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MINISTRY OF PUBLIC WORKS AND WATER RESOURCES

STRENGTHENING IRRIGATION MANAGEMENT IN EGYPT:

A PROGRAM FOR THE FUTURE

COST RECOVERY FOR WATER SERVICES TO AGRICULTURE

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COST RECOVERY FOR WATER SERVICES TO AGRICULTURE

INTRODUCTION

Charging users for provision of water and water services is a sensitive issue in many countries. It involves political, historical, social, religious and economic factors. Beneficiaries will tend to prefer low or zero charges, and this preference will be reflected by their political representatives. Their position may be reinforced when investments have been made in the national interest—to ensure food security, develop new areas or diversify the economy, thus implying some higher goal than the direct productive impact on those receiving the service. In the case of agriculture, and a predominantly agrarian economy, the combination of these factors is often powerful, and full recovery of service charges correspondingly rare.

When direct revenues from a service are low, the possibility that the service will be under-funded is correspondingly high. The agency providing the service is seen as a consumer rather than a provider of funds to the government, and its claim on scarce resources is weak[1]. The subsidy provided to meet the gap between revenues and expenses will often be less than what is required, and maintenance consequently under-funded.

Such "savings" in public funds are often expensive: the cost of routine and preventative maintenance is usually much lower than the cost of major rehabilitation, and the costs in lost production (when irrigation facilities are not working properly), and damage to land (when drainage facilities are poorly maintained) greatly exceed the cost of proper operation and maintenance.

Thus an important underlying consideration in formulating an approach to cost recovery is that, for society as a whole, costs are recovered. Recovery may be directly from beneficiaries, indirectly through sectoral taxation, through diversion of resources from one use to another, or simply by default—reduced production from un-maintained, deteriorated facilities. Even when costs are financed by grant aid from a foreign donor it is not difficult to identify a source of the indirect cost recovery: the opportunity to utilize those funds for an alternative purpose has been lost. Thus the deferred maintenance undertaken through the Structures Replacement program constitutes indirect cost recovery *from* alternative beneficiaries of those funds (education, health care, investments in pollution control, etc.) *for* those who have benefited from the facilities, and who will benefit from their replacement.

Seen from this perspective, the question is not whether to recover costs, but from whom, how, and in what proportion.

Study Objectives

The objective of the cost recovery study, as agreed and set out in the Final Work Plan[2] was "to make further progress towards clarifying and establishing Egypt's future policy towards cost recovery and cost sharing to ensure the sustainability and efficiency of water resource management".

To meet this objective, the following were undertaken: a review of existing cost recovery policies for water services; an assessment of the appropriate allocation of costs for water services among sectors; an analysis of alternative mechanisms for recovery. Based on this and a review of other

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1 The Government of Egypt's policy incorporates this factor explicitly by setting pay rates for revenue generating sectors at higher levels than non-revenue generating sectors such as irrigation.

2 Cairo, March 1995

papers and studies, options for allocating costs and phasing of the introduction of service charges have been recommended.

Work Program

The assignment was carried out jointly with Egyptian counterparts. A Task force within the MPWWR was established, chaired by Eng Kamal Anani (General Manager, Project Preparation Department), and including representatives of various agencies as indicated below:

Eng Fawzy Md Ibrahim Khalil	PPD
Eng Hoda Salah El Dien	PPD
Eng Bahai Ghonem	PPD
Samir Md Ahmed	PPD
Dr Lotfy Youssef Nasr	WRC
Eng Thoraya Abd Elwan	IIP
Eng Shenawy Abdel Aty	IIP
Eng Md Hamed Abdel Latief	Planning Sector

A number of Egyptian consultants were engaged, including Professor I. M. Elassiuti, Dr Ahmed Samy El-Zaher, and Dr Raouf Khouzam, in order to take advantage of their specific experience in formulating and undertaking various analyses of cost recovery that have been undertaken in the recent past.

A consultancy agreement was also entered into with the International Food Policy Research Institute (IFPRI), to adapt an existing simulation model of the Egyptian agriculture sector to assess the impact of water service charges.

The assignment was carried out over a period of four months (mid-January to mid-May, 1995).

Organization of the report

This report addresses the topic of water service charges for agriculture. In doing so, it draws on the contents of reports prepared by IIMI and the Task Forces during the course of IIMI's collaborative program of work with MPWWR, as well as numerous other existing reports and special studies undertaken during the assignment. This report deliberately focuses on bringing results together into a framework which is intended to be concise but sufficient to provide the logical background for the conclusions and recommendations.

