Government of Pakistan/USAID
IRRIGATION SYSTEMS MANAGEMENT PROJECT

An Evaluation of Existing Irrigation Water Pricing Policy in Pakistan

PRC Engineering/Checchi
Islamabad
November, 1985

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PREFACE

This is the first of a series of research reports to be prepared on the subject of "Water Charges and Cost Recovery Issues" by the PRC/ Checchi Team. The completion of this report marks compliance with the first sub-task on this entire subject as outlined in task IV of Integrated Work Plan for the PRC/Checchi Team of September, 1985. Research reports about other specific activities outlined in this task will appear during the comming months.

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Several other people contributed to this report in a number of ways. Mr. James J. Dalton, Team Leader for Planning, Management and Training Team, read various drafts of this report and provided valuable editorial advice. Mr. Russel Backus of USAID and Messers Thomas F. McCarthy and Thomas C. Irvin of PRC/Checchi made helpful comments and suggestions. However, any remaining errors are the responsibility of the author.

TABLE OF CONTENTS

LIST OF TABLES

EXECUTIVE SUMMARY

This study evaluates the existing water pricing policy in Pakistan within the framework of various developmental objectives and existing studies that have been done on the subject. This is necessary because the question of raising water rates to make them compatible with relevant economic parameters needs urgent answers in view of the huge rehabilitation investments now occurring. In the last five years, only two authoritative studies (PIDE, 1981; Chaudhry, 1985) have been conducted to address some of the important issues that frequently arise in the process of fixing water rates. These are treated in this paper; but in view of the very increased cost of water supplies caused by the current major rehabilitation effort as well as the presumably altered repayment capacity of farmers, need for evaluation of current pricing policy can hardly be overemphasized.

This paper asserts that an economic evaluation of existing water pricing policy reveals that present levels of water rates for different crops are considerably lower than the water charges rationalized either on the basis of applying a cost principle or a marginal value product principle. The current low charges are also attributed in this paper as a major cause for inefficient water use in Pakistan. If water charges are set purely on the basis of a marginal benefit approach, they are found to be beyond the payment capacity of the farmers. However, a preliminary analysis of the cost and income

parameters of various crops indicate that a reasonable increase in existing water charges would still be within the paying capacity of the farmers. In essence, the existing water charges constitute a very small fraction of the per acre income and therefore cannot be regarded as having a significant impact on the cropping patterns.

Review of the literature and regulations shows that the objective of cost recovery has not been given much attention in the Pakistani project planning process. The facts show that the revenue-expenditure gap of the entire irrigation system is consistently increasing at an alarming rate. It has gone up nation-wide from Rs.578 million in 1980-81 to Rs.1002 million in 1983-84. In Punjab, cost recovery has dropped from 88 percent in 1974-75 to 64 percent in 1983-84; while cost recovery in Sind has dropped by 23 percent during the same period. It is estimated that O&M costs were Rs.20.61 per acre-ft, Rs.51.67 per irrigated acre, and Rs.31.20 per cropped acre as compared to recovery of Rs.13.02 per acre-ft, Rs.32.64 per irrigated acre, and Rs.19.71 per cropped acre in 1982-83.

The O&M costs for canal water was Rs.15.30 per acre-ft in Punjab and Rs.11.09 per acre-ft in Sind as compared to the O&M cost of public tubewell water which was Rs.84.93 per acre-ft in Punjab and Rs.85.93 per acre-ft in Sind in 1982-83. The cost of public tubewell water was 82 and 87 percent higher than the canal water cost in Punjab and Sind provinces, respectively.

The most significant effect of neglecting the cost recovery objective is that the irrigation infrastructure has deteriorated over

a period of time. Lack of adequate O&M funds lead to deferred maintenance. Today, a major canal rehabilitation program is being financed in order to overcome deferred maintenance and to restore the original capability of the system. This will further increase the cost of water, at least in the short-run. In future, a necessary condition for efficient continued operation and maintenance of the restored system is that it must be financially self-supportive. Aside from technical and management improvements in O&M, this essentially calls for: (i) an improvement in the cost recovery situation through an increase in water charges; (ii) technical revision of the "yardstick model" to make it an effective tool for budgeting procedures; and (iii) elimination of "financial leakages" from the revenue collection system.

In Pakistan, subsidization of irrigation water amounted to Rs.10.89 per acre-ft and Rs.35.78 per irrigated acre in 1983-84. Total subsidies on irrigation water in Punjab and Sind had gone up from Rs.217.70 million and Rs.140.30 million in 1979-80 to Rs.435.30 million and Rs.288.50 million in 1983-84, respectively; showing an increase of almost 100 percent in 4 years. A major portion of this subsidization is going for operation and maintenance of the public tubewell schemes. In 1983-84, per farm subsidy amounted to Rs.138.30 for small farms, Rs.383.50 for medium farms and Rs.849.80 for large farms. The income inequalities among large and small farmers are further increased due to a very high subsidy on irrigation water because large holdings not only get higher subsidy in proportional terms but also derive more benefits by growing cash crops whose water rates are highly subsidized.

In Summary, this review of literature and data on existing water pricing policy within the context of various developmental objectives suggests an urgent need for a significant increase in the prevailing water rates. But, on the other hand, introduction of Ushar (an Islamic levy on agricultural output) in 1982-83 has stopped further increases in water charges for the time being because the amount required to be collected through Ushar is significantly higher than the amount foregone due to elimination of the land revenue tax. It is therefore, imperative to analyze the farmers current payment capabilities before justifying a specific increase in the present level of water charges.

An increase in water charges could not only improve the efficiency of resource allocation both at micro and macro levels but also relieve the Government of heavy financial strains. However, it may not be possible (for many economic and political reasons) to raise the existing water rates to the target level with one stroke. The most appropriate way to reach the target level would be to develop a phased schedule that is based on gradual increases so that it would be acceptable to farmers. Those gradual revisions should take into account the changes in general price level which affects the value of returns as well as certain components of the cost of cultivation. Moreover, considerable political support will be needed to implement a promotional type pricing policy if subsidies are to be reduced over time.

CHAPTER - 1

INTRODUCTION

Water Pricing in the Overall Economic Setting

Pricing policies in the agricultural sector are used by Governments for a variety of purposes. They may serve as an instrument to stimulate agricultural production by encouraging new technology or to stabilize the income of various socioeconomic groups. They may also improve the efficiency of resource allocation, encourage consumption patterns, induce investment, provide benefits to special interest groups and exploit potential trade advantages. These objectives can be achieved through the use of various policy instruments including administered product and input prices, export taxes and import restrictions. Today, as in the recent past, the Government of Pakistan intervenes heavily both in output and input markets to accomplish any one or more than one of the objectives listed above.

An efficient pricing system in an economy not only provides signals for investment in new opportunities arising from technical and institutional developments but it provides a basis to rationalize some other economic, social and administrative objectives. Choosing appropriate prices is therefore equivalent to choosing the best set of taxes and subsidies, a choice central to the design of a public policy. Since prices influence the pattern of resource utilization and level of production and consumption, therefore, failure to examine the social desirability of the price system is irresponsible (Josling, 1973).

Irrigation water pricing falls within the domain of input pricing policies and can be used as a policy instrument to accomplish the following three major developmental objectives: (i) efficiency - allocation of available irrigation water according to equi-marginal principles; (ii) equity - reduce the income distribution gap among different socioeconomic groups; and (iii) financial - recover the capital and operational costs of the irrigation system. In practice, it is difficult to have a policy which could pave the way for reaching all these objectives simultaneously.

The suitability of different criteria for determining water charges will depend on the priority given to different objectives (Doppler, 1977). In Pakistan, setting water charges for different canals has historically been affected by factors like operation and maintenance costs, interest on capital costs, repayment capacity of the farmers, quantities of water required for maturing a particular crop, availability of water in different seasons and value of produce and incentives for certain crops (Government of Pakistan, 1970). Although a number of questions can be raised regarding the quantum, mode of assessment, structure and the uniformity and diversity aspects of water rates, the baseline policy must focus on cost of irrigation water, value of water in terms of farm produce and the repayment capacity of the beneficiaries. Water charges established in isolation of any one of these issues would not accomplish the designed objectives in an efficient manner.

The need for the formulation of an effective water pricing policy in Pakistan can hardly be overemphasized especially when the state is supposed to manage and operate the largest contiguous irrigation system in the world. The current rate of investment in the irrigation sector is very high as compared to the rest of the sectors of the economy. Various components of the irrigation infrastructure are being rehabilitated with the help of huge financial borrowings from the International Lending Agencies to ensure greater water supplies at farm level. The magnitude of these investments calls for a water pricing policy that should support the saving and investment efforts of the country in the interest of domestic resource mobilization for further development. The level and structure of water charges should provide meaningful economic signals to the farmers so that social benefits could be maximized through an efficient allocation of scarce resources.

