

IRRIGATION UNDER THREAT: A WARNING BRIEF FOR IRRIGATION ENTHUSIASTS

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I believe we, the irrigation community, are at an important juncture so far as irrigation policy and investment are concerned. Although it may appear self-evident that irrigation must play a pivotal role in the era of agricultural intensification that we are now being forced to enter, it is by no means certain that this role will be offered.

I have therefore cast this paper as a cautionary tale. Unless the growing unease regarding the merits of irrigation is quickly dispelled, then national governments and the donor community alike may turn their back on the sector. If this comes about, then the present relative complacency about Asian food security may prove to be misplaced. Furthermore, the comparatively small but nevertheless important contribution irrigation can make to Africa's agricultural recovery and future growth will also be threatened.

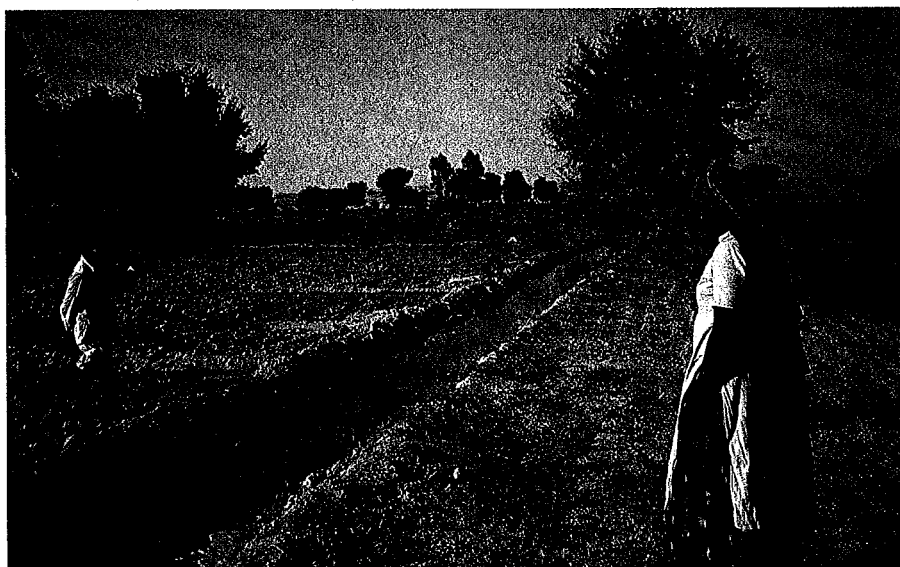
There are clear indications that irrigation is becoming less popular. In a global review, H.M. Horning, recently retired head of the Land and Water Division of FAO, presents a depressing account of expansion of irrigation area. He estimates that although irrigation occupies 210 million ha in developing countries, 14 percent of the cultivated land, and the rate of growth in area was 5 percent per annum between 1965-75, it fell to only 1.5 percent from 1975-85. Clearly the availability of suitable land and accessible water in close proximity is reaching its limit. We can identify several additional factors contributing to this.

Macroeconomic difficulties of governments and shortfalls on aid budgets are now, more than ever, constraining government efforts. New irrigation development is too expensive -- the obvious and cheap projects are already developed. Heightened environmental consciousness and recognition

of the problems of salinization of soils, catchment protection, flood protection, and water-related disease control, all require large capital investment and the introduction of apparently intractable management-intensive operating systems. There are increased marketing problems of major irrigated crop products and a growing prejudice against cash crops, especially in relation to Sub-Saharan Africa. And last, there has been a political failure to support irrigation development in crucial spheres such as service charges, amidst suspicion that the regressive income distribution impact is often deliberate.

intensification or rehabilitation, should become unfashionable, no matter how unjust that might be, both capital and recurrent expenditures will become increasingly scarce. Irrigation supporters should not be complacent about the virtues of their sub-sector. The most important threats to be faced at this time are problems of "markets," "finance," "management," and "environment."

