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APPROACHES TO FINANCING IRRIGATION

by

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Introduction

An old adage claims there is no such thing as a free lunch. Despite much apparent evidence to the contrary, there is no such thing as free irrigation. Irrigation always consumes resources - land, labour and usually capital, which have valuable alternative uses.¹ In this paper we consider various methods of supplying any necessary finance for effective operation of irrigation. The alternative to proper finance is deterioration, repeated failure and finally abandonment. Abandonment can be prevented by periodic rehabilitation. In these circumstances rehabilitation can be regarded as an idiosyncratic system of finance, not to be recommended except in exceptional circumstances.²

Broadly speaking financial allocations for irrigation can come from one or more of several sources: internal borrowing from the public; Central Bank credit creation; foreign loans and grants; general tax revenues; and user fees. The scope for regular dependence on the first three sources is limited and other areas of the economy may have a prior call. For these and other reasons those responsible for irrigation finance might look at the latter two sources of tax revenues and user fees.

In a few countries a tradition of free irrigation water for farmers is maintained. Yet there is a widespread and growing economic ethos in capitalist, socialist and mixed economies alike, that prices should be used to signal broad national economic priorities. 'Get the Prices Right' (GTPR) is the current slogan and whilst it is at best a little vague for most policy implementers and it clearly begs the key questions, it usually implies a particular mix of efficiency and equity goals. But Governments have other relevant responsibilities notably those relating to achieving full employment, price stability and growth. It may be important when studying irrigation finance to devise and use pertinent criteria in relation to these latter goals as well as efficiency and equity. For example, in many countries without appropriate irrigation finance sub-optimal growth is inevitable.

Irrigation is increasingly important and increasingly productive but paradoxically most societies are failing to devise mechanisms to adequately finance the service.

Irrigated agriculture and the macro-economy

Use of general tax revenues, rather than user fees, to finance irrigation is admissible and indeed desirable when the agriculture sector is squeezed by one means or another squeezed to finance the Treasury. In many countries the large agriculture sector has suffered discriminatory trade, exchange rate, fiscal and monetary policies plus inefficient and expensive parastatal marketing boards. All this has created adverse

domestic terms of trade for agriculture compared to industry. If farmers are receiving only a portion of the export parity prices the case for user charges for irrigation is clearly weakened. This is the situation in many countries. The World Bank estimate protection of agriculture in the 1970s and 1980s to be 0.76 in Philippines (1974), 0.88 in Mexico (1986), 0.75 in Egypt (1981), and 0.35 in Nigeria (1980) (World Bank 1986 p.62). World Bank studies have also shown, in countries as widespread as Malaysia, Sri Lanka, Guyana and Mexico, that indirect, implicit taxes by fixed product prices below import parity prices were a much higher burden than recurrent costs of irrigation. Sometimes, the indirect charges are several times higher burden than water charges. In these countries there is little point in the irrigation agency campaigning for user fees in line with costs. On the contrary, they might campaign for free water and stress the need to transfer some of the indirect charges to sustain the wealth creating irrigation system

The general point here is that fiscal policies relating to irrigation have to be seen as part of the macro-economic management problem. If irrigated agriculture is already subject to implicit taxation the scope for user fees is clearly restricted. This can be readily accepted. In Burma irrigation water is 'paid for' by indirect recovery through compulsory purchase of a portion of the crop at prices below export parity price. David Potten (private communication) points out that this can be inflexible. In recent times the agree rice procurement price has been higher than export parity so a rice 'tax' has become a subsidy. Success of the rice element of the Green Revolution, leading to self-sufficiency at 'normal' prices, is a real threat to any parallel revolution in raising revenue. In Burma, Thailand, Indonesia and Sri Lanka (amongst others) Governments are more concerned about a rice price collapse or financing surplus purchase and export, than about raising revenue. Increasing user fees at a time of falling prices of a dominant crop is not good politics.

However, if depressed prices precludes fees being collected the converse is also true. If, in response to a new macro-economic climate favourable to agriculture we find macro policies neutral or assisting that sector, irrigation agriculture can be reassessed as a tax base for general revenue or at least it can be expected to bear its real costs. GTPR is not just a slogan for pricing agricultural products, it is equally relevant for production inputs including irrigation water.

Irrigation water as a tax base

One of the potential impacts of GTPR is to reduce Government revenue sources. If agriculture is not to be squeezed excessively then new revenue sources, at least in the short run, have to be found.³ Irrigated land can be used as a tax base. To some it will seem unprincipled to regard water as a source of taxation. For example, Boulding (1980) speculates whether the sacredness of water as a symbol of ritual purity exempts it in some degree from the dirty rationality of the market. Tax authorities are not normally so squeamish as to exempt vital or essential commodities. In the Middle Ages in Europe the essential commodity salt was subject to a tax! The loss of revenue as governments move to (GTPR), by for example removing export duties, will force them to reconsider all possible sources of tax revenue.

In principle water charges can be levied with an eye on total costs, marginal cost or benefits. In practice cost approaches are only options if benefits are sufficient to provide the minimum incentive for farmers. All user charges thus boil down to variations on the benefit system. If benefits are substantial then a tax approach can be considered to raise revenue from irrigated land.

The simple graphics of revenue generation

In some respects irrigation water would make a good tax base. In arid areas there is an inelastic demand for water at the price presently charged. Raising the price of water would not affect the quantity demanded. In fact at the low prices normally charged the capacity is exceeded before demand is satisfied.

This is shown graphically in Figure 1. The demand curve DD is relatively steep over most of its range.⁴ At price P₁, demand would be q₂ which is greater than the available supply Oq₁. This is what leads those favourably placed on systems (i.e. nearest the source) to steal additional water or to offer canal operators 'prices' higher than the official charge. Direct water charges are generally set at levels much below supply costs and far below the benefits-in-use to the farmer.

If water was a tax base it might be worthwhile from a revenue viewpoint to charge even higher prices to maximise revenue. For example, price P₂ would raise substantial revenue but with less than full capacity use (hence there would be an economic loss). Price P₃ would be the highest price that could be charged to use all capacity.