Historical Background of the Irrigation Water Pricing System

The history of water pricing in the Indo-Pak Sub-continent dates back to 1854 when water charges were introduced as Government policy. The development and maintenance of irrigation infrastructure was entrusted to the newly created Public Works Department. In 1873, the irrigation water charges were regularized under a Legislative Act known as the Northern India Canal and Drainage Act - VIII. After independence, the name of the Act was changed in 1949 to Canal and Drainage Act of 1873. The Canal Act was applied to all provinces with certain amendments made by the respective Provincial Governments.

This Act empowers the Provincial Governments to revise the water rates to account for the improvements in irrigation facilities and costs of obtaining a higher production for the needed farm commodities. Moreover, it allows the Government to impose taxes on the appreciated value of irrigated lands. The Act suggests gradual changes in the structure of water charges in order to ensure adequate opportunities for the farmers to adjust their farming practices and avoid socio-political disturbances among the farm population that might arise from its rapid modification. However, the Act does not allow for any adjustments in water rates for various categories of farms. The sale of water or exchange of water turns among farms are prohibited under this Act. Specific rules and regulations are provided in this Act to deal with issues relating to canal navigation, construction of drainage works, obtaining of labour in emergency for canal construction and settlement of disputes arising out of irrigation. Tenancy legislation was also introduced to apportion the water charges between the tenants and landlords. Province-specific developments in water charges are summarized below.

Punjab: The original schedule of water charges for different crops was prepared in 1891 for the command areas of Upper Bari Doab Canal. Similar schedules were prepared and implemented for each canal command upon the completion of respective canals. Major determinants of water rate schedules were costs of construction of canals and payment capacity of the farmers.

The initial schedule of water charges was increased in 1924 by

25 percent because of enhanced farm incomes. At that time the farmers located in canal commands with higher water rates indicated their dissatisfaction over the wide difference in water rates among various canal commands. Accordingly, the canals (Pakpattan, Depalpur and Mailsi) built after 1924 exhibited less variation in water charges. The water charges for certain canals (Haveli, Rangpur, and Thal) constructed between 1943 and 1947 were kept deliberately low due to low payment capacity of the farmers located in these commands. In 1934, water rate schedules developed in 1924, were reduced by 12 and 16 percent for gravity and lift canals respectively, due to overall depression in output prices. The water charges for seasonal canals were also set as 50 percent of the water rates charged for perennial canals. In 1948, an increase of 40 percent was announced in water charges but this decision was not implemented because of unfavorable farmer response. Therefore, the charges fixed in 1934 remained effective until 1953.

The water charges for inundation canals were raised by 50 percent in 1953 and were put in line with the water charges of perennial canals. In 1954, water charges for orchards were doubled because of higher water requirements of this crop. A further revision of water charges in 1965 shifted their level back to what had prevailed back in 1924. Later on, an upward revision in water charges was made in 1969, 1978 and 1981.

North Western Frontier Province (NWFP): Water charges for Kabul, Upper and Lower Swat canals were fixed in 1931 and for Paharpur canal

in 1936. These water rate schedules remained effective until 1959 without any upward revision. Before 1959, farmers were required to pay 25 percent of water charge as development cess. This development cess was merged into water charges when the Government made a decision in 1959 regarding classification of canals according to their pattern of irrigation supplies and rationalization of water charges which connotes their fixation in proportion to quantities of water consumed in maturing different crops. According to this decision, canals were classified into Barrage Canals and Non-Barrage Canals. Uniform water charges were introduced for all crops for both perennial and non-perennial canals. However, water rates for rabi crops were fixed separately for non-perennial canals as these delivered water only for crops sown in rabi season. After the classification of canals and rates for each crop, water charges applicable in 1934 were uniformly raised in 1959. Later on, between 1959 and 1969, a number of enhancements in water charges were made to generate required amounts of funds for efficient operation and maintenance of the irrigation system. However, water charges were increased slowly and gradually to avoid general mass resentment.

Sind: A composite levy (water charge + land revenue) was imposed on the canals of Sind and Khairpur. The composite rates for major crops were assessed on the basis of sliding scales so that increases could be realized in proportion to the increases in output prices. Irrigation receipts were assumed to constitute about 90 percent of the composite levy. The composite levy was bifurcated into water rates and land revenue again in 1955.

In 1959, the Government made a decision regarding rationalization of water charges by reclassifying the canal systems to remove the prevailing disparities in the level of water rates for different canal systems. After classification of canals and rates, water charges were uniformly raised in 1959. In December 1972, a flat rate system was introduced. A major feature of this system was that it was leviable on the entire land holding of the farmer irrespective of whether or not the land was cultivated or irrigated. This system was withdrawn in March 1980 and the old system of acreage basis was adopted once again. The main reasons which led to the abolition of the flat rate system were: (i) the bigger farmers resorted to the stealing of irrigation water on a large scale because they wanted to bring their entire land under cultivation to get maximum benefit from the system; and (ii) the downstream farmers were always short of water because of excessive unauthorized withdrawls in the head reaches and because of the massive struggle to cultivate all of the available land.

Baluchistan: The application of the Canal and Drainage Act was extended to Quetta and Kalat Divisions of the Baluchistan province in 1964. The structure of water charges for this province was the same as it was for Sind because Baluchistan's irrigated area used to be assessed alongwith the area of Sind. The composite rate policy remained effective until 1955, and was followed by a flat rate system in 1972-73. Later on, the flat rate system was changed to a crop-based system in 1977-78 as a result of the recommendations of the

committee set up by the Government for rationalization of water charges for the southern zone. In 1981, the Irrigation Department of the Baluchistan Province felt the need to increase water charges to take care of consistently increasing operation and maintenance expenditures. The revised rates were introduced through an ordinance in 1981. According to this ordinance, water charges would vary by the category and system of irrigation and would be levied on a crop-based system.

Present Status of Water Pricing Policy

A brief review of both the history of water charges in Pakistan and available literature on this subject reveals that the question of raising water rates to make them compatible with other relevant economic parameters has surfaced again and again. Many committees have been formed both at provincial and national levels to rationalize the structure of water rates. The recommendations of these committees have either been accepted partially or not at all depending upon how the policy makers viewed the recommendations in the context of the economic and political situation of the country at a particular time.

Presently water charges in Pakistan are imposed on an acreage basis and vary with the crops grown in each season. These charges are also not uniform country wide and vary among provinces. Acreage basis charges are applied because these are easy to implement and farmers find them easy to comprehend. The existing water rates for

major crops in all the provinces are shown in table 1.1. Water charges are set on adhoc basis and there appears to be no systematic procedure for increasing them. Though water charges among crops vary considerably, this variation has little relationship to the consumptive crop water requirements. Moreover, the current level of water charges constitutes a very small fraction of the net per acre income of various crops and hence has no effect upon the mix of crops grown by the farmer. Various studies (reviewed in next chapters) conclude that the present level of water charges is nowhere close either to the cost of water supplies or to the value of water in terms of farm produce.

The water pricing issue has become especially critical since the mid-seventies when revenues from irrigation water users, once a source of surplus over current outlays, began to fall progressively below the operation and maintenance (O&M) costs. Today, the Government's stated objective is to attain full recovery of O&M expenditures in the water sector by the late 1980s or early 1990s (phased according to provinces). In the past few years, water charges were revised a couple of times to get closer to this objective but those increases in water rates did not match the changes in general price levels.

Table 1.1 Existing Water Rates For Major Crops in All the Provinces (Rs/Acre)

Crops	BALUCHISTAN		N.W.F.P.		SIND		PUNJAB	
	Perennial Canals	Non-Perennial Canals	Perennial Canals	Non-Perennial Canals	Perennial Canals	Non-Perennial Canals	Perennial Canals	Non-Perennial Canals
Sugarcane	63.06	51.25	65.60	53.60	64.00	48.50	64.00	61.60
Orchards[a/]	50.00	23.63	50.40	42.40	50.00	50.00	41.60	41.60
Rice	31.25	27.56	29.60	23.20	31.25	31.25	32.00	32.00
Cotton	32.81	27.56	29.60	17.60	32.75	28.25	33.60	33.60
Maize	14.06	15.75	19.20	13.60	14.00	14.00	19.20	19.20
Wheat	18.75	15.75	19.20	17.60	18.75	15.50	21.60	21.60
Kharif Oilseeds	26.56	19.69	24.00	19.20	26.50	26.50	23.20	23.20
Rabi Oilseeds	18.75	11.81	22.40	17.60	18.75	14.50	11.20	11.20

a/ for half year.

Source: Irrigation Departments of the Provincial Governments.

CHAPTER - 2

ECONOMIC EVALUATION OF EXISTING WATER PRICING POLICY

This chapter evaluates the existing water pricing policy within a context of the economic efficiency objective. More specifically, economic evaluation takes into account the impact of present level of water charges on allocative efficiency, water use efficiency, net farm income, cropping patterns and other relevant economic parameters.