Irrigation advocates will puzzle over doubts on the merits of irrigation. They will point to the production successes of the Indian sub-continent



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Within the irrigation sub-sector many new projects are less attractive than alternatives. Two potential alternatives include, first, the current shift, especially in Southeast Asia, to intensification of existing irrigation through multiple cropping and on-farm investment such as tubewells: and second, rehabilitation, completion, and modernization which are often urgent and, given huge sunk costs, promise high return investments.

However, if new irrigation, its

and stress the role of irrigation in achieving this agricultural growth. India, with a population increase of well over one million persons per month, is now virtually self-sufficient in foodgrains. Most of us can probably remember the impact of bad monsoons in the mid-1960s that gave rise to books with titles such as *Famine 1975* and *The Hungry Planet*, and provided political support for the massive USA PL480 food aid transfers. Irrigation, particularly

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groundwater irrigation, is widely believed to have drought-proofed India - a claim that is undoubtedly true for the present. However, fertilizers and new crop varieties, with and without irrigation, have probably provided the bulk of the incremental production. This is all the more so in Pakistan where fertilizer consumption has doubled in the last 10 years, providing the main source of the 3-4 percent annual growth in agricultural production.

Nevertheless, as irrigation advocates will no doubt argue, it is irrigation that provides the necessary conditions for complementary agricultural technology to reach its potential. It is worth remarking, as an aside, how often partisan evaluation from suppliers of one of the joint inputs to production claim all the incremental benefits to a favored single input -- hence the benefits from an irrigation project may be separately claimed by agricultural researchers, engineers, credit agencies, the extension service, educationists, health workers, transport enthusiasts, and others.

Every scientific advance in technology complementary to irrigation, increases the physical return to water investments. For example, new seeds, better fertilizer advice, and crop protection all shift the water response function upwards. The production successes in Asian rural developments are, to varying extents, supported by irrigation. Irrigation improvements explain the increased rice production in Philippines, Indonesia, Thailand, Pakistan, Sri Lanka, and elsewhere. Thailand's agriculture, has been so successful that there is now restraint on its exports to the EC. Indonesia, once a large rice importer, has reached the peculiar situation where it cannot afford to buy and store all the domestic rice surplus at present prices, it cannot find a profitable export outlet, and it cannot leave the rice on the market for fear of domestic political repercussions should rice prices collapse. Diversification from rice is a key goal, but it presents all large rice producers with intractable technical marketing problems.

Most of the obvious alternatives to rice face a highly price inelastic demand schedule. Hence even partial success in diversification may provide little additional financial benefit. Indeed it is conceivable that the total income from rice substitutes could fall with any increased production. The supply related problems of success make up

part of the worry of those financing irrigation.

The market problems of irrigation will be exacerbated by external and internal pressures that create macroeconomic management problems. Governments that are concerned with food security are likely to find the surplus disposal programs of Europe and USA and the efficient rainfed agriculture of countries such as Canada, Argentina, Australia, and New Zealand the most secure source of food. Despite much rhetoric in the EC and USA, there is little prospect of effective reform of agricultural policy that will cut the food and feed grain, beef and sugar surplus that depresses world prices. Indeed, there is an enormous reserve of political will to continue farm support despite the fact that in the EC and USA support of agriculture is now estimated to be costing every family \$900 and \$700 per annum respectively.



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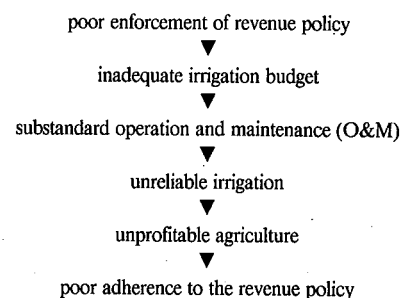
Within developing countries, urban-based and urban-biased treasury ministers, intent on keeping urban voters well-fed, and sometimes with eyes on counterpart funds they gain from selling food aid, will all too often prefer real food security, which for them is imports, rather than the risks of trying to squeeze food from a disparate, impoverished peasantry. Such short-term perspectives are common among developing country politicians, and deprive domestic agriculture in general and irrigation in particular, of resources.

