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IRRIGATION WATER CHARGES AND RECURRENT COST RECOVERY

by

Muhammad A. Chaudhry

IRRIGATION WATER CHARGES AND RECURRENT COST RECOVERY IN PAKISTAN[1]

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Muhammad A. Chaudhry[2]

The objective of this paper is to examine the existing level and structure of water charges in Pakistan within the context of issues related to recovery of recurrent costs. This is necessary because the question of raising water charges to make them compatible with relevant economic parameters needs urgent answers in view of the consistently increasing revenue - expenditure gap of the irrigation system and huge rehabilitation investments now occuring.

There are five sections in this paper. Section 1 provides an overview of irrigated agriculture and irrigation system in Pakistan. Section 2 reviews the historical background and current status of water pricing policy in Pakistan. The situation with respect to cost recovery, irrigation subsidies and "target level" water charges is discussed in Section 3. Present O&M budgeting procedure and full funding O&M requirements are discussed in Section 4. Major conclusions and policy recommendations are presented in Section 5.

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[1] The views presented in this paper are those of the author alone and do not necessarily represent those of PRC/Checchi or USAID.

[2] Project Economist, PRC/Checchi/USAID, Pakistan Irrigation Systems Management Project.

1. INTRODUCTION

1.1 Irrigated Agriculture in Pakistan: Agriculture plays vital role in the economy of Pakistan. It accounts for 70 percent of national export earnings, 55 percent of the labor force, and 29 percent of gross domestic product. Its growth rate in 1985-86 was 6.5 percent indicating that weather conditions were favorable and availability of key agricultural inputs was satisfactory. A variety of crops are grown in various agro-climatic zones of Pakistan; however, in general, wheat, cotton, rice, sugarcane and maize are the most important crops. Most of the foreign exchange earnings of the country are generated within this sector, mainly through the export of rice and cotton.

The foundation of Pakistan's agriculture is the irrigated area which is reported to be 15.3 million hectares, accounting for 75 percent of total cultivated area (Government of Pakistan, 1984). About 74 percent of this area is irrigated by canals and 19 percent of the area receives irrigation water from tubewells. Irrigated agriculture contributes about 80-90 percent of Pakistan's agricultural production.

Agricultural production increases of the recent past are attributable to an expansion in irrigated area, since crop yields remained almost constant. The national average yields for all crops are far below the potential which is achievable with the currently available human and natural resources. From the irrigation standpoint, overall scarcity of irrigation water, non-availability of irrigation water at the right time and inefficient utilization of available water are the leading factors responsible for the gap between actual and potential yield levels.

Irrigation water is the vital input for a prosperous agriculture in the country. Presently, agricultural production is severely constrained by the overall scarcity of irrigation water. The supply and demand analysis of irrigation water, conducted by WAPDA (1979), indicates that available water supplies are about 30 percent short on an annual basis. The shortage in rabi season[3] (34.6 percent) is somewhat more severe than in kharif season (25.1 percent). In the rabi season, shortage is acute in the months of February and March when wheat is at heading and flowering stage and irrigation is critical. In the kharif season, large shortages occur in the months of June which delays the planting of cotton, and September which is serious for boll formation of cotton.

1.2 Public Irrigation System: Irrigation water supplies under the public irrigation system are derived both from the surface system and the public tubewells. The surface water for irrigation is obtained from the Indus Irrigation System which is the largest contiguous irrigation system in the world. The Indus System encompasses the Indus River and its tributaries, three major storage reservoirs[4], 19 barrages/headworks, 12 link canals, 43 canal commands covering about 90,000 chaks[5]. The total length of the canal system is about 39,000 miles with water-courses[6], field channels and field ditches running another 1.0 million miles.

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[3] Rabi season (October to March); kharif season (April to September).

[4] Tarbela has 9.3 MAF livestorage, Mangla 5.9 and Chashma 0.7.

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

[6] Watercourse is the communal irrigation delivery facility within each chak.

Approximately 103 million acre feet (MAF) of surface irrigation supplies are diverted annually into this canal system.

In the public sector, groundwater is obtained from SCARP (Salinity Control and Reclamation Project) tubewells. Government has installed about 12,500 tubewells over 12 completed SCARP projects, covering about 20 percent of the country's irrigated land and costing approximately Rs.6.5 billion at the time of installation (World Bank, 1986). In 1985, about 10 MAF water was available from SCARP tubewells and other public irrigation tubewells.

Both sub-surface and surface drainage facilities are needed in the irrigated areas of Pakistan. Except for rice area commands, sub-surface drainage facilities are required in all the irrigated areas of the country where water table is less than 5 feet. The Government has attempted to handle sub-surface drainage problems through the SCARP programs plus a very limited tile drainage program where applicable. Over the years, a large net work of surface drains have also been constructed in the country to take care of surface drainage problems.