Marginal Cost Pricing

Theoretically, the allocative efficiency objective can be met by setting the price of a resource equal to its marginal cost, so long as the price is below marginal value product. The marginal cost rule optimizes allocative efficiency since the charge is exactly equal to the value of resource outlays required to supply water.

Davis and Heneke (1971) advocated that marginal cost be measured in terms of short-run operation and maintenance costs. The short-run concept is argued on the grounds that investment is a sunk cost and should be ignored. Coase (1971) strongly objected to setting public utility prices equal to marginal cost, especially where marginal cost is below average cost (hence requiring public subsidy). Millman (1972) argued in favour of the long-run marginal cost concept, including investment amortization. The long-run marginal cost has an obvious economic advantage but because of conflicting social and political objectives it is not likely to be adapted (Carruthers and Clark, 1981).

The marginal cost pricing principle is theoretically very attractive but difficult to apply, particularly in view of the fact that economists have proposed a variety of definitions to measure this concept. Moreover, in practice, it is difficult to estimate because large lumpy investments are required to increase irrigation water supplies. At best one may be able to talk about incremental charges of several thousand cubic meters of water (Easter, 1980). In the Pakistani context, it is also possible that some part of the system might have already been paid for since receipts from water charges exceeded the operation & maintenance costs until the mid-seventies. However, if we "approximate" the operation & maintenance costs as short-run marginal costs, then there is a basis for increasing the water rates by considerable amounts as is evident from the discussion to follow.

The average O&M cost of canal irrigation water in Pakistan was Rs.14.62 per acre foot in 1982-83. However, the O&M cost showed wide variation among provinces and it was found highest in NWF province (Rs.53.97 per acre-ft) followed by Punjab (Rs.15.30 per acre-ft) and Sind (Rs.11.09 per acre-ft. The existing water rates for different crops were found to be considerably lower when these were compared with the water charges rationalized on the basis of O&M costs estimated above (see table 2.2). If we compare the existing water charges with the water rates developed on the basis of O&M costs of both the canal system & SCARP[1] tubewells, the situation becomes much worse.

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[1]Salinity Control and Reclamation Project.

Marginal cost pricing becomes very important when the price elasticity of demand is very high. The elasticity of demand for water is likely to be low at low water prices in the short-run. However, when the price rises and the length of run increases, the price elasticity also increases. Since higher water prices encourage farmers to use water more efficiently, therefore, as one goes from lower to higher prices, and as one goes from short-run to long-run demand curves, the elasticity will increase and marginal cost pricing will have a greater impact on water use efficiency (Seagraves & Easter, 1985). The price elasticity of demand for irrigation water in Pakistan has been estimated as follows from the demand schedules generated by various studies using different techniques and different data sets.

(i) Chaudhry (1985) generated a demand schedule for supplemental water by varying the pumping cost of tubewells. It was estimated from this function that price elasticity of tubewell water was -0.31 at lower prices and -0.86 at higher prices.

(ii) Chaudhry (1985) used a parametric programming approach to generate a step-wise demand function for canal irrigation water. This information was used to develop a generalized demand curve and a price elasticity of -0.78 was estimated from this demand function.

(iii) A demand function was estimated on the basis of historical water supplies expressed as a function of price of water

(actual receipts from water charges were assumed as price of water). This demand function yielded a price elasticity of -0.03 and -0.07 in Punjab and Sind provinces respectively.

Marginal Value Product of Irrigation Water

Economic efficiency criteria suggests that a given quantity of water should be allocated in a manner such that the marginal value product of water is equal among all uses. In order to satisfy this criteria water may have to be reallocated among uses which implies that transfer among uses has a "cost" called its opportunity cost. This means that economic efficiency criteria becomes the means for allocating a given quantity of water among uses until it has the same marginal value product or opportunity cost in each use.

In practice, it is difficult to make "accurate" estimates of marginal productivity of water because: (i) crop production is a biological process that is carried out in uncontrolled and highly variable environments; (ii) irrigation decisions are made by a large number of individual farmers, each varying widely in management capability; (iii) irrigation water application is especially sensitive to the rate at which water is combined with other inputs; (iv) varietal differences in a particular crop may respond somewhat differently to water application; and (v) it does not account for technological changes over a period of time. However, social scientists still attempt to derive these estimates by using different analytical techniques. The most frequently used techniques are: pumping cost of

tubewell water, tabular analysis, production function approach and linear programming models.

The underlying assumption of using the pumping cost of private tubewell water as a proxy for the marginal value product is that the availability of tubewell water will relax the water scarcity constraints and subsequently the profit maximization hypothesis will guide the farmer to pump the water to the point where the value obtained from an incremental unit of water equals the incremental cost of supplying that unit of water. The operational cost of pumping per acre inch of water from one cusec tubewell is Rs.5.30 (WAPDA, 1980). Rationalization of water charges on the basis of pumping cost indicates that existing water rates for various crops would have to be increased at least by 5 times to reflect the efficiency value of water (see table 2.2). This apparently seems justifiable as various studies (Khan, 1977; Clark, 1967; Gotsch et al., 1975; Chaudhry, 1985) concluded that there were very high financial and economic returns to tubewell technology. However, Muhammad (1965) argued that pumping cost of tubewell water cannot be regarded as a proxy for the value of surface supplies because tubewell water is generally used to supplement rather than to substitute canal irrigation.

The value of water can also be estimated by using the tabular analysis technique applied to cross section data or experimental data. We used the information compiled by WAPDA (1982)[2] to calculate marginal

[2]This information is based on data collected by WAPDA under Expanded Agricultural Economic Survey (XAES) and survey of 61 water courses. For details, see Irrigation Practices for Different Crops and Their Evaluation, Planning Division, WAPDA, 1982.

value product of water for different crops. It was found that, on an average, a per acre inch of water increases the crop yields to the extent of 0.244, 0.215 and 0.05 maunds in case of wheat, rice and cotton respectively. The marginal contribution of a per acre inch of water, calculated on the basis of 1984-85 output prices and above mentioned marginal physical productivities, comes to Rs.15.93 in wheat, Rs.16.95 in rice and Rs.8.82 in cotton.

The marginal value product of irrigation water in Pakistan has also been estimated through applying the production function approach and from linear programming models. However, there is one striking difference among the values derived from these two analytical techniques. The values derived from the production function approach provide information regarding change in net income due to change in factor supplies assuming all other inputs are held constant. In programming models this concept is also known as a "shadow price" and it is defined as the change in the value of objective function due to per unit change in the limiting resource assuming appropriate adjustments in all other inputs. The values derived by various studies in Pakistan using both these analytical techniques are shown in table 2.1. It may be noticed that these values vary considerably across the provinces and among crops.

It appears then that the existing water charges are extremely low if we compare them with the water rates developed on the basis of marginal value of water, regardless of the method of determining this

Table 2.1 Estimates of Marginal Value Product of Water in Pakistan.

Analytical Technique/ Study or Author.	MVP (Rs/Acre inch)	MVP Calculated on Crop Basis or on Farm Basis	Other Remarks
Production Function			
Khan (1975)	22.49	Farm	Punjab
Hussain (1981)	34.23	Farm	NWFP
"	39.33	Farm	Punjab
"	4.48	Farm	Sind
"	31.48	Cotton	Marginal Soil Conditions
"	8.30	Wheat	" " "
"	11.94	Rice	" " "
"	30.93	Sugarcane	" " "
Chaudhry (1982)	15.19	Wheat	Head Farms
"	22.80	Wheat	Tail Farms
"	17.11	Wheat	Punjab
Linear Programming			
Falcon & Gotsch (1968)	20.44	Farm Size=12.5 Acres	Traditional techonology-Punjab
" "	5.27	Farm Size=12.5 Acres	Modern techonology-Punjab
Johnson (1977)	20.70	Farm Size=500 Acres	Total area commanded by a water course was considered as farm area. Values represent year round average.
Chaudhry (1985)	20.64	Farm Size=20 Acres	Financial Prices } a/
"	53.30	"	Economic Prices } a/
"	23.70	"	Financial Prices } Values represent year round average.
"	56.61	"	Economic Prices } Values represent year round average.

a/ Marginal return to per Acre inch of water $= \frac{\Delta \text{ in net farm income from one water supply scenario to other.}}{\Delta \text{ in water supply from on water supply scenario to other.}}$

value (see table 2.2). As a matter of fact, rationalization of water rates in relation to cost of tubewell water or marginal productivity of water may not be feasible because farmers will not be ready to pay this price beyond a limited period of time. It is estimated that equalization of water rates with the value of water in crop output (determined on the basis of pumping cost of tubewell water) would require the farmers to pay more than 25 percent of their net income from wheat, sugarcane and cotton. Water rates estimated for various crops in relation to average marginal value product of water exceeded the net per acre income of these crops indicating that these charges are beyond the payment capacity of the farmers. However, if the water charges are set at some fraction (say 5-8 percent) of the marginal benefit, a considerable leeway exists today to raise the water charges even under conventional water management practices.