The effect of improving agricultural technology would be to shift the demand for water to the right (to D₂ D₁) increasing the level of prices that could be charged and incidentally increasing the returns to supplementary supplies. It is the shifting of demand curves for irrigation water with new agricultural technology that have made tubewell irrigation profitable and which create the opportunity to recoup the costs of new water supply enhancing investments such as rehabilitation of schemes. The shift of demand for assured water supply is also likely to keep political pressure on Governments for new schemes which are likely to be in less favoured sites and thus with more expensive capital and recurrent costs. Typically water charges are much below O & M of existing schemes but, more seriously very much below the long run marginal costs of new capacity. Indeed long run marginal costs are often greater than gross value of production.⁵

Simple graphs such as this can also be used to demonstrate the problem of inflation and the effect of failure to adjust user fees in time with financial needs. Sometimes (normally) Governments fail to adjust because of inertia, or a misplaced sense of fighting inflation. In Figure 2, P₁ is the price to farmers in year 1, P₂ is the same price in real terms in year 2 after serious inflation. This problem is exacerbated if collection or transaction costs are considered. If C₁ is the collection costs the margin between collection costs and revenue will diminish each year. If, as often happens, governments 'protect' civil service pay, then differential inflation occurs and collection costs will rise in real terms

Figure 1.

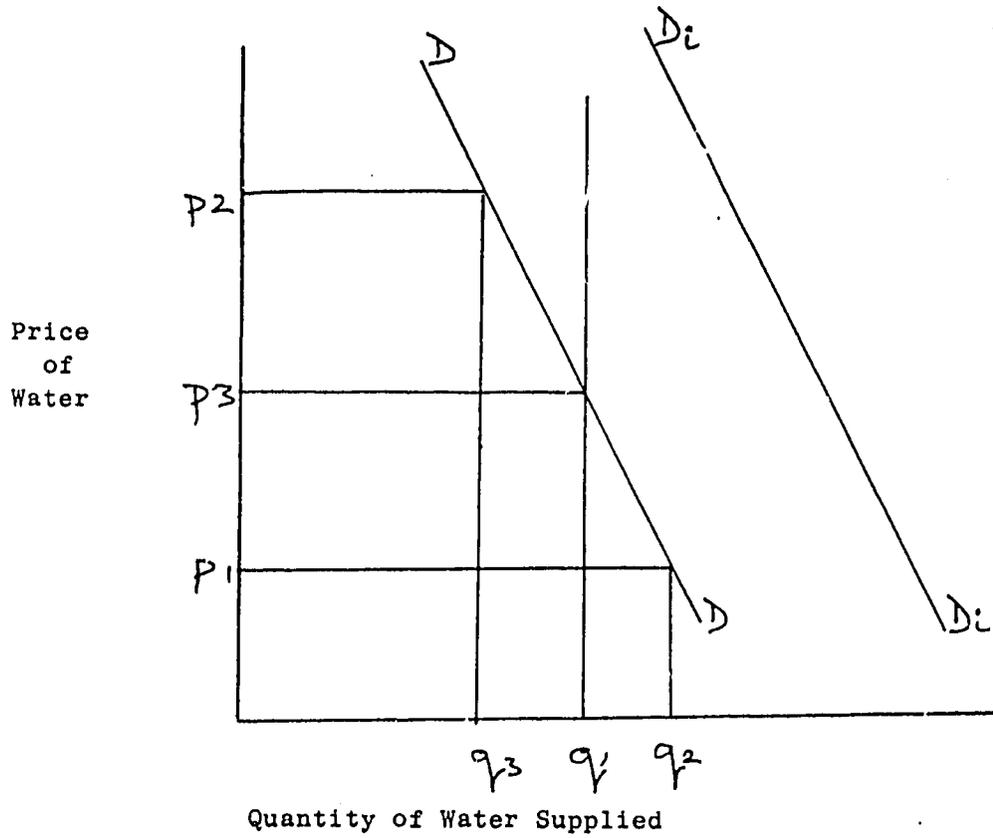
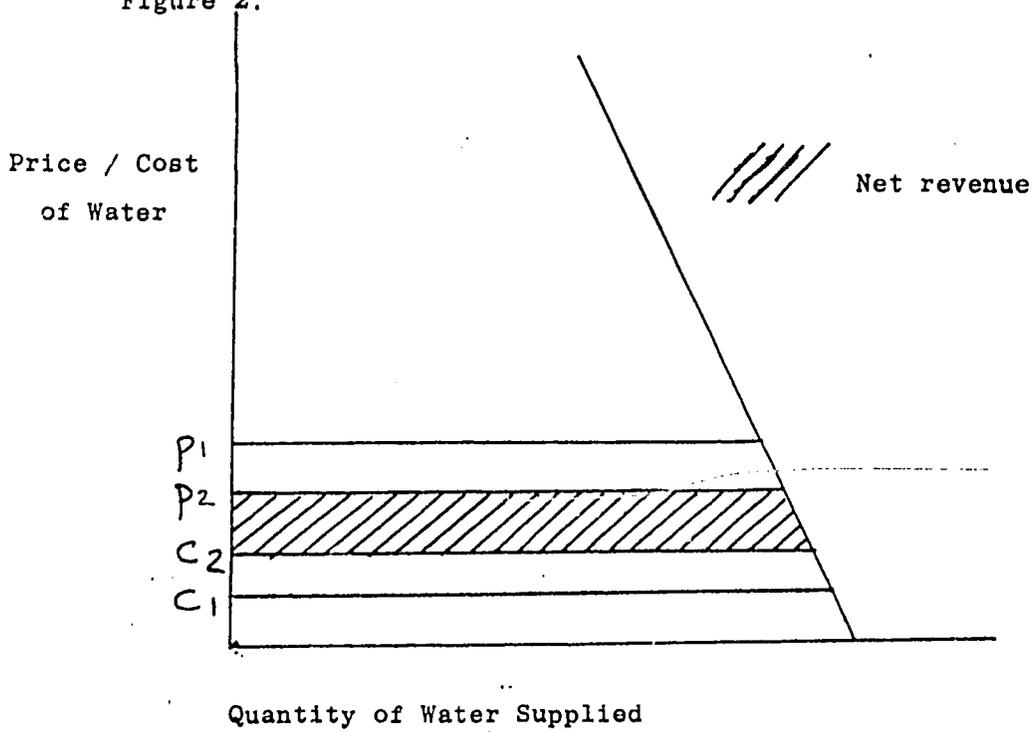


Figure 2.



to C2 further squeezing the net revenue from irrigation. No studies are known on the real costs of collecting irrigation water rates but this is clearly an important topic. It is the first rule of revenue collection that revenue must exceed collection costs - in terms of our diagram C must be below P.

