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An Impact Evaluation Study of a Drainage Project to Control Waterlogging and Salinity Problems in Sindh, Pakistan

(Case Study of the Mirpurkhass Component of the Left Bank Outfall Drain Project)

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1. Introduction

The development of an irrigation system in Pakistan with no provisions for a drainage facility has created problems of waterlogging and salinity, which are the principal threats to the sustainability of irrigated agriculture and is creating an environmental problem in the affected areas. According to the Agriculture Statistics of Pakistan 1997/98, about 11.42 million hectares were found to be affected by waterlogging and salinity in 1994. Especially in Sindh and Punjab Provinces, the problem was found to be very severe. In Sindh Province waterlogging and salinity had occurred after the construction of Sukkur (1932), Kotri (1955), and Gudu (1962) barrages, because these barrages were constructed with no provisions for drainage. Therefore the water table in the area gradually became higher.

Considering the severity of the problem, the Left Bank Outfall Drain (LBOD) project is constructed in the left bank command area of Sukkur Barrage Sindh Province. The construction of the project was started in 1985 and completed in 1997 at a cost of 605.3 million U.S. dollars (WAPDA [1]). The project covers a 0.53 million-hectare area of Nawabshah, Sanghar, and Mirpurkhass districts. Its main aim was to rehabilitate uncultivable lands to prevent further productive lands from going out of cultivation because of waterlogging and salinity and to increase cropping intensity from the traditional level of 81% (28% in kharif and 53% in rabi cropping seasons) to 147% by a remodeling of the canals.

The main objective of this study is to evaluate the effect of the LBOD project on social factors and agriculture and to estimate the benefit-cost ratio based on the field survey in Mirpurkhass where the Tile drainage system was constructed in September 1995; it started working from December 1995.¹

2. Social and Economic Impact of the Project

This farm survey was carried out in February and November 1999 in the Bareji minor command area near Mirpurkhass city. Thirty farmers were interviewed to estimate the economic benefit of the project. Per hectare annual benefit, overhead, and annual operation and maintenance (O&M) costs of Mirpurkhass component project were estimated. The construction cost of the project was normalized at 1997 using GDP deflator of World Bank and International Monetary Fund (IMF) for Pakistan to estimate the benefit-costs ratio. The findings of the survey are as follows.

1) Social Impact

After the drainage facilities in the area were provided, the migrated people especially tenant families are returning to cultivate the land. Because of the increase in crop yields and net earnings,

the living standard of the people of the area is now getting better than before. The price of arable land has increased two to three times over earlier prices. Because of lowering of water tables, the possibility of water borne diseases has been reduced; it has also made possible the planting of trees that will turn the barren land into green and the diseased environment into a healthy one.

2) Economic Impact

It can be seen in Table 1 that the project has a positive effect on agriculture. Once the project was finished the total cultivated area had increased by 226.7 hectares, i.e., an increase of about 130%. The cropping intensity that was about 37% before project had reached up to 86% with an increase of about 130%. The highest percentage increase in cultivated area was for chilies (892%), followed by onion (352%) crops. The highest increase in cultivated area was for wheat, followed by cotton and sugarcane, 82, 65 and 39 hectares, respectively. The main reasons of increases in the cultivated area, especially, cotton and wheat crops, were price stability, less irrigation water requirements, and the short period these crops required from sowing to harvesting. The lowest increase in cultivated area

Table 1. Cultivated Area and Cropping Intensity Before and After the Project

Cropping season	Crop	Before 1994/95 (ha)	After 1997/98 (ha)	Change (ha)	Change (%)
Kharif	Chilies	1.2	12.0	10.8	892
	Sugarcane	39.7	78.7	39.0	98
	Cotton	47.0	112.0	65.0	138
	Jantar	7.7	13.2	5.5	65
	Subtotal	95.6	215.9	120.3	158
Rabi	Wheat	65.0	147.0	82.0	126
	Onion	6.5	29.4	22.9	352
	Alfalfa	7.3	8.9	1.6	29
	Subtotal	78.8	185.3	106.5	135
Total		174.4	401.1	226.7	130
Total Area		466.4	466.4	~	~
Cropping intensity (%)		37	86	~	130

Source. Survey data collected by authors in 1999

was for alfalfa and jantar crops.

