ECONOMIC BENEFITS OF THE WATER MANAGEMENT PROGRAMME: A CASE STUDY OF THE WATER MANAGEMENT PROJECT OF THE UNIVERSITY OF AGRICULTURE, FAISALABAD

M. Aslam Chaudhry, M. Rafiq & Abdul Saboor

Department of Agricultural Economics, University of Agriculture, Faisalabad

This paper evaluates the economic benefits of the Water Management Research Project of the University of Agriculture, Faisalabad run over an area of ten thousand hectares in ten villages of Shahkot area of district Sheikhupura from 1978-79 to 1991-92. The results of the study show that implementation of this project brought about significant improvement in the plight of the project farmers in terms of enhanced crop productivity and better farm incomes. The application of the discounted measures of project worth also confirmed that public sector investment in this long term project has been a highly economical proposition with BCR at 1.084, NPW at Rs. 861(000) and m.R at 23.56% at the assumed opportunity cost of capital of 13.5%.

Key words: economic benefits, water management

INTRODUCTION

Indus Basin represents one of the richest agricultural tracts of the world. However, despite richness of resources, the productivity of its lands has tended to remain low as compared to the developed and even some of the developing countries. The available empirical evidence suggests that vast irrigated plains of Pakistan achieved a significant breakthrough in crop productivity in late 1960s and early 1970s and a substantial progress was witnessed in the overall agricultural production. Nevertheless, in the subsequent years the agriculture sector of Pakistan did not fully succeed in achieving the much cherished goal of self reliance for the economy as a whole. Seen in an historical context in the light of some research studies (Clyrna and Afzal, 1975; Doral, 1975; Awan and Ali, 1980 and Waiter, 1990), it becomes evident that lack of proper water management has been mainly responsible for the colossal wastage of the most critical input of irrigation water which is not only limited but also a limiting factor for agricultural economy of Pakistan. The nature of the water management problem reveals that efficient utilization of available water has always been as important in Pakistan as securing additional irrigation supplies. Timely and adequate allocation of water to different crops does not only improve crop yields but also helps in conserving available supplies, and reducing the possibility of waterlogging and salinity. For better use of the available irrigation water resources, "On Farm Water Management Programme" was initiated in 1976 with the technical assistance and collaboration Of the Colorado State University (USA).

A number of packages of new farm practices and technologies were developed for farmer's adoption. The project activities have since been expanded manifold by the government and technologies thus disseminated to the farmers have come to be quite popular.

The University of Agriculture, Faisalabad was inducted into this programme in 1978-79 through an experimental project entitled, "Water Management Research and Training Project for Rural Development" .. This project encompassed ten villages in Shahkot area of Sheikhupura district with the objective of developing appropriate water management technologies and services. It aimed at reducing water losses and improving the efficiency of irrigation at the farm level. This project remained operative for more than thirteen years. During this period, apart from implementation of a watercourse improvement programme, a number of technological innovations .were introduced and demonstrated in the project area through various components of the project. . The programme as it appears from the annual reports of the project, has made a significant contribution in improving not only the water use efficiency in the project villages but-also in giving a real boost to agricultural productivity. This paper evaluates the overall impact of the project in terms of economic benefits to the farming community of the area.

MATERIALS AND METHODS

Through a preliminary survey of farm households, 100 farmers from the ten project villages were randomly

selected and stratified into three categories on the basis of the operational size of holding i.e. small (up to 5 hectares). medium (from 5 to 10 hectares) and large (above 10 hectares). A comprehensive and pretested interviewing schedule was used to collect primary field data.

Another data set was procured from the base line studies and periodic annual reports and research studies for the purpose of deriving estimates of annual project expend: tures and change in productivity and overall crop production trends. The data sets thus gathered were subsequently analyzed using appropriate analytical techniques to determine the real economic worth of the project.· Results of this study have been reported under two main heads in the proceeding section.

A. An examination of direction and extent of change in physical parameters of the project.

8. Impact assessment in terms of real farm level economic benefits of the project (project feasibility).

Direction and extent of change encompass information on the level of use of production inputs over the years and their subsequent· impacts on cropped hectarage, crop yield. cropping intensities, cropping patterns, crop production, gross production values, etc. Impact assessment synthesizes the above information into overall project costs and benefits for the project period (1978-79 ro 11)91-92). Assuming opportunity cost of capital to be 13.5 %, the economic analysis has been carried out in terms of 1978-79 prices. The folloWing three well known discounted measures of project worth were applied ro derive various estimates:

I.· Benefit cost ratio (BeR)
2. Net present worth (NPW)
3. Internal rate of return (/RR)

RESULTS AND DISCUSSION

The basis used for jUdging the overall economic impact of the project implementation is detailed below.

A. Direction and Extent of Change: The implementation of this development oriented project of the University has significantly influenced the farm business and some perceptible changes have come about in the overall· structure of the economy of the area during 1978-79 to 1991-92 period. The changes are depicted in Table I.

B. Project Feasibility: The overall impact of the project implementation on cropping patterns, intensities,

crop yields, etc. was visibly significant as shown in Table 1. However, for determining real economic worth of developmental projects of longer duration. the most commonly used method of evaluation is the application of discounted·· measures of project worth. Accordingly, an effort has been made in the following section to determine economic feasibility of this project. The discounted measures of project worth used here are:

1'. Benefit- Cost Ratio (HCR): The present worth of both project benefits and costs is determined by means of discounting, mostly at the opportunity cost of capital. In the present study, the opportunity cost of capital was assumed to be 13.5 %. The first discounted measure of BCR is used almost exclusively as a measure for economic analysis. It is most comrnonjv used for agricultural projects.

$$\text{Thus BCR} = \frac{\text{Present worth of benefits @. 13.5} \sim}{\text{Present worth of costs @ 13.5 \%}}$$

When BCR is used to evaluate a project, the formal decision criterion is to accept a project if this ratio comes to be one or greater.. Judging on the above criterion, this project came out to be an economically feasible Proposition with BCR at 1.084 (Table 2).

$$\text{BCR @ 13.5\%} = \frac{7828.986}{7222.125} = 1.084$$

2. Net Present Worth (NPW): Another straight forward discounted cash flow measure of project worth is the net present worth (often abbreviated as NPW). This is simply the present worth of the incremental net benefits or the incremal cash now stream.