In a mixed economy taxes are judged first by two criteria: is the tax fair (equity); and does the tax interfere unduly with the market and economy (efficiency). Irrigation taxes might be considered equitable if all who had irrigation paid the tax (the benefit principle) but it would only be 'horizontally equitable' if all families with irrigation had similar circumstances and bore similar taxes (no special scheme taxes, tubewell irrigators paying the same for irrigation as gravity scheme irrigators) and only 'vertically equitable' if ability-to-pay was considered. The ability-to-pay criterion generally assumes that those who earn greater income such as by taking more or better (i.e. more reliable) irrigation should assume greater burden. This burden could be progressive - with average tax rates increasing with increasing benefit, proportional - with average rates constant with increasing benefit, or regressive - with average revenue rates falling. Most irrigation pricing schemes are proportional but an imaginative radical government, tired of land reform, might consider progressive water charges as an alternative and sound measure for achieving equitable taxation.

Options in cost recovery

If Governments are to restrict their concern to irrigation cost recovery several options face them:

- Direct water charges
- Betterment levies
- Land tax
- Agricultural product taxes
- Price controls

Water charges appear the most obvious mechanism but they are seldom successful because volumetric measures of water used cannot yet be economically made (a technology gap?), particularly on large schemes, in open channel flow with high silt loads and large seasonal variations.

Betterment levies require recouping a portion of the increase in capital value of the land, that occurs once irrigation is supplied. This is a tax, readily understood by farmers but the most strongly resisted even when due to be paid over a number of years. One reason for this is that it often comes soon after the irrigation of a scheme, before yields reach potential and when on-farm capital requirements are at their highest. However, the betterment levy deserves careful re-examination after rehabilitation projects. It is likely that modernisation and rehabilitation of old-established schemes will provide an increasing proportion of capital investment in the next few years.

Land taxes are indirect measures of cost recovery. The limits to their value include the fact that they are usually set very low, seldom adjusted regularly in line with inflation, and often not allocated to irrigation (e.g. Indonesia).

Taxes on agricultural production work well when the crop is processed. For example on the modern irrigation schemes in Morocco a tax on sugar beet is sufficient to pay most of the O & M irrigation costs for the whole scheme. If these taxes are on a percentage of value basis the inflation effect is taken into account.

Price controls on crops, export taxes, maintaining an overvalued exchange rate to undervalue agricultural exports, are all devices to accumulate or apportion to the public exchequer a part of the value added from irrigated agriculture. In this GTPR era it is an unfashionable method and it effects rainfed and irrigated products alike. However, although it is a crude instrument it has been the most successful way in which part of the income accruing to farmers is recouped by Government. There might be less criticism of it if it were applied more wisely and the productive assets such as irrigation infrastructure that generated the wealth had received a due share to maintain them.

Direct irrigation prices are a preferred mechanism for charging for water so that the users get a clear signal of the resource cost of their economic activity. The literature on pricing provides the premises, theory and guidelines for application of this mechanism.

The literature on pricing

The economics literature on pricing policy stresses efficiency rather than equity. A recent text is Gerald Meier Pricing Policy for Development Management (1983) Johns Hopkins University Press, which consists of a carefully edited set of classic readings with a very strong editorial theme. Paul Samuelson, Joseph Schumpeter, Peter Bauer, Robert Dorfmann, Tibor Skitovsky, Ian Little, James Mirrlees, Basil Yamey, Harry Johnson, Kenneth Arrow and other neo-classical economists feature prominently but socialist writers such as Janos Kornea's and Oscar Lange appear. This is the recommended basic textbook for anyone concerned with irrigation finance or any public sector pricing problem.

Several literature reviews specifically addressing irrigation pricing issues have recently been completed. These include Carruthers et al Annexe VI (1985) from Devres Inc. for USAID; Easter and Ellingson (1982); and Small et al (1986) from the International Irrigation Management Institute for ADB. (See also Westgate (1984), Cruz et al (1984)).

A recent broader review of the theory and practice of water prices in urban and rural use has been produced by Diana Gibbons (Gibbons 1986). This relates theory and practice in the United States of America and is a monograph showing more that could well be repeated for developing countries where water is in multiple use with high opportunity costs.

Most of the economics literature assume the necessary benefits accrue and has looked at the costs of irrigation and has applied guidelines derived from theories of public utility pricing.⁶ Unfortunately

irrigation systems do not fit well into the apparently simple and straightforward marginal cost pricing solutions often advocated in applied economics textbooks (e.g. Killick 1981). The marginal cost pricing rule aims to raise economic efficiency by pricing irrigation water at the marginal cost of delivering it. Meier (1983) explains how pricing any input such as water at marginal cost maximises the economic benefits. However, he admits problems of measuring marginal cost (very problematical in the case of irrigation), problems in measuring differences between short run and long run marginal cost (very large in the case of irrigation), and difficulties of coping with cost variations of a geographic or locational nature (should there be different rates for different schemes, should farmers at the head pay more than those at the tail of irrigation schemes?). Furthermore the difference between the financial costs generally considered and the economic or social costs actually incurred can be large, difficult to estimate and impossible to apply. To be theoretically valid it should be applied in all sectors of the economy simultaneously.

