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**AGRICULTURAL DEVELOPMENT SYSTEMS
EGYPT PROJECT**

UNIVERSITY OF CALIFORNIA, DAVIS

MAJOR ISSUES IN EGYPTIAN WATER POLICY

by

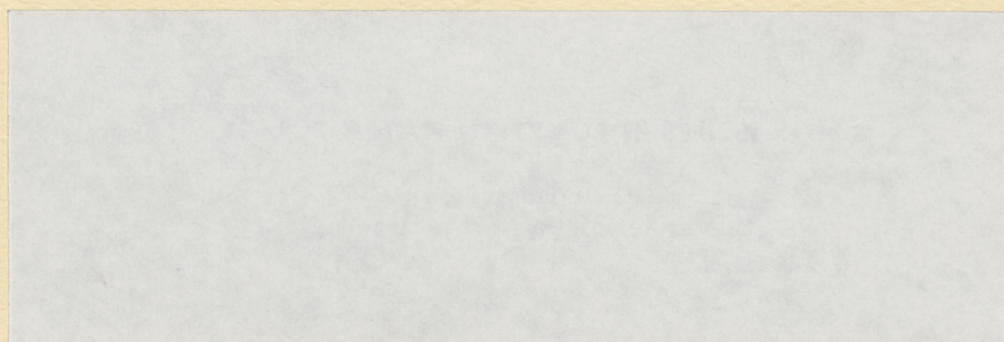
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Major Issues in Egyptian Water Policy

W. Eric Gustafson

When asked to do a paper for this workshop, I decided that the sponsors thought that ignorance of the subject would be a prime qualification of the proposed author. That is not quite how they put it: I think the words were "unbiased view." I consequently started from ground zero and read all of the literature I could find. The attached bibliography summarizes my reading on irrigation, drainage, and land reclamation in Egypt, and has a certain utility in itself, since I know of no other listing of the recent literature of comparable scope.

As one acquires knowledge, however, one acquires biases--or reinforces existing ones. In addition I must confess to having smuggled in a bit of knowledge, which accounts for some pre-existing biases. I have done considerable work on irrigation in India and Pakistan, and before coming to work on this paper, had read widely on the history of Egyptian irrigation because of its development by engineers who had started their professional careers in India. In any case, the result of this mixture of old and new knowledge, plus my professional deformation, the peculiar (twisted?) way in which economists look at the world, has led to observations on water policy which may have a certain utility: at least I will say them in a loud voice.¹

One of the virtues of the ignorant wanderer in the literature is that common themes come more readily into focus when one sees the whole literature in a matter of weeks. The major theme which struck me was ignorance. Even

though the Nile is the best studied river in the world, the amount of expressed ignorance about the Nile and the irrigation it supports seems prodigious. A good bit of this ignorance is technical; more, perhaps, is economic and social.

For instance, we are told that "most of the canal intakes are not provided with precise control or measuring devices," [46, p. 142] so that our knowledge of water quantities delivered, let alone those used, is shaky. The amount of water in fact delivered under field conditions by a saqia is not known, apparently, within a factor of two. The rotational system on the canals "has not been completely evaluated." [46, p. 142] Although water-loss figures are extremely important in deciding what amounts of water are actually placed on the land, Samaha and Abu-Zeid inform us that "studies conducted so far are only of a general nature.... Very few studies have been conducted that give these losses on an area basis and show how these losses vary along the entire irrigation network in the country." [46, p. 142] The same authors tell us that ground-water contributions have apparently not yet been considered in determining water duties.

The factors so far listed are only technical. Problems and ignorance multiply as we get into the social area: the technical data are not really what we want. We need not experimental data, nor data on what it is the farmer ought to do if he ran experimental plots, but what the farmer actually does.

