Sri Lanka Journal of Social Sciences

The Management of Irrigation Systems in Sri Lanka: A Study in Practical Sociology*

M. P. MOORE

Introduction

The purpose of this paper is to demonstrate that a relatively simple and jargon-free sociological analysis can provide some explanation of the workings of one branch of the public service and indicate possible solutions to problems of poor performance. The branch of the public service studied deals with the construction and management of large-scale canal irrigation schemes. For ease of reference the persons involved will be described as the 'irrigation bureaucracy'. The focus is on officials working directly on irrigation schemes rather than on administration. The discussion relates mainly to the more senior cadres. The cadres with whom we are concerned perform a wide range of tasks. These tasks fall into two distinct categories: investigation, design and construction (henceforth 'design and construction') on the one hand, and operation (i. e. water management) and maintenance on the other. The analysis sets out mainly to explain why levels of performance in operations and management appear so much lower than in design and construction. In order to render the arguments intelligible to non specialists it is necessary to provide a considerable amount of background information on the operation of canal systems and on the structure of the irrigation bureaucracy. This information is intended only to orient the present analysis, which deals with only one aspect of water management. The fact that other aspects of the subject are not discussed does not mean that they are not of equal importance.

The importance of improved water management does not require much emphasis. The economic prospects of Sri Lanka depend, to a large extent on the exploitation of the agricultural potential of the Dry Zone.

* The author is deeply indebted to: a) a very large number of people in Sri Lanka who provided information; b) his colleague, Robert Wade, whose research, as yet mostly unpublished, on the management of canal systems in India provided an invaluable stimulus and introduction to the problem; and c) to Robert Chambers, Ron Dore, Marcus Karunanayake, Michael Lipton, John Sender and Robert Wade for very helpful comments on an earlier draft of this paper.

And this in turn depends largely on the successful management of existing and planned large-scale irrigation schemes. Sri Lanka is not alone in finding that the performance of existing schemes is well below expectations and physical potential.[1] Although no strict performance comparisons have been made, informal estimates suggest that the level of management in Sri Lanka is among the worst in the world. This is in marked contrast to the excellent reputations of Sri Lankan civil engineers for design and construction of all kinds of schemes, including irrigation schemes.

The factors leading to poor management of irrigation schemes may be deeply rooted. Equally, and this can scarcely be stressed enough, the potential economic and social benefits of improved performance are very large.[2] They have considerably increased as a result of the decision to accelerate the construction of the Mahaweli project, since there is concern about the adequacy of supplies of water to irrigate planned acreages. Supplies will be adequate only if rates of water use per acre can be reduced well below those current on other large schemes.

One kind of reaction to poor water management has been to seek ways of by-passing the problem. For example, in other parts of South Asia there has been a shift of private and public investment to the exploitation of groundwater by the use of tubewells. This obviates the management problem of large canal organisations and gives the owners a direct incentive to use water efficiently, since the use of water costs money. This is at best a very limited option for Sri Lanka since it does nothing to generate a better return on enormous existing investment in canal systems. Further, in most areas of Sri Lanka's Dry Zone groundwater supplies are meagre, and they are often protected by layers of crystalline rock.[3] Tubewells are not feasible.

---

1. P. R. Crosson (1975) "Institutional Obstacles to Expansion of World Food Production", *Science*, 188, p. 522, remarks that many Third World countries have been disappointed with the results of large investments in big canal irrigation schemes and that ".... irrigation building institutions have performed better than irrigation management institutions".

2. R. Chambers, 1975 "Water Management and Paddy Production in the Dry Zone of Sri Lanka", *Occasional Publication Series No.* 8, Agrarian Research and Training Institute, Colombo, p. 64.

3. The extent of usable groundwater supplies is controversial. C. M. Madduma Bandara ("The Prospects of Recycling Subsurface Water for Supplementary Irrigation in the Dry Zone" in S. W. R. de A. Samarasingha (ed.) *Agriculture in the Peasant Sector of Sri Lanka*, Ceylon Studies Seminar, Peradeniya, 1977.) argues that the potential has been underestimated. However, the fact that he uses the term "supplementary" indicates the limited extent of the potential.

Another suggestion is water charges to force farmers to economise on water use.[4] This poses major technical and management problems. It would require very high levels of supervision, policing, maintenance of structures, observation and measurement of water use, and water control. It will only become a policy option after the bureaucracy is in a position to control and measure the flow of water. At present they can do little of either.

A third view is that one should concentrate on bringing the supposed beneficiaries of the system, the cultivators, into the management. It is commonly argued that, if made responsible for management, farmers would run the system effectively because they, unlike irrigation staff, have a direct material interest in doing so. There is a certain potential here. In several parts of South Asia it is being recognised that there are advantages in turning over local responsibilities to farmer organisations. These may be collectively responsible at the local level for the clearance and maintenance of channels and for water distribution among farmers.[5] In effect this amounts to a system of informal contracts between farmers' groups and the canal management: the latter contracts to supply water if the former maintain their part of the physical infrastructure and distribute water. Sri Lanka has moved a little in this direction with the recent decision to appoint 'Representative Farmers' to oversee maintenance and water distribution at the level of the individual field channel. The element of collective and contractual responsibility is however low.

More could be done in Sri Lanka to develop responsible farmers' groups. There are however three reasons for believing that the main effort in water management must come from reforming the irrigation bureaucracy. The first is that there are major conflicts of interests between categories of farmers notably 'top-enders' and 'tail-enders' (see below), which seriously limit the potential for management by farmers. Such involvement of farmers must take place within a 'steel framework' of overall control and discipline on the part of the irrigation bureaucracy. This leads directly to the second reason. There are a series of vicious circles operating in respect of water management in most schemes; they are outlined below. In most cases the consequences are that the 'irrational' or non-optimal behaviour of one category, the farmers, only elicits corresponding behaviour from the irrigation bureaucracy and vice versa. Levels of trust

4. e.g. International Labour Office, *Matching Employment Opportunities and Expectations: A Programme of Action for Ceylon*, Geneva, 1971, p. 102.

5. H. C. Hart, (1978) "Anarchy, Paternalism, or Collective Responsibility under the Canals", *Economic and Political Weekly*, Vol 13 (51 & 52).

and goodwill between the two categories are low. Only the irrigation bureaucracy can take the initiative to break these vicious circles of bad performance and bad faith. There is now wide agreement among water management specialists that a dependable and well-regulated supply of water to the farmer is a precondition for good water management at the farm level, while the reverse is not true: there is no causal link between good farm-level practice and better management of schemes as a whole.[6] The third reason is that farmers' organisations have a very poor record in Sri Lanka. The gap between acceptable and actual levels of performance is far greater in the case of farmers' organisations than in the case of the public service. It is thus thought that administrative resources should concentrate on problems where a solution seems nearest: within the public service. The implication of these arguments is that if water management is to be substantially improved, this must stem mainly from better performance of the irrigation bureaucracy.

Existing Practice

There are in principle two main ways of scheduling the delivery of water to fields under canal irrigation. They may be described as 'demand scheduling' and 'supply scheduling' according to whether the main decisions lie with the user (the farmer), or the supplier (the management) respectively.

Demand scheduling is practised in some countries, including the United States, Australia, Italy and Spain. The individual farmer decides how much water he requires and at what time. He informs the management of his requirements, and they meet them as nearly as possible and charge him accordingly. The successful operation of such systems depends partly on such variables as the physical area irrigated. The larger the area, the more important it is to have the use of advanced communications technology, so that by means of telephone or radio the individual farmer, the management office and the irrigation fieldsman can be in constant contact in order to arrange details of the volume and timing of supplies. Another factor is farm size, absolute and relative to the size of the scheme. The larger the amount of water used by each farmer, the more economical it is to record and charge on an individual basis. Farm size (and physical layout of the channels) also affect the amount of water lost in conveyance through channels: if water is continually switched from one channel or

6. e.g. R. C. Lazaro, D. C. Taylor and T. H. Wicknam "Irrigation Policy and Management Issues: An Interpretive Seminat Summaty" in International Rice Research Institute, *Irrigation Policy and Management in Southeast Asia*, Los Banos, Philippines, 1978, pp. 4-5.

distributary to another in relatively small quantities to meet the demands of individual small farmers, then a great deal is lost in continually re-wetting channel beds and sides. Demand scheduling can never work in a pure form. Factors such as faults in the physical structures or in aggregate scarcities of water mean that the management cannot meet every demand for water. Bargaining has to take place over quantities and timing, and for this reason as well a good communications system becomes all the more important. In the absence of efficient field communications, aggravated by a preponderance of very small farms, as in Sri Lanka, demand-scheduling obviously has at best very limited application.

The principle followed in Sri Lanka has always been that of supply-scheduling. The release of water conforms to a cultivation calendar agreed on before each season by a meeting of farmers and officials; water is provided for the agreed period of tillage; the supply is reduced during the period of crop growth; it is cut off altogether at the end of the agreed cultivation period – on the presumption that all farmers have sown a rice variety of the same duration and that all have planted on time. While this at least is what happens in principle, practice is somewhat different, and to some degree inevitably. The perfect functioning of a supply-scheduled system is, just as in the case of a demand-scheduled system, premised on either perfect foreknowledge of total water supplies or of the existence of supplies which exceed the largest possible demand, and on the ability of the management to actually control water distribution. It is rare that these premises are fulfilled. All water management involves, among other things, the reconciliation of conflicts between the management and farmers and/or between farmers.

What actually is done to reconcile these conflicts in Sri Lanka varies from scheme to scheme; a description could occupy many hundreds of pages.[8] The following brief sketch is adequate to characterise the general process and to provide a factual background for the later analysis of the working of the irrigation bureaucracy.

8. A great deal has been written about the management of canal systems in Sri Lanka, but mostly in official documents and consultants' reports not widely available. This may be one of the reasons why the gravity of the situation in the Dry Zone irrigation schemes is not generally appreciated. The only publicly-available critiques are by R. Chambers: op. cit. and "On Substituting Political and Administrative Will for Foreign Exchange: The Potential for Water Management in the Dry Zone" in S. W. R. de A. Samarasinghe (ed.) *Agriculture in the Peasant Sector of Sri Lanka*, Ceylon Studies Seminar, Peradeniya, 1977. The situation in India however is very similar, and a series of articles in the *Economic and Political Weekly* provide a good introduction to the issues. There are five by R. Wade in the following volumes: 10 (26), 1975 10 (44&45), 1975; 11 (13), 1976; 13 (12), 1978; and one by H. C. Hart in 13 (51&52), 1978.

The following are the main points:-

1. Only a small minority of cultivators actually attend the seasonal 'water meeting', have any significant say in the decisions, or feel morally obliged to obey them.

2. Mainly because of massive over-use of water by those nearest the tank - i. e. those at the top ends of canals, distributaries and field channels- the aggregate supply of water is frequently inadequate, especially in the dry *(Yala)* cultivation season. Many farmers are uncertain about receiving supplies.

3. For a variety of reasons decisions of the water meeting are not adhered to. Farmers till and sow late, or use a paddy variety of longer duration than agreed. They use political influence to force the irrigation engineers to supply water for longer than agreed. This is another cause of recurrent aggregate scarcity of water.

4. Although water issues are in principle supply scheduled, actual day to day decisions are to a