The relevant reports produced during IIMI's program of work are:

- *Non-agricultural Cost Recovery*, Rita Cestti, April 1995
- *Agricultural Cost Recovery*, Adrian O. Hutchens, March 1995
- *Water Policy in Egypt—An Analysis with IFPRI's Agricultural Sector Model*, Hans Lofgren, April 1995
- *Financial Management Systems in the MPWWR—An Analysis And Recommendations For Meeting Current And Future Needs*, Charles Lewis, Mohammed Mahmoud Hilal, April 1995

The present report is ordered as follows:

- First, a brief background to cost recovery in the agricultural sector is presented, and Egypt's present policies are summarized.
- Second, the procedures for the allocation of basic costs of operation and maintenance and capital costs are reviewed, the improvements and changes to the

existing ISPAN analysis described, and the results of the resulting analysis are presented.

- Third, the implications of various mechanisms for cost recovery from the agricultural sector are assessed and analyzed.
- Fourth, and finally, some options for introducing cost recovery are described, indicating the particular advantages and disadvantages of each. Other important conclusions are also noted in this final section.

Previous studies and comments on the options and impacts of introducing service charges are extensive.[3, 4, 5, 6] Consideration has been given to: flat rate charges (imposing an additional tax, similar to the existing land tax which is independent of the crop grown or water consumed); imposing taxes which are crop specific and reflect the assumed water consumption (thus introducing a degree of linkage between the extent of the service provided and the water charge); and a volumetric charge, directly linking the quantity of water delivered to the charge. Some studies also considered combinations of charges.

Conclusions have generally been similar, arguing that as long as water is sufficient for agricultural needs a flat land tax is the simplest and most convenient way of recovering service charges. A crop related charge provides a positive incentive to farmers to seek more water-efficient cropping practices. Volumetric charges are most effective in the case of scarcity, but involve high administrative costs. Bowen and Young (1983) additionally considered the option of water rationing through fixed seasonal or annual allocations. They argued that this would induce an efficient response from farmers while avoiding the administrative costs of volumetric measurement and charging. A question raise at the Round Table Conference (1992) was whether any useful purpose would be likely to be achieved by the introduction of service charges. Each of these options is considered in this report.

1. COST RECOVERY FOR AGRICULTURAL WATER SERVICES IN EGYPT: BACKGROUND, PRESENT PRINCIPLES AND PRACTICES

Service charges are advocated for three main reasons: to recover costs from beneficiaries of the service; to encourage efficiency in the provision of the service, and the use of resources provided; and as a means of taxing benefits. The last objective is not considered in this study.

Thus is assessing alternative approaches, three elements will be considered: the *financial* objective—to recover from beneficiaries the cost of providing water related services; and the two *efficiency* objectives—to encourage efficient use of the resource provided, and to provide the water service at a reasonable cost. These objectives will be re-visited in the final section as a basis for evaluating options.

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3 *Notes on the Allocation, Pricing and Valuation of Irrigation Water*, Robert A. Young, presented to the seminar "Economics of water Uses in Egypt", Cairo, 1983

4 *Appraising Alternatives for Allocating and Cost Recovery for Irrigation Water in Egypt*, Richard L. Bowen and Robert Young, Agricultural Economics 1 (1986), Elsevier Science Publishers, Amsterdam.

5 *Allocative Efficiency and Equity of Alternative Methods of Charging for Irrigation Water in Egypt*, EWUP Technical Report No 37, Cairo, 1983.

6 The Economics of Water Supply and Demand, in Round Table on Egyptian Water Policy, Proceedings of a Seminar on Egyptian Water Policy, Abu Zeid, M., and Seckler, D. (eds), Cairo 1992.

Background

Government revenues from agriculture up to the late 1980s were derived through implicit taxes on agricultural production: prices of farm products were low; marketing was controlled; cropping patterns were set to meet government priorities; and GoE captured substantial profits from sales of commodities (especially cotton) on world markets. The result of these policies, combined with increasing domestic demands, was a rapid deterioration in the agricultural trade balance. To restore farmers' incentives, a radical program of reforms to agricultural policy was initiated in 1986[7]. Much closer correspondence between international and domestic prices for the major crops was allowed, and controls on cropping patterns were gradually eliminated. The response to this policy change has been dramatic: yields and production of major crops have increased sharply, and farm incomes have increased (after allowing for the increased cost of inputs) by some 25% in real terms[8].