To a certain extent, lack of knowledge is our own fault as economists. One can note, at least, that there has been precious little work done by Egyptian economists on the economics of water use. There are notable exceptions: Prof. El Kholei's work on land reclamation is well known [22-25], and Hassan Khedr [35] has worked on the economics of tile drainage, but those

two, plus Salah Kandiel and Mohamed El Gabaly, are the only Egyptian Ph.D.'s in agricultural economics (out of roughly 150) who have worked on water economics. The record is sad, given the fact that Egypt is the country in the world most heavily dependent on irrigation. In spite of the large amount of money spent on water research in Egypt, I would argue that Egypt is still underinvesting in technical, economic, and social information about irrigated agriculture.

One of the major themes of ignorance seems to be a most important one: how much water does the farmer actually use? Two authors tell us that "water application in many areas of Egypt on the farm level is more than double the theoretical evapotranspiration needs of the crops." This statement raises several issues, but the one at hand here is knowledge. Statements of that sort do not appear to be based on direct observation of what it is the farmer does. It is clear, for instance, that the Water Master Plan did not have systematic observational data. Its Second Interim Report [12, p. 65] notes, I thought somewhat ominously, as follows: "The Water Use Committee has been established but agreement has not yet been reached on how to compute use for water balances. A major effort will be required to resolve this difficult issue." Apparently the "difficult issue" was not to be resolved by measurement of what happens, but by a committee decision.

I do not wish to minimize the difficulties involved in actually measuring application of water by small-holders with scattered plots and several crops. I have thought about it a good deal, and have been involved in such an effort. But difficult as the process of measurement may be, assumptions are hardly a useful substitute for about what it is farmers actually do--and why.

The final Water Master Plan document reports that the issue was ultimately settled by using "the results of Egyptian experiments on consumptive use for major crops." [13, p. 39] This procedure certainly seems a

step ahead of deriving consumptive use from one of the several alternate theoretical formulas, but it still does not represent what the farmer actually does. It represents what the experiment station actually does.

Unless one can devise a system (and it has been suggested to me seriously by an Egyptian water engineer) which delivers to the farmer just what he is Supposed To Have according to formula, then planning had better take into account what the farmer thinks his actual use ought to be, and then think of ways of getting him to modify his behavior if that is useful, which it would certainly seem to be, given that he has a scarce crucial input available at a zero price.

One way, of course, is to price the use of water. Indeed, Dr. Abu-Zeid of Egypt's Water Research Center has advocated this solution, starting with the new lands where the kind of irrigation development planned will permit the metering of deliveries. This leaves to one side the issue of whether once having decided to develop new land, one wishes to provide added disincentives to its development on top of the formidable ones already present. But more important is whether such a solution can ever be applied to the old lands. As it is now, the measurement and control aspects of the canal system are so poor that one would be hard put to know how to base an irrigation charge, at least one which would be tied directly to the quantity of water used, which is the only kind which would present the necessary incentive to economize. (See my paper [28] for discussion of the long debate in India on volumetric charges for water.)

The classic Egyptian solution has been to require lift for all irrigation water delivered by gravity flow. (The origin of the policy is obscure, but seems to date back to the British era.) In view of the fact that most water is in fact lifted a half meter before use, it is hard to entertain at the same

time the thought that the Egyptian farmer is putting vastly more water onto his crops than they "need." Suppose he is; then does that not call into question the avowed goal of the Government of mechanizing all lift, especially with subsidized energy? Subsidized lift will certainly make it easier to over-water.

It is at this point that one gets into the possibility of major structural changes in the irrigation system, involving considerable capital expenditure.

There are at least two sorts of possibility of interest. One is a major reconstruction of the canal system (or parts of it) to permit ready and accurate control over the amount of water flowing down it, so that the system as a whole could be more responsive to farmer's demands. (This already assumes that we are interested in paying attention to the farmer's demands, which is not universally the case.) At the same time one could contemplate converting the system to gravity feed, to avoid the deadweight loss of all that animal power, more sensibly devoted, one would think, to meat and milk and the plough.