1.3 Private Irrigation System: In Pakistan, there are about 186 thousand privately owned tubewells which can be regarded as country's private irrigation system. These tubewells are located in both canal command and dryland areas. Groundwater pumpage from these tubewells accounts for nearly 80 percent of Pakistan's total pumpage, about 20 percent of the total irrigation supply at the source, and approximately 30 percent of total irrigation supply at the "root zone" (World Bank, 1986).

About 65 percent of the private tubewells are installed in canal command areas and are used as supplementary sources of

irrigation; whereas the remaining 35 percent provide the principal source of irrigation (WAPDA, 1979). According to a WAPDA survey (1980), about 88 percent of the investment on private tubewells is contributed by the farmers out of their own resources, 3 percent by government subsidy programs and 7 percent by credit advanced by the Agricultural Development Bank of Pakistan.

The government is also encouraging the installation of private tubewells by providing direct cash subsidies and credit on soft terms and conditions. Direct cash subsidies are available for construction of private sector tubewell facilities and to get power connections for tubewells. Private sector tubewell owners also benefit from implicit operational subsidies because the agricultural tariff for electric energy is less than the actual cost of generation, transmission and distribution.

The subsidy for diesel operated tubewells is provided to the farmers who own, individually or collectively, a minimum of 25 acres of land. In Punjab, the rate of subsidy is uniform for all sizes of tubewells, but varies according to the location of tubewells in different areas. The present rate of subsidy is Rs.20,000 for dryland areas, Rs.18,000 for sailaba (flooded) areas and Rs.16,000 for canal commanded areas.

1.4 Comparative Performance (Public vs Private Irrigation Systems): In order to shed some light on efficiency aspects of private-vs-public managed irrigation systems, these systems are compared on the basis of the following performance indicators: investment costs, O&M costs, utilization rate and productivity.

One recent study (ACESGI, 1984) reported that, in 1983-84, the capital cost of SCARP water was Rs.115 per acre-ft, while the

capital cost of water pumped from private tubewell was Rs.87 per acre-ft (electric tubewell) and Rs.57 per acre-ft (diesel tubewell). The same study reported that, in 1983-84, annual O&M cost of SCARP water was Rs.144 per acre-ft, while the O&M cost of privately pumped water was reported to be Rs.59 per acre-ft (Electric tubewell) and Rs.155 per acre-ft (diesel tubewell).

The Central Monitoring Organization (CMO) of WAPDA conducted one study in 1973, to compare the effects of SCARP tubewells and private tubewells in non-SCARP areas, having almost the identical agro-climatic and soil conditions. This study concluded that: (i) the rate of utilization for public tubewells ranged from 29-56 percent, and for private wells it ranged between 26-31 percent; (ii) the cropping intensities achieved under private tubewells were comparatively higher than those attained in SCARP areas; and (iii) the crop yield under private tubewells were as good, if not better than the SCARP tubewells. These comparisons clearly indicate that though private tubewells are planned and installed in a haphazard and sub-standardized manner, these yield comparatively better financial and economic benefits to farmers.

1.5 Major Problems of the Public Irrigation System: Improved agriculture sector performance is directly related to improved levels of farmgate water delivery. Therefore, the Government of Pakistan has prepared and implemented, with the assistance of numerous donors, a series of comprehensive programs to improve the performance of the irrigation system. These programs included construction of big dams and link canals; development of groundwater resources; implementation of waterlogging and salinity control projects; efforts to improve the physical and operational characteristics of the irrigation system; and introduction of various institutional development arrangements.

As a result of substantial investments in these programs the situation with respect to overall water availability has improved. However, the system is not yet designed to maximize agricultural output. The existing system is still characterized by a number of economic, financial, technical, operational, institutional and managerial problems.

Leading the list of these problems is inadequate operation and maintenance of the system. Inadequate maintenance of the canals results in their frequent breaches and consequent interruptions in water supplies. The performance of SCARP tubewells has also been affected seriously as these are now being operated only at about 35 percent of their installed capacity. The drains have become clogged with sediment and weeds due to inadequate maintenance.

The ability to carry out maintenance is inhibited, to some degree, by financial constraints. Financial constraints are becoming more evident because the revenue generated by the system has not kept pace with the rising O&M costs; the latter tend to rise due to the positive relationship between system's deterioration rate and the age of the system. In addition, very high O&M costs of public tubewells have made additional demands on already scarce financial resources.

Continuous expansion in irrigation and insufficient drainage facilities have caused serious waterlogging problem in the Indus Basin. The areas having a groundwater table within 5 feet depth have now been declared as "disastrous area". This is reported to be about 11 million acres and 5 million acres during October and June, respectively (Government of Pakistan, 1983).

