has been decreased drastically after IMT. The trends of government budget allocation in West Gandak and BLGWP are presented below.

Chart 1: Government O&M Budget in West Gandak and BLGWP



Source: IWMI and RTDB, 1998

Hypothesis 2: IMT increases the share of irrigation costs borne by farmers.

Indicator	Data source
Pumping costs/ annual irrigation costs	Farm Survey
Labor contribution for maintenance	Farm Survey

The figures are given below.

Table 2: Annual Irrigation Costs to the Farmers in Transferred and Non-transferred Minors in West Gandak

Cost Components	Units	Manjhariya (without IMT)	Palhi (with IMT)	Parsauni (with IMT)	Difference in costs between IMT and non-IMT minors
Cash payments per hectare	NRs./ha	61	335	224	218 (t= -4.81)*
Value of unpaid family labor contributions for canal maintenance	Person Days/ha	8	12	5	0 (t= 0.143)

* t test comparing the means of with and without IMT samples indicate that there is a statistically significant difference in the means at the 95 % confidence level.

Source: Farm Survey (July 1998)

Table 3: Annual Irrigation Costs to the Farmers in the Transferred and Non-transferred Tube Wells in BLGWP

Cost Components	Units	TW 5 (without IMT)	TW 58 (without IMT)	TW 13 (with IMT)	TW 48 (with IMT)	Difference in costs between IMT and non-IMT tube wells
Demand Charge	NRs/ha	368	375	600	150	
Pumping charges per hectare	NRs./ha	916	556	1608	756	446 (t= - 3.3)*
Unpaid family labor contributions for canal maintenance	Person Days/ha	4	12	7	2	-3.5 (t= 3.0)*

Source: Farm Survey (July 1998)

Notes:

1. Labor-days have been calculated as days/ha considering 8 hrs a day.
2. Labor contribution data in TW 5 and 58 are inclusive of the labor contributed in rehab works in relation to IMT.
3. In calculations for irrigation costs, the total cost has been divided by irrigable area (by canal) of the individual respondent.
4. Since the electricity demand charge is not related to IMT, it has not been added for irrigation cost comparisons.

5. Since the demand charge rate is fixed, the same has been taken as the data except in TW 5 where different rates exist for lined portion (NRs. 450/ha) and earthen portion (NRs. 300/ha) of the canal system. For TW 5, the average of the payments has been taken.

Findings

West Gandak

1. Irrigation cash costs to farmers are higher in the transferred minors than that in the non-transferred minor.
2. Unpaid labor contribution in IMT sites, on average, is not different than that in the non-IMT sites.

BLGWP

1. Pumping charges for irrigation in the IMT schemes are higher than that in the non-IMT schemes.
2. Unpaid labor contribution in IMT schemes is lower than that in non-IMT schemes because the data in non IMT sites include the labor contributed in rehab works. Hence no conclusion can be drawn with regard to change in labor contribution before and after IMT.

Hypothesis 3: IMT will improve the quality of irrigation service to farmers.

Indicator	Data source
Farmer perception of adequacy of water	Farm survey
Farmer perception of timeliness of water	Farm survey
Farmer perception of equity of water distribution	Farm survey

The farmers' perception regarding the quality of irrigation service in IMT and non-IMT schemes are given below.

Table 4: Adequacy of Irrigation in Transferred and Non-transferred Minors in West Gandak

Perception by percent of response	Without IMT		With IMT			
	Manjhariya		Palhi		Parsauni	
	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif
Adequate most of the time	9	12	21	15	21	20
Sometimes adequate	42	50	61	68	49	44
Never adequate	49	38	18	17	30	36

Source: Farm Survey (July 1998)

Table 5: Adequacy of Irrigation in Transferred and Non-transferred Tube-wells in BLGWP

Perception by percent of response	Without IMT				With IMT			
	TW 5		TW 58		TW 13		TW 48	
	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif
Adequate most of the time	59	59	5	6	87	86	93	94
Sometimes adequate	35	32	95	94	13	14	7	6
Never adequate	6	9	-	-	-	-	-	-

Source: Farm Survey (July 1998)