Another sort of possibility in the small. If we are to convert to pumping, surely it must be inefficient in a simple engineering sense to use such small pumps, which then further disperse a good bit of the energy they consume by jetting water in graceful arcs. It certainly would be possible to design a distribution system built around larger pumps, designed to serve a substantial number of feddans and hence farmers, distributing water on a tight and dependable rotation. Distribution could be through the medium of cheap PVC pipe. What I am describing is a system introduced in India on the "state tubewells" of Uttar Pradesh, with World Bank help. The system is designed to operate by remote control, with little (corruptible) human intervention. The

automatic control system is constructed entirely with components (relays and the like) manufactured in India. A further bonus is that the system can deliver measured quantities, so that one can operate it on a coin-in-the-slot basis, thus giving us water pricing in a direct and easy-to-understand way.

The latter solution (indeed, the two are complementary) does have the virtue that one can implement it in a small area independently of what is being done elsewhere. The fact that the system can operate independently has the virtue that one can begin; it also has the virtue that it can be run experimentally. It needs to be tested and perhaps modified to suit Egyptian conditions. Indeed, Egyptian conditions themselves may vary considerably in relevant respects, particularly sociological ones. It is probably a mistake to think of the Delta as homogeneous sociologically any more than it is agronomically.

I am puzzled by the insistence in most of the official literature that there is plenty of water for current irrigation uses, given a fair amount of evidence that there are substantial local water shortages. The Egyptian Water Use Project, for instance, finds evidence of considerable maldistribution along particular canals and watercourses. Rice farmers in the north of the Delta were widely reported to be without sufficient water last year. The fish farm at Zawiya has run for three years at one third of capacity because the irrigation ministry refuses to deliver the agreed amount of water. It may simply be a matter of local imbalances, but if so the local imbalances seem to occur all over the system. John Waterbury claims that there is simply not enough water for the system as a whole [53]. (See also The Economist [16].)

In any case, water seems badly allocated by the system as it stands; the point hardly seems controversial. If the system as a whole is water-short,

then the point is simply sharper: Egypt is going to have to face the issue of how the system handles water at its lower levels. Once water leaves the hands (or pipes) of the Ministry of Irrigation, how is it distributed by the farmers along a mesqa? To my amazement, I have been told by people at the Colorado State Project that there is no organization among farmers for the distribution of water. Surely that means that they have simply not looked hard enough. Something (an institution, a set of rules, a Warrant of Precedence existing only in the mind) determines who gets water first, who gets water second, who does without if water is short. But the point is that the sort of institution or institutions which now exist do not seem to be doing their job particularly well. Farmers with a low marginal value for water are (apparently) getting it when farmers with a high marginal value are not, and the fact seems to have little to do with the operations of the Ministry of Irrigation.

Existing operations could be improved. Indeed, there is widespread concern in the Third World for improving the organization of water distribution by the farmers themselves; the job is surely too big for irrigation departments anywhere to take on for themselves; they cannot handle the job they have now, not because they are bad but because the job is large.

Such organization is certainly possible in the Third World. Farmers are organized formally and informally in many parts of the Third World to allocate water among themselves, often without the blessings of the state. In some countries the blessing of the state may be necessary, however, given current water law, in order for such farmer organizations to form and operate. Pakistan has just finished the process of passing provincial ordinances for water-users' associations. (The most recent of these is for the province of

Sind; see [49].) The problem here is that we do not even know--apparently--how farmers organize to distribute water among themselves in Egypt, and with what variety of patterns over the country. Even if water is not now in short supply, there will have to be more attention in the future focussed on questions of this sort.

It is precisely the lack of concern with issues such as I have been discussing which distresses me about the recently completed Water Master Plan. The Egyptian Water Use and Managment Project has of course concentrated more on issues of the sort I have mentioned, but there seems little recognition of the part of the Water Master Plan documents that what happens on the farm, or what one might want to happen on the farm, has important implications for the whole water storage and delivery system.²

The WMP concentrates on computer models, files, subroutines, calibration, and so on, in terms which suggest information storage rather than economics (or agriculture, for that matter, or even engineering). Much of what has been done is certainly along the lines of necessary building blocks. What is lacking is a focus on the question which economists (and perhaps engineers?) might want to look at: how can the system be made more responsive to the needs of farmers? The WMP, on the other hand, seems to view the farmer as a passive part of the system with nothing to contribute to it.