In such circumstances the urge to ignore or at least to downplay marginal cost pricing rules is tempting. We would accept the validity of the theory and the problems of application and would also accept that any move toward marginal cost pricing is likely to increase economic efficiency. We also accept that there are some ingenious adaptations to the theory to cope with application problems (Saunders *et al* 1977).⁷ Nevertheless we shall downplay the role of marginal cost pricing theory in this paper, not on the grounds of these operational problems but because narrow financial or cost recovery matters are more pressing and more direct approaches are preferable. We accept that pragmatic application of social (economic) long run marginal costs would in most circumstances improve economic efficiency. However, in today's economic climate cost recovery finance must be considered to trump economic efficiency. The global recession of the early 1980s was longer and deeper than most anticipated, the voluntary and involuntary obligations of Government are growing faster than revenue, debt burden has increased and 'structural adjustment lending' has produced much less adjustment than the advocates intended. In short many developing Governments face a revenue crisis.

Primacy of cost recovery

Social marginal cost pricing will normally result in large financial deficits in the case of irrigation. Irrigation has high fixed costs and economies of scale. Average total costs are normally decreasing over the design range and therefore the marginal cost curve is below average cost curve. In these circumstances marginal cost pricing will always result in a financial deficit (see Killick 1981).

Under these conditions the normal response is to accept the deficit and to accept the case for an irrigation service subsidy. Introduction of an irrigation subsidy to promote use, to stimulate development of an area or a group, to promote income redistribution and such benefits are legitimate goals. But with public sector revenue falling below needs the opportunity cost of all subsidies will rise. Recent studies of subsidies have shown that they may not reach the target group or they may not be the least-cost way of pursuing the declared goal.⁸ More generally Meier

(1983) argues that advocates of a subsidy will find it necessary to meet the criticisms "that the subsidy will lead to unanticipated distortions elsewhere in the economy, may require counter-subsidies to offset distortions created,⁹ may become burdensome administratively, may inhibit incentives to efficiency, may give unwarranted market protection, and may be difficult to terminate" (p.222).

Elimination or moderation of food subsidies can spark riots or have other harmful political impact. Irrigation pricing is potentially as explosive an issue, albeit a rural rather than an urban problem. This accounts in part for the often found reluctance of Governments to increase user charges or even to enforce agreed legal fees. In those economies dependent upon subsidised irrigation we can expect, in present harsh economic circumstances, increasing financial shortfalls in irrigation departments. This in turn will result in a slow deterioration in O & M standards (Carruthers 1983 Ch.7). If adequate and/or unreliable supply is combined with a tax or other financial squeeze on irrigated agricultural products to finance or satisfy urban priorities there is a double loss. Squeezing agriculture at this time when irrigation is becoming increasingly productive (i.e. when the response curve to water input is shifting upwards because of developments in complementary agricultural technology) will increase the opportunity costs of failing to find finance. In principle if irrigated agriculture is burdened by maintaining an overvalued exchange rate, by export duties or by other macro-economic measures (see World Bank, World Development Report 1986 Ch.4) the Treasury can justify 'subsidising' irrigation.

Treasury economists are usually reluctant to admit 'earmarked' revenue. We can look for evidence or comparison in the form of good financial support for O & M when agriculture is squeezed. There is no discernable inverse correlation between adverse terms of trade for agriculture and high standards of operation and maintenance. For example Nigeria, Egypt and Philippines all give substantial manufacturing sector protection compared to agriculture, and thus squeeze resources from the agricultural sector, but their irrigation is not known for its excellent operation and maintenance standards.

Earmarked or retained revenue is found in some countries. Even if scheme revenue is retained this is a necessary but not a sufficient for sound irrigation operation finance. Scheme finance has been found in China for at least 25 years (Nickum 82 p.33) and introduced into Sri Lanka very recently. In China an irrigation district or a pumping station should be fully self-sustaining but in Sri Lanka a contribution toward operating costs is presently sought. It is intended in Sri Lanka that O & M should, in time, be fully financed by farmers but during field visits by the writer in August 1986 it appeared that the Government was, naturally enough, pre-occupied with national security and other higher-level political goals and seemed unlikely to provide technicians with the strong political backing necessary to implement unpleasant policies. The general lesson for those concerned with irrigation finance is that water charges are always unpopular measures and the political will to sustain these unpopular policies is seldom to be found. This theme is taken up again later.

Some practical achievements

The case studies in this Conference show that achievements in raising user-fees are exceptional. Even in the rare instances where costs are proportional to water delivered, such as with pumps or tubewells, distortions occur. For example in Egypt energy prices are a fraction of world prices and in India electricity prices are often subsidised.

The 1985 Devres study (Carruthers et al 1985) concluded that in all five countries visited a growing financial liability was being created. Irrigation in all countries was underfunded. However, although finance was scarce and charges are levied, little serious effort has been made to actually collect revenue. In Peru it was claimed that all this will change to offset revenue losses from lower central government allocations. (Such expectations are oft repeated in planning documents - they are clearly a triumph of hope over experience).

In Dominican Republic collecting water rates is taken more seriously and they are set to recoup half the O & M costs and the team expected them to come close to this. However, over the next five years they plan to reach collections equivalent to full O & M costs. Once again optimistic expectations of unprecedented events.

In Morocco collection on a large modern scheme runs at 80 per cent of levied rates. This high percentage is obtained by deducting the charge before paying for a sugar beet crop that has to occupy a proportion of the farm. Clearly collection problems are minimised if a cash crop goes through a central processing unit.

In the Philippines we found another irrigation agency full of good intentions but this time the extremely severe macroeconomic problems have put some urgency into resolving at least the O & M financing problems. The National Irrigation Agency's approach is to realise Treasury support is not to be forthcoming and to implement a hastily prepared devolution scheme with promising if optimistic plans for water user groups taking over many management functions. The easy-to-organise groups have already been formed (25% on the Scheme we visited) and a good deal of determination and political support will be required if a large slice of management responsibility is to be handed over to farmers. The farmers' financial liability is expressed in terms of a weight of paddy (or its cash equivalent) which is a crude method of indexing the charge and a way of ensuring 'payment' if cash is not available.

In Indonesia there have been major investments in recent years to rehabilitate and modernise old systems. Considerable management responsibility is assumed by farmers and they do pay a land tax that can find its way into the O & M budget. But very little of the land tax appears to go to irrigation at present. We were left with the impression that central government funding is likely to be the major source of finance for some years. Without it the rehabilitation works of the last 20 years will soon deteriorate.