Table 6: Timeliness of Water Supply in Transferred and Non-transferred Minors in West Gandak

Perception by percent of response	Without IMT		With IMT			
	Manjhariya		Palhi		Parsauni	
	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif
Mostly on time	8	10	24	20	17	20
Sometimes on time	45	52	54	62	58	50
Never on time	47	38	22	18	25	30

Source: Farm Survey (July 1998)

Table 7: Timeliness of Water Supply in Transferred and Non-transferred Tube Wells in BLGWP

Perception by percent of response	Without IMT				With IMT			
	TW 5		TW 58		TW 13		TW 48	
	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif
Mostly on time	57	59	10	11	85	84	80	90
Sometimes on time	37	35	90	89	15	16	10	10
Never on time	6	6	-	-			10	-

Source: Farm Survey (July 1998)

Table 8: Fairness of Water Distribution in Transferred and Non-transferred Minors in West Gandak

Perception by Percent of Response	Without IMT		With IMT			
	Manjhariya		Palhi		Parsauni	
	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif
Mostly fair	9	14	18	14	28	28
Sometimes fair	31	34	29	39	31	30
Unfair	60	52	53	47	41	42

Source: Farm Survey (July 1998)

Table 9: Fairness of Water Distribution in Transferred and Non-transferred Tube Wells in BLGWP

Perception by Percent of response	Without IMT				With IMT			
	TW 5		TW 58		TW 13		TW 48	
	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif
Mostly fair	94	88	18	18	98	98	98	98
Sometimes fair	3	10	82	82	-	-	-	-
Unfair	3	2	-	-	2	2	2	2

Source: Farm Survey (July 1998)

Table 10: Difficulty of Arranging Water in Transferred and Non-transferred Minors in West Gandak

Perception by Percent of Response	Without IMT		With IMT			
	Manjhariya		Palhi		Parsauni	
	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif
Difficult	62	54	44	35	58	47
Sometimes difficult	30	34	38	47	22	28
Easy	8	12	18	18	26	25

Source: Farm Survey (July 1998)

Table 11: Difficulty of Arranging Water in Transferred and Non-transferred Tube Wells in BLGWP

Perception by Percent of response	Without IMT				With IMT			
	TW 5		TW 58		TW 13		TW 48	
	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif
Difficult	44	48	39	40	11	14	5	4
Sometimes difficult	19	19	55	53	22	25	7	4
Easy	37	33	6	7	67	61	88	92

Source: Farm Survey (July 1998)

Table 12: Difficulty of Getting Assistance from WUA/Irrigation staff in Transferred and Non-transferred Minors in West Gandak

Perception by Percent of Response	Without IMT	With IMT	
	Manjhariya	Palhi	Parsauni
Difficult	54	35	47
Sometimes difficult	34	47	28
Easy	12	18	25

Source: Farm Survey (July 1998)

Table 13: Difficulty of Getting Assistance from WUA/Irrigation Staff in Transferred and Non-transferred Tube Wells in BLGWP

Perception by Percent of Response	Without IMT		With IMT	
	TW 5	TW 58	TW 13	TW 48
Difficult	24	10	15	-
Sometimes difficult	10	73	17	-
Easy	66	17	68	100

Source: Farm Survey (July 1998)

Findings

West Gandak

1. The adequacy of irrigation water is better in transferred minors.
2. The timeliness of irrigation water is better in transferred minors.
3. The water distribution is fairer in transferred minors than in non- transferred minors.
4. Farmers of transferred minors face less difficulty in arranging for irrigation water.
5. West Gandak farmers feel it easier to get assistance of the WUAs in transferred minors as compared to getting the assistance from the agency in non-transferred minors.

BLGWP

1. The adequacy of irrigation water is better in transferred tube wells as compared to the non-transferred tube wells.
2. The irrigation water supply is more timely in transferred tube wells.
3. The water distribution in transferred tube wells is fairer.
4. It has become easier to arrange for water in transferred tube wells.
5. Farmers feel it more difficult to get assistance of agency staff in not-transferred tube wells as compared to getting assistance of the WUAs in transferred tube wells.

Hypothesis 4: IMT results in improved maintenance of irrigation facilities.