The reliability and efficiency of the system at the macro level have declined due to deficient water policies and practices. Lack of integrated management of water, as well as other inputs by farmers, government agencies and others also prevent higher agricultural production. Due to inadequate management and given the physical characterstics of the system, more than half of the water diverted into the system from surface supplies is lost. These losses, together with unpredictable variations in water supplies, cause considerable uncertainty at the farm level as to whether water will be available at periods critical to crop development.

1.6 Irrigation Development Strategy : In order to address some of the problems outlined immediately above, the Sixth Five Year Plan lays out the Government of Pakistan's (GOP) threefold water strategy for the 1980's. The salient features of this strategy are: (i) Protection of fertile land and infra-structure from waterlogging, salinity and floods by completing repair work on Tarbela and the Indus Basin Programs, giving priority to severely waterlogged areas having saline groundwater and replacing deteriorated tubewells; (ii) improvement of existing irrigation and drainage facilities by canal remodeling, rehabilitation of the irrigation system, command water management, on-farm water management and reorganization of the institutional framework; and, (iii) extension of irrigation and drainage through new irrigation schemes, medium sized reservoirs, public tubewells in underdeveloped areas, and new schemes in Baluchistan and the Federally Administered Tribal Areas.

A comprehensive program has been prepared to implement this strategy and an amount of Rs.32.1 billion has been allocated for the development of irrigation sector in the Sixth Five Year Plan.

Major portion of the allocations would go to drainage, reclamation and irrigation because large areas are still water-logged despite extensive SCARP programs. The Plan's proposed strategy is to focus on "disastrous" areas where the water table is within 5 feet of the surface. The total allocation for the water sector is almost equally divided between on-going and new projects.

2. WATER PRICING POLICY IN PAKISTAN

2.1 Historical Overview: The first schedule of an occupier's rate was prepared for Upper Bari Doab Canal in 1891 and similar schedules were prepared for different other projects on their completion. The first revision of the rates was done in 1924 when the rates were increased by about 25 percent. In 1934, the rates were reduced due to a slump in the prices of agricultural produce. The reduced rates continued for 20 years in spite of the fact that the prices of agricultural commodities showed an increasing trend. In 1955, the Punjab Government revised the occupier's rate to the pre-1934 level. In 1959, the Government decided to increase water charges on a uniform basis throughout West Pakistan. After 1959, there have been successive increases in water charges of major crops (see Table 1).

In Pakistan, historically, setting water charges for different canals has 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 and income generated by different crops. A brief review of the history of water charges in Pakistan 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 charges. 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 that particular time.

2.2 Present Status: Presently, water charges 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. Water charges are set on an 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 consumptive crop water requirements or income generated by different crops.

Despite the fact that current spending on water supplies varies widely among various canal commands, water charges are generally levied in accordance with the perennial and non-perennial nature of the canals. Moreover, since the cost of water, availability of water and farmer's payment capabilities vary significantly in non-SCARP and SCARP areas, differentiated water charges are levied in these areas. According to the existing policy, water charges in SCARP areas are double than those levied in non-SCARP areas.

2.3 Mode of Assessment: The assessment 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 many 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). A recent study by Chaudhry (1985) estimated that the annual financial mis-appropriations resulting from under-assessment were about Rs.60 million in Punjab and Rs.17 million in Sind.

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 the mogha (outlet from canals to water-courses). The magnitude of this favor is determined by the number of cultivated acres on the water-course 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 despite being 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 compel the farmers to search for additional supplies of water which opens the doors of corruption for officials of the Irrigation Department.

Although it is impossible to make the revenue assessment system perfect by all standards, efforts can be exerted to eliminate or at least reduce the magnitude of financial leakages resulting from current illicit practices. Elimination of such illicit practices can ensure recovery of sizeable amount of funds which can be used for efficient O&M of the system. In this direction, the flat rate pricing policy can be considered as an alternative to current crop-wise assessment policy.

Among the flat rate pricing options, the flat land water charge has some distinct advantages[7]. First, institutional costs of administering this pricing method are very low because it only requires the knowledge of farmers' land holding. Second, the required information is available from land revenue records which are accurate, of long standing, kept current, and understood by all. Third, adoption of this pricing policy will directly result

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[7] The flat rate system was never tried in the Punjab Province but it remained inforce for quite a long period of time in the Sind Province before it was finally abandoned in 1980. It was abolished because it led to massive stealing of water by influential farmers and unauthorized withdrawls in the head reaches. Failure to curb such illicit practices reflects both administrative inefficiences in the operating agency and a lack of legal enforcement authority. It, by no means, implies that the mode of assessment is inefficient or inequitable.

in an annual saving of huge amounts of money presently mis-appropriated from the system due to under-assessment/mis-reporting. Fourth, the new policy would result in saving of costs associated with administering of current pricing policy.

