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New Challenges Facing Asian Agriculture under Globalisation

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Economic Impact Assessment of the Left Bank Out-fall Drainage Project: A Case Study

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Introduction

Pakistan has one of the world's largest integrated irrigation systems. On one hand, this system had played a very important role in the development of agriculture, but on the other hand the development of this system without provisions for drainage facility has created problems of water logging and salinity in the canal-irrigated areas. The water logging and salinity problems are the principal threats to the sustainability of irrigated agriculture which contributes with more than 25 per cent of the gross domestic product (GDP), 46 per cent of total employment and almost 60 per cent to annual export earnings in primary and processed forms. Moreover, the increase in underground water table and the accompanying salts due to mismanagement of the irrigation system and continued surface irrigation over the years and seepage losses from unlined canals and watercourses is decreasing fresh ground water areas very rapidly. This is creating an environmental and, hence, a food problem for the country's rapidly increasing population. As reported by the World Bank (1994), Pakistan is losing about 25 per cent of its potential production of major crops, or about US\$2.5 billion per year due to this problem. According to the Agriculture Statistics of Pakistan (1997/98), about 11.42 million hectares of farmland was found to be affected by this problem in 1994. The situation was very severe especially in the Sindh Province where about 6.17 million hectares were found to be affected by this problem. In the Sindh Province the problem of water logging and salinity has severely affected the livelihood of more than 80 per cent of the rural population whose survival depends on agriculture and its allied businesses, particularly small farm holders, sharecroppers and other agricultural labours. Their single most important source of income from agriculture had decreased, and this has pushed them under heavy burden of debt and poverty.

In order to address the problem, the Government of Pakistan with the assistance of the World Bank and other foreign agencies, has constructed the Left Bank Out-fall Drainage (LBOD) project in the left bank command area of the Sukkur Barrage (Indus River) in Sindh province in 1997 at a cost of US\$ 605.3 million. The project covers an area of about 0.53 million hectares of Nawabshah, Sanghar and Mirpurkhass districts. The main aim of the construction of the project was to rehabilitate damaged land and to prevent further productive land from going out of cultivation because of water logging and salinity problems. In addition, it aimed to increase the cropping intensity from the traditional level of 81 per cent (53% in Autumn and 28% in Spring cropping season) to 147 per cent by remodelling of irrigation canals and tapping of underground fresh water resources through tube wells, and to

provide a comprehensive system of surface and sub-surface drainage to dispose off the excess salts and drainage through spinal drain into the Arabian Sea. Under the project in the Mirpurkhass area, the *Tile drainage* system was constructed in September 1995 and started operating from December 1995 (WAPDA, 1996)

Study Area and Surveyed Households

The study area, Deh Sodhro, is located about 250 kilometres north of Karachi near Mirpurkhass city at the distance of about 10 kilometres. Bareji Minor that starts from Nara canal and Nara canal that starts from the Sukkar Barrage were the main sources of irrigation water. The conjunctive use of canal and tube well water was very low, because in most of the areas, the underground water was saline. The total number of agricultural farms in the study area was 307, covering an area of 3,746 hectares. According to farm size, landholding distribution was as follows:

- 120 farms (39%) were of small size farms (0.1 to 5.06 hectares)
- 103 farms (34%) medium size (5.07 to 10.12 hectares) and
- 84 farms (27%) large size farms (more than 10.12 hectares), respectively.

The total areas covered by the small, medium and large size farms were 343.1 hectares, 709.2 hectares and 2693.6 hectares, respectively. Landowner-cum-tenant and owner-operator were the main forms of land occupancy. Sharecropping on equal (50:50) basis was more widespread, occupying about 62 per cent of total farms and 77 per cent of the total farmland area. In sharecropping arrangements, the landowner, being a main source of credit, had a great influence on decision-making on farming activities. The decisions that most landowners took by themselves were crops to be grown and land allocation to the tenants. The majority of the landowners supervise their farms by themselves. The practice of making use of the services of a farm manager or locally called *Kamdars*, was found to be widespread, particularly on the large sized farms. The main crops grown in area were cotton, sugarcane, wheat, onion, chilli and fodder. After the implementation of the LBOD project, the government has banned the cultivation of rice crop in the project command area. Crop marketing was done mainly by the private sector. The institutional and non-institutional credit agencies such as Agriculture Development of Pakistan (ADBP), Co-Operative Bank, Commercial Banks, village moneylenders, friends, agriculture input sellers and grain machetes, were the main source of credit for the landowners in this area.