Indicator	Data source
Farmer perceptions of conditions of irrigation facilities before and after IMT	Farm survey

Farmers' perceptions about the condition of the irrigation facilities in IMT and non-IMT schemes are as follows:

Table 14: Present Condition of Canals and Structures Compared to 1993 in Transferred and Non-transferred Minors in West Gandak

Perception by Percent of Response	Without IMT				With IMT							
	Manjhariya				Palhi				Parsauni			
	Within Study Unit		Main System		Within Study Unit		Main System		Within Study Unit		Main System	
	Canal	Stru.	Canal	Stru.	Canal	Stru.	Canal	Stru.	Canal	Stru.	Canal	Stru.
Better now	1	-	-	-	9	-	9	-	-	-	-	-
About the same	42	40	50	46	67	49	67	50	46	49	-	-
Better before	57	60	50	54	24	51	24	50	54	51	-	-

Source: Farm Survey (July 1998)

Table 15: Present Condition of Canals and Pumps Compared to 1993 in Transferred and Non Transferred Tube-wells in BLGWP

Perception by Percent of Response	Without IMT				With IMT			
	TW 5		TW 58		TW 13		TW 48	
	Canal	Pump	Canal	Pump	Canal	Pump	Canal	Pump
Better now	15	15	-	-	57	57	36	36
About the same	43	60	8	8	37	35	58	53
Better before	42	25	92	92	6	8	6	11

Source: Farm Survey (July 1998)

Table 16: Present Condition of Canals and Structures in Transferred and Non Transferred Minors in West Gandak

Perception by Percent of Response	Without IMT				With IMT							
	Manjhariya				Palhi				Parsauni			
	Within Study Unit		Main System		Within Study Unit		Main System		Within Study Unit		Main System	
	Canal	Stru.	Canal	Stru.	Canal	Stru.	Canal	Stru.	Canal	Stru.	Canal	Stru.
In excellent condition	2	1	1	1	15	4	12	4	-	-	-	-
In reasonably good condition	47	50	57	54	53	34	55	33	41	45	-	-
In poor condition	51	49	42	45	32	62	33	63	59	55	-	-

Source: Farm Survey (July 1998)

Table 17: Present Condition of Canals and Pumps in Transferred and Non-transferred Tube Wells in BLGWP

Perception by Percent of Response	Without IMT				With IMT			
	TW 5		TW 58		TW 13		TW 48	
	Canal	Pump	Canal	Pump	Canal	Pump	Canal	Pump
In excellent condition	33	33	6	10	2	2	24	19
In reasonably good condition	54	67	82	88	85	73	70	73
In poor condition	13	-	12	2	13	25	6	8

Source: Farm Survey (July 1998)

Findings

West Gandak

1. Within the study units, the canal condition of transferred Palhi minor is the best among the three whereas the other transferred minor Parsauni has slightly better condition than that in non-transferred Manjhariya minor.
2. The canal condition of the main system is better in transferred Palhi minor as compared to the same in non-transferred Manjhariya minor. Parsauni minor takes water from the Indian Main Canal and hence is not accounted in the analysis of the main system condition.
3. The farmers have mixed and inconclusive perceptions about the condition of structures in transferred and non-transferred study units as well as in their main systems.

BLGWP

1. The present condition of canals in transferred tube wells is better than in non-transferred tube wells.
2. The condition of structures and pumps also is better in the transferred tube wells.

Hypothesis 5: IMT will improve the agricultural production performance.

Indicator	Data source
Main and second season crop yields	Farm survey
Spatial variations in crop yields	Farm survey
Farmer perceptions on the changes in crop yields	Farm survey

The data on farmer perceptions of the agricultural yields in IMT and non-IMT schemes are as follows.