3. COST RECOVERY AND WATER CHARGES

3.1 Cost Recovery Situation: A review of the historical relationship between O&M expenditure and receipts from water charges (Table 2) indicate that both O&M expenditure and recoveries from water charges have been increasing consistently over a period of time but the latter has not increased in the same proportion as the former. In Punjab, cost recovery has dropped from 88 percent in 1974-75 to 58 percent in 1984-85, while cost recovery in Sind has dropped by 27 percent during the same period.

The revenue-expenditure gap of the entire irrigation system is consistently increasing at an alarming rate over the past couple of years. The implicit subsidies (O&M cost of irrigation system minus revenues from water charges) in Pakistan have gone up from Rs.578 million in 1981 to Rs.1175 million in 1985. Two important reasons for this consistently increasing revenue-expenditure gap are: (i) the present level of water charges is very low; and (ii) there are excessive financial leakages from the system due to under-assessment/ mis-reporting of water charges.

A major portion of the subsidy is going for operation and maintenance of the public tubewells schemes. A system-wise analysis of total subsidies indicates that in 1984-85 the subsidy on SCARP tubewells amounted to Rs.788 million as compared to Rs.387 million estimated for the surface system. According to a

World Bank Report (1986), Pakistan's SCARPs have become the World's most expensive and costly vertical tubewell drainage program.

The subsidy on various inputs undoubtedly helps in the adoption of new technology. However, in practice, these subsidies are often distributed inequitably. In Pakistan, 74 percent of the total number of farmers are under 12.5 acres and they occupy about 45 percent of the total irrigated area. If subsidy is a direct function of the 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. The average per farm subsidy has been estimated to be Rs.125 for small size farms, Rs.347 for medium size farms and Rs.769 for large size farms.

Because of the differences in consumptive water requirements of various crops and as such the actual water applied to different crops, the amount of subsidy involved in growing of various crops also varies. This eventually affects farmers decisions regarding selection of crops to grow on their farms. A review of the farm-wise cropping pattern statistics indicates that farmers with large holdings devote more acreage to cash crops (which are usually more water consumptive) while small farmers bring more area under food crops and fodders. This implies that large holdings derive relatively more benefits because they not only get higher subsidy in proportional terms but also by growing cash crops whose water rates are highly subsidized.

The above review of the cost recovery situation does not present a promising picture. If the current recovery patterns

continue to persist, the situation will become even worse because, in future years, significantly higher financial allocations will have to be made for annual operation and maintenance of rehabilitated parts of the system. This underscores the need to adopt a water pricing policy that should make the system financially self-supportive and also support overall saving and investment efforts of the country. Such a policy obviously calls for significant increases in the current levels of water charges.

3.2 O&M Spending and Cost of Irrigation Water: An analysis of the cost of supplying irrigation water is presented in this paper for the Punjab and Sind Provinces only since these provinces account for more than 90 percent of the country's total O&M expenditure. During the period 1981-86, on an average, financial allocations for O&M activities have increased at an annual rate of 15.08 percent and 16.18 percent in Punjab and Sind provinces, respectively (Table 3). This implies that financial allocations have not only increased in nominal terms but also in real terms; since inflation during the same period averaged about 9 percent.

From an O&M spending viewpoint, the irrigation system can be grouped into canals, tubewells, flood protection bunds, small dams and other works. In addition to all these hardware, input and service items, there is an establishment budget -- salaries/allowances for staff/ employees. Approximately two-thirds of the overall budget goes for O&M activities of irrigation facilities and one-third for establishment. The share of these components in total PID budgets vary by provinces. In Punjab, the leading share-holder of country's irrigation O&M budget, expenditure for tubewells dominates the O&M portion of the budget, accounting for 66 percent; canal O&M totals 26

percent; and flood control and drainage accounts for almost all the remaining 8 percent of O&M expenditure.

The establishment cost covers all staff activities, not just operations and maintenance activities, but the entire set of activities involved with capital development projects, including rehabilitation. Since these other activities tend to consume inordinate shares of staff time, it becomes somewhat arbitrary as to what part of the establishment bill should be charged to routine O&M, per se. It can always be assumed, of course, that capital projects (new canals, rehabilitation, etc.) are intrinsic to the O&M system and staff time on them thus should be included. Indeed, that assumption has generally been made when trying to assess revenue needs of the Provincial Irrigation Departments.

In 1985-86, the average O&M cost of canal irrigation water in the Punjab Province was Rs.20.03 per acre-ft as against Rs.15.79 per acre-ft estimated for the Sind Province. In both the provinces, per unit O&M cost of SCARP water was extremely high as compared to per unit O&M cost estimated for the surface water. The cost of tubewell water was Rs.128.03 per acre-ft and Rs.129.80 per acre-ft in Punjab and Sind provinces, respectively. Cost comparisons on a provincial basis indicated that the cost of supplying per acre-ft of canal water in Punjab was about 27 percent higher than in Sind. However, the per unit cost of tubewell water was almost similar in both the provinces.