This period of rapid adjustment, during which government's revenues from the sector fell sharply, also provided the opportunity to adjust other prices to more appropriate levels. To some extent this was done, as subsidies for farm inputs were reduced. Charges for water services (to agriculture or to other users[9]) were not introduced, however.

Present Practices

The recovery of capital investment costs and the recovery of operating costs are often treated separately, and this is the case in Egypt. This study focused on operational costs, but a brief summary of policies for investment cost recovery in the agricultural sector is provided below for completeness. The approach recently agreed with the World Bank[10], which is a reflection of Law 218, provides the basis for this summary.

Capital costs are recovered for meska-level investments such as the Irrigation Improvement Project according to a formula which requires repayment of the full capital cost, excluding interest, over a period of ten to twenty years, beginning no more than five years after completion of the works. (Costs of the pump are recovered during the initial five years.) Assuming 4% inflation (an average of the estimate in the Appraisal Report) and 12% opportunity cost of capital, this schedule of recovery equates to recovery of about 16.5% of costs for civil works. No costs are recovered for improvements above the meska, which account for about 25% of civil works expenditures. Thus the subsidy on capital investments is in the order of 85-90%.

A similar approach is followed in the case of drainage investments, which have been made over large areas of Egypt during the last 20 years. Recovery from these investments currently totals about LE 15 M/year, or about LE 8 per feddan served.

In the New Lands, farmers are also responsible for investment costs for all infrastructure including and downstream of the booster pumps that draw from the distributary canals, serving areas in the order of 100-200 feddans. Such investments may either be undertaken independently at farmers' expense, or by government with cost recovery according to the rules set out above.

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7 See Hazell et al (1994) for a summary of the process of liberalization.

8 *Overview of the Economic Impact of Agricultural Policy Changes in Egypt, 1981-1995*, USAID, Cairo 1995

9 Water is provided free in bulk to all users by MPWWR. Intermediate services of treating water for domestic consumption are charged for by the agencies concerned.

10 Irrigation Improvement Project, Staff Appraisal Report (December 1, 1994)

Thus the policy of GoE with respect to capital cost recovery is to recover no charges above the delivery point (meska head in the old lands, booster pump in the new lands) and a small proportion of investment costs below the delivery point.

Operation and Maintenance Costs are the responsibility of farmers below the delivery point. Failure to fulfill this obligation results in the work being undertaken by the MPWWR and charged to the farmers. Examples of this were encountered during a field survey of "other expenses" undertaken by the Task Force[11]. On average, farmers surveyed pay LE 18 per feddan per year for meska maintenance in the old lands, either to the cooperative or as a contribution of labor.

2. ALLOCATION OF OPERATION AND MAINTENANCE COSTS

Water resource investments on the Nile comprise a multi-purpose development serving the needs of power, navigation, municipalities and industries, as well as farmers. Some of these demands are competitive (agricultural and industrial consumption), while others are complementary (releases for agriculture can be passed through turbines to generate power, and used by ships for navigation without detriment to the other consumers).

Two common approaches[12] are available and widely used as a basis for allocating costs in cases such as this: the Use of Facilities method, and the Separable Costs Remaining Benefits method (SCRB).

The Use of Facilities (UoF) approach is conceptually simple: costs incurred in system operation are allocated among purposes in proportion to the extent to which each facility is utilized for the purpose in question: thus canals operated to provide water to municipal and agricultural users would have associated costs divided in proportion to the water delivered to each user. The transparency of the approach is appealing, but difficulties arise in relating consumptive to non-consumptive uses (navigation, and hydropower for example). The approach is also highly dependent on disaggregated data, which at present is almost completely absent (see Lewis, 1995). The attempt to apply the UoF method to the Nile system[13] was severely hampered by the lack of detailed information on actual application of MPWWR funds by purpose, and lack of information about non-agricultural demands. On the other hand, the approach is rather well suited to treatment of O&M costs, which is appropriate where a separate policy for capital cost recovery exists, as in Egypt.

The SCRB approach, which was applied comprehensively in the ISPAN[14] report, consists of assigning all costs which serve a single need (a power house only serves the power sector; a lock only serves for navigation) to the benefiting sector. Remaining "joint" costs are assigned in proportion to the benefit derived by each user from that service (for example, costs associated with a navigable canal are allocated to both agriculture and transportation beneficiaries).