Table 18: Yields of Major Crops in the Transferred and Non-transferred Minors in West Gandak

Crop	Units	Manjhariya (without IMT)			Palhi (with IMT)			Parsauni (with IMT)		
		1997/98	1996/97	1995/96	1997/98	1996/97	1995/96	1997/98	1996/97	1995/96
Wheat	Tons/ha	1.37	1.59	1.57	1.15	1.02	0.95	1.65	2.10	1.79
Paddy	Tons/ha	3.20	3.22	3.23	2.83	2.73	2.62	3.99	3.63	3.21
Sugarcane	Tons/ha	39.45	41.97	45.21	-	-	-	37.44	40.54	39.98

Source: Farm Survey (July 1998)

Table 19: Yields of Major Crops by Location in the Transferred and Non-transferred Minors in West Gandak – 3 Years' Average

Crops	Units	Manjhariya (without IMT)			Palhi (with IMT)			Parsauni (with IMT)			Difference in crops yields between IMT and non-IMT schemes			
		Head	Middle	Tail	Head	Middle	Tail	Head	Middle	Tail	Head	Middle	Tail	Agg.
Wheat	Tons/ha	1.53	1.20	1.56	1.23	1.14	0.88	1.04	1.41	1.87	2.94	1.76	-0.16 (t=-0.84)	-0.04 (t=0.34)
Paddy	Tons/ha	3.51	3.30	2.97	2.74	3.08	2.47	2.73	3.17	3.87	4.9 ³	3.58	-0.47 (t=- 2.15)*	-0.08 (t=0.39)
Sugarcane	Tons/ha	35.32	38.13	47.40	-	-	-	-	35.46	46.44	60.09	38.77	0.14 (t=-0.02)	-3.46 (t=0.95)

Source: Farm Survey (July 1998)

Table 20: Farmer Perceptions on Major Crop Yields in Transferred and Non-transferred Minors in West Gandak

Perception by Percent of Response	Without IMT		With IMT			
	Manjhariya		Palhi		Parsauni	
	Wheat	Paddy	Wheat	Paddy	Wheat	Paddy
Higher Now	58	45	27	80	82	97
About the Same	39	50	46	20	8	3
Lower Now	3	5	27	-	10	-

Source: Farm Survey (July 1998)

³ The reported yields are exceptionally high.

Table 21: Comparison of Yields of Major Crops in the Transferred and Non-transferred Tube Wells in BLGWP

Crop	Units	TW 58 (without IMT)			TW 5 (without IMT)			TW 48 (with IMT)			TW 13 (with IMT)		
		97/98	96/97	95/96	97/98	96/97	95/96	97/98	96/97	95/96	97/98	96/97	95/96
Wheat	Tons/ha	1.69	1.76	1.76	0.97	1.43	1.48	1.31	1.61	1.48	1.00	1.66	1.66
Paddy	Tons/ha	4.05	3.85	3.93	3.58	3.38	3.35	4.02	3.91	3.65	3.21	3.22	3.15

Source: Farm Survey (July 1998)

Table 22: Yields of Major Crops by Location in the Transferred and Non-transferred Tube Wells in BLGWP – 3 Years’ Average

Crop	Units	TW 58 (without IMT)			TW 5 (without IMT)			TW 48 (without IMT)			TW 13 (without IMT)			Difference in crops yields between IMT and non-IMT schemes							
		Head	Middle	Tail	Agg.	Head	Middle	Tail	Agg.	Head	Middle	Tail	Agg.	Head	Middle	Tail	Agg.				
Wheat	Tons/ha	1.85	1.62	1.79	1.74	1.13	1.65	-	1.28	1.13	1.72	1.10	1.43	1.62	1.34	1.49	1.44	0.1 (t=-0.4)	-0.17 (t=1.26)	-0.23 (t=0.64)	-0.07 (t=0.55)
Paddy	Tons/ha	4.26	3.84	3.85	3.96	3.36	3.50	-	3.41	4.03	3.76	3.80	3.87	2.92	3.04	3.50	3.19	0.06 (t=-0.24)	-0.31 (t=1.62)	-0.36 (t=1.22)	-0.17 (t=1.28)

Source: Farm Survey (July 1998)