At times the WMP's authors seem to find the actual behavior of people repulsive:

Some data are available on actual water use in recently reclaimed lands and they indicate that actual use is far greater than designed delivery amounts. The discrepancy is related to many factors; the area of land actually being irrigated is only a small portion of the total block reclaimed, irrigation efficiencies are below normal, and water management is not good, causing waterlogging and related problems. Such variability cannot be accepted for water planning nor for operations. For the Master Water Plan Project, the MOI criteria for water requirements of new lands will be used. [13, p. 26]

What people actually do is unacceptable, and we will hence substitute what someone at a desk in Cairo thinks people ought to be doing. This attitude seems to me a disastrous basis for water planning. It is disastrous in two ways. First, it is disastrous in that it assumes that the farmer must be regimented. One finds this undertone--if not explicit statement--in much discussion with engineers. Take for instance the following: "Under the present irrigation regime in Egypt it is found essential to consolidate crops on the branch and distributary canals level. Crops may be irrigated by turns on these canals according to irrigation requirements." [46, p. 143] The farmer certainly does not find it essential to consolidate crops. In winter, at least, fields in governorates with which I am familiar look like patchwork quilts. This diversification serves some function for the farmer; he is not operating on caprice. Is it really necessary to issue him another layer of detailed marching orders, especially when we do not know what we are sacrificing by so doing?

Second, and of course closely related, is the fact that if one looks at the irrigation system as something which is to determine what the farmer does rather than to be responsive to what the farmer does, one is rejecting the knowledge which the farmer has. There is an old saying that fifty million Frenchmen can't be wrong; I think I would like to suggest that six million farmers can't be wrong: if they are doing something, there must be a reason for it. The tendency of many is to offer with missionary zeal to run out and tell the farmer what he ought to be doing. Economists, these days, having been substantially influenced by the writings of Theodore Schultz, would tend to think that the farmer probably has it right, given the constraints he

faces. If the farmer is applying "too much water," what purpose is it serving? (In the Indian context, it seems to be a response to uncertainty of future deliveries; what is it in Egypt?) What system characteristic can be changed to make his response the "correct" one, or a better one from the point of view of society, without simply issuing him orders which do not take into account his circumstances, and which breed yet more resentment?

One really cannot finish a paper on water in Egypt without some discussion of land reclamation, since without land reclamation, Egypt's need's for new water would be modest. There are several points worth making without my trespassing unduly on what is of course a sensitive local issue.

The first has to do with the nature of land as a constraint. There is a tendency in much literature to treat land as the be-all and end-all. For instance, after pointing out that cultivated acreage per capita in Egypt was cut almost exactly in half between 1930 and 1977, Dr. Abu-Zeid notes that in order to keep per capita acreage the same, "it is imperative to reclaim a new area amounting to about 150,000 acres/year." [2, p. 277] Jennifer Bremer notes in her paper [8] urging a new approach to land reclamation that Egyptian policy-makers are better than the economists today because they understand the wisdom of providing additional land.

The fact is worth sustained contemplation that the United States now uses roughly the same total amount of land for crops that it did in 1910. Crop land per capita has been cut in half over that time, and yet the United States feeds itself, not to mention others. Land is simply not as important as it was when you grew more food simply by adding to land (in the era before man-managed technological change). One should spend more time asking how Egypt can increase its yields per acre rather than the alternate one of how much additional land is needed. Drainage, fertilizer use, better varieties,

insecticides, different crops, different crop mix (less berseem?), all these plus others give one a tremendous elasticity of approach to the problem of having Egypt feed itself (or pay for its own food, which may be a better approach to food security) without even mentioning the possibility of a price policy designed to induce production. Land is unlikely to be the key.