3.3 Target Level Water Charges: One important policy question which must be addressed here is: what should be the level and structure of water charges? Assuming current O&M spending levels as cost recovery targets, target level water charges are estimated on the basis of per unit cost of water reported earlier

earlier and water actually applied to different crops. The comparison of target level charges with the existing water charges (Table 4) provides inferences about the magnitude of shortfalls in irrigation costs and present receipts on a crop basis.

The analysis reveals that, in both the provinces, if cost recovery is to be accomplished, existing water charges of all crops (except oilseed in non-SCARP areas of the Punjab Province) need to be increased significantly. Moreover, the magnitude of the required increase in the current water charges, to bring these to the estimated level, in SCARP areas is significantly greater than those required in non-SCARP areas.

If water charges are estimated on a flat rate basis, O&M spending for non-SCARP areas of Punjab Province calls for the recovery of Rs.48.24 per cultivated acre as compared to the existing recovery rate of Rs.36.26 per cultivated acre. The estimated target for SCARP areas is Rs.213.51 per cultivated acre as compared to the existing recovery rate of Rs.72.14 per cultivated acre. Cost recovery targets for non-SCARP and SCARP areas in Sind Province suggest levying of Rs.79.90 and Rs.246.55 per cultivated acre, respectively. The present recovery rate in Sind Province is Rs.33.66 per cultivated acre in non-SCARP areas and Rs.54.08 in SCARP areas.

Given the existing system of water allocation (warabandi[8]) any change in either the level or structure of water charges is not expected to register a significant improvement in economic efficiency. However, the likely change in relative profitability

[8] Warabandi means fixation of turns (wara means turn and bandi means fixation).

of various crops as a result of implementation of actual water applied-based charges may indirectly affect water use (water use shifting from less to more profitable crops). The flat land water charge will encourage the farmers to increase their cropping intensity where profitable to do so. However, it is questionable whether this would indeed be profitable since intensities are already high compared to water availability; so it is not likely that an increase in water-use efficiency would result.

As discussed above, the target level water charges are significantly higher than the existing water charges. But, for many economic and political reasons, it may not be possible 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 are accepted by the farmers with less resistance.

3.4 Payment Capacity of Farmers: Farmers' capacity to pay for irrigation water serves as an important criterion in setting the level and structure of water charges. The net income criterion generally serves as a good approximation of a farmer's ability to pay for water charges. Financial costs and returns of selected crops are estimated in Table 5 so as to examine the relationship between current water charges and net per acre income of various crops, and to see whether farmers can afford to pay "target level" water charges.

The current water charges constitute a very small fraction of financial net returns estimated through the cash flow method[9]

[9] Cash Flow Method: (total income) - (cash production costs).

(about 2 percent in non-SCARP areas and 4 percent in SCARP areas in both the provinces). However, the current water charges constitute a fairly high proportion of net income when this latter parameter is estimated through the residual budgeting method[10]. In that case, on an average, in non-SCARP and SCARP areas, current water charges are about 18 percent and 27 percent of the net returns in the Punjab Province and about 10 percent and 22 percent of the net returns in the Sind Province, respectively.

As it is evident from Table 5, net returns of some of the crops estimated under the residual budgeting method turned out to be negative. It may be pointed out that negative net returns do not necessarily imply a financial loss. As a matter of fact, the negative returns are a result of the dominance of labor in the production function. This implies that a farmer would not, in fact, be able to compensate himself, his family and hired labor at the wage levels assumed in the analysis.

In both the provinces, in non-SCARP areas, water charges of all crops (except rice in the Sind Province), estimated to represent the macro level cost recovery target, are well within the payment capacity of farmers[11]. Contrarily, in SCARP areas, target level rates exceed the payment capacity of farmers. This implies that government will have to subsidize the irrigation services in SCARP areas unless early steps are taken to divest the public tubewell schemes. Until such a policy decision is

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[10] Residual Budgeting Method: (total income) - (total production costs excluding water charge).

[11] Net returns estimated through the residual budgeting method could be safely attributed as returns to irrigation water. Therefore, it can be approximated as the maximum amount a farmer would be willing to pay for irrigation water.

taken, a reasonable increase in the existing water charges will still be required to reduce the overall magnitude of irrigation subsidies in these areas.

Since, in future years, farmer's capacity to pay for irrigation water can alter due to a variety of reasons, there will be a constant future need to examine and monitor closely the relationship between farmer's payment capabilities and increased water charges. Moreover, in view of the government's current stated policy regarding withdrawl of subsidies being paid on agricultural inputs, the future structure of economic incentives must ensure fairly steady growth in farm income. This can be done by increasing the output prices at a faster rate than the rate at which input subsidies are withdrawn, in real terms.

4. BUDGET FOR O&M ACTIVITIES

4.1 Present O&M Budgeting Procedures: 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 in Punjab and Sind Provinces 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.