My conclusion after studying marginal cost and efficiency approaches is that if this rationale is pursued there will be serious underfinancing of irrigation and a dangerous complacency will grow that the low or even zero charges are in line with economic efficiency. A mental attitude will

develop that assumes Treasury subsidies are justified and will be provided just at the time when the Treasury officials are switching back from economic to financial logic and appear hell-bent on reducing subsidies often with outside leverage to encourage them. For their own good it is time for irrigation officials to join up with the accountants and go for user fees. The battle with Treasury officials should be on the issue of retaining all revenue collected from farmers, not on the grounds of more subsidies to sustain economic (marginal cost) pricing. Once agreement on instruments, fee levels and their retention is achieved, the Treasury and Irrigation officials should jointly seek the strongest political support for what is inevitably just the beginning of a battle to turn policy into achievement.

Problems of success

A special financial problem, mentioned previously, is emerging in the rice economies of Asia. Successful modern rice production is following hard on the heels of the success with irrigated wheat production. Several economies are faced with self-sufficiency and even surpluses in rice at present prices. Strange as this may seem, this is not an immitigated benefit. The rice cannot be exported on a large scale at present domestic prices. It cannot be put on the local market or prices will collapse to the benefit of purchasing consumers but to the great loss of many farmers. Purchase for storage and subsidised export presents financial problems that only an oil exporting country such as Indonesia could contemplate and even then if oil prices recovered to former high levels. Subsidised exports will depress international prices and give traditional exporters additional financial problems. Switching irrigation systems designed for rice to other crops is possible, but potentially expensive and, given the massive area in rice, fraught with new marketing problems.

The emerging market conditions in reice economies do not create auspicious times for pushing a cost recovery programme based on user-charges.

Some observers argue that the benefits from the additional rice go largely to consumers and thus they should share the costs of producing the rice. Attributing the incidence of benefits from a technological improvement is an economic nightmare, but the notion has obvious political appeal.

A need for political economy

In these circumstances we see the key problems of irrigation policy analysts are to devise policy instruments to obtain relatively small amounts of finance from large numbers of widely scattered, often very poor farmers and then, this being achieved, establishing how to provide an effective and efficient irrigation service. If irrigation user fees were to be the sole method of obtaining such finance, many countries would have to increase water rates severalfold just to reach operation and maintenance levels. To do so presents firstly political, secondly administrative problems.

We have seen that there is some elegant economic theory that appears to support rational practical financial policies. However, in the real world very few Governments act on these guidelines. If we follow the precepts of positive economics we note the sections which dictate that when facts and theories contradict each other we must reject the theories and search for a richer hypothesis. We can postulate two potential weaknesses in the economic abstractions - first simplistic views of people and their behaviour and second a lack of politics. These are really two aspects of social organisation.

Michael Cernea and collaborators have recently highlighted the failure to balance our technical physical and economic understanding of irrigation by social insights (Cernea 1985). They blame technical difficulties upon inattention to the social organisation of irrigators. Coward, Freeman and Lowdermilk, Bagadion and Korten in their contributions to the Cernea book stress the importance of sociological frameworks to assist preparation of projects, the introduction of new technologies and the management of water. None of the writers discusses at any length the link between sociological insight and irrigation finance. However, it is implicit in their discussion that anything so complex as trying to get relatively poor people, collectively, to pay for a basic service requires a high level of social insight and political determination if it is to be successfully achieved.

Politics can be defined as the art of Government and this art must therefore feature in deliberations over assessing and collecting revenue or user fees. Technical agencies such as irrigation departments are sometimes uneasy with acknowledging and accepting the political dimensions of their activities. Economists are also sometimes ambivalent about the nature of their work. For example, Young (1986) in an excellent review of the economies of allocating and pricing natural resources cites Kenneth Boulding's three mechanisms for ordering natural resource use: 'prices', 'policemen'; and 'preachments'. He explains prices represent the market system but 'policemen' the legitimate enforceable political order and 'preachments' the moral order. Politics determines the enforcement methods, hopefully conditioned by the moral order or human values system of the community.¹⁰ Young goes on to elaborate the pro's and con's of market oriented approaches but does not take up the enforcement and moral issues despite concluding 'water has been viewed as too important to be left to the market-place, so that its administration falls largely in the political realm'.

Stanley Please (1985) is the most coherent critic of a failure of political commitment to policy. He persuasively asserts that the policy cycle should replace the project cycle because the "project cycle has proved to be too weak a conceptual and operational framework for handling policy issues". His policy cycle comprises:

- "1. The formulation of development objectives.
2. The diagnosis of the policy constraints to the achievement of the objectives.
3. The formulation of alternative packages of policy changes which could relieve these constraints.

4. Agreement within government of a politically acceptable package of policy reform including its broad time phasing.
5. The formulation of the detailed measure which reflect the politically acceptable program of policy change, i.e., program development.
6. Implementation and monitoring of policy reform measures including feedback to the formulation of subsequent stages of policy reform.
7. Evaluation of impact of policy changes on achievement of objectives and lessons for the future."

He describes obtaining political commitment as the weakest link in the policy cycle. "It is all too easy and all too common for situations to arise in which politicians pronounce ill-formulated rhetorical objectives while technocrats (particularly economists) work on detailed programs to implement such political pledges, but the two groups fail to get together sufficiently often to ensure that what is technically required is politically acceptable. It is no use pursuing the detailed legislative, financial, institutional, etc., aspects of policy reform until the broader implications of reform have been accepted by the political leadership."

Put simply economists and financial analysts are talking to each other and not to the people with power.

A political analysis of irrigation would soon focus on the question of corruption. The beneficiaries of low official water rates are often the irrigation department personnel who can tap the 'economic rents' being reaped by farmers. Sometimes a complicated 'parallel' tax system involving engineers, revenue personnel and politicians exist with interests that are favoured by the present unsatisfactory system (see Wade, 1982 and Jagannathan, 1986). These issues are seldom faced frankly by national governments and the donor community. Irrigation is becoming too important to agricultural development for this issue of illicit payment to remain hidden and neglected.