A number of points should be noted: first, the method ensures that charges to any user must always be less than the benefit derived; second, the method explicitly deals with competing and

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11 *Unaccounted-for Farm Expenses*, Raouf F. Khouzam, Cairo, May 1995.

12 See Hutchens (1995) for a detailed comparison.

13 *Allocation Model for Irrigation Water Cost: A Case Study of the Nile Valley in Egypt*, Mohamed Nasr Allam, Water Resources Bulletin, American Water Resources Association, Vol 23 no 2, April, 1987

14 *Irrigation Water Cost Recovery in Egypt: Determination of Irrigation Water Costs*, Irrigation Support Project for Asia and the Near East (ISPAN), January 1993

complementary demands; and third, the approach is transparent, allowing beneficiary groups to understand the underlying assumptions and the derivation of the assigned cost.

The approach is normally applied in a planning context, where investments are yet to take place, and options exist to change the configuration of the investment and hence the groups, sectors, and areas to be benefited.

Application of SCRB to a system that has been in place for many years introduces a number of difficulties. First, the approach allows no cost allocation to any user in excess of the cost of the alternative minimum cost solution. On that basis, no costs were assigned to users whose needs could have been met from direct withdrawals from the Nile, so that for example the city of Cairo and industries along the Nile would not be charged for withdrawals. While this may have been true at the time of construction of the HAD, the logic is far less clear now. The scale of subsequent development in all sectors, and the size of Cairo itself are intrinsically linked to the construction and effects of HAD, and current water requirements could not reliably be met by the uncontrolled flows of the Nile, and might in any case have been captured by upstream users within Egypt.

Second, a number of major investments were treated as "sunk" costs and excluded from the analysis, so that capital costs were included in the analysis for new areas but excluded for old areas. (In practice this may correctly reflect the implicit cost recovery that went on in the recent past, but the transparency of the analysis is reduced.)

Third, the linkage of cost allocations to benefits derived makes the result sensitive to the time at which the analysis is done. Benefits to agriculture, for example, have increased rapidly over the last decade as a result of changes in government policy.

Aside from these difficulties of application to an already-developed system, some additional difficulties with the approach were identified, the most important of which are noted below.

The ISPAN study contains a mixture of O&M and investment activities on the cost side (including development of new lands and a number of IMS activities which result in service improvements and thus constitute investments).

On the benefit side, the report seems to assume that IIP benefits will be achieved on large scale over a wide area as a basis for projecting the sectoral benefits to agriculture. This increases the cost allocated to agriculture in the old lands through the mechanism of the higher derived benefit.

Finally, the study embodies some assumptions about alternative costs which are difficult to confirm, relating particularly to the cost of alternative sources of water for domestic use; and the existing model was difficult to run and update.

In consequence, the following changes were made to the SCRB analysis:

- updated actual costs of O&M were introduced;
- benefits were updated;
- capital investment components were deleted from the cost projections;
- the impacts of investments were deleted from the benefit projections;
- cost allocations for main stem users were determined on the basis of derived benefits rather than the assumed alternative cost;
- revised estimates of alternative costs for municipal and industrial supplies provided through canals were included; and

- revised estimates of municipal and industrial (M&I) demands based on a more comprehensive approach to the determinants of growth were introduced.

This unexpectedly complex and time-consuming revision had associated costs and benefits. The team originally planned to produce a Use of Facilities analysis, but, based on the report on Financial Management Systems (Lewis, 1995) the Team decided that existing accounting procedures would not allow the necessary disaggregation of costs by purpose on which a UoF analysis must be based in the time available for the study.

On the other hand an updated SCRB model has now been developed as part of the study exercise, in readily accessible spreadsheet form, which allows much more convenient testing of assumptions than was possible with the previous model, and hence incorporation of the numerous revisions to projections made in the non-agricultural study.

The new model also allowed extensive exploration of a variety of underlying assumptions and sensitivity tests to differing levels of benefit in agriculture, different assumptions about new lands development, and alternative estimates of benefits to other sectors.

An important conclusion of the entire exercise of re-examination of the ISPAN model was the relative insensitivity of the agricultural cost allocation to various changes in the underlying assumptions. The ISPAN estimates of cost allocation to agriculture in the old lands ranged from 75% to 83% of total costs; current estimates range from 70% to 81%.