Efficiency of Water Use

In Pakistan a large percentage of the irrigation water is lost in the system through seepage, transient, and operational losses. The Government of Pakistan (1983) reported that total water losses from canal head to farm gate were about 40 percent of the water available at canal head. These losses occur at every stage of the distribution system but losses from water courses have become a major issue during the past couple of years. Various studies (WAPDA, 1979; FAO, 1977; World Bank, 1976 & 1981; Gasser, 1981; Lowdermilk, 1978) estimated that 30 to 70 percent of water available at the

Table 2.2 Comparison of Existing Water Rates With the Water Rates Developed on the Basis of Various Economic Mechanisms in Punjab Province.

Crops	Average[a/] Consumptive Water Requirements (Acre Inches)	Existing Water Rates (Rs/Acre)	Water Rates Developed on the Basis of				Per Acre[f/] Net Income Without Water Charge
			Average[b/] O&M cost (Rs/Acre)	MVP[c/] (Rs/Acre)	MVP[d/] (Rs/Acre)	MVP[e/] (Rs/Acre)	
Wheat	18	21.60	22.95	95.40	286.74	360.00	371.60
Rice	34	32.00	43.35	180.20	576.30	680.00	167.00
Cotton	33	33.60	42.07	174.90	291.06	660.00	598.60
Sugarcane	64	64.00	81.60	339.20	-	1280.00	1173.60

a/ Consumptive water requirements generally vary for different canal commands due to a number of agronomic and climatic factors. The above water requirements represent an average for the Punjab Province.

b/ Short-run Operation and Maintenance cost is Rs.15.30 per acre-ft for canal water supplies, adjusted to farm gate level.

c/ Pumping cost of tubewell water is Rs.5.30 per acre inch (WAPDA, 1980, Page 66).

d/ MVP of per acre inch of water is assumed Rs.15.93 for wheat, Rs.16.95 for rice and Rs.8.82 for cotton (derived from the information compiled by WAPDA, 1982).

e/ Average marginal value product of water is assumed Rs.20.00 per acre inch (derived from the information in table 2.1 of this report).

f/ Taken from Staff Appraisal Report, Pakistan Irrigation Systems Rehabilitation Project, World Bank, 1982, Page 74.

watercourse head is lost before it reaches the individual field diversions. These huge losses are occuring due to operational characteristics built into the system, poor management by farmers, lack of effective organization at village level and inefficient water management practices. The financial magnitude of these losses is reported by a World Bank study (1983) indicating that if water losses are cutdown from 50 percent to 30 percent, the value of water saved would be equal to the capacity of three Tarbela Dams (equal to 9 billion dollars investment).

These water losses are occuring at a time when water is considered to be a scarce commodity. The results of above referenced studies imply among other things that farmers are failing to utilize irrigation water satisfactorily. This in turn has prevented the full realization of the potential social benefits from the huge investments in irrigation projects. No doubt, technological progress is presently being made aimed at reducing water losses at watercourse level and increasing water use efficiencies at farm level; but significant improvements would be improbable unless economic changes are brought about in conjunction with the technical changes. In this direction, the major economic arrangement would be to raise the price of water to an extent that it could perform its allocative role more efficiently. Though an increase in the water charges will not help to avoid the water losses presently leaking through the 'entire' system, they will at least result in reduction of losses occurring at watercourse and farm level.

An important question frequently asked in the context of economic efficiency is how an increase in water charges will force the farmer to use water in a more efficient manner, especially, when the charges are levied on a area-based principle? It is true that area-based charges do not offer any economic incentive to a cultivator to avoid wastage of water because his payments are unrelated to the quantum of water taken by him. Volumetric charges, on the other hand, are theoretically very attractive as the farmer pays for every unit of water he uses. However, in the Pakistani system there are practical difficulties involved in implementing volumetric charges. The most important are those of measurement and negative attitudes among the farmers towards such a system. In addition, the institutional costs (technological costs and administrative costs) of administering such a system are expected to be very high. Greater sophistication in water pricing systems cannot be justified if the benefits generated by efficient allocation of water are offset either by higher costs associated with administering more sophisticated water measurement instruments or by the rigidity of water delivery systems. A volumetric pricing policy would lead to higher allocative gains only if the water delivery system can be made to be more flexible and operated on a demand basis.

An analogical approach to volumetric pricing, under the existing water allocation rule (warabandi)[3], would be to rationalize the water charges on the basis of cost of supplying per unit of water and

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[3]The present system of water allocation observed in most parts of the Pakistan (Wara means turn and bandi means fixation).

consumptive water requirements of a specific crop. The advantages of adopting this approach are two-fold. First, farmers would be paying exactly for the quantities of water required by them to mature their crops (this approximates volumetric charges). Second, farmers would find this approach easy to comprehend since it would be in line with the existing practice of levying water charges. Rationalization of water charges on this principle would call for an increase in the existing water charges of wheat, rice, cotton and sugarcane by 6.25 percent, 35.46 percent, 25.21 percent and 27.50 percent, respectively. The water charges established on the basis of this approach would require the government to make very certain that the delivery of water required by the farmer to mature his crops would be delivered in time and in the volumes needed.

Farm Income Analysis

Farm income and crop budget analysis helps to assess the payment capabilities of the farmers and subsequently provides a rational basis to formulate an appropriate water pricing policy. Water charges can be expressed as some proportion of either gross income or net income. The Government of India (1972) suggested that water rates should be set about 10 percent of the gross income of a crop. This approach automatically takes into account the effects of inflation because the fluctuations in general price levels are reflected in input and output prices. Various studies (World Bank, 1982; Chaudhry & Ashraf, 1981; Chaudhry, 1985; UAF, 1982; WAPDA, 1979) developed crop budgets for various areas of Pakistan. Some of the results of these studies are summarized in table 2.3. These results revealed

Table 2.3 Water Charges as Percent of Production Cost, Gross Income, and Net Income.

Crops/Farm Size	Water Charges as Percent of		
	Production Cost (Rs/Acre)	Gross Income (Rs/Acre)	Net Income (Rs/Acre)
Crops[a/]			
Cotton	5.18	2.76	5.95
Rice	6.36	5.01	23.70
Wheat	4.58	2.63	6.17
Sugarcane	4.58	2.51	5.54
Farm Size[b/]			
Small	3.00	2.00	4.00
Medium	3.00	2.00	4.00
Large	5.00	1.00	2.00

a/ World Bank, Staff Appraisal Report, Pakistan Irrigation System Rehabilitation Project, 1982 (Page 74).

b/ Chaudhry & Ashraf, An Economic Analysis of the Level and Structure of Irrigation Water Charges, PIDE, 1981 (Page 162).

that water charges constituted a very small fraction of cash production costs (4-6 percent), gross income (2-5 percent) and net income (5-6 percent) of all major crops except rice. The World Bank estimates for rice crop indicated that water charges represented about 24 percent of net income. This finding, however, was not in line with the estimates made by other studies because the per unit output price used by the Bank was very low. The farm income analysis of various categories of farms indicated that water charges constituted only 3 percent of production cost, 2 percent of gross income and 4 percent of net income on small and medium size farms. On large farms, water charges represented somewhat different proportions of various financial parameters.

The most important question is what proportion of income should be considered as a basis for setting the water charges? There are no specific rules to set these formulas, but review of relevant literature for India and Pakistan indicates that water charges should range between 6-12 percent of gross income and 8-15 percent of net income per acre of a given crop. It is suggested that a lower limit should be used to fix water rates for food crops and an upper limit for commercial or cash crops. The payment capacity criteria should ensure reasonable financial surplus for the farmer, after appropriating for an increase in water charges, to make him stay in the business. It is reasonable to assert, therfore, that the cost and income analysis for different crops indicates a considerable scope to increase the present level of water charges on the basis of criteria spelled out above.

Impact of Water Charges on Cropping Pattern

Theoretically, a significant increase in water charges can affect the cropping pattern negatively. Chaudhry & Ashraf (1981) examined this relationship for the period 1965-67 to 1977-78 and concluded that wheat in particular and area under rice, cotton and maize in general have tended to decline during the first one to two years after the upward revision in water charges in 1969-70. However, subsequent revisions in water charges beyond 1978-79 did not confirm this relationship and instead a fairly stable cropping pattern was observed. As a matter of fact, farmer's decisions to allocate acreage among various crops are mainly guided by the net revenue functions of these crops rather than their water charges alone. Since water charges constitute a very small fraction of the net income of a particular crop, therefore, it may be concluded that water charges alone cannot have had a significant impact on the cropping pattern. Moreover, the prices of outputs have increased more frequently than the water charges, and the increases in output prices have been relatively higher than the increase in water rates, which has offset the impacts, if any, of an increase in water charges on the cropping pattern.