Economists and financial analysts are also talking at too ethereal or at too macro a level. Few really able technocrats appear to be prepared to create the detailed administrative arrangements necessary to translate abstract principles into operational policies. Some years ago, whilst acting as a planning officer in an East African country, I found what I considered to be a brilliant marginal cost pricing scheme for rural water supplies (see Carruthers, 1972) rendered ineffective because I failed to recognise revenue could not be collected by local Chiefs without account numbers, appropriate forms and revenue books, safes to store money, Askari's to guard safes and so forth. Here was a prime example of a failure to take account of transaction costs and detailed administrative arrangements.

Please (1985) makes the additional point that bureaucratic barriers exist because aspects of policy are split between different ministries each, with its own separate interest. Fragmentation of responsibility results in no overall view and no authority for implementation. In the

East African case cited previously the responsibility for implementation was split between the Ministries for Water Development, Agriculture, Treasury, Planning, Health, Local Government amongst others. Policy was supposedly coordinated by an Inter-Ministerial Committee but within a year the senior bureaucrats assigned to it had been replaced by relatively powerless junior substitutes. Revenue was never near budget estimates, but no effective action was taken.

Some few years later poor finance resulted in a need for project rehabilitation. Although there should be no direct link between poor revenue performance and inadequate O & M provision it is often found to occur.¹¹ Many aid donors find policy dialogue hard to define, defend and execute. In particular inter-ministerial policy dialogue is very difficult to carry out. Aid donors prefer to deal with technocratic planning groups, usually from a single ministry, who are often divorced from political power or real political interest. Please puts it this way

"At best planning ministries are led and staffed by highly respected economists and technocrats who formulate programs of policy reform in an impressive manner. But policy reform requires political acceptability based on the opportunity to use political muscle. It does not depend simply on logical argumentation. At worst planning ministries are virtually an irrelevant part of the government machine which become more and more marginalised as their irrelevance to policy making becomes apparent to both the staff and others. At times it is almost as though they existed to keep external donors happy and busy and to provide a pretence that government is taking development and policy reform seriously."

What is clearly necessary to improve policy implementation is a political commitment to an agreed programme and not just a technocratic argument. Perhaps this means shifting the venue for meetings such as this from FAO to UN New York and from water personnel such as ourselves to Finance Ministers. We have perhaps the right agenda but the wrong participants and all too often we are addressing the wrong audience. In any event I believe we should shift concern with water charges and related covenants in aid agreements from project level to sector policy dialogue.

A final comment on the political line. In some countries the public sector financial crisis has resulted in stringent cuts in public expenditure in key areas such as education and health as well as agriculture. These cuts are often agreed and in effect supervised by the aid community through structural adjustment lending. If public services are to be improved and expanded recurrent funding cannot come from further cuts or savings, nor where people are poor or receiving bad services can it come from increased user fees. In these circumstances it seems inescapable for aid donors who wish to promote a particular sector, to provide medium or even long-term recurrent budget support.¹²

Assessing systems

A hierarchy of criteria including financial issues for determining successful irrigation can be derived from a review of the available literature and less accessible agency evaluations. Suggestions are set

out in Table 1. First and foremost irrigated agriculture has to be profitable to farmers. Increasingly it seems likely that Government induced economic distortions will be reduced but they are unlikely ever to be eliminated.¹³ In many situations irrigation is becoming more profitable because of innovation in irrigation itself and the complementary advances in agricultural technology. This will continue with scientific progress. Not all irrigation projects are likely to be profitable. In many arid zones a backlog of investment including rehabilitation needs, land levelling and a lack of drainage is likely to preclude profitable irrigation. In such circumstances major change to increase farmer pay-back is likely to fail. This does not necessarily mean that the project should be phased out. Irrigation might still be the least costly development investment. Unprofitable schemes may be accepted for complex but legitimate social and political reasons. In any event, the least-cost system of ensuring effective if not efficient irrigation of good and bad schemes is likely to require profits for the farmers. Furthermore, waste will be minimised if farmers have high value-in-use for irrigation water. It is high value water not high cost water that prevents waste.¹⁴ Farmer profitability is thus the first criterion for success.

Table 1.

A Hierarchy of Criteria for
Efficient and Effective Irrigation

1. Irrigated Agriculture is profitable to farmers
2. Irrigation systems are manageable
3. Finance for good O & M is available
4. Irrigation is adequate and reliable
5. If equity is a criterion charge farmers for irrigation.

Secondly irrigation systems have to be manageable. Some systems have poor original design (e.g. no flood escape provision on main canals) and some have such deteriorated facilities that they are to all practical purposes unmanageable in some or all conditions. Some systems have important exogenous constraints outside the control of managers such as unreliable electricity supplies.

Sometimes the system is unmanageable for socio-political reasons. For example political powers may preclude certain actions such as an even distribution of water, the implementation of sanctions against offenders of irrigation rules or even the raising of charges in line with inflation. Sometimes ambiguity exists. In Jordan cut-off sactions were applied to non-payers and payments jumped to near 100 per cent but no increase in rates were allowed for several years despite double digit inflation.