The effect of the project on crop yields is shown in Table 2, which reveals that after the project the yield of all crops had increased. The highest percentage increase in yield per hectare was found for chilies (284%), followed by wheat (157%), onion (156%), sugarcane (74%), and cotton (74%) crops respectively. In comparison with IIMI's findings in 1996 in the Mirpurkhass area², the higher increase in per hectare yield, especially for sugarcane was found in our study. The main reasons for the higher increase in per hectare yield of sugarcane might be due to the increase in price and to increased demand of sugarcane because of the installation of a sugar mill there at the end of 1996. This sugar mill also provides interest free credit in the form of fertilizer and pesticides to the sugarcane growers. The supply of irrigation water has also increased because of the formation of the water user's farmer organizations.

The net return per hectare is shown in Table 3. The table reveals that before the drainage facility, the cultivation of wheat and onion crops was not profitable, but after the drainage facility, net return per hectare for all crops had increased. The highest increase in net return per hectare was for chilies (\$592), followed by sugarcane (\$587), onions (\$295), cotton (\$248), and wheat (\$154) crops, and the overall change in net return per hectare was found to be \$1,875. The increased benefit and per hectare yield of Jantar and alfalfa crops is not estimated because of the lack of availability of farm records. Because these crops are fed directly to livestock, animals are often left to graze the standing crop. Therefore the farmers don't keep farm records about expenses incurred and returns received

from these crops.

Table 2. Average Yield Per Hectare by Crop Before and After the Project

Crop	Before	After	Change
	1994/95 (Kg)	1997/98 (Kg)	
Chilies	301	1,157	284
Sugarcane	45,092	78,649	74
Cotton	936	1,633	74
Wheat	878	2,257	157
Onions	1,920	4,924	156

Source. Survey data collected by authors in 1999

Table 3. Average Net Return Per Hectare Before and After the Project at Constant Price of 1997

Crop	Before	After	Change
	1994/95 (\$)	1997/98 (\$)	
Chilies	27	619	592
Sugarcane	472	1,059	587
Cotton	164	412	248
Wheat	-66	88	154
Onions	-53	241	295
Total	544	2,419	1,875

Source. Survey data collected by authors in 1999

3. Estimation of Benefit-Cost Ratio and Internal Rate of Return

A per hectare annual benefit of \$290 was estimated by dividing the total changed net return \$135,256 by the total surveyed area of 466.4 hectares. Per hectare overhead and annual O&M cost was estimated at about \$1664 and \$6 respectively. The annual benefit and O&M cost was assumed constantly over the period of the usable life of project, which was assumed to be 40 years. The annual interest rate was assumed at the rate of 10 percent. The benefit-cost ratio was found to be 1.26, and the internal rate of return was found to be 12 percent.

4. Concluding Remarks

The development of an irrigation system with no provision of drainage facility is the main reason for waterlogging and salinity in Pakistan. The results of the study show that the rehabilitation project has a positive social and economic influence on the surveyed area. The increases in yields and net returns are motivating farmers to invest more in farm business. The change in cropping patterns and increase in cropped area by the reclamation of further land will create more job opportunities. The operation and maintenance system of the canal is yet to be transferred from the irrigation department to the farmers. Therefore it is expected that in the future, by the transfer of irrigation management system to the farmers and because of a greater increase in the supply of irrigation water by the remodeling of the canal, the cropping intensity will reach the expected target of 147 percent.

Notes

¹No economic or social impact assessment study has been done in the project area. Intermediate project evaluation was done by WAPDA in 1996. The estimated B-C ratio and IRR was found to be 1.4 and 12.9% in the whole project area (WAPDA [1])

²Under the LBOD project, the International Irrigation Management Institute (IIMI) conducted a land productivity survey on the whole project area in 1996 with the main aim of transferring the irrigation management system to farmers within the project area. IIMI's survey revealed that the per hectare yield of cotton, wheat, and sugarcane in the Mirpurkhass area was 1,853, 2,109 and 50,598 kg, respectively (Memon Yameen et al [2]).

References

- [1] Pakistan Water and Power Development Authority WAPDA., "Left Bank Outfall Drain Project Stage-1", General Manager (Water) South, Hyderabad, 1996, p.13.
- [2] Memon Yameen et al., Socio-Economic Baseline Survey For Three Pilot Distributaries In Sindh Province, Pilot Project For Farmer-Managed Irrigated Agriculture Under the Left bank Outfall Drain Stage 1 Project, IIMI Hyderabad, 1997, pp. 70~71.