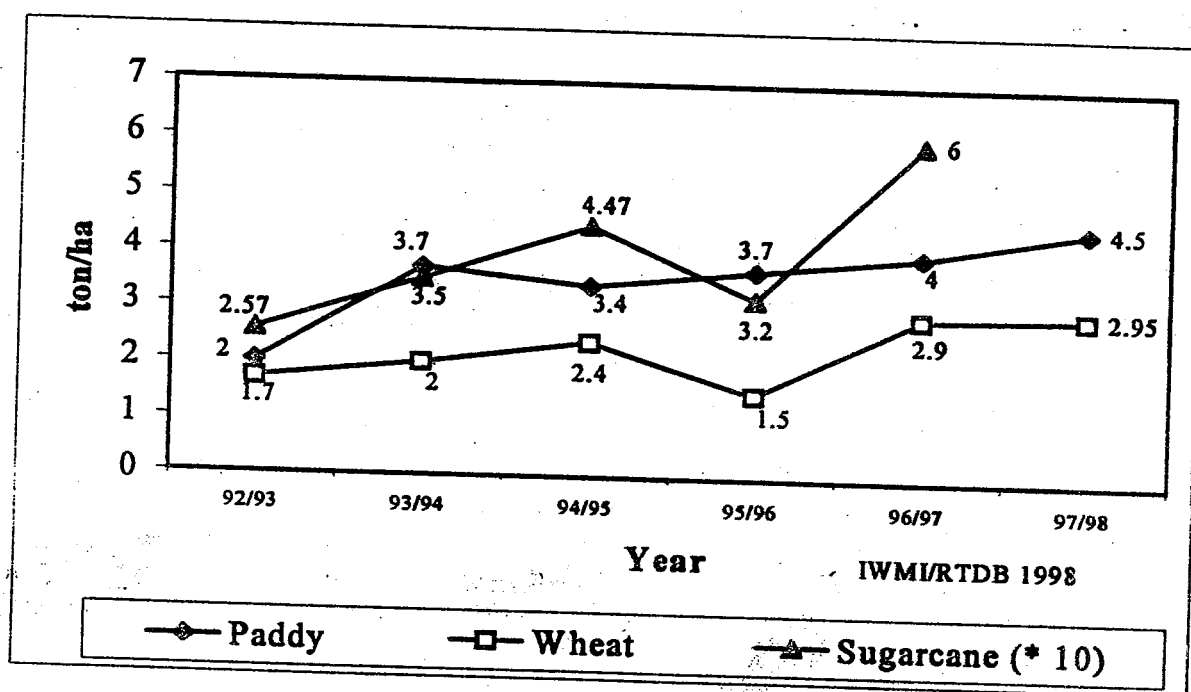
Table 23: Farmer Perceptions on Major Crop Yields in Transferred and Non-transferred Tube Wells in BLGWP

Perception by Percent of Response	Without IMT				With IMT			
	TW 5		TW 58		TW 13		TW 48	
	Paddy	Wheat	Paddy	Wheat	Paddy	Wheat	Paddy	Wheat
Higher Now	74	31	58	12	50	14	96	94
About the Same	26	56	40	40	47	64	2	6
Lower Now		13	2	48	3	22	2	-

Source: Farm Survey (July 1998)