Maintenance of the farm records was a very common practice in the area. The main idea behind keeping this farm record was to avoid misunderstanding or conflict between the landowner and sharecropper tenants and to monitor the performance of tenants and the farm.

The average age of the 30 farm owners surveyed was about 41 years. The number of their family members was seven people on average, of which four were males and three females. With regard to their educational level, seven farmers were illiterate and 23 were literate. Ten farm owners got ownership of farmland through purchasing from other farmers, while the remaining 20 farmers inherited their land. Eighteen farm owners were operating their

farms through the help of sharecroppers while the remaining 12 were owner-operators. The total farmland area of the surveyed 30 farms was 466.4 hectares. In terms of farm size ownership, nine were small sized farms, seven medium sized and 14 of large sized farms. The farmland area covered by the small, medium and large-sized was 26.8 hectares, 54.7 hectares and 384.9, respectively. Male and female family labour of the landowner and the sharecropper tenants was the main source of labour power. Hired labour services were mainly utilized for activities such as weeding and harvesting.

The Effects of the Project

In order to assess the effect of the LBOD project by farm size on the agriculture and the income of the surveyed farm owners, a farm survey was carried out in November 1999. Detailed information on the physical characteristics of farms and farm owners was collected by face-to-face interview with farm owners. Most of the farm owners were personally known and co-operated well during the survey. The farm records kept by the selected farm owners were the main source of input-output data of the crops, as well as of the data on prices received by them. The information collected related to the agricultural cropping year 1994/95 (before the project) and 1997/98 (after the project) according to farm size holding. We compared cultivated area, cropped area, cropping intensity, crop yield per hectare, working man days and net returns per hectare before and after the project in order to examine the impact of the project. Also compared were gross crop income and cost per hectare that includes the cost incurred for seeds, fertilizer, pesticide and hired labour, before and after the project, and was estimated at the average prices of 1997/98. The information about the cost incurred on the construction of the LBOD project was collected from the Water and Power Development Authority (WAPDA) office located in Hyderabad City. The following sections discuss the findings.

Effects on Cultivated Area

The effect of the project on the cultivated area is shown in Table 47.1. The total cultivated area increased from 100.6 hectares before the project to 299.1 hectares thereafter, with an increment of 198.5 hectares or about 198 per cent. According to the farm size, small, medium and large sized farms, the cultivated areas had increased after the project by 9.1 hectares, 9.2 hectares and 101.1 hectares, respectively. Percentage-wise, the increases for small, medium and large-sized farms were 85 per cent 39 per cent and 166 per cent, respectively. Reasons for this increase might be the reclamation of land affected by the water logging and salinity problems through providing drainage facility on the selected farms.

Table 47.1: According to the Farm Size Cultivated Area before and after the Project on the Surveyed Farms

Farm Size Category	Cultivated area			
	Before (1994/95)	After (1997/98)	Increase	
	(ha)	(ha)	(ha)	(%)
Small	10.7	19.8	9.1	85
Medium	23.6	32.8	9.2	39
Large	66.3	176.4	110.1	166

Source: Farm Survey, 1999.