Given the magnitude of the changes introduced into the analysis, the consistency of these results may be surprising, but is explained as follows. First, it should be noted that the cost which is being allocated is the cost of operating the system (plus in the case of ISPAN some investment costs), so that the total amount being allocated is similar in both cases. Second, by far the most significant user of water is agriculture, accounting for perhaps 85-90% of total use. Third, the re-evaluation of other uses increased their share in the total, but because the actual volume assigned to such uses is minor. In fact, the revised treatment of M&I and industrial demands led to much higher cost allocations to these sectors than in the original analysis by ISPAN (a total of about 11%, compared to 0.2%). However, this increase was offset by declines in the allocations to hydropower (from 3% to less than 1%) due to improvements in non-hydro generation capacity and hence less releases from Aswan for power, and reduced benefits to tourism (from 7.7% to 2.1%) based on updated estimates.

Representative results are presented in the table on the following page.

Sector	Cost (LE)
Municipal and Industrial (per '000 m3)	
Canal delivery	12.32
Direct Intake or Groundwater	1.62
Industrial Direct Intake	2.33
Old Lands Agriculture	
Land Basis (per feddan/year)	74
Volume basis (per '000 m3)	11.65
New Lands Agriculture	
Land Basis (per feddan/year)	73
Volume basis (per '000 m3)	11.32

Note: Results are based on SCRB approach, following ISPAN methodology, updated as indicated in the text. The cost of O&M was based on MPWWR's 1994 budget, which are over-estimated, in that staff costs are not dis-aggregated between O&M and other activities, and under-estimated to the extent that budgetary requests are less than required for adequate O&M.

For the agricultural sector, the stability of these results was tested for sensitivity to the major the major variables—benefits to the agricultural sector, various scenarios of new land development, rates of growth in industrial production, and changed assumptions about population growth rates. The variation in the costs allocated to agriculture was in all cases marginal. A 15% change in estimated agricultural benefits produced only 3% change in the computed service charge. *This adds considerable confidence to the results as a basis for making policy decisions.*

However, within the agricultural sector, results are particularly sensitive to pumping costs. Pump lifts for agriculture and M&I use are most common in Upper Egypt, and specifically allocating this cost by region results in agricultural service costs in Upper Egypt, Middle Egypt, and the delta of LE 128, 81, and 60 per feddan respectively. This issue is discussed further in the final section of this report.

4. THE IMPACT OF WATER SERVICE CHARGES ON AGRICULTURE

An analysis was undertaken using the IFPRI model of Egypt's agricultural sector, which is a modified, extended and more complete version of the agro-economic model developed as part of the Water Master Plan. The analysis was designed to explore a number of issues. The first set relate to farm incomes and the effect of alternative ways of charging for water services:

a) What is the impact on farm incomes and agricultural production of the introduction of full cost recovery for agricultural water services?

b) What would be the impact on agricultural production if service charges were assessed:

   (i) at a fixed rate per feddan, irrespective of crop or water use;

(ii) at crop-specific rates, charging higher rates for more water-intensive crops;

(iii) volumetrically, on the basis of actual water use.

In each case, the charges were set so that total revenue remained equal to actual O&M costs, estimated at LE 70/feddan15.

Impact on Farm Incomes

Net farm incomes are estimated by the IFPRI model to average about LE 1,650 per feddan per year (that is, income to the farm enterprise, excluding the cost of family labor). This figure is quite consistent with other estimates. The World Bank Appraisal of the Irrigation Improvement Project (IIP) estimated farm incomes to range from LE 1740–2000; Value Added, Crop Choice and Agricultural Production in Egypt16 indicates individual crop returns17 to range from LE 520/feddan (flax) to LE 2470/feddan (cotton), with most crops in the LE 800-1200 range. With cropping intensity of about 180%, net farm incomes would range from about LE 1,600–3,000 per feddan.

Taking LE 1,700 per feddan as an average figure, we conclude that full cost recovery of water services in agriculture would reduce farm incomes by about 4.5% on average.

The brief field survey18 undertaken during this study indicated a number of additional costs borne by farmers, most of which are minor except for land rent. Farmers who rent land typically pay in the order of LE600 per feddan per year. This would reduce farm income to about LE 1,100 per year, and increase the proportion of a water service charge to about 6.5% of income, if charged to the renter (an issue that is addressed in the final section).

It is concluded that full recovery of water service charges to agriculture would not substantially affect farm incomes.