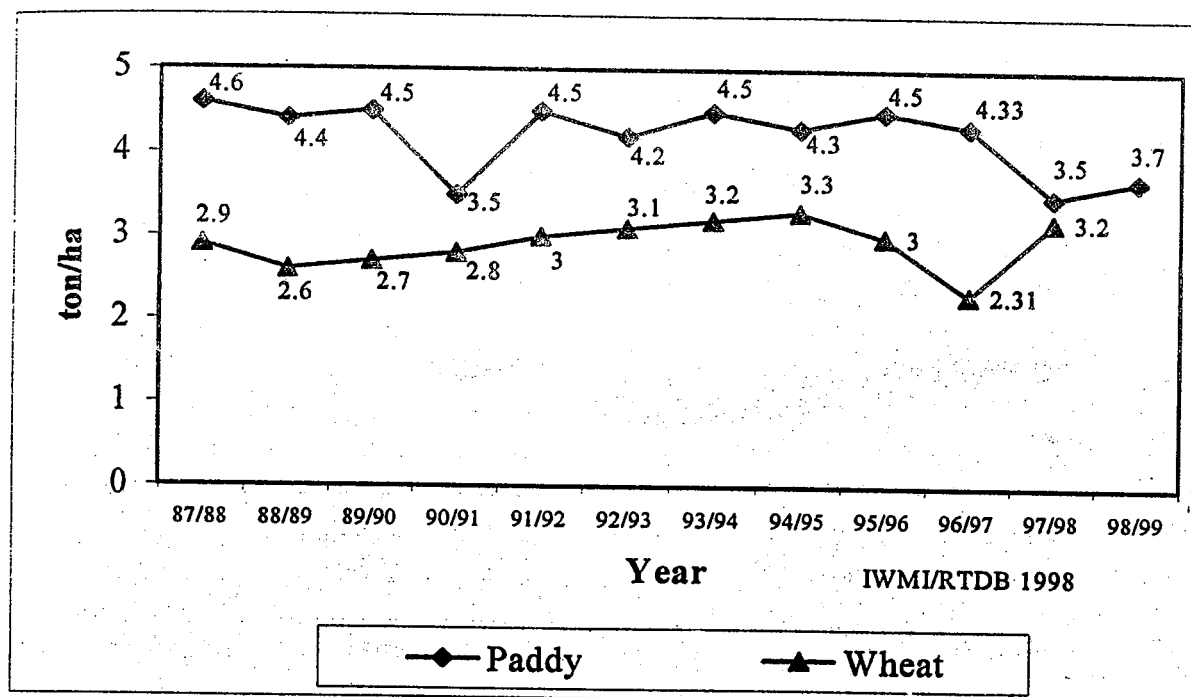
The average yields of major crops reported by the concerned projects are given below. These figures represent the averaged data in the whole system that are recorded in the individual systems based on crop cutting surveys.

Chart 2: Yields of Major Crops in West Gandak



Source: Performance Assessment Study, IWMI and RTDB, 1998.

Chart 3: Yields of Major Crops in BLGWP



Source: Performance Assessment Study, IWMI and RTDB, 1998.

Findings

West Gandak

1. Yields of wheat and paddy in Palhi minor have been increasing over the last three years and sugarcane is not grown at all.
2. Paddy yields in Parsauni minor also has been increasing over the time.
3. Yields of sugarcane in Manjhariya minor have a decreasing trend.
4. Wheat yield is the lowest in Palhi minor and the highest in Parsauni.
5. There are no significant differences in aggregate yields of major crops in transferred and non-transferred minors.
6. No significant variations by location are found in the yields of major crops.
7. Perception on the change in paddy yields in transferred minors is positive than that in non-transferred minors.
8. Parsauni farmers perceive that wheat yields have gone up.
9. Yields of all the crops reported by farmers are lower than those reported in project documents.

BLGWP

1. Paddy yields in BLGWP schemes have increased over the time and are lower than the project records.
2. Wheat yields have a decreasing trend over the last three years and are lower than project records.
3. There are no significant differences in aggregate yields of wheat and paddy in IMT and non-IMT schemes.
4. Variations in the crop yields by location are insignificant.
5. Farmers' perceptions about changes in major crop yields in transferred and non-transferred tube wells are inconclusive whereas perception about the change in transferred tube well no. 48 is positive.

SUMMARY

In sum, results and findings related to hypothesis 1, i.e. IMT will decrease O&M costs to the government; no conclusion can be drawn with regard to West Gandak as minor-wise government's O&M expenses are not available. However, overall O&M budget allocation for the entire system has decreased drastically with gradual IMT of the irrigation system.

In BLGWP, the average O&M cost to the government per ha in non-transferred schemes of the BLGWP over the last six years has been NRs. 497/ha. This has reduced to ZERO after the IMT supporting the above hypothesis.

With regard to hypothesis 2, i.e. IMT will increase cost of irrigation to the farmers; the annual irrigation costs to the farmers in IMT sites in West Gandak are significantly higher than that in non-IMT sites. However, there is no significant difference in unpaid family labor contributions for maintenance between IMT and non-IMT sites.

Also in BLGWP, the annual pumping costs for irrigation in IMT sites are significantly higher than that in non-IMT sites. Unpaid labor contributions in IMT schemes appear to be lower than that in non-IMT schemes. This is mainly because the data in non IMT sites include the labor contributed in rehab works and hence no conclusion can be drawn in absence of information about the exact amounts of labor contributed during rehab and afterwards. However, the rises in the irrigation cost to the farmers in cash in both the systems supports the hypothesis.