Rising prices per unit of work, highly constrained budgets and increasing physical requirements has led to a situation in which PIDs are continuously attempting to obtain greater funding

naturally varies somewhat between provinces. The effort normally include both the "doctoring" of outdated physical and financial yardsticks and the use of Annual Development Plan (ADP) funds for maintenance. In general, efforts over the 1970's and 1980's to acquire improved O&M funding have tended to be based on "we need twice as much", or "we need 50% more", and the like.

4.2 Full Funding[12] O&M Requirements: Historically, operation and maintenance practices were prescribed quite carefully. These were supplemented by physical and financial yardsticks which were generally acceptable to the Finance epartments. But, that was a time when the canals were by-and-large in regime and operated within their design capacities. Now, they are operated at 150 to 180 percent of their designed capacity. As of the late 1960's and early 1970's, these practices render time sanctioned processes redundant and, in general, no longer workable. This suggests a need to update physical and financial parameters of the yardstick model so that PIDs can prepare O&M budgets corresponding to required technical O&M standards suited to current operating conditions.

There have been a number of efforts to assess new full-funding level O&M requirements in the recent past. The Government of Sind (1979) has estimated that full-funding level budget for O&M of canals was more than double the amount provided in the budget (Rs.131 million as against Rs.60 million). WAPDA (1979) has reported that the amount required for efficient O&M of the canal system was Rs.17 per acre as against the actual expenditure of Rs.12 per acre. The World Bank (1982) has estimated that an

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[12] The amount required to maintain canals in fully operational and effective condition on a sustained basis, after these have been moved to an efficient condition under a rehabilitation program.

of Rs.12 per acre. The World Bank (1982) has estimated that an amount of Rs.25 per irrigated acre would be required annually for efficient O&M activities of canal/drain/bund. A recent attempt by DAI (1984) concluded that full-funding level requirements were about 19-24 percent higher than the current O&M expenditure. The preliminary findings of full-funding level estimates being developed by PRC/Checchi indicate that, on an average, full-funding level budget for maintenance of rehabilitated canals is about 1.5 times greater than the amount currently being allocated for O&M activities.

A review of the recent history of efforts to estimate full-funding O&M indicate that there is such a plethora of different numbers used, different data elements in grouped estimates, different assumptions, assumptions left out or not stated, and so on, that it is quite impossible to trace trends accurately, to make comparisons and contrasts, and to otherwise find out what has been going on. Also, it seems that perhaps the most important problem has been the failure to estimate properly the volume and degree of physical work needed to be done. Moreover, in spite of the work which has gone into these sequence of estimates, there is very little evidence that anyone at policy-making level is paying much attention. Under the circumstances, therefore, it is important that the PRC/Checchi effort be continued since it is attempting to measure full-funding level O&M requirements not only on the basis of improved physical and financial yardsticks, but, to determine the actual physical/technical standards required to maintain rehabilitated parts of the system.

Despite the foregoing morass of non-supporting numbers, one thing is quite evident: full-funding level water charges are going to be significantly higher than the existing water charges.

they pay as water charges, on the one hand, and what they get from the PID on the other. Today, water charges disappear into an enormous and non-identifiable general revenue fund and farmers have no way of knowing if their money is being spent on the part of the irrigation system they identify with. However, if the water charges are increased, which undoubtedly is a necessary condition to ensure efficient continued operation and maintenance of the restored system, there will be a need to have these earmarked specifically for O&M activities. It may also be pointed out here that water charges should not be viewed as the only source of revenue generation. Various types of other taxes must be analyzed to see whether some proportion of same should support the cost of improved O&M services.

4.3 Farmer's Participation in the System: By and large, the farmer has not participated in the system's conception, design, construction (some employment as a laborer perhaps), or operation. Historically, the farmer has just not been consulted. There is nothing unique about that; there is hardly an irrigation project in South-East Asia in which farmers, the actual end-users, have been asked to participate in planning, design and operations. Yet those persons planning, building and operating do not particularly suffer if errors are made in design, operations, construction, maintenance, or whatever. The farmer does. Thus, the farmer is not wildly enthusiastic about paying more for a system in which he has been, for the most part, a residual, is thus hardly surprising.

There is extensive experience to indicate, however, that effective cooperation, certainly at the water-course level, can produce some positive results regarding maintenance and repair, and water savings. Farmers often are prepared to share costs when

they can see the direct application of their funds. In principle, then, the payment of more water rates is going to have to be attendant upon greater farmer participation. However, the experiences of the On-Farm Water Management (OFWM) Project in Pakistan shows that this participation is by no means easy.

5. CONCLUSIONS AND RECOMMENDATIONS

Availability of the required amount of funds, as and when needed, for proper operation and maintenance of the irrigation system is one of the necessary conditions to maximize the benefits from an on-going rehabilitation program over a longer period of time. But, as it stands now, the irrigation system is not financially self-supportive because the water charges are very low. This leads to continuous deferred maintenance; eventually resulting in high water losses and unreliable supply schedules. Moreover, the irrigation subsidies, which are distributed inequitably as well, have touched the levels which are unjustified on economic efficiency grounds. In addition, the present level and structure of water charges do not provide meaningful economic signals to farmers because these charges constitute a very small fraction of cash production costs and are not related exactly to yield values. This state of affairs calls for an immediate increase in existing water charges.

In non-SCARP areas, water charges estimated to recover total O&M costs (target level charges) have been found to be within the payment capacity of farmers. Proposed increases in water charges remain within farmer's payment capacity even if the payment capacity is reduced by 50 percent. Therefore, in non-SCARP areas water pricing policy must be based on cost recovery of improved O&M services. However, water charges should be increased on a

O&M services. However, water charges should be increased on a gradual basis so that proposed increases are accepted by the farmers with less resistance. In order to implement such a promotional type of pricing policy, efforts must be addressed to securing political support.

In SCARP areas, it is not feasible to implement cost-based water charges because these are three to four times higher than those estimated for non-SCARP areas and are beyond the farmer's payment capacity. However, crop/farm income analysis for these areas indicate that significant increases in current water charges are still possible.

It is a well documented fact now that increasing O&M investments in SCARP tubewells, given current management inefficiencies, can neither be justified on benefit grounds nor on a cost recovery basis. Therefore the government should take immediate steps to divest these schemes. As a matter of fact, for the time being, it may be economically wise to divert the resources being spent on O&M of public tubewells in fresh groundwater zones to more efficient O&M of other components of the irrigation infrastructure which are deteriorating rapidly due to lack of O&M funds.

If the cost recovery objective is to be persued in the long-run, there is a strong need to link the water charges with the benefits conferred by irrigation. The need for developing such linkages can be hardly overemphasized especially when the future O&M costs for rehabilitated parts of the irrigation system are anticipated to be quite high. Therefore, a comprehensive program should be initiated to collect information required to measure the additional net benefits from irrigation.

Due to the presence of certain illicit practices in the current assessment method, considerable amounts are mis-appropriated. In order to eliminate these financial leakages, imple-mentation of flat rate pricing policy is recommended. In addition to the elimination (or at least reduction) of financial leakages, the flat rate policy would also help to save the institutional costs associated with the administering of existing pricing mechanism.

The Government's stated objective is to withdraw the subsidies being paid on agricultural inputs. This will put a downward pressure on farm incomes. Therefore, the structure of economic incentives should be designed in such a manner as to ensure fairly steady growth in farm incomes. This essentially suggests that output prices should increase at a faster rate than the rate at which input subsidies are withdrawn.

The required increases in agricultural production can be realized mainly through an expansion in irrigated areas. But, expansion in irrigated areas directly depends upon availability of additional water supplies, which are expected to come mainly from groundwater development since surface supplies are fixed in nature. Therefore, government should encourage installation of tubewells in the private sector through expansion in on-going subsidy programs and by providing agricultural credit to small farmers on soft terms and conditions.

Water charges should not be considered as the only source of funds required to meet the costs of improved operation and maintenance services. The structure of various types of taxes (agricultural income tax, property tax on irrigated land and usher tax) must also be analyzed in detail in order to see

whether some proportion of these taxes can be utilized for supporting the costs of improved O&M services. Moreover, since the excessive use of canal roads/banks for transportation purposes contribute to their deterioration, some kind of toll tax should be levied on vehicles/commodities passing through these roads.

Methodological deficiencies in present budgeting procedures also contribute to inadequate budgets for O&M funding. These require updating and flexible application so that the effects of various economic and technological changes are effectively captured in the form of improved O&M budgeting. Also, since there is no gurantee that revenues from increased water charges would be reappropriated for irrigation system maintenance, receipts from water charges and O&M appropriations should be internalized. In other words, if it is at all feasible, receipts from water charges should be earmarked specifically for the provision of O&M services.

Table 1: Historical Increases in Water Charges of Some Major Crops. (Rs./Acre)

Year	Crops			
	Wheat	Rice	Cotton	Sugarcane
1959	6.00	10.00	9.80	20.00
1963	6.40	10.40	10.40	21.60
1965	7.20	11.20	11.20	24.00
1968	8.60	13.60	13.60	28.80
1969	10.40	16.80	16.80	32.80
1978	13.00	20.00	20.00	41.00
1980	16.80	25.60	26.40	51.20
1981	21.60	32.00	33.60	61.60

Note: Water charges reported for the period 1959-69 are for major canal systems of West Pakistan. The rates shown for the post 1969 period are for the Punjab Province; since provincial governments adopted separate water rates schedules during this period.

Source: Provincial Irrigation Department, Government of the Punjab.

Table 2: Operation and Maintenance Expenditure and Recoveries From Water Charges in Punjab and Sind Provinces for the Period 1974-75 to 1984-85. (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	60.90
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
1984-85	1347.30	782.80	564.50	603.62	246.50	357.12

Source: Provincial Irrigation Department, Governments of Punjab and Sind.

Table 3: Financial Allocations to Punjab and Sind Provincial Irrigation Departments for O&M Activities. (Million Rupees)

Province/System	Years					
	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86
Punjab						
Surface System	312.10	461.90	494.30	567.10	666.60	680.00
SCARP Tubewells	425.30	469.60	513.00	628.20	680.70	790.00
Total	737.40	931.50	1007.30	1195.30	1347.30	1470.00
Sind						
Surface System	230.17	317.65	304.50	384.17	435.37	460.56
SCARP Tubewells	72.79	87.88	108.90	131.49	168.25	163.15
Total	302.96	405.53	413.40	515.66	603.62	623.71
Total						
Punjab & Sind	1037.36	1337.03	1420.70	1710.96	1950.72	2093.71
All Pakistan	1127.60	1472.00	1550.10	1822.00	2125.80	N.A

Source: Provincial Irrigation Departments, Governments of Punjab and Sind.

Table 4: Estimation of Water Charges on the Basis of Actual Water Applied to Various Crops and Their Comparison With the Current Water Charges, 1985-86 (Rs./Acre)

Crop	Estimated Water Charges*		Current Water Charges[b]	
	Non-SCARP Areas	SCARP Areas	Non-SCARP Areas	SCARP Areas
Punjab Province				
Cotton	38.75	247.74	33.60	66.00
Rice	57.75	369.15	32.00	64.00
Sugarcane	111.37	711.85	64.00	128.00
Maize	32.72	209.12	19.20	38.00
Kh. fodder	31.65	202.18	13.60	27.00
Rb. fodder	38.52	246.24	11.20	23.00
Wheat	25.99	166.12	21.60	43.00
Oilseed	15.47	98.90	23.00	43.00
Sind Province				
Cotton	66.29	561.38	36.02	72.05
Rice	62.15	510.37	34.37	68.75
Sugarcane	133.46	1097.13	70.40	140.80
Orchards	104.55	859.49	55.00	110.00
Kh. fodder	34.41	282.86	15.40	30.80
Rb. fodder	38.58	317.14	20.62	41.25
Wheat	27.04	222.28	20.62	41.25

Source: *Estimated by the Author; [b]Provincial Irrigation Departments.

Table 5: Financial Costs and Returns of Various Crops in Punjab and Sind Provinces, 1985-86 (Rs./Acre).

Province/Area	Variable	Crops							
		Cotton	Rice	Sugarcane	Maize/[1] Orchards	Kharif fodder	Rabi fodder	Wheat	Oilseed
Punjab	Total income	2614	2518	3770	1811	1344	2407	2231	1720
Non-SCARP	Cash production costs	1055	949	1492	678	361	611	800	524
	Total production costs	2357	2407	3470	1727	1282	1840	2031	1599
	Net returns (CFM)[2]	1559	1569	2278	1133	983	1796	1431	1196
	Net returns (RBM)[3]	257	111	300	84	62	567	200	121
SCARP	Total income	1508	2263	3535	1638	1293	2175	1858	1440
	Cash production costs	656	764	1285	548	322	496	410	424
	Total production costs	1676	2053	3170	1483	1139	1546	1613	1365
	Net returns (CFM)[2]	652	1499	2250	1090	970	1679	1248	1016
	Net returns (RBM)[3]	-168	210	365	155	154	629	245	75
Sind	Total income	2232	1848	4761	5719	1120	1976	2059	
Non-SCARP	Cash production costs	908	812	1819	1308	295	491	731	
	Total production costs	1965	1945	4318	4735	1035	1476	1788	
	Net returns (CFM)[2]	1324	1036	2942	5411	825	1485	1328	
	Net returns (RBM)[3]	267	-97	443	1984	85	500	271	
SCARP	Total income	1875	1560	4336	5879	1064	1820	1760	
	Cash production costs	734	750	1505	1217	255	409	574	
	Total production costs	1634	1835	3674	4662	881	1252	1483	
	Net returns (CFM)[2]	1141	1210	2831	5486	809	1411	1186	
	Net returns (RBM)[3]	241	122	662	1217	183	568	277	

NOTES:

[1]Financial costs and returns are for maize crop in the Punjab Province and for orchards in the Sind Province.

[2]Cash Flow Method: (total income) - (cash production costs)

[3]Residual Budgeting Method: (total income) - (total production costs excluding water charge)

Source: Derived from "Water Charges and Farmers Repayment Capacity in Punjab and Sind Provinces, PRC/Checchi, Islamabad (1986).

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