Impact on Production of Alternative Charging Systems

The second set of issues addressed in IFPRI's study relates to the impacts on production, cropping pattern and farm income, of various ways of implementing overall water service charge of LE 70 per feddan. Three options are assessed19. Each was computed for both short and long-run scenarios—the most important difference being that in the long-run scenario sugar cane is expected to disappear from the cropping pattern in favor of the more water- and land-efficient sugar beet crop. Since this phenomenon has yet to appear, the more conservative short-run impacts provide the basis for the analysis described below.

The first option is a simple undifferentiated tax of LE 70 per feddan per year, and the result was a fall in farm income of 4.5%. This was expected—a flat land tax has no impact on choice of crops and technology.

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15 The following calculation was used to determine the service charge on which the IFPRI study was based, since the results of the revised cost allocation were not then available: the total cost of O&M is about LE 600 Million/year; 85% of the water provided goes to agriculture; and the area served is about 7.3M fed. The cost allocated to agriculture on a strictly proportional UoF basis would thus be approximately: 600 * 0.85 / 7.3 = LE 70/feddan/year. This approximation fortunately turned out to be within 5% of the final estimate!

16 Zakir Hussain, David Seckler, and Farouk Abdel-Aal, Strategic Research Program, NWRC, July 1994

17 Adjusted for comparability to exclude family labour and land rent

18 Khouzam, 1995

19 A fourth option was explored, placing a heavier charge on cash-oriented crops such as cotton and sugar cane, but the results were inferior from all perspectives to the other options, and are not described here.

The second option simulates a crop-water charge per feddan, proportional to calculated average water consumption. Since the IFPRI model allows a wide range of crop choices in terms of planting dates and water stressing, this option gives the farmer considerable incentives to "fine tune" his cropping. The result was more efficient from both the farmers perspective (farm income falling only 2.4%), and the national perspective (water demand falls by 3.5%), while returns to water increased by 2.7%.

The third scenario imposes a volumetric charge, and simulates the effect of measuring and charging for the quantity of water delivered. For the present situation, where water is not a severe constraint to crop choice, the results from this scenario are virtually identical to those obtained through the second option described above.

This indicates that, for the level of charges implied by full cost recovery for water services, the impact of a relatively simple charge on cropped area has the same efficiency benefits as a volumetric charge.

Impact of Alternative Charging systems in Case of Water Shortage

The third set of issues concerned the impact of water shortage on production, and the role that water charges might play in inducing an efficient response from farmers to such shortages.

Reductions in supply of 15% and 30% were analyzed. The model was significantly revised from the previous version to simulate:

- how shortage is shared under present management (concentrated locally at tail ends or otherwise disadvantaged locations) or
- efficient management, which would share shortages equitably among all farmers.

The results show that from the national perspective, a water shortage of 15%, if inefficiently managed (concentrated among tail-end farmers), would result in a 7.1% fall in agricultural production, while an efficiently managed shortage (evenly distributed among all farmers) would limit the fall in agricultural production of 4%. It is interesting to note that because the overall demand for agricultural commodities is inelastic, reductions in supply result in more than proportional increases in price, so that farmers (as a group) receive increased incomes.

Finally, the usefulness of volumetric water pricing as a mechanism to promote efficient water use was explored. The price increase required to induce a 15% reduction in consumption was computed by progressively raising the volumetric service charge. The analysis indicated that *the service charge would have to reach a level equivalent to about 25-40% of farm income, corresponding to LE 400 per feddan, to achieve the required reduction in demand.* Volumetric charges are thus not a viable means of controlling the demand for water, or significantly affecting the efficiency of use.

4. Conclusions, Recommendations and Options for Cost Sharing

The preceding sections have identified a number of conclusions, which are listed below, before moving to consider their implications for an appropriate service charge policy for agriculture.

- The average cost of providing water services to agriculture is LE 70 per feddan per year;
- This cost is stable, and little affected by likely variations in underlying assumptions;

- The cost does vary significantly by region due the importance of pumping costs;
- The present system of accounting does not allow accurate differentiation of costs by purpose and location;
- Under present conditions of supply, volumetric charges for water are only marginally more successful in encouraging efficient water use than crop-based charges, which in turn are somewhat better than a flat land tax;
- Volumetric charges are an unrealistic means of encouraging significant reductions in demand, because very high charges are required to have a significant impact.

In Part 1 of this report, three distinct objectives were identified as underlying the purpose of service charges: the *financial* objective—to recover from beneficiaries the cost of providing water related services; and the two *efficiency* objectives—to encourage efficient use of the resource provided, and to provide the water service at a reasonable cost.