In summary, this economic evaluation of existing water pricing policy has focused on the cost of irrigation water supply, value of water in terms of farm produce and the payment capacity of the farmers. The present water rates for various crops are found to be considerably lower than the water charges rationalized on the basis

of operation and maintenance cost of the irrigation system. The current water charges are also attributed as one of the major reasons for inefficient water use in Pakistan. This is evidenced in the form of very high water losses at watercourse level. A very high marginal value product (MVP) of water in Pakistan suggests that a significant increase in the current level of water charges should be made, ensuring as well that it is within the payment capacity of the farmer, to improve the efficiency of resource allocation both at micro and macro levels. Fixing water rates purely on the marginal benefit approach seems to be beyond the payment capacity of the farmers. However, these could be fixed as some proportion of the marginal benefit, gross income, or net income of a given crop. A preliminary analysis of the cost and income parameters of various crops indicate that a reasonable increase in existing water charges would still be within the paying capacity of the farmers.

CHAPTER - 3

COST RECOVERY, IRRIGATION SUBSIDIES AND OTHER CONSTRAINTS

Cost recovery is a financial objective and government decisions in this regard depend upon whether the public funds are tight or less constrained. Full cost recovery can be defended as part of the efficiency objective because the allocation of resources by the beneficiaries will be guided by the true costs of the resources. In practice, cost recovery from irrigation projects is low in both developed and developing countries. Duane (1974) surveyed 17 irrigation projects financed by the World Bank and found that, on an average, 30 percent of total projects costs are recovered. The irrigation works are mostly constructed and operated by the Governments and since their utilization confers benefits on only a section of the cultivators, it is proper that appropriate costs are recovered by the states (Gole et al., 1977).

Cost Recovery at Macro Level

A standard recommendation is that water charges should recover the capital costs incurred in the construction of irrigation and drainage schemes, plus operating expenses (Reca, 1982). This practice has rarely been followed in Pakistan and recoveries from water charges represent only a fraction of the value required to cover these costs. The revenue-expenditure gap of the entire irrigation system is consistently increasing at an alarming rate over the past couple of years.

It has gone up from Rs.578 million in 1980-81 to Rs.1002 million in 1983-84. At macro level, O&M costs of the entire irrigation system constituted 8.45 percent of the total expenditure of the economy; while on the recovery side receipts from water charges represented only 4.64 percent of the total revenues in 1983-84.

The historical relationship between O&M expenditure and receipts from water charges for two leading provinces of Pakistan (Punjab & Sind) is examined in table 3.1. It is evident from these statistics that both O&M expenditure and recoveries from water charges have been increasing consistently over the period of time but the latter has not increased in the same proportion as the former. In Punjab, cost recovery[4] has dropped from 88 percent in 1974-75 to 64 percent in 1983-84, while cost recovery in Sind has dropped by 23 percent during the same period. If we take into account the capital cost of the system, the cost recovery situation becomes even worse.

Cost Recovery at Micro Level

Operation and maintenance costs of the entire irrigation system and receipts from water charges are estimated under different unit scenarios in table 3.2 to have a micro level perspective of the revenue-expenditure situation. It was estimated that O&M costs were Rs.20.61 per acre-ft, Rs.51.67 per irrigated acre, and Rs.31.20 per cropped acre as compared to recovery of Rs.13.02 per acre-ft, Rs.32.64 per irrigated acre, and Rs.19.71 per cropped acre in 1982-83. A

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[4]Cost recovery is defined as receipts from water charges as percent of the O&M expenditure.

Table 3.1 Operation and Maintenance Expenditure and Recoveries From Water Charges in Punjab and Sind Provinces for the Period 1974-75 to 1983-84.

(Figures in Million Rupees)

Year	Punjab			Sind		
	O&M Expenditure	Receipts	Deficit	O&M Expenditure	Receipts	Deficit
1974-75	312.40	275.00	37.40	109.20	73.70	35.50
1975-76	371.10	277.70	93.40	128.00	67.10	60.80
1976-77	390.80	314.90	75.90	171.10	61.60	109.50
1977-78	417.00	360.70	56.30	138.80	86.60	52.20
1978-79	480.70	417.40	63.20	213.70	98.90	114.70
1979-80	645.40	427.70	217.70	235.40	95.00	140.30
1980-81	734.50	473.00	261.50	329.00	131.50	197.40
1981-82	931.50	593.10	338.40	407.30	203.00	204.30
1982-83	1007.30	688.11	319.20	420.20	210.00	205.00
1983-84	1195.30	760.00	435.30	513.40	224.10	288.50

Source: Provincial Irrigation Departments.

Table 3.2 Comparison of Operation & Maintenance Costs With the Receipts From Irrigation Works in Pakistan Under Various Per Unit Measures in 1982-83.

Unit Measure	O&M Costs (Rs)	Receipts (Rs)
1. Per acre foot	20.61	13.02
2. Per irrigated acre	51.67	32.64
3. Per cropped acre	31.20	19.71

further analysis of the costs incurred on operation and maintenance of different components of the irrigation system revealed that per unit O&M costs for public tubewell schemes were extremely high as compared to the per unit O&M costs estimated for the canal irrigation system. The O&M cost for canal water was Rs.15.30 per acre-ft in Punjab and Rs.11.09 per acre-ft in Sind as compared to Rs.84.93 per acre-ft in Punjab and Rs.85.93 per acre-ft in Sind for the water supplied from public tubewell schemes in 1982-83. The cost of tubewell water was 82 and 87 percent higher than the canal water cost in Punjab & Sind provinces, respectively. Cost comparisons on a provincial basis indicated that the cost of supplying per acre-ft of canal water in Punjab was 27.5 percent higher than Sind. However, the per unit cost of tubewell water was almost similar in both the provinces.

Total Irrigation Subsidies

Neghassi and Seagraves (1978), in a review which summarizes the extent of irrigation subsidies, found that irrigation projects are generally highly subsidized, implying that the direct beneficiaries do not pay for the complete cost of irrigation. Their estimates indicate that the cost of irrigation in the lower Indus region is only 10 percent of the returns to irrigation. Historically, the main reason for very low water charges (or high subsidies) in Pakistan can be attributed to the point advanced by Carruthers and Clark (1981) ... " very low irrigation rates may be found in countries with many old-established schemes. Costs of these schemes were initially low and, because they are now fully depreciated, only operation and maintenance costs have to be recovered by rates. In these circumstances, it is usually not politically practicable to set very different rates for new, high cost projects. Water rates within a country tend to be equal no matter what the cost of supplying water to the individual scheme".

In Pakistan, the total implicit subsidy (O&M cost of irrigation system minus revenues from water charges) has been consistently increasing over the past many years. This is due to under-pricing of water. The subsidy has gone up nation-wide from Rs.160 million in 1975 to Rs.908 million in 1984. If we include the annualized capital cost of the system, the situation becomes much worse. Total historical subsidies were estimated by adjusting the historical streams of O&M costs and receipts from water charges to a common year (1984)

price level, and then calculating the difference between the capital sum of these two streams. Expressed in this manner, total subsidies for the years 1965-84 amounted to Rs.2344 million. The subsidies in the SCARP areas were significantly higher as compared to non-SCARP areas.

The total water supplied at the mogha[5] was 82 MAF from the canal system and about 10 MAF from the public tubewell schemes. This irrigated about 28 million acres of land in 1983-84. It is estimated, on the basis of these figures, that the subsidy on water was Rs.10.89 per acre-ft and Rs.35.78 per irrigated acre in 1983-84. The total implicit subsidy on irrigation water in Punjab and Sind has gone up from Rs.217.70 million and Rs.140.30 million in 1979-80 to Rs.435.30 million and Rs.288.50 million in 1983-84 respectively, showing an increase of almost 100 percent in 4 years. A major portion of this subsidy is going for operation and maintenance of the public tubewell schemes. In view of these facts, the Government is considering initiation of a tubewell divesting program for transferring operation and maintenance of public tubewells in the fresh ground water zone to the private sector. This may relieve the Provincial Governments from heavy financial burdens.

Currently, as a matter of overall policy and in order to mobilize resources for further economic development, the Government is gradually reducing the element of subsidy being paid on various

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[5]Outlet from canals to watercourses.

agricultural inputs. Perusal of historical statistics indicate that subsidies on other inputs (fertilizer, seed, and pesticides) have dropped nation-wide from Rs.2602 million in 1980-81 to Rs.1736 million in 1983-84. However, it is probable that the social benefits from these efforts can't be maximized until the subsidy on irrigation water is also eliminated because presently it just offsets the possible effects of these efforts.

Distribution of Subsidies

The subsidy on various inputs undoubtedly helps in the adoption of new technology. This is one of the many reasons why almost all inputs in Pakistan have been heavily subsidized in the past, either in a explicit or implicit manner. The failure to charge users for services (and thus the subsidization of those services) is frequently justified on equity grounds. But, in practice, these subsidies are often distributed inequitably. The major portion of these subsidies, and the resulting benefits are captured by the influential farmers which further aggravates the income distribution gap among different groups within the agricultural sector. Subsidies can only be justified if these are carefully targetted at the poor.