It may appear paradoxical that in rich countries with only 2-10 percent of

the population in agriculture, there is strong political support for huge agricultural subsidies, whereas in poor countries, where farming is the basis of livelihood for 30-80 percent of the population, we find a sector starved of resources and subject to direct and indirect taxes. There is no paradox. When farmers are few the majority can subsidize them, when they are the majority they must perforce pay their way and support other State activities. Irrigation farmers in developing countries suffer like other agriculturists from adverse domestic terms of trade, but given the financial subsidies they almost always receive in the form of free or virtually free water, they are generally less exploited than those agriculturists who depend on rainfall.

Moves are currently underway in many countries to give farmers higher prices; for example, to exempt them from export duties or the harmful impact of overvalued exchange rates. This might be expected to give a boost to the irrigation sector. Unfortunately such moves also require the elimination of subsidies for inputs, and typically irrigation capital and recurrent costs are highly subsidized -- often to the tune of 100 percent. In World Bank experience, the legal covenants agreed with sovereign governments for cost recovery on irrigation projects are frequently broken. In most countries, government commitment to initiate a water charging policy, and having done so to enforce water rates, is seriously lacking. An absence of political will in this area is a key ingredient in a chain such as that of Figure 1.

Figure 1. A probable chain of irrigation problems resulting in the absence of strong political leadership.



The Bank review showed that at audit, soon after completion of the projects, O&M was already satisfactory in about one-half of the 48 projects. Clearly many were already well on their way to becoming fashionable rehabilitation projects.

In the past, irrigation has been hopelessly oversold. The forecast rates of returns to irrigation have been excessively optimistic. Typically, schemes have cost overruns, delays in completion, and are slow to achieve forecasted agricultural benefits. Costs as specified are also underestimated deliberately or in error. What should be integral components, such as land levelling, field channels, land drainage and adequate communications, are all too often excluded from design. In the operating phase, government departments or other managing agencies do not have adequate recurrent financial resources for various reasons, hence operational defects abound. Management of the schemes in line with design often seems impossible.

Despite problems, the rice economies have seen yields double or even triple in the last 25 years, and double and even triple cropping is technically possible. In the arid zones, the potential productivity is enormous. Nevertheless, there are early warning signs that the central government planning authorities, who have for a long period favored irrigation in allocating public sector resources and promoting private investment, as well as the various bilateral and multi-lateral aid agencies, are beginning to critically focus on the gap between this potential and the realized benefits. The specter of an investment backlog for drainage, deferred maintenance, replacement of old structures, modernization and so forth, is beginning to make the open-minded observer, the non-irrigation enthusiast, cautious, even suspicious, of expenditure in this sector.



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If finance is to be found to bring O&M standards up to design, there is a growing consensus that it must come from the farmer beneficiaries. Devising mechanisms for obtaining small amounts of money from large numbers of admittedly poor, though not usually ultra-poor, small farmers, is one of the greatest challenges facing the irrigation advocates.

Management and environment are two terms with such multifarious meanings that although they inevitably appear in any list of irrigation problems, they fail to convey any precision in diagnosis. Of course management defects abound--that is why there is now an International Irrigation Management Institute (IIMI). The exact nature of the problems is hard to discern which is why of course IIMI is engaged in research.