Regarding the hypothesis 3, i.e. IMT will improve the quality of irrigation service to farmers, the adequacy of irrigation water has improved in transferred minors of West Gandak. Similarly, the timeliness of irrigation water has become better and the water distribution has become fairer in transferred minors than in non-transferred minors. Farmers of transferred minors face less difficulty in arranging for irrigation water and West Gandak farmers feel it easier to get assistance of the WUAs in transferred minors as compared to getting the assistance from the agency in non-transferred minors.

In BLGWP, the adequacy of irrigation water is better in transferred tube wells as compared to the not-transferred tube wells. Similarly, the irrigation water supply is more timely in transferred tube wells and the water distribution is fairer. It has become easier to arrange for water in transferred tube wells and farmers feel it more difficult to get assistance of agency staff in not-transferred tube wells as compared to getting assistance of the WUAs in transferred tube wells. All of these indicate improvements in the irrigation quality as stated by the hypothesis.

On hypothesis 4, i. e. IMT results in improved maintenance of irrigation facilities, within the study units of West Gandak, the canal condition of transferred Palhi minor is the best among the three whereas the other transferred minor Parsauni has slightly better condition than that in non-transferred Manjhariya minor. The canal condition of the main system is better in transferred Palhi minor as compared to the same in non-transferred Manjhariya minor. Parsauni minor takes water from the Indian Main Canal and hence is not accounted in the analysis of the main system condition. The farmers have mixed and inconclusive perceptions about the condition of structures in transferred and non-transferred study units as well as in their main systems.

In BLGWP, the present condition of canals in transferred tube wells is better than in non-transferred tube wells. The condition of structures and pumps also is better in the transferred tube wells. The better canal conditions of in West Gandak and better conditions of both canal and structures support the above hypothesis.

On hypothesis 5, i.e. IMT will improve the agricultural production performance, the overall yields in West Gandak scheme increased substantially from 2.0 to 4.5 ton/ha. The differences between the transferred and non-transferred minors are less pronounced. Wheat and paddy yields in Palhi minor of West Gandak have been increasing over the last three years. Paddy yields in Parsauni minor are increasing too. Yields of sugarcane in Manjhariya minor, a non-IMT case, have a decreasing trend. However, there are no significant differences in the aggregate yields of major crops in transferred and non-transferred minors. Similarly, there are no significant variations in the crop yields by location in both transferred and non-transferred minors.

Nevertheless, farmers in Parsauni minor perceive that paddy and wheat yields have increased after IMT. Palhi farmers also express positive perception about the increase in paddy yields.

In BLGWP paddy yields have increasing trends whereas wheat yields have decreased over the time. There are no significant differences in aggregate yields of wheat and paddy in IMT and non-IMT schemes and no significant variations are found by location. Farmers' perceptions about changes in major crop yields in transferred and non-transferred tube wells are also inconclusive whereas perception about the change in transferred tube well no. 48 is positive.

It was noted that the yields of all the crops reported by farmers in both systems are lower than those reported in project documents. It is mainly because the project data are based on the crop cutting surveys whereas farmers reported the net productions after deducting the losses incurred during harvesting, transportation, harvesting wage payments that are customarily often paid in some share of the harvested bundles of crops, etc.

In conclusion, it can be said that the IMT has had following effects:

- Decrease in the government's allocation for O&M
- Increase in the irrigation costs to farmers
- Improvement in the quality of irrigation service
- Farmers perceived the physical conditions of the irrigation facilities are better after transfer. Partly this may be caused by the rehabilitation that preceded the IMT process. However, in the transferred tube wells and minor canals the positive perception was more pronounced than in the non-transferred ones.
- In West Gandak irrigation system agricultural production increased substantially. Differences between transferred and non-transferred minors are less pronounced. Yields in BLGWP tube wells increased only slightly, since the yield levels were already quite high before management transfer. It is difficult to desegregate contributions to improvements in yields to IMT and rehabilitation.