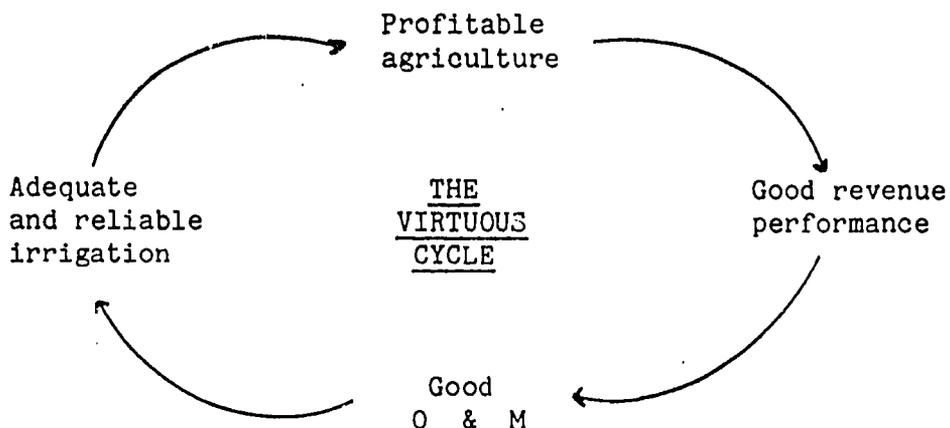
The third criterion is that adequate finance must be made available for the operation and maintenance budget. This can come directly or indirectly from farmers, from taxation or other Government sources and the provision must be indexed and adequate to sustain realistic standards. Whilst financial shortages are commonplace we should note that many engineering standards are inappropriate to the resource endowment of the country concerned. Technical rather than economic efficiency dominates engineering plans with designs that appear to be drawn from, say, Californian rather than local experience. It is important that irrigation departments recognise that given widespread poverty and financial stringency all public institutions have to operate in below technically optimum level. Irrigation advocates have to acknowledge that it is not good public sector policy to create 'islands of excellence' at the cost of the general good. In economic terms the trick is to obtain equi-marginal returns to all investments within the economy.

It is imperative that any agreed financial flows are fully compensated for inflation. The use of non-indexed budget allowances are powerful but harmful ways of achieving savings in public expenditure. In some circumstances appropriate finance does not imply funding on historical levels. Many irrigation departments have low productivity and excessive staffing levels. Financial stringency has exacerbated the staff to other recurrent cost ratios. In some departments overmanning is an obvious problem.

The fourth criterion relates to adequate and reliable irrigation. Farmers in field visits stress this, particularly reliability. Under-investment in a variety of ways (less ploughing, less weeding, less fertiliser etc.) is the norm when reliability fails.

The final criterion is the oft mentioned, seldom implemented one of equity. My conclusion from studies of farm economic surveys and field interviews is that irrigation farmers, though often poor, are seldom the ultra-poor and therefore, on equity grounds some form of user charge and/or some ways of encouraging greater farmer responsibility for management is highly desirable. Engineers have to relinquish substantial managerial responsibility to increasingly better educated groups of farmers, and politicians have to back up the detailed plans for user charges drawn up by administrators fully sensitive to local culture, customs and mores and the opportunity costs of failing to obtain revenue.

Given farmer profits, sound scheme design and management, good operation and maintenance, an adequate and reliable irrigation supply should be assumed. This could create the 'virtuous circle' shown below:



Three comments are in order. First the cycle can be ground to a halt by external influences. For example if weather is bad, fertilisers fail to appear, food aid floods the market or one or more of a myriad of factors disturb farm profits then revenue will fall and disrupt the cycle. Second, the cycle will not flow automatically and administrative aid may be needed to ensure it works. For example, good revenue performance will not result in O & M resources without administrative commitment. Third the cycle may work better backwards. Profitable agriculture may manage to command adequate and reliable irrigation and good O & M which in turn will give good revenue performance. Those who argue for more farmer control will favour this view. Farmer managed irrigation is becoming a slogan (to which I generally subscribe) given emphasis by shortages of Government finance. Advocates have to acknowledge the widespread failure of farmers to construct on-farm works, to level fields, to connect up to drains and so forth. Such experience needs detailed analysis before the slogan becomes policy. Finally it may be worth repeating that before and during rehabilitation would seem the best time to make detailed and agreed plans with farmers to get this cycle rolling.

FOOTNOTES

1. In the case of labour the generally preferred alternative is leisure if remunerative work is not available.
2. Rehabilitation projects may be the preferred form of finance where temporary shortages of finance preclude maintenance. It is then deferred maintenance. Rehabilitation may also be preferred if finance is only available for rehabilitation e.g. from an aid donor with an offer of capital but no recurrent budget support and with rehabilitation classed as capital and regular maintenance as recurrent expenditure. Aid donor rules relating to recurrent budget support can encourage rehabilitation.
3. The problem is exacerbated in Pakistan where Government is removing the explicit and implicit taxes on agriculture operating through export duties and overvalued exchange rate and has also abolished the old land revenue tax in favour of a religious tax to be used for social purposes.
4. New developments in agronomy are creating technology that increases the return to assumed water supplies. The demand curve for water is shifting to the right and becoming more inelastic.
5. This is not just a developing country problem. 'Pork-barrel politics' in the American West have created highly subsidised rent seeking farmer interests - see for example Gardner (1983).
6. Studies of the theory and practice of public utility pricing are numerous. The earliest reference is Jules Dupuit, 'On the measurement of utility of public works', Annales des Ponts et Chaussees ser. 2, vol.8, 1844 (English translation in International Economic Papers 2, London, 1952). Theoretical aspects of marginal cost pricing are discussed widely and a classic survey article is Nancy Ruggles, 'Recent developments in the theory of marginal cost pricing', Review of Economic Studies, 17, pp.107-26, 1949-50. Most studies of application to particular industries have been concerned with electricity; e.g., M. Crew, 'Electricity tariffs' in R. Turvey (ed.), Public Enterprise (Penguin Books, London, 1968). For water supply the best article is by J.J. Warford, 'Water requirements: the investment decision in the water supply industry (with an appendix by W. Peters)', Manchester School, 34 (1966). There are a few examples of the application of the general economic principles to the particular conditions of less developed countries. One relevant study is Nasim Ansari, Economics of Irrigation Rates - a Study in Punjab and Uttar Pradesh (Asia Publishing House, London, 1968). A study relating to domestic water supply in a developing country is I.D. Carruthers, 'A new approach to domestic water rating', Eastern Africa Economic Review, 4, (2), 73-96 (December 1972).
7. The literature also has some simplistic advocacy of marginal cost pricing. A recent example OECD (1985) suggests "The 'quantity of water' notion covers, in fact, several commodities which can be priced separately:

- i) Total volume supplied in the year (measured for instance in cubic meters);
- ii) Maximum available flow (measured in litres per second);
- iii) Energy potential (measured by the pressure or by the altitude of point of supply);
- iv) Geographical location of supply (measured by the distance of transportation);
- v) Supply period and time (since water in peak hour, or in the hot season is more costly);
- vi) Water quality (which depends upon a great number of parameters, such as salinity, and upon the use of water, such as irrigation or drinking).