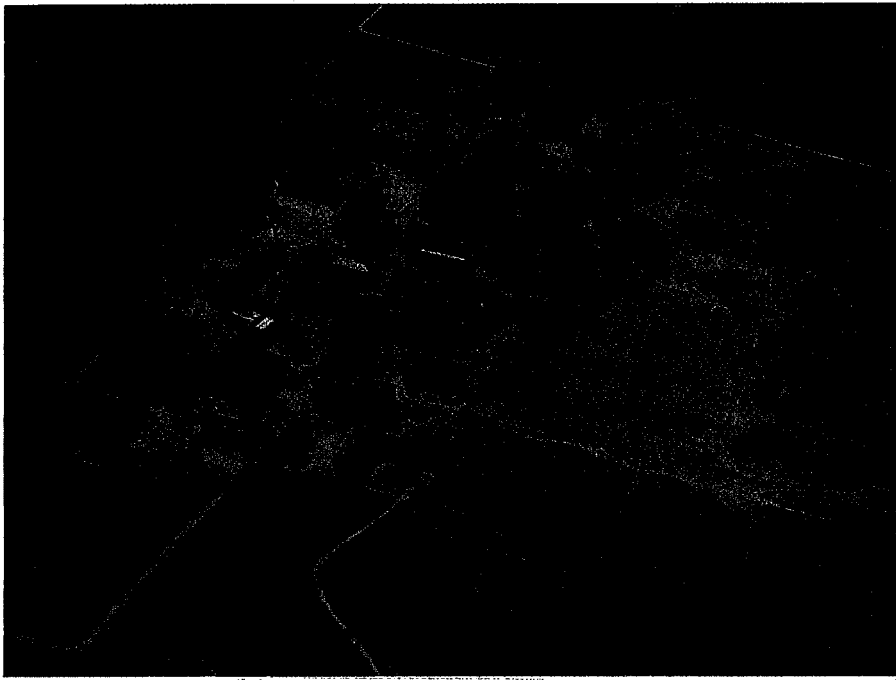
My hypothesis would be that irrigation managers are like peasant farmers before high-yielding varieties and chemical fertilizers -- efficient but poor. It is unlikely that much improvement can be made with their existing resources or within existing irrigation institutions (supply agencies and user groups). This is not a call for a massive injection of cash resources or new parastatal bodies to look after irrigation. Some of the ingredients that do appear to me to be necessary in many countries before resources are injected are first, a rehabilitation of the budgeting process, often now virtually a game played without enthusiasm but with great cynicism; second, a higher degree of autonomy and accountability in managerial matters though not necessarily privatization, which is becoming so popular in UK and elsewhere; third, a post-experience education of managers to upgrade professional skills (with basic tools: economics, statistics, accounts, personnel etc.; awareness level training in analytical techniques: OR techniques, CPA linear programming, survey design and analysis, systems analysis, model building and simulation; training in modern office technology including communication equipment and micro-computing with standard software packages; and finally but most important, training in interpersonal skills of teamwork, leadership, verbal presentation, and media work). More thought also needs to be given to appropriate farmer management training as there is little doubt that

most governments have exceeded their capacity to effectively supply services to farmers, and farmer-managed services must become a more important source of support.

Within the discipline of economics, there is a lively debate as to its current relevance to developing countries with protagonists who either believe economic principles are universal, transcending culture and politics, or who believe economics, whether neo-classical or Marxist in origin, has little relevance in the Third World. Similarly there is a debate in management science with those at one end of the spectrum who subscribe to a generally applicable theory or set of theories of modern management, to those at the other end who claim such theories devised for industry in rich countries have little relevance to those who work in the rural sector of poor countries. This latter group also argue that the Japanese, who appear to transgress key principles of modern management, are demonstrably successful. It might be worth adding that apparently Japanese farmers are also successful managers receiving over US\$ 10 billion in subsidies in 1985 and convincing consumers to pay food prices 60 percent above what they would be if world prices were charged.