In Pakistan, 74 percent of the total number of farms are under 12.5 acres and represent about 45 percent of the total irrigated area. If subsidy is a direct function of area irrigated, then an immediate inference can be drawn from these statistics that 26 percent of the total number of farms (above 12.5 acres) are utilizing 55 percent of

the total subsidy. On an average, nation-wide subsidy on irrigation water amounted to Rs.146.20 per farm in 1983-84. It is estimated on the basis of total number of farms classified by size and total area irrigated under each category of farm that per farm subsidy was Rs.138.30 for small farms, Rs.383.50 for medium farms and Rs.849.80 for large farms in 1983-84.

Although the per acre subsidy is the same for all categories of farms, it varies among crops. This eventually affects farmer decisions regarding selection of crops on these farms. Subsidies on irrigation water involved in growing per acre of major crops is estimated in table 3.3. These show a direct relationship with the consumptive water requirements of a crop. The cropping pattern statistics indicate that farmers with large holdings devote more acreage to cash crops while small farmers bring more area under food crops and fodders. The large holdings have derived significantly higher net income per acre of cash crops (cotton, rice, and sugarcane) as compared to other categories of farms (Chaudhry & Ashraf, 1981). This study also indicated that, on an average, per acre net income on large holdings was about 42 percent higher than per acre net income of small farms. If we view cropping patterns across these categories of farms in conjunction with the level of subsidy involved in growing of different crops and per acre net income estimates certain distortions become evident. It appears that the lower water charges (or higher subsidy on irrigation water) are further aggravating the income distribution gap because large holdings not only get higher subsidy in proportional terms but

Table 3.3 Implicit Subsidy Involved in Growing of Major Crops in Pakistan in 1983-84.

Crops	Consumptive Use Water Requirements (Acre Inches) [a/]	Cost of Water (Rs/Acre) [b/]	Existing Water Charges (Rs/Acre)	Implicit Subsidy (Rs/Acre)
Wheat	18	29.70	21.60	8.10
Rice	34	56.10	32.00	24.10
Cotton	33	54.45	33.60	20.85
Sugarcane	64	105.60	64.00	41.60

a/ Consumptive water requirements generally vary for different canal commands due to a number of agronomic or climatic factors, but above water requirements represent an overall average.

b/ Cost of water is Rs.19.80 per acre-ft which is estimated on the basis of total O&M costs and total water supplies adjusted to mogha level.

also derive more benefits by growing cash crops whose water rates are highly subsidized.

Other Constraints

The above review indicates that Pakistan is falling short of cost recovery targets mainly due to low water charges. Nevertheless, there are other constraints too which can be attributed as contributing to shortfalls in the cost recovery objective. These constraints can be categorized as institutional (deficiencies present in the revenue assessment/collection system) and financial (out-dated O&M budgeting procedures).

Institutional Constraints: The present water pricing system consists of detailed written records and every action is cross-checked at one stage or the other. When first designed, the underlying assumption of having such a complicated system was to eliminate or lessen opportunities of corruption for petty Government officials. Yet, in practice, there are opportunities of this kind. According to the present system, an irrigation patwari (an assessor) assesses the water rates on the basis of crop conditions. This provides him an opportunity to make arrangements between himself and individual farmers. He is a poorly paid official who enjoys significantly high social power within his area of jurisdiction, typically encompassing four or five villages. Small farmers are reluctant to cause him trouble and big farmers can buy him out. A patwari can reduce the farmer's tax by: (i) falsely claiming hailstorm damage or some other act of God such

as flooding or earthquake, (ii) identifying cultivated land as fallow, (iii) reporting healthy plants as having been struck by disease, and (iv) declaring seeds as completely or partially failing to germinate (Johnson et al., 1977). Another important irrigation official from the farmer's standpoint is the canal overseer. He can favor the farmers by allowing them to enlarge the size of mogha. The magnitude of the favor is determined by the number of cultivated acres on the watercourse and the degree of mogha enlargement. In sample villages payment have ranged from a minimum of Rs.600 to Rs.6000 (Lowdermilk et al., 1975).

Poorly paid officials of the Irrigation Department, with little promotion prospects, control a commodity which although rated as nearly valueless (because of its low price) is an essential and scarce input for the majority of the rural population. The scarcity and essentiality constraints determine the farmer's actions in the process of optimizing behavior and open doors for favors. Under these circumstances it is possible that there may not be any need for increased water rates if the financial leakages present in revenue assessment/collection systems are eliminated or atleast reduced. Robert & Singh (1951) advocated that elimination of the patwari and his exactions would be one of the most beneficial institutional changes that could be made. However, in order to accomplish this change, some other institutional arrangements for the assessment & collection of water charges would have to be established.

Financial Constraints: Inadequate financial resources is one of the major reasons for rapid deterioration of the irrigation system.

In periods of high inflation, budgetary allocations have remained almost constant, resulting in a decline in real terms. The high maintenance costs of public tubewell schemes have further increased the financial burdens on the Provincial Governments. One major reason, as mentioned earlier, for shortfalls in O&M funding was that the system was not able to generate enough funds to support itself. Apart from low water charges, methodological deficiencies in present budgeting procedures also contribute to inadequate budgets for O&M funding. The annual O&M budget is presently prepared on the basis of a "Yardstick Model" which was developed decades ago. Although various parameters of this model have been revised over the years to take into account cost escalation factors, it still has a number of deficiencies. There is no provision in the model for purchase of durable goods or for the maintenance of such goods. Yardstick rigidities do not allow the model to capture the effects of various economic and technological changes which may take place over the long-run.

There have been a number of attempts to assess the optimum level of O&M activities to be funded in the provincial non-development budget. WAPDA (1981) has estimated that an "adequate" level of O&M expenditure should be Rs.28.00 per CCA per annum. A recent study done by DAI (1984) estimated that Rs.66.36 and Rs.49.37 per CCA would be required for "optimum" operation & maintenance of the irrigation system (both canals and public tubewells) in Punjab & Sind provinces, respectively. Optimal funding requirements for efficient operation & maintenance of the irrigation system calculated by the World Bank

(1982) are Rs.28.17 per CCA for canal system and Rs.51.24 per CCA for both canal & public tubewell schemes.

The existing funding level is significantly lower than the amount required for efficient operation and maintenance of the system. In order to make the system self-supporting, accuracy of budgeting procedures will have to be improved. This essentially calls for a major technical revision of the yardstick model to make it an effective device for budgeting procedures. Apart from this technical revision, the weighting composition of total canal miles needs to be redefined in view of the presently on-going canal rehabilitation works. The total funding requirements also call for a significant increase in the water charges but increases of such magnitude may not be justified on economic efficiency grounds. However, a gradual increase in water rates during the next 4-5 years will enable the system to meet its funding targets. According to the existing system, revenues from all sectors are pooled in the national treasury and then allocated to various sectors of the economy. Under this kind of arrangement, although there is no guarantee that increased revenues from water would be reappropriated to irrigation system's maintenance, some degree of correlation may be expected.

CHAPTER - 4

CONCLUSIONS AND POLICY CONCERNS

An Overview of Conclusions

Appraisal of the existing water pricing policy in the previous chapters leads us to conclude that: (i) though water charges among crops vary considerably, this variation has little relationship with the consumptive crop water requirements; (ii) present water rates for various crops are lower than the water charges rationalized on the basis of the marginal cost principle or marginal value product principle; (iii) very low water charges is one of the major reasons for high water losses at watercourse level; (iv) an increase in water charges is not likely to effect the existing cropping patterns; (v) water charges constitute a very small fraction of the net farm income and an increase in these charges may be within the payment capacity of the farmers; (vi) operation and maintenance costs of the existing system are consistently increasing; (vii) operation and maintenance costs of public tubewell schemes are significantly higher than the costs required for operation and maintenance of the canal system; (viii) the gap between receipts from water charges and O&M costs is consistently increasing; (ix) the revenue-expenditure gap can be attributed to low water charges and various other institutional and financial problems which may make the existing investments more unproductive and inefficient; (x) irrigation water is being subsidized

very heavily; and (xi) benefits of the subsidy are not equitably distributed among various socioeconomic groups within the agricultural sector.

These conclusions underline the fact that existing water pricing policy has not only failed as an institutional mechanisim to perform its allocative role but it is also putting the Government under heavy financial strain. The Government has to divert huge financial resources from other sectors of the economy to finance the irrigation sector because the latter sector is unable to raise revenues for its own operation and maintenance. The social cost of these diverted financial resources is estimated as very high because the financial inefficiency of the irrigation sector is partially being supported from general tax revenues rather than from fees purely paid by the beneficiaries. Existing budgetary problems at macro level further illustrate the need to make the irrigation sector financially self supportive, and this objective can be partially accomplished through an increase in existing water charges.