Second, there is the argument that land reclamation is an over-riding social objective, and hence immune from economic criticism. It needs to be emphasized over and over that economists ought to be quite able to accept any objective the customer wants and to design a least-cost strategy to help him fulfill it. Or alternatively to look at the trade-off between output and the achievement of some other desired good and help the policy-maker see what is being sacrificed in the way of output as one achieves various target levels of some other variable. Economists frequently make the mistake of assuming that maximizing the production of economic goods is their stock in trade, rather than a way of looking at the world which tries to minimize sacrifice in the attainment of stated objectives.

It is certainly true that land reclamation may subserve non-economic objectives, but that fact does not sanctify unlimited amounts of land reclamation or prescribe some particular route to it. There are still problems of choice left, and the economist can help with these. I want to mention here the ideas and work of two or three groups.

First, an illustration of the trade-off between economic and political goals. In a most interesting paper, Guariso and others have attempted to construct a model for evaluating the El Salaam canal which incorporates at least one possible objective for land reclamation in that part of Egypt. As they state it "the political objective has been assumed to be the maximization

of the minimum percentage of land reclaimed among the regions" in the eastern Delta and Sinai. They say, "This representation of the political objective does guarantee a fairly equitable distribution of reclaimed land among the reclamation sites." (p. 1588) One can argue that they have not chosen the most useful form for stating the political objective, but it is up to the political authorities to say that. (Are regions now devoid of inhabitants clamoring for equality of treatment?) The important thing is that economists not abandon the policy arena when non-economic values enter as objectives: there are still economic and non-economic ways, costly and less costly ways, of meeting those objectives.

Second, there is a certain amount of thinking and research going on concerned with better and worse ways of conducting land reclamation. Official Egyptian thinking itself has undergone a considerable shift away from large-scale reclamation. But there is still much to be done in considering what takes its place. Carl Gotsch and Thomas Tomich are now looking at private-enterprise land reclamation efforts in Egypt; these have in fact been extensive, widely scattered, and in some cases impressive, since they are minimally subsidized.³ North of the Alexandria-Rashid road, for instance, are 100,000 feddans reclaimed (the figure is from a local farmer, and may be quite notional, but I have seen the land), much of it reclaimed for truck gardening and raising date-palm seedlings, by hauling in sand for a build-up of three to six feet. Along many drains there is similar private-enterprise reclamation of land for quite a different sort of farming. We can hope that Gotsch and Tomich's study will give us insight into the tricks of success. Certainly one of the tricks is to use the skills and motivation of the farmer himself.

Nothing I have said in this paper should be construed as a criticism of

those whom I have quoted. The problems are gigantic, and we involved in Egypt are only beginning to recognize the extent of our ignorance about water and its use in Egypt. The amount of needed information is immense, and virtually by definition hard to come by--or else we would have it already. Those concerned with water in Egypt have been (somewhat puzzlingly) a precious few, and they can scarcely be expected to have discovered what we need to know with the extremely low level of funding given to the social-science study of water problems in Egypt. Little as we know, the technological side is where our strength is now; the crying need is for more knowledge on the side of social science, on the side of the actual behavior of the Egyptian farmer in the field as he uses water. Only with more knowledge can those in charge make responsible decisions about Egypt's future.

NOTES

1. William Strunk, Jr., and E. B. White, The Elements of Style, 3d ed. (New York: Macmillan, 1979), p. xvi. E. B. White in the introduction quotes Strunk as saying, "If you don't know how to pronounce a word, say it loud!"
2. The WMP does display familiarity with a number of basic economic concepts, if it does not always apply them with finesse. The staff clearly understood the difference between economic and financial values and made an attempt to use economic ones, although the values used seem sometimes to be pulled out of a hat. It does not seem to use economics as a means of understanding and perhaps seeking to modify human behavior.
3. Their final report has since become available [27a].

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