I would argue that, despite important reservations, there is a set of relevant principles/formal management theory that can help managers to understand their problems and to formulate key questions, and there is a set of relevant analytical techniques that can guide them in acquiring and analyzing the data, provided they have a minimum of subject matter expertise in agriculture, engineering, and a range of other subjects including insights from social sciences. Given such broad intellectual demands, we must aim to encourage the highest calibre entrants into the irrigation service. The cadre needs convincing of its professionalism, and I wish IIMI well in its research and extension task in this regard. Irrigation development is now primarily a management task and not a design and construction task, and we must adapt our institutions and skills in line with these new opportunities.

We should not underestimate the extent and nature of the management problems. They are not simply a set of engineering problems. Repetto (1986) summarizes several studies and identifies the following list:



- Responsibilities are fragmented among construction, operating, agricultural, and financial agencies, which do not coordinate to provide good services to farmers.
- Most government irrigation agencies are not accountable to the farmers they serve, either for employment or funds.
- There are usually no effective means for monitoring and evaluating the performance and effectiveness of the system.
- Irrigation agencies in many countries are staffed with poorly trained, supervised, motivated, and rewarded operatives.
- Many agencies are plagued by pervasive corruption and indiscipline.
- Water users within sections of public irrigation projects, who are physically interdependent by virtue of a common water supply system, usually don't organize, cooperate, or participate effectively in operating and maintaining the system.

He then goes on to characterize irrigation projects not as hydraulic systems to be run according to engineering principles, but as socio-economic systems, where all participants -- farmers, managers, and politicians -- presently maximize their private interest at the cost of the social good. Thus management problems are symptomatic of the underlying conflicts in the political economy of irrigation. Our management science has to

penetrate these symptoms if the real causes of the problem are to be addressed. Repetto rightly stresses that all the complicated incentive systems must be invoked as part of any management solution to the problems listed above. Management skills can be improved, but the problem has to be respecified as one of applying a multi-disciplinary art and not simply one of using traditional engineering science.

Despite lacking a clear definition of their remit, the environmentalists are perhaps the greatest threat to the irrigation sector. Environmental impact assessment of irrigation is likely to produce high-ranking criteria and provide an increasingly operational perspective for selection of new and rehabilitation projects. Environmental impact has economic, biological, and social dimensions that have to be integrated to give an overall synthesis if a practical criterion is to be derived.

Planners have passed the stage of simply describing the repercussions of irrigation projects on bio-physical processes in the area. Attempts are normally made at describing and evaluating the effects on bio-physical systems but social impact -- the repercussions of development on individuals, groups, and cultural norms -- is not always recognized as important. But things are changing. Cornucopians who believe technical solutions will arise whatever

the problem are less evident in planning groups, and are being replaced by environmental managers, or even by advocates of rules based on "ecological" morality. Irrigation cannot be divorced from changes in ideas regarding the environment, fed as they are by well-publicized philosophical tracts on environmental issues; increases in scientific knowledge; the obvious problems of large-scale projects which have created a widespread mood of caution; and numerous well-documented, practical, managerial, legal, health, political, and participation problems. The impact on irrigation development in developing countries of this environmental mood is less than in developed countries, but this could rapidly change.

The recommendations of a report, widely read and cited, show the extreme antagonism water resource projects are generating among some influential environmentalists.

"In the light of today's knowledge, it is clear that the building of large-scale water development schemes can only be justified to an electorate and to the world at large by systematically covering up -- as governments and their advisers have shown themselves adept at doing -- their true implications.

Unpalatable as it must undoubtedly be to the dam-building industry, there is clear evidence that building large dams is not an appropriate means of feeding the world's hungry, of providing energy, or of reducing flood damage.

For it to be so, we would have to accept as largely expendable the human and non-human population of the whole area affected by the dam, simply in order to further the political and financial interests of a very small minority.

To persuade Third World governments to abandon plans to build water-development schemes, to which they are often totally committed, is a lost cause. The only way to prevent their construction is to appeal directly to donor governments, to development banks, and to international agencies without whose financial help such schemes could not be built. It is not that the latter are more responsible, only that they operate in the industrialized world where public opinion can be mobilized more readily against the pursuance of their present policies.