Present Policy Concerns

The review of the cost recovery situation suggests an urgent need for significant increases in the present level of water charges to bridge the continuously increasing revenue-expenditure gap and to initiate measures to reduce O&M costs of the public tubewell schemes. The Government is presently attaching more weight to the second policy option and considering initiation of a "SCARP Transition

Program". According to this program, tubewells in fresh ground water zones would be transferred to the private sector for operation, maintenance and replacement. A feasibility study to determine the scope of this program was carried out in 1984. The preliminary findings indicated that this program would be financially viable and economically feasible. This program with private sector involvement, is not only expected to increase water supplies through an efficient operation & maintenance of the system, but will also reduce the O&M burden on Provincial Governments. However, whether or not this program will be socially acceptable or practically possible is still an open question. About 92 percent of the direct beneficiaries want these projects to remain in the public sector but with improved operation & maintenance operations[6]. In case this program is not implemented, the Provincial Governments will come under heavy financial strains because of high replacement costs of those units which are completely out of order.

Because of shortfalls in non-development budget funding, Provincial Governments and the Federal Government have included certain deferred maintenance items, described as rehabilitation, in the Annual Development Plans. Further, to alleviate the funding problem, the Federal Government has assumed the rehabilitation of flood protection works as a federal responsibility and included it in the Federal Annual Development Program.

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[6]A socio-economic survey was carried out as part of the feasibility study. The respondents were asked to give suggestions for improving SCARP well performance from a series of alternatives provided in the questionnaire. For details see Feasibility Report on SCARP Transition Project, ACESGI, 1984.

The most significant effect of neglecting the cost recovery objective has been that existing irrigation infrastructures have deteriorated over a period of time mainly due to deferred maintenance. In future, at least in the short-run, the average cost per unit of water delivered is expected to increase because major investments will still be required to rehabilitate the system. The incidence of increased costs will also fall upon other projects deprived of resources when irrigation rehabilitation is undertaken and upon potential consumers of the lost products of the project (Carruthers, 1981).

For many developing countries, the funds available for new capital projects are more plentiful (because they come largely from concessional assistance) than the funds available for operation and maintenance of the existing projects (which come largely from domestic resources). Various International Lending Agencies supporting Pakistan's efforts to expand irrigation water supplies through rehabilitation of several components of the system recognized the importance of this issue. These agencies have realized that it is not sufficient to build massive dams and extensive irrigation schemes but the most important issue is to strengthen the recipient country's capability to budget for O&M funding and to identify the sources of O&M funds. Therefore, in recent years, the Government of Pakistan (GOP) and the International Development Agency (IDA) have held continuous dialogue on the subject of water charges. Also, this issue has been discussed between the GOP and IMF as part of the Extended Fund Facility (EFF) agreement. During these discussions, the GOP declared its intention

to introduce a phased increase in water charges in order to cover the full O&M costs of the irrigation facilities.

However, in practice the GOP has not been able to keep up the same enthusiasim in raising water charges expressed while securing financial assistance to begin new projects. This can be partly attributed to the introduction of Ushar[7] in 1982-83. It is generally argued that Ushar is a substituting tax for land revenue and has nothing to do with the water rates. This argument is valid only if the per acre amount collected through Ushar is exactly equal to the amount foregone due to elimination of the land revenue tax. In reality, it appears that the situation is different since the farmer ends up paying a much higher amount under the Ushar system as compared to the old land revenue tax (see table 4.1). Our objective here is not to get into the intricacies of the religious aspects of this levy, but to point out that if the farmer is really paying this levy in accordance with the formula prescribed by the Government than it might have affected the water charge payment capabilities of the farmers severely. Although a preliminary analysis of the cost and income parameters of various crops indicate that farmers can afford to pay (in addition to Ushar) increases in water charges, our findings are not conclusive. A very careful analysis of the farmers payment capabilities will have

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[7]Ushar is an Islamic levy on agricultural output. On irrigated lands, it is to be collected in cash from every landowner, grantee, allottee, lesee, leaseholder or land holder at the rate of 5 percent of his share of the produce, as on the valuation date, after deducting one - third of the total produce.

Table 4.1 Estimates of Ushar for various Crops.

Crop	(1) Per Acre Production (Kgs)	(2) Two-third of (1) (Kgs)	(3) 5 Percent of (2) (Kgs)	(4) Price (Rs/Kg)	(5) Ushar (Rs/Kg)	(6) Land Revenue (Rs/Acre)	(7) Difference Between Ushar & Land Revenue (5-6)
Wheat	764	504.24	25.21	1.60	40.33	10.00	30.33
Rice						10.00	26.31
Basmati	489	322.74	16.14	2.25	36.31		
Irri.	939	619.74	30.99	1.28	39.67	10.00	29.67
Cotton	153	100.98	5.05	4.65	23.48	10.00	13.48
Sugarcane	14681	9689.46	484.47	0.24	116.27	10.00	106.27

to be done before justifying a specific increase in the present level of water charges.

Proposed Policy Directions

A revised water pricing policy, whether based on a cost approach or a benefit approach, obviously calls for significant increases in the water charges of various crops (if the farmers can afford additional charges). An increase in water charges would improve the overall efficiency of the system because increased availability of funds should ensure that financial constraints will not limit allocations for operation and maintenance. This would also help to defray some of the costs of large prospective drainage and irrigation projects which might otherwise be delayed for lack of funding. As a policy matter, it may not be possible for many economic and political reasons to raise the existing water charges to the "target level" with one stroke. The most appropriate way to reach the "target level" would be to develop a phased schedule that is based on gradual increases so that increased charges would be accepted by the farmers. These gradual revisions should take into account the changes in general price level which affects the value of returns as well as certain components of the cost of cultivation.

Frequent revisions in water pricing policy generally create a sense of insecurity among the farmers. Therefore, they may allocate their resources inefficiently in the short-run. The revisions also involve additional expenditure by the Government. But, on the other hand, continuation of old rates for too long throws them out of their

intended relationship with the benefits (NACER, 1959). Finally, considerable political support will be needed to implement a promotional type pricing policy if subsidies are to be reduced over time. In reality, it may be almost impossible to develop such political support especially due to the dominance of agrarian elites on the national political scene. However, if the ruling alliance has the will to protect national interests over vested interests, then nothing is impossible.

Another policy issue concerns the warabandi system. Today, when the weekly warabandi schedules are prepared, actual losses in the watercourses are not taken into account. This results in a potentially serious inequity in the distribution of water supply within a chak[8]. Various studies (WAPDA, 1979; Lowdermilk et al., 1978; World Bank, 1981) have confirmed this phenomenon by concluding that existing patterns of water distribution lead to unfavourable effects on downstream farmers in the form of low per acre yields, less cropping intensities and lower per acre returns. Contrarily, some Agricultural Engineers hold the view that conveyance losses were carefully considered when the warabandi system was introduced and those losses are taken into account by allowing correspondingly longer flows of water to downstream farms. This contradiction leads us to conclude that the conveyance losses assumed at the time of introduction of the warabandi system were lower than the current ones.

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[8]Lowest order command covering, on an average, about 400 acres and 35 farm units.

It is therefore suggested as a matter of policy that the conveyance losses be adjusted while determining the duration of turn for each farmer in such a way that all farmers located on a watercourse will get an equal amount of water per unit of land. One obvious implication of this system is that it will be perfectly equitable but whether or not any efficiency losses are associated with it is an empirical question. Chaudhry (1985) explored this and found that losses of head farms were offset by the gains of tail farms, indicating no efficiency losses under this kind of arrangement. The group of farmers who are located at the head of the watercourse would obviously oppose this suggested arrangement but its implementation really depends upon how much weight policy makers would like to assign to social equity.

In another policy instance, a differentiated water rate policy could be adopted under a number of circumstances. This would have the objective of reducing the income distribution gap between certain target groups. A recent study by Chaudhry (1985) showed that differentiated water rates for different groups of farmers will not detract allocative efficiency and is an inexpensive method of redistributing income among different categories of farmers. This study estimated that if small farmers and downstream farmers are charged 66.7 percent of the water rate paid by big farmers and upstream farmers, the income equity measure[9] would improve by 2.1 percent and 6 percent, respectively.

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[9]Income equity measure is defined as income of small (or downstream) farmer as percent of big (or upstream) farmer's income.

The study further estimated that a 1 percent increase in income of small farmers and downstream farmers would require about 9.5 percent and 3.3 percent reduction in their water charges, respectively. This means that a differentiated water rate policy could lead to a very modest redistribution of income because water charge constitute a very small fraction of farm expenses. The existing differentiated water rate policy for SCARP and non-SCARP areas should continue unless these schemes are handed over to the private sector for operation & maintenance.