Effects on Cropped Area and Cropping Intensity

Table 47.2 indicates significant increase in the cropped area on the surveyed farms both in Spring and Autumn cropping seasons, after the project. As shown in the table, the total cropped area that was 173.8 hectares before the project, had increased up to 401.1 hectares, an increment of 227.3 hectares or about 131 per cent. The table also indicates that after the project, area under cash crops such as, cotton, onion, chillies and sugarcane, had increased in comparison to grain and fodder crops such as wheat, Egyptian clover and jantar. The total cropped area under the cash crops had increased from 94.3 hectares to 232.1 hectares, an increase of 137.7 hectares or 141 per cent, while that under grain and fodder crops had increased from 79.5 hectares to 169 hectares an increase of 89.5 hectares (113%). After the project, the highest increase in cropped area was in wheat, followed by cotton, sugarcane, onion, chillies, jantar and Egyptian clover. Whereas, the highest percentage increase in cropped areas was for chillies, followed by onion, cotton, wheat, and sugarcane, jantar and Egyptian clover crops.

According to the farm size, after the project, the total increase in the cropped area for small, medium and large-sized farms was 11.7 hectares, 28.6 hectares and 187 hectares, or an increase of 60 per cent, 94 per cent and 151 per cent, respectively. The highest increase in cropped area under both cash crops and grain and fodder crops was found on the large farms, followed by the medium and small size farms. Likewise, except sugarcane, the higher per percentage increase under both cash crops and grain and fodder crops was found on the large farms, followed by the medium and small size farms. After the project, it was found that the cropped areas of jantar and Egyptian clover had decreased on all farms.

It also can be seen in Table 47.2 that once the project was completed the cropping intensity which was about 41 per cent before the project, had reached up to 86 per cent, an increase of about 110 per cent. After the project the higher per cent increase in cropping intensity was found on large farms, followed by the medium and small-sized farms, i.e. about 195 per cent, 96 per cent and 86 per cent, respectively. This trend of increase in the cropped area and cropping intensity shows that without adequate drainage facility, the surveyed farmers were unable to bring more area under cultivation. The decrease in the cropped area of fodder crops, such as jantar and Egyptian clover, indicates that after the project the surveyed farmers

Table 47.2. According to the Farm Size, Cropped Area and Cropping Intensity before and after the Project on the Surveyed Farms

Cropping season	Before (1994/95)				After (1997/98)				Increase				% Increase			
	Small (ha)	Medium (ha)	Large (ha)	Total (ha)	Small (ha)	Medium (ha)	Large (ha)	Total (ha)	Small (ha)	Medium (ha)	Large (ha)	Total (ha)	Small %	Medium %	Large %	Total %
Crop																
Autumn																
Chillies	0.0	0.0	1.2	1.2	1.1	2.8	8.1	12.0	1.1	2.8	6.9	10.8	100	100	569	892
Cotton	7.0	11.0	29.0	47.0	10.4	19.8	81.8	112.0	3.4	8.8	52.8	65.0	49	80	182	138
Jantar	0.0	0.0	7.7	7.7	0.0	0.0	13.2	13.2	0.0	0.0	5.5	5.5	-	-	71	71
Spring																
Onion	1.2	0.0	5.2	6.4	2.3	0.6	26.4	29.4	1.1	0.6	21.2	22.9	92	100	405	356
Wheat	7.5	14.5	42.5	64.5	10.1	23.9	112.9	146.9	2.6	9.4	70.4	82.4	35	65	166	128
Egyptian clover	0.0	0.0	7.3	7.3	0.0	0.0	8.9	8.9	0.0	0.0	1.6	1.6	-	-	22	22
Annual																
Sugarcane	4.0	4.8	30.9	39.7	7.5	11.7	59.5	78.7	3.5	6.9	28.6	39.0	87	145	93	98
Total	19.7	30.3	123.8	173.8	31.4	58.9	310.8	401.1	11.7	28.6	187.0	227.3	60	94	151	131
Cash crops	12.2	15.8	66.3	94.3	21.3	35.0	175.8	232.1	9.1	19.2	109.5	137.7	74	122	165	146
Other crops	7.5	14.5	57.5	79.5	10.1	23.9	135.0	169.0	2.6	9.4	77.5	89.5	35	65	135	113
Cropping intensity (%)	63.0	55.0	33.0	41.0	117.0	108.0	81.0	86.0	54.0	53.0	48.0	45.0	86	96	145	110

Source: Farm Survey 1990.

had focused to bring more areas under cash crops in order to earn maximum returns. After the project, the installation of sugar mill and cotton factory in the area, which is the result of the increased cropped area and yield of sugarcane and cotton crops, has not only encouraged the farmers to bring more area under cotton and sugarcane crops, but it also has created more job opportunities for other peoples of the area.