We thereby call upon those organizations, herewith, to cut off funds from all large-scale water-development schemes

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that they may plan to finance, or are involved in financing, regardless of how advanced those schemes might be."

Such an extreme recommendation is not the outcome of a skimpy pamphlet but a well-documented if strident three volume study. Their position is supported by journalists highlighting prominent failures such as The Economist's February 1985 report on the infamous Bura Scheme in Kenya:

Originally, 35,000 settlers were supposed to grow cotton and a few staple crops on 14,000 hectares of land at Bura, which would have a total population, including traders and others, of 65,000. Today, seven years after work began, only 2,800 hectares have been planted. Much more than that has been cleared, but the dust blowing up from it makes it unlikely that there will be enough topsoil left to grow crops. Some 2,000 families -- maybe 20,000 people -- have moved to Bura. Ten villages, out of a planned 25, are finished; the sites for other villages, marked by neat little rows of stand-pipes, look a bit like graveyards.

The scheme's failures have become part of development folklore: an official of the World Bank, the project's biggest donor, has compiled a 40-page bibliography on the project. Costs proved much higher, and crop yields lower, than the planners had budgeted for.

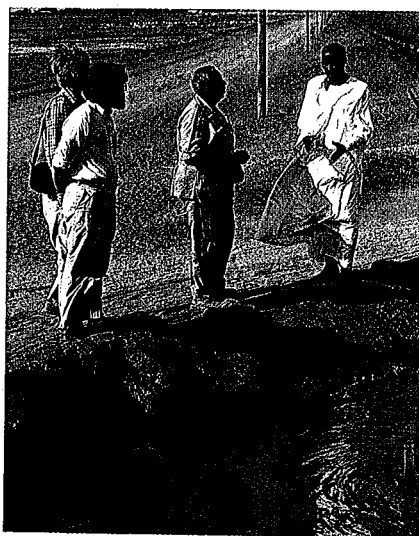
Although the size of the project was drastically reduced, spending went ahead unchecked: capital costs have risen from the \$98.4m planned in 1977 to nearly \$110m so far. The pumped irrigation system, which was supposed to be a stop-gap until a gravity system could be developed, is still Bura's only source of water. This has serious consequences: the pumps often break down, depriving the crops of water. The conclusion of a World Bank appraisal last year was that the project's management was over-centralized and incompetent."

Irrigation enthusiasts cannot ignore such reports nor dismiss them as unique. These problem schemes must be countered by reports of success. And the problems themselves must be accurately addressed and resolved.

Robert Repetto (op.cit) in another recent iconoclastic attack on irrigation, serves a grave more general warning that links problems of markets, finance, management, and environment.

The political economy of public irrigation systems leads to poor use of

water and invested capital. Pervasive (economic) rent-seeking, which stems from the divorce of benefits from financial responsibility, distorts investment decisions, the design and operation of irrigation systems, and patterns of water use. The consequences are inefficient, inequitable, fiscally disastrous, wasteful of increasingly scarce water, and environmentally harmful. While the rent-seeking phenomenon is legendary in public irrigation systems in the United States, it is being underemphasized in the rest of the world. Those concerned with irrigation development are trying to "work around it" to improve the performance of public irrigation systems by physical rehabilitation and efforts to strengthen management. These efforts, while also critical, are unlikely to succeed unless the incentive issues are squarely faced. Much can be done to correct incentives by placing financial responsibility on beneficiaries. Successful models exist, and now is an opportune time for change."



If he is right, irrigation professionals had best study and replicate the successful models. The enthusiasts may for their own reasons keep the irrigation bandwagon moving, but the US\$100 billion he claims is likely to be spent on irrigation in the rest of this century will only be forthcoming if a much-improved operating performance is demonstrated.