A marginal cost, as well as an average cost, can be computed for each of these commodities, and the pricing can be set up in accordance with the results of these computations".

8. For a pesticide example see Repetto, 1985; and for a review of fertiliser subsidies see Dalrymple, 1975. The World Bank's World Development Report 1986 is a very strong attack on all ill-considered subsidies and public sector distortions.
9. For example in UP in India groundwater irrigators have been able to lobby successfully for subsidies on the grounds that canal irrigation is subsidised. Their subsidy takes the form of cheap electricity tariffs. The uptake of tubewell irrigation exceeds the capacity of some local aquifers creating social costs (higher pumping) and the excessive power consumption causes economic costs elsewhere in the economy. R. Palmer-Jones - private communication.
10. This moral imperative explains the insistence in many countries that water shall be free. No amount of external pontificating on opportunity costs and the like will change their collective will. For them 'get the prices right' in the case of water means it should be free.
11. In the rural water example a senior Treasury official told me he thought the rural water supply was premature and that poor revenue performance was evidence of this. No support would be coming from him for Treasury subsidies.
12. This is the conclusion of Kydd and Hewitt (1986) in relation to health and education. For an irrigation example see Carruthers (1983. p.104)
13. Please note the relevant distortions are not just those taxes and subsidies on irrigation and irrigated crops. All distortions within the economy make it impossible to be sure that any price is appropriate. I have heard Indian irrigationists saying until urban electricity, telephone, water supply and such services are economically priced (all subsidies removed) irrigation shall not be subject to the logic of efficiency pricing. This is an example of what economists describe as 'the general problem of the second best' (see Killick op.cit, pp.18-20).

14. The somewhat puritanical notion that high prices rather than high value prevents waste is still extant despite very little evidence to support it. M.E. Jensen, National Programme Leader on Water Management and Salinity, USDA wrote recently 'The efficiency with which water and need is linked to its cost to the user or the value placed on water. Water as a primary resource needed for food production should not be provided at little or no cost to agricultural users. Free or low cost water leads to waste". M.E. Jensen (1985).

REFERENCES

- Boulding, K.E. (1980) The implications of improved water allocation policy. In Western Water Resources: Coming Problems and Policy Alternatives, Marvin Duncan (ed). Westview Press, Boulder, Co.
- Carruthers, Ian, N.S. Peabody III, A.A. Bishop, A.D. LeBaron, Rekha Mehra, Remchand Ord, Dean Peterson, Dennis H. Wood (1985) Irrigation Pricing and Management Report to USAID by Devres Inc. 2426 Ontario Rd. NW Washington, USA.
- Carruthers, Ian (ed) (1983) Aid for Irrigation Development OECD, Paris.
- Cernea, M.M. (1985) Putting People First: Sociological Variables in Rural Development. Oxford University Press, Oxford.
- Cruz, M.C., N.D. Briones and M.M. Hufschmidt (1984) Water Resources Management in Asia: A Selective Bibliography with Introductory Essays, East-West Centre, Honolulu, Hawaii.
- Dalrymple, D.G. (1975) Evaluating Fertiliser Subsidies in Developing Countries, USAID Washington.
- Easter, K. William and E. Hingson (1982) A Review and Bibliography of Studies Regarding Irrigation Institutions, Management and Investment in Asia, University of Minnesota, St. Paul, Minnesota.
- Gardner, B.D. (1983) 'Water pricing and rent-seeking in California agriculture' (in T. Anderson Ed., Water Rights: Scarce Resource Allocation, Bureaucracy, and the Environment. Ballinger, Cambridge USA. (see also Rucker and Fishback in same book).
- Gibbons, Diana C. (1986) The Economic Value of Water Resources for the Future, Washington.
- Jagannathan, N.V. (1986) Corruption, delivery systems and property rights. World Development 14, (1).
- Jensen, M.E. 'New technology related to water and water policy' Paper to Conference on Water and Water Policy in World Food Supply. Texas A & M May 1985.
- Killick, R. (1981) Policy Economics, Heinemann, London.
- Kydd, J and A. Hewitt (1986) 'Effects of Structural Adjustment Lending: Initial Evidence from Malawi:' World Development 14, 3.
- Nickum, James, E. (1982) Irrigation Management in China - a Review of the Literature. World Bank Staff Working Papers No. 545, Washington DC.
- OECD (1985) Management of Water Projects Decision-Making and Investment Appraisal, OECD, Paris.

- Please, Stanley "From Project cycle to Policy Cycle" Royal Tropical Institute Amsterdam International Symposium on the Effectiveness of Rural Development Cooperation. October 1985. See also Stanley Please (1984) The Hobbled Giant: Essays on the World Bank, Westview Press, Colorado.
- Repetto, R. (1985) Paying the Price: Pesticide Subsidies in Developing Countries, World Resources Institute, Washington.
- Saunders, R.J., J.J. Warford and P.C. Mann (1977) Alternative Concepts of Marginal Cost for Public Utility Pricing: Problems of Application in the Water Supply Sector, World Bank Staff Working Paper 259, Washington.
- Small, Leslie E., M.S. Adriano and E.D. Martin (1986) Regional Study on Irrigation Service Fees: Final Report ADB: Manila.
- Wade, R (1982) The system of administrative and political corruption: canal irrigation in South India, J. of Development Studies. 18, (3).
- Westgate, Richard (1984) 'Suggested readings: Meeting Recurrent Costs of Irrigation Systems in Asia' Dept. of Agricultural & Applied Economics, University of Minnesota. St. Paul Minnesota (mimeo).
- World Bank (1986) World Development Report 1986, Oxford University Press.
- Young, R.A. (1986) On the allocation, pricing and valuation of irrigation water, Ch.6 in Irrigation Management in Developing Countries: Current Issues and Approaches, Nobe, K.C. and R.K. Sampath (eds.) Westview Press, Boulder, Co.