Average Yield per Hectare by Crop

Crop yield is a very important indicator for evaluating performance of any project or scheme. The effect of the project on crop yields is shown in Table 47.3. The table reveals that, in comparison to the status before the project, the yield per hectare of all the crops had increased after the project. The highest percentage change in yield per hectare was found for chillies, followed by wheat, onion, cotton, and sugarcane crop, i.e., by 284 per cent, 57 per cent, 156, 74 per cent and 74 per cent, respectively.

Table 47.3: According to the Farm Size Average Yield per Hectare by Crop before and after the Project on the Surveyed Farms

Crop	Before (1994/95)				After (1997/98)				% Increase			
	Small (kg/ha)	Medium (kg/ha)	Large (kg/ha)	Average (kg/ha)	Small (kg/ha)	Medium (kg/ha)	Large (kg/ha)	Average (kg/ha)	Small %	Medium %	Large %	Average %
Chillies	-	-	301	301	1,442	1,104	1,065	1,157	-	-	254	284
Cotton	917	836	1,022	936	1,745	1,477	1,647	1,633	90	77	61	74
Sugarcane	44,282	50,859	42,119	45,092	73,435	87,066	77,484	78,649	66	71	84	74
Wheat	1,050	727	888	878	2,176	2,145	2,354	2,257	107	195	165	157
Onion	854	-	2,275	1,920	4,170	8,285	4,890	4,924	388	-	115	156

Source: Farm Survey, 1999.

According to farm size, the higher percentage increase in yield per hectare of cotton and onion crop was found on small farms. In comparison to small and large-sized farms, the higher percentage increase in yield per hectare of wheat crop was found in the medium-sized farms. Whereas, on large farms, a higher percentage increase in yield per hectare of sugarcane crop was recorded.

Impacts on Job Opportunities

The effect of the project on the job opportunities is shown in Table 47.4. The table shows that the project had a positive influence on the job opportunities for tenants and other agricultural labour. The table indicates that, as compared to the opportunities before the project, there had been an increase in the labour use on the surveyed farms. Average total number of working man days of about 27 days per hectare before the project had increased up to about 58 days per hectare, an increment of 31 days, or about 116 per cent, after the project. According to the farm size after the project, a higher average per hectare increase in the man-days was found on the small farms, followed by the large and medium farms, respectively.

Table 47.4: According to the Farm size Average per Hectare Man Working Days before and after the Project on the Surveyed Farms

Farm Size Category	Man Working Days			
	Before 1994/1995 (days/ha)	Before 1997/1998 (days/ha)	Increase	
			(days)	(%)
Small	27	61	34	124
Medium	26	55	29	113
Large	27	58	31	115
Average	27	58	31	116

Source: Farm Survey, 1999.

The average per hectare increase in number of man-days work on the small, large and medium farms was about 34 days, 31 days and 29 days, an increase of 124 per cent, 115 per cent and 113 per cent, respectively. This increase is the result of the increased cropped area and yield, especially for cotton and sugarcane crops that involve more labour for inter-culturing and harvesting activities.

Change in Average Net Income per Hectare

The average net income per hectare is the sum of net incomes from chillies, sugarcane, onion, wheat and cotton. It is calculated by deducting the per hectare cost incurred for seeds, fertilizer, pesticide, hired labour, etc. from per hectare gross income of these crops. Table 47.5 indicates the significant increase in the net income of the landowners after the implementation of the project. As shown in the table, the average net income of \$243 per hectare, before the project, had increased up to \$1,445, an increase of \$1,202, or about a 496 per cent increase after the project. According to farm size, the highest increase in the net income per hectare was in the medium-sized farms, followed by the large and small-sized farms at \$1,454, \$1,041 and \$935, respectively. However, percentage-wise, the highest increase in the net income per hectare after the project was found in the medium-sized farms, followed by the small and large-sized farms at 616 per cent, 444 per cent and 348 per cent, respectively.