Finally, I feel bound to complain that we seem to be slow learners. In 1976, I was one of several authors who prepared a workshop report entitled "A suggested action programme on irriga-

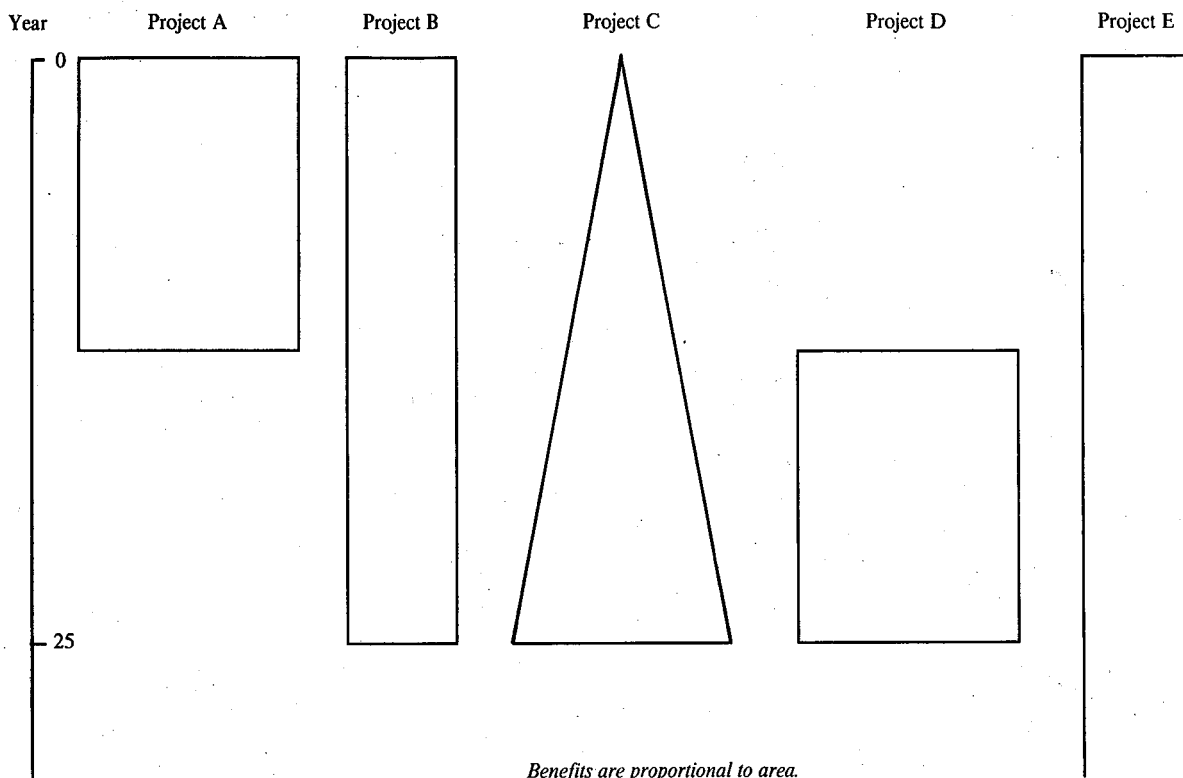
tion management" that was part of the British Government submission to the World Water Conference in Argentina in 1977. The report concluded that management was inadequate, new projects were a pitfall and priority should be given to improving existing irrigation. Seven specific recommendations were made to achieve this: more evaluation and feedback to include technical, political, organizational, managerial, and farmer incentive issues; more prestige and resources for O&M; more political support for necessary and unpopular measures (e.g., farmer discipline); improved extension and training; encouragement and experiment with small irrigation groups; more modernization and intensification; and a political priority for irrigation.

Movement in these areas has been slow. Indeed an agenda for reform today, more than ten years later, would include all of the elements in that seven point program.