NPW = Present worth of benefits minus present worth of cost..

NPW @13.5%=7828.986 -n22.125 = 606.861
(000 Rs.)

The formal selection criterion for the net present worth measure of project worth is to accept the project if it gives a positive net present worth when discounted at the assumed opportunity cost of capital. It can be seen from Table 2 that the project generates a positive net present worth and should, therefore, be acceptable.

3. Internal Rate of Return .. (lRR): Still another way of determining the real project worth is to find out the discount rate which just makes the net present worth of

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Table I. Direction and extent of change in physical parameters of the project area

Parameters	Unit	1978-79 base year	1991-92 end year	Change in 1991-92 over 1978-79
I. Size of Holding	Farm (%)			
a) Small « < 5 ha)	"	58	40	-45.00
b) Medium (5-10 ha)	"	28	32	14.30
c) Large (> 10 ha)	"	14	27	92.80
2. Cropping Pattern	% area			
a) Sugarcane	"	2.50	5.25	110.00
b) Rice	"	20.00	23.00	15.00
c) Wheat	"	44.00	47.00	7.00
d) Fodder	"	17.00	17.00	0.00
e) Oil seeds	"	2.00	1,00	50.00
3. Intensities	(%)			
a) Land use,	"	92.00	96.00	4.3
b) Cropping	"	138.00	146.00	5.8
4. Production Inputs	(kg/ha)			
a) Fertilizer	"	71.6	103.7	44.8
b) Seed	% area with imp.seed	27.00	89.00	229.6
c) P.P. coverage	area	39.00	92.00	135.8
5. Crop yield	kg/ha			
a) Sugarcane	"	28468.4	41505.3	45.79
b) Rice	"	2087.9	2987.4	43.31
c) Maize	"	822.8	1934.7	135.13
d) Wheat		1989.2	2915.8	46.58
e) Fodder: Rabi	"	40470.0	63788.8	57.62
Kharif	"	12846.7	27724.5	115.80
6. Crop Production Values				
a) Total cropped area	ha	10605.4	11453.7	7.99
b) Gross production value				
With project	"	3508.8	5530.20	57.61
Without project	"	3508.8	4037.60	15.07
c) Variable production cost				
With project	"	2661.30	4373.60	64.34
Without project	"	2661.30	3128.30	17.55
d) Gross margin:				
With project	"	847.5	1156.40	36.45
Without project	"	847.5	909.30	7.29
e) Net project benefits	"	0.00	247.10	

Table 2. Project feasibility

| Project year | Overall project cost (Rs.OOO) | Overall project benefit (Rs.OOO) | Project worth @ 13.5 % | | |
			P.W. factor @ 13.5 %	P.W. of cost (Rs.OOO)	P. W. of benefit (Rs.OOO)
1978-79	335.28	0.00	0.88	295.33	0.00
1979-80	426.47	0.00	0.77	330.94	0.00
1980-81	1072.87	924.07	0.68	733.84	632.06
1981-82	1305.30	1197.00	0.60	787.09	721.79
1982-83	1248.14	1339.50	0.53	681.87	711.27
1983-84	1635.31	1618.38	0.46	765.35	757.40
1984-85	1899.31	1756.82	0.41	782.51	723.80
1985-86	795.99	2007.62	0.36	288.94	728.76
1986-87	1521.00	2098.55	0.32	486.72	671.53
1987-88	2667.00	2306.47	0.28	752.09	650.42
1988-89	1181.00	2483.55	0.24	92.88	415.92
1989-90	433.00	2724.59	0.21	313.82	596.68
1990-91	2079.00	2793.68	0.19	401.24	539.18
1991-92	1820.00	2830.20	0.17	309.40	481.13
Total	-	-	-	7222.12	7828.98

Benefit cost ratio (BCR) = 1.084; Net present worth (NWP) = 606.861 (000 Rs.); Internal rate of return (IRR) = 23.56 (0/.»)

the cash flow equal to zero. This rate of discount is termed as the internal rate of return. Internal rate of return turns out to be a very useful measure of project worth. It is the measure which IBRD (World Bank) uses for practically all its economic and financial analysis of agricultural projects, and is also used by most other national financing agencies.

The value of the internal rate of return is determined by using the following common straight line interpolation formula:

IRR = LDR + DBDR = $\dfrac{\text{Present worth of the cash flow at the lower discount rate}}{\text{Absolute difference between the present worth of the cash flow at the two discount rates}}$

Where,
LDR = Lower discount rate
DBDR = Difference between the two discount rates
Thus in the present case, IRR was computed as:

IRR = 23.56%

The formal selection criterion for the internal rate of return measure of project worth is to accept a project having an IRR equal to or greater than that of the opportunity cost of capital. The IRR calculations made above also showed that the average earning capacity of the project over its active life period has been well above the minimum rate of return of 13.5% , that is, the assumed opportunity cost of capital. On the basis of three measures of project worth used above, ii may be concluded that the Water Management Project of the University of Agriculture, Faisalabad which remained in operation for over 13 years, proved to be economically feasible and a reasonably rewarding proposition.

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