Table 47.5: Average Net Income per Hectare before and after the Project on the Surveyed Farms According to the Farm Size

Farm Size	Before 1994/1995 (\$/ha)	After 1997/1998 (\$/ha)	Change	
			(\$/ha)	(%)
Small	211	1146	935	444
Medium	235	1689	1454	619
Large	299	1339	1041	348
Average	243	1445	1202	496

Source: Farm Survey, 1999.

Operation and Maintenance of the Project

Currently, Water and Power Development Authority (WAPDA) is paying for the operation and maintenance (O&M) cost of the project. The O&M cost, which includes labour, material, spare parts, electricity and administration costs are expected to be recovered, in the future, from the beneficiaries of the project, through the increased water charges (abiana) assessed on the crop grown. The Government of Sindh will introduce the increased water charge (abiana) annually. After every third year, a 15 per cent escalation in the water charge is estimated until the expiration of the project life estimated around 40 years. During the survey, the selected farmers were asked about their sanctification from the operation of the project and willingness to pay O&M cost of the project through increased water charges and to provide other support. Almost all of the farmers were satisfied by the operation of the project and were ready to provide manual support (labour) for the maintenance of the drainage canal. Regarding payment of the O&M cost of the project, the majority of the respondents were reluctant to pay this cost due to the burden of other taxes on the agricultural sector, increasing cost of agriculture inputs, and the burden of loans taken by farmers from friends and other agencies to maintain their livelihood before the implementation of the project.

It should be noted that the benefit from increased per hectare yield of Jantar and Egyptian clover crops were not estimated because of the lack of farm records. These crops are fed directly to livestock, and animals are often left to graze from the standing crop. Farmers do not keep farm records about expenses incurred, returns received and yield from these crops

Concluding Remarks

The project has a positive influence on agriculture and the income of the surveyed households. After the project, due to reclamation of affected lands, the increased cultivated and cropped areas and crop yields had created more job opportunities for tenants and other landless agriculture labours. The project has also made an increase in cultivation and productivity of land of the surveyed farms possible. A shift and expansion into cultivation of cash crops due to implementation of the project had increased the income level of the surveyed farmers. The increase in net returns is motivating farmers to invest more in farm business. The increase in net income per hectare, especially on the small farms, and the job opportunities for agriculture labour is a positive indicator of improvement in the living standards of this class. The estimated Gini coefficient decreased from 0.577 before the project to 0.222, which shows that income distribution among the farm owners had improved after the implementation of the project.

Moreover, still about 40 per cent of landholdings on the surveyed farm was found uncultivated. This was because of the uncertainty of irrigation water supply from upper stream and lack of underground water. Therefore cultivation of more land was risky for farmers, and they were rather reluctant to bring more land under cultivation of crops that require more irrigation water. At the end of year 2001, by the transfer of operation and maintenance system of the irrigation canal from irrigation department to the water user's organizations and by the remodelling of the irrigation canals in LBOD command area, the supply of irrigation water was improved. Therefore it is expected that in the future the

organizations and by the remodelling of the irrigation canals in LBOD command area, the supply of irrigation water was improved. Therefore it is expected that in the future the cropping intensity, which was about 86 per cent in 1997/98, will reach up to the expected project target of 147 per cent.

Regarding the operation and maintenance cost of the project network, this large infrastructure needs funds for its operation and maintenance in order to maximize and sustain its benefits. In the light of the present economic situation of the country, the government may find it difficult to provide such funds. Therefore the active role of farmers in operation and maintenance of the project is indispensable for the sustainability of the project. The findings of the study prove that by the implementation of the project, the income of the farmers had increased. Further increase in the income level of the farmers is expected in future. Therefore, farmers, who are the actual beneficiaries of the project, are in a position to pay the operation and maintenance cost of the project.

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