The irrigation lobby should not always see the environmental lobby as an enemy. There is one particular area where current economic practice adds grave problems to irrigation development and where environmentalists could bring helpful pressures. All participants to irrigation planning and ex-post evaluations are aware that irrigation is a longterm investment. Although expensive, it is not particularly risky. The main risk stems from the fact that the speed with which potential benefits can be realized is slower than most plans predict. Irrigation is a tortoise wishing it was a hare. Mindful of my fables, I recall that it is often better to be a tortoise. However, the investment appraisal rules do not favor the slow but sure investment.

The main economic criterion for selecting investment is some form of net present value (IROR, CBA, or NPV). The effect of this is to give emphasis to early benefit. To bring out the point I wish to make, I need to show some arithmetic gymnastics. The key points are well illustrated in Figure 2. The first four of the five projects produce equal amounts of total benefit over a 25 year life. Economic assessment using any discount rate would rank the projects A,B,C,D. Project A could involve pumped sprinkler irrigation but after 10 years the soil is eroded and the project ceases. Project B is an O&M project.

Figure 2. Diagram showing various distributions of benefits for a given level of investment.



Project C is a slow rehabilitation project, but Project D a slowly-built labor intensive scheme. Project E produces twice as much benefit but the investment lasts 50 years. At 10 per cent discount rate, the project with twice as much net benefit would add less than 10 percent to total NPV and at 15 per cent discount, double the production gives less than 3 percent extra to NPV.

Environmentalists worry greatly about Project A especially if the net present value results in irreversible deterioration in the soil. They would rightly point out that any net benefits from repeating B, C, and D, and any technical improvements that might take place, are not taken into account in the original calculation.

Some environmentalists would consider any weighing of benefits by the time in which they occur to be immoral. Others would argue it is the poverty of the beneficiaries that is important in deciding weighting, not when benefits arise. Who is confident that, say, a typical Bangladeshi in the year 2000, with 157 million countrymen, will be any less poor than today? Why should we, as irrigation investors using 15 percent discount rates, argue from a monopoly position regarding resource development, that a dollar to a

Bangladeshi in 2000 will be worth the equivalent 16 cents of today's benefit, i.e., one-sixth of a dollar? It can be argued that discounting is only valid if the next generation is expected to be wealthier such that diminishing marginal utility arguments can be deployed.

Most irrigation enthusiasts are uneasy about the "tyranny of compound interest" or its reciprocal, the discount rate. It is responsible sometimes for the haste to get benefits, the dropping of components to lower early costs, the ignoring of large late-arising benefits and costs (e.g., salinization of soil) and worst of all, the fraudulent manipulation of forecasts to ensure that the project arithmetic produces the minimum cut-off rate of return. I have argued elsewhere that investment criteria have to be multiple, that they are not inherently equal, and that the economic criteria although important, need not be the dominant test. Environmentalists with a different perception of time issues can do much to aid and not hinder irrigation development.

It is vital that the reputation of irrigation as a productive sector for public and private investment is rehabilitated. Population growth is continuing and a further 1.4 billion are

expected in low and middle income countries by the year 2000. With extremely limited scope for increases in area cropped, the specter of Malthus is never far away from us. Sir Kenneth Blaxter (1986) concluded very dismally.

"One can argue that the pessimism of Malthus was largely dispelled in the nineteenth and early twentieth century by increasing the land resource consequent upon the opening up of new lands in the Americas, Australia and Southern Africa. In the last half century, the pessimism has been further attenuated by the success achieved in increasing yield per unit area through the use of energy derived from past eras of photosynthesis to augment that currently produced. There is at present no sign of some new additional delaying tactic that could be employed to postpone Malthus' vista."

If we are to thwart the Malthusian predictions of population growth controlled by "misery and vice" to give time for a new delaying tactic to emerge, then the full panoply of modern agricultural technology together with effective and reliable irrigation will be essential. We can no longer feed the world simply from rainfed agriculture on compost-enriched soil. Irrigation is going to be a central component of sustaining food supplies and livelihoods. □