The results of the analysis now allow some further consideration of these objectives. The first is straightforward: any of the service charge schemes assessed would meet the criterion of recovering the full financial cost of the service.

The efficiency objectives have been partially addressed. The analysis indicates that the level of service charges required to meet the financial objective are so low (6% of farm costs; 4.5% of income) that their impact on cropping decisions by farmers will be minimal.

The results of the IFPRI study show clearly that even volumetric charges are unlikely to produce significant efficiency results within the politically feasible range of charges. In further support of this contention, it is instructive to evaluate the benefits of volumetric supply in relation to possible costs.

The short-run impact of a 15% reduction in water supplies indicates that efficient management of shortage leads to a fall in sectoral production of 4% while inefficient management would result in a fall of 7.1%—a benefit to the combination of service charges and management of 3.1%. These figures can be approximately[20] interpreted as follows, for the situation when shortage of water is a significant constraint to production:

- With agricultural production at LE 1,700 per feddan per year, the productive benefit would be LE 1,700*3.1%, or LE 53 per feddan per year.
- To achieve these benefits would require the introduction of a system of water delivery capable of providing measured quantities of water to each individual farm: the infrastructure of the Irrigation Improvement Project would meet this need, and currently is estimated to cost LE 1,550 per feddan for civil works.
- Ignoring all other effects, the return of LE 53 per year on the investment of LE 1,550 indicates that *the introduction of volumetric charging for water is unlikely to be economically viable*.

This conclusion applies with equal force to suggestions of rationing water allocations (Bowen and Young, 1983), and tradable water rights (Lofgren, 1995) because the infrastructural and management implications are similar in each case. This is not to say that improved

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[20] The major approximation is in assuming that the relationships are linear over the range 0-15% shortage. This assumption over-estimates the impacts of shortage and the consequent benefits of intervention.

management may not have numerous other benefits, but rather to indicate that the benefits resulting from improved allocational efficiency are small.

Finally, we turn to the question of how the introduction of service charges may influence efficiency in providing the service. A benefit of service charges is to make both the service provider and the service receiver conscious of costs incurred. To achieve this linkage, service should be disaggregated to units where the link is transparent. For example, in the US many *projects* are provided with water by federal agencies at agreed (and often subsidized) rates, and *within the project* the farmers bear the full cost of operation, maintenance, and also set their own charges. This might correspond in Egypt to supplying water at a common rate to all Directorates, and setting charges within the Directorate to meet costs incurred at that level. As long as a central authority has responsibility for delivery of water from Aswan to the meska, as well as associated responsibilities for water quality, maintenance of navigation flows, and so on, it will be difficult to establish a link which the beneficiaries can identify with, and as a group exert pressure to change the service and the associated cost of providing the service.

Three essential changes would underpin such a situation: first, as already noted, the introduction of accounting procedures to allow clear identification of costs incurred; second the definition of a service point above which the government agency provides water services at an agreed cost, and below which the beneficiaries pay service-related charges; and finally the definition of the service to be provided at the service point (in terms of quantity of water, timing, rights in case of surplus or deficit, etc.

These points relate closely to future operational decisions, which are beyond the scope of this paper, but the following comments are offered. First the definition and introduction of defined services will be time consuming and especially difficult in Egyptian circumstances. The system presently operates as a demand system with enough water to meet the vast majority of needs.

If that is to continue (that is, if water supply to existing agriculture is not going to be significantly cut by direct withdrawals for new lands, increasing demands for water intensive crops, and effective reductions in available water through high rates of pollution) it is doubtful whether the exercise of water allocation is required—the system can simply continue to be run as a demand system. If not, water service definitions will be required. The point is that the driving logic for establishing service definitions will be the future water balance rather than cost recovery considerations. The present cost of providing the water service is relatively low, and it is doubtful whether likely efficiency gains in the cost of the service would justify the problems which will arise in the definition of water allocation and water rights.

Before listing our recommendations, three further issues are identified, all of which are politically sensitive:

- Should there be cross-subsidization between sectors?
- Should agricultural water service charges be the same in all regions?
- Should service charges be levied on the owner of the land, or the farmer?