Although a policy of differentiated water charges would alleviate some of the economic problems of small farmers, at the same time, it might deny economies of scale. That is, it would provide an incentive for the sub-division of large holdings. Contrarily, it may be argued that agricultural enterprises in less developed countries are labor-intensive, and the cost per unit output does not vary appreciably as the size of enterprise is increased or decreased. Cost economies generally occur because of substitution relationships among inputs. It is true that the least cost mix of inputs will change as the size of enterprise change but in less developed agriculture, alternative methods of producing an output are limited because the substitution possibilities are limited.

Some Additional Considerations

It is advocated above that an increase in existing water charges is imperative but this contention needs further justification on two

grounds. First, the burden of taxation on the agricultural sector needs to be compared with the taxes from other sectors of the economy and with an overall tax rate of the economy to see whether or not levying of more taxes on this sector is justifiable on equity grounds. The analysis of this issue is particularly important because presently it is being hypothesized at policy-making levels that additional taxes on the farmer in the form of higher water rates are not justified. It is said that Pakistani farmers are already paying a considerable amount as indirect taxes (since domestic output prices are below the international prices). Second, it is possible that there may not be any need to raise water rates if the financial leakages present in revenue assessment/collection systems are eliminated, or at least reduced. In this connection the total receipts "supposed" to be collected through water charges should be estimated by taking into account existing cropping pattern and water rates for different crops. These estimates should be compared with the "actual" receipts to find out the magnitude of financial leakages.

Equity of Taxation: Agricultural taxation falls within the purview of general taxation and its major components are land revenue, water rates and agricultural income tax. A new agricultural levy called "Ushar" has also been imposed on the agricultural sector as part of the diversified efforts being made by the present government to "Islamize" all sectors of the economy. As mentioned elsewhere, the impact of this special levy on farmer net income requires careful study.

For the country as a whole the agricultural income, at current prices, between 1981-84 rose about 27.17 percent as compared to gross national income which rose about 29.23 percent during the same period. It thus appears that prices of both agricultural and non-agricultural products have risen almost at the same rate implying that domestic terms of trade have not shifted significantly in favor of either sector.

The relationship between taxes and income for various sectors of the economy is explored in table 4.2. The analysis indicates that the agricultural tax, on the average, represented about 2.66 percent of total agricultural income. This relationship showed a declining trend during the last three years. The declining rate of tax collection indicates that the tax structure is not income-elastic and an increase in income does not lead to an automatic proportional increase in tax collections (Hamid, 1970).

During 1981-84, average non-agricultural taxes represented about 3.59 percent of total non-agricultural income. In general, the average tax burden on the economy was about 13.85 percent of total national income during this period. This analysis indicates that the burden of taxation on the agricultural sector is far below that of the burden of taxation on the non-agricultural sector and the overall tax rate of the economy during the last several years. These macro-level conclusions strongly suggest the need for additional taxes on the agricultural sector to make this sector compatible with other sectors of the economy in the interests of resource mobilization for further development.

Table 4.2 Relationship Between Taxes and Total Income in Agricultural and Non-Agricultural Sectors.

Description	Years		
	1981-82	1982-83	1983-84
Case - 1			
(i) Total agricultural income (Million Rs)[a/]	89311.00	101593.00	113579.00
(ii) Total agricultural taxes (Million Rs)[b/]	2607.00	2641.00	2820.00
(iii) (ii) as percent of (i)	2.92	2.60	2.48
Case - 2			
(i) Total non-agricultural income (Million Rs)	234178.00	266379.00	304480.00
(ii) Total direct taxes (Million Rs)[c/]	9038.00	9762.00	9859.00
(iii) (ii) as percent of (i)	3.86	3.66	3.24
Case - 3			
(i) Total income in economy (Million Rs)	323489.00	367972.00	418059.00
(ii) Total tax revenues (Million Rs)[d/]	43003.00	49924.00	61374.00
(iii) (ii) as percent of (i)	13.29	13.57	14.68

a/ Includes income from all crops, livestock, fishing and forestry.
b/ Includes taxes from land revenues, irrigation, forests, interest income & others.
c/ Includes federal income & corporation tax, federal & provincial property taxes (excluding land revenues) & other direct taxes.
c/ Includes direct taxes, indirect taxes and taxes on international trade etc.

Source: Constructed on the basis of information in Tables 1, 19, 20 and 22 of statistical Appendix. Review of Sixth Five Year Plan, World Bank, 1984.

At micro-level, a recent study by Chaudhry (1985) estimated that total taxes (land revenue, irrigation charges, and ushar) represented about 8.5 percent of net farm income on a 20-acre farm, and that this tax burden was considerably lower even than the amount of Government subsidy on fertilizer used at the farm.

The comparison of domestic prices of major crops with their international prices indicate that the agricultural sector is probably paying more taxes (direct + indirect) as compared to the rest of the economy. If inputs and outputs are valued at economic prices, the indirect tax burden (i.e. transfer to government and consumer) was about 26.21 percent of net farm income on a 20-acre farm (Chaudhry, 1985). Although the burden of indirect taxation "appears" to be high on the agricultural sector, this rate is not comparable with the average tax rate of the economy because of different prices used in calculations. Moreover, this burden may not "appear" as significant as it presently is, if the indirect burden of taxation on other sectors of the economy is estimated by using economic prices of inputs and outputs. Therefore, the conclusion regarding the low burden of taxation on the agricultural sector is valid only under the assumption that price distortions are distributed neutrally over all sectors of the economy.

Additional taxes on this sector would help the country to bridge its revenue-expenditure gap which has been consistently increasing during the last couple of years. Water pricing can be viewed as an instrument for additional taxes. However, the existing structure of

water charges needs to be appropriately designed within the context of some specific developmental objectives.

Financial Leakages: Reder (1975) has defined corruption as the "unanticipated and unaccepted failure of an agent to serve his principal". It arises from arbitrariness in decision making. It not only leads to inefficient revenue collection but it can also spoil the intended incentive structure of a given pricing mechanism. An overall scarcity of irrigation water in Pakistan compels the farmers to search for additional supplies of water which opens the doors of corruption for officials of the Irrigation Department. The two important officials involved in the process are the "canal overseer" and the "irrigation patwari". It was explained in chapter 3 how these officials can grant concessions to farmers.

This section attempts to quantify the magnitude of "financial leakages" which can be attributed to under-assessment (or under-reporting) of water charges. A very simple methodology has been adapted to arrive at these estimates for the year 1981-82[10]. The tax revenues "supposed" to be collected were estimated by multiplying the area (irrigated by canals and public tubewell schemes) sown under each crop with its respective water rate, and were summed over all the crops. The difference between these estimates and actual receipts from water charges is defined as "financial leakage" from the system.

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[10]This year was selected because all the data required for calculations were available for Punjab and Sind provinces.

The estimates with respect to "financial leakage" due to under-reporting of tax are shown in table 4.3. It was found that under-reported tax was about Rs.63 million in Punjab province and about Rs.18 million in Sind province in 1981-82. The leakages were found to be 9.58 percent and 8.10 percent of the total collectable taxes in Punjab and Sind provinces, respectively. However, all of the gap between collectible and actually collected taxes can't be regarded as "financial leakage" because farmers can be relieved from paying the water charges because of crop failures due to many reasons. Assuming that 3-5 percent of total collectible taxes are written off due to crop failures, the magnitude of "financial leakage" is still very high in a country where financial resources are scarce. In order to confirm the validity of this conclusion and to see the trend in "financial leakages", it would be appropriate to carry out this analysis beyond 1981-82. Such an analysis would help the Irrigation Department to introduce effective administrative measures to eliminate, or at least reduce, the magnitude of these leakages.

In Summary, this exercise was carried out to see whether or not there would be any need to increase the water rates if the "financial leakages" present in the country's revenue assessment system are eliminated. The analysis revealed that "collectible" revenues constituted about 70 percent and 54 percent of actual O&M costs of the irrigation system in 1981-82 in Punjab and Sind provinces, respectively. This implies that existing water charges would still have to be increased even if the revenue assessment system is made perfect by all standards.

Table 4.3 Financial Leakages Due to Under-Assessment of Tax Revenues in Punjab & Sind Provinces For the Year 1981-82.

	Description	Punjab Province (Million Rs)	Sind Province (Million Rs)
(i)	Amount to be recovered from Canal System[a/]	439.41	186.23
(ii)	Amount to be recovered for SCARP[b/]	216.58	34.68
(iii)	Total amount to be recovered (i+ii)	655.99	220.91
(iv)	Actual receipts from water charges[c/]	593.10	203.00
(v)	Financial Leakages (iii-iv)	62.89	17.91

a/ Cropping pattern data was taken from tables III - 51 (Page 100) and IV - 17 (Page 207), Pakistan Development Statisties, WAPDA, Aug. 1984.

b/ Cropping pattern data was taken from tables 3.5 (Page 3-19), SCARP Transition Project, Vol: 1, Main Report, ACESGI Consultants, 1983.

c/ Data taken from Provincial Irrigation Departments.

However, it is imperative first to do a careful analysis of the farmers payment capabilities in order to justify specific increases in the present level of water charges.

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