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ECONOMICS OF KAREZ IRRIGATION IN BALOCHISTAN

Muhammad Sajid Hussain, Munir Ahmad, Muhammad Rafiq' **& Khalid** Ahmad/
'Department ofAgricultural Economics, University of Agriculture, Faisalabad, 2p&I, WAPDA House, Lahore

The focus of this paper was on assessment of the viability of experimental improvements in Karez Abdul Hakim, Quetta. The benefit-cost ratio was estimated to be 2.55: I. The results showed that the income of the beneficiaries increased by more than 100 % with the Karez improvement work. The results of this study suggest that the Karez irrigation system is beneficial for the farming community and thus efforts should be made to keep tllis irrigation system in working condition.

Key words: Balochisian. economics. karez irrigation

INTRODUCTION

Karez irrigation in Balochistan province is one of the oldest methods of irrigation. Many of the karezes in Kalat, Quetta, Qila Saitullah, Loralai and Zhob areas were built during the time of Mughals. which are still in working condition. The karezes have been used successfully for 2000 years or more in Iran and for many centuries in Afghanistan, much of the Middle East and parts of Africa.

A karez consists of a yielding well (the mother well) and a series of open wells connecting an underground tunnel through which the water is delivered to the agricultural lands. A karez works on gravity and requires no power for its operation. Hence. it can he regarded as a cost free source of irrigation. However. it takes 10-15 years to dig a karez of about 1.5 km length. The working and sustainability of such a type of irrigation source is of prime importance in a situation prevailing in Balochistan, where energy prices of extracting groundwater are increasing day by day on the one hand and an evident shortage of energy supply on the other. Oosterbaan (1983) examined the existing laws of water rights in Balochistan with particular reference to karez irrigation and its future working. Khalil (1989) reported that the area irrigated by karezes in Balochistan has decreased by 72 % in 1986-87 over that in 1971-72, whereas the area irrigated by tubewells has shown an increase of 426% during the same period. The internal economic rate of return ([ERR) for karez and for iubewell irrigation option worked out to be 19 % and 20 %, respectively. The focus of the present study was on economic analysis of karez irrigation system in certain parts of Balochisian.

MATERIAL AND METHODS

The analysis is based on the performance data of Karez Abdul Hakirn, subtehsil Panjpai, district Quetia. A number of improvements were carried out in this karez under a USAID research programme. The basic bench mark data were collected from the published reports and the performance data were obtained from the USAID/ISMR publications.

Economic analysis was undertaken to wo'rk out the benefit cost ratio mCR). For this purpose. following assumptions were made:

1. Constant tarrngare prices were used to avoid possible effects caused by oscillating price trends.
2. Only direct benefits and costs were considered and the indirect ones were ignored.
3. To estimate the contribution of enhanced irrigation water and to offset the contribution of non-water inputs. a uniform yield level was assumed for the base year and for the year 1990.
4. The economic life of various improvements has been assumed as 15 years and the costs and benefits have been discounted at 14 % rare of interest.

RESULTS AND DISCUSSION

The salient features of Karez System arc: a) Age of karez is 50 years. b) Number of access wells is 74. c) Length of karez tunnel is 7992 ft. d) Length of open channel is 1700 ft. e) Command area is 100 acres. t) Average karez discharge is 0.17 cl'. g) Conveyance losses are *40'Jr.*

Karez Performance: This karez had a number of problems in its operation, due to which its discharge had decreased to an alarming point. Keeping in view these problems, certain improvements were made to enhance its working. Improvements along with the costs are given in Table I.

Table I. Karez improvements and their costs

Type of improvement	Costs (Rs.)
Tunnel cleaning	X0,000
Capping of wells	2,46,664
Check dam on nearby stream	4,70,000
Lining of tunnel with plastic tube	22,000
Lining of open channel	68,310
Construction of water rank	60,000
Command area development	35,369
Total	9.X2,343

The improvements helped in increasing the amount of irrigation water by about 180% over the base year i.e. 1987. The discharge was recorded as 0.17 cf during the bench mark survey and the average daily discharge during 1989-90 was recorded as 0.56 cl'.

Table 2. Cropping intensities and crop production

Crops	Cropping pattern and intensities (percentage of total crop acreage)		Crop yields (kg/acre)	Total production (kg)	
	1987	1990		1987	1990
Onion	14	30	7403	103642	222090
Wheat	10	18	448	4480	8064
Barley	2	5	374	748	1870
Cumin	5	9	187	935	1683
Alfalfa	3	6	11974	35922	71844
Apple	0	10	0	0	0
Grapes	0	5	2250	0	11250
Total	34	83		145727	316801

Cropping Intensities and Crop Production: The increased availability of irrigation water showed positive effect on the cropping intensity and crop production (Table 2).

The data in Table 2 showed that an impressive increase was achieved in cropping intensity which doubled in case of non-orchard crops over the bench mark period. As the command area of the karez is 100 acres. the area figures of a crop also represent the intensity of that crop. The enhanced irrigation facility has also affected the traditional cropping pattern. No orchard existed there in the base year but after improvements an orchard on 15 acres was found in the area (10 acres under apples and 5 acres under grapes). The changes increased the cropping intensity from 34 % in 1987 to 83 % in 1990. Assuming contributions of non-water inputs constant. total output increased by about 171074 kg over the base year on account of enhanced cropping intensity as a result of increased irrigation supplies. Apple production was not available as an apple orchard starts production in the 7th year. Thus when the apple orchards will start yielding fruit, the production will go higher even if per acre yields remain constant.

Economic Analysis: The objective of the economic analysis was to assess the viability of experimental improvements that may guide whether the investment on karcz improvement could ensure any economic returns to give new life to this irrigation system which will in turn improve the conditions of the poor farmers.

Project Benefits: To achieve the objective of economic analysis, gross value of production (GVP). farm costs and net value of production (NVP) were computed at constant prices. Table 3 indicated that a considerable increase was achieved in terms of economic performance. The aggregate annual benefits for the base year *(1987)* i.e. without the project involvement. were about 518.0 I thousand rupees. while this figure in 1990 was 1125.70 thousand rupees. Consequently. 607.69 thousand rupees were generated by effecting experimental improvements.

Project Costs: The total costs of experimental improvements were Rs.982.54 thousand. These costs were annualized at 14% rate of interest. The annual costs worked out as Rs.159.97 thousand. Adding Rs.23.08 thousand (amortized value of Rs.30.000) as operation and maintenance costs of the improvements, the recurring costs worked out to be Rs.185 .05 thousand.

Benefit Cost Ratio: Benefit cost analysis of the improvement work at Karez Abdul Hakim is given below:

Net benefits (000 Rs.)	607.69
Amortized value of net benefit @ 14% (D.F. = 0.769468)	467.60
Recurring costs	183.05
Benefit cost ratio	2.55: I

The analysis shows positive contribution of the improvement work by yielding a BCR of 2.55: I. It may be noted that the returns will further increase when the orchard starts yielding fruit.

Income of the Beneficiaries: The following comparison is made to gain better understanding regarding the beneficiaries of the karez improvements.

	1987	1990
Net value of production (000 Rs.)	518	I 126
No. of households	15	15
No. of beneficiaries	120	127
Command area (acres)	100	100
Annual Irri supply (Ac. It)	123	405
Income pn tanu family	34533	75067
Income per capita	4316	8866
Income per acre of area	5180	11260
Income per acre foot of water	4211	*i5022*

The results clearly showed that karez improvement work significantly improved the income of the farmers since 100% increase was achieved in 1990 over the base year 1987..

Recommendanons: It is recommended that efforts should be made to keep the karez irrigation in running condition. No energy is required for its operation and this is very important in view of the short supply of energy on the one hand and its ever increasing cost on the other.. Increasing cost of energy would ultimately cause the costs of production to increase.

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