On the first issue, two points are important: first, given the higher priority generally given to non-agricultural users, and the considerably higher benefit derived in such uses, it might be appropriate to charge premium rates (consistent with the principles of the Use of Facilities approach). However, the very large proportion of water consumed in agriculture means that such an approach will have limited impact on water service fees for agriculture[21]. Second, if

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21 As an approximate example, increasing charges by a factor of 3 for non-agricultural users would only reduce agricultural charges by about 20%.

cross-subsidization is introduced, the allocations should be clear and transparent, so that potential benefits of a linkage between "service" and "payment" are not lost in complex accounting procedures. For example, it might be appropriate to base (increased) M&I charges on some proportion of pumping costs as a means of subsidizing this element of the service to agriculture, while leaving system O&M to be covered by agricultural charges. Such a clear allocation would ensure that service providers and service receivers would retain interests in efficiency of resource use and service provision.

The second issue is essentially political. The considerably higher cost of delivering to parts of Upper Egypt would result in charges of about 8% of farm incomes, and would have a limited impact on water use. It would therefore be preferable to have higher rates in pump-lift areas, but the political considerations involved may preclude this. If services are ultimately defined on the basis of a service point, the problem might be resolved by having uniform rates to the service point, at an average cost that equalized pumping charges.

The third issue is both political and economic: a charge levied on tenant farmers correctly links the benefit to the service, and will induce more efficient crop selection, if charges are crop-specific or volumetric. On the other hand, farm incomes for tenants are lower by 30-40% and charges would in consequence be a higher proportion of income for this group. The eventual effect of charging tenant farmers will be a small fall in rental charges (which are in any case due to be liberalized from present controls in 1998).

With this background, the following recommendations are made:

- *Non-agricultural users should pay the full cost of delivery, based on metered charges or estimated consumption. If the latter, estimated consumption should be sufficient to encourage installation of meters.*
- *The basis for setting service charges to beneficiaries should be crop-related, and reflect water consumption of the crop, either individually or by grouping crops into high consumption(sugar cane, citrus, paddy), medium consumption (rice), and other crops.*
- *Beneficiaries should have the right to claim remission of rates in case of crop failure.*
- *MPWWR should introduce the proposed financial accounting system (Lewis, 1995) so that there is transparency in the costs allocated to agriculture and other users.*
- *Service charges should be levied on farmers and tenant farmers directly, and that the officially allowed rental rates should be reduced in parallel.*
- *If it is decided to move towards Federations of Water User Associations or Directorate level allocations of water, service charges should reflect the new interface between government and farmers, and charges set separately for these two components of the system.*
- *If MPWWR remains responsible for delivery to the meska, it is recommended that the Finance Ministry, should collect water service charges through its existing field staff, on advice from MPWWR or MOA about cropping patterns. Otherwise, if services are disaggregated to serve federations of Water User Associations, it is recommended that the Federation pay MPWWR directly, and set and collect its own charges internally.*

The introduction of service charges will take time, both because of the significant policy change required, and because a number of related decisions and actions are needed. Most

importantly, the introduction of full cost accounting is needed to indicate accurately and transparently what the cost of providing the service is. This process may take three to five years. Second, decisions are also required on whether the nature of the irrigation service should change, defining the service delivery point as the Directorate or Federation of Water User Associations.

However, the clear present indication of the likely magnitude of the required charge suggests that:

- *action can be initiated now, with the target of full cost recovery over an agreed period. The precise amount to be recovered will be clarified during that period as accounting procedures are improved, and the introduction of full charges will provide the proper base for agreeing with farmers as to whether they wish to undertake more obligations themselves, and what the reduced water service charge would be.*
- *In the meantime, the Government of Egypt should provide the full estimated cost of system O&M to MPWWR each year.*

On the question of capital cost recovery:

- *the existing policy for capital cost recovery should be reviewed in light of the very high subsidies resulting from the present procedures.*

A number of issues which have not been directly addressed in this report can now be clarified on the basis of these conclusions. If volumetric charging is accepted as being infeasible for the foreseeable future, it should further be clear that charging by quality of water will be equally problematic. The variation in quality by location and time make this parameter even more complex to measure and account as a basis for charging than the actual volume delivered.

Also, since capital cost recovery is treated separately from operating costs, it would not be appropriate to charge differing rates in "improved" areas. Such distinctions should arise naturally through the capital cost recovery mechanism, which was the basis for the improvement. In such cases, since service is expected to improve significantly, the ratio between incomes and charges should be even higher than that calculated above for the average case. The World Bank-financed Irrigation Improvement Project estimates that farm incomes will increase by LE 730 per year for a 2 feddan farm, while the costs of capital repayment (in accordance with the procedures described in Section 1, above) amount to about LE 140, after allowing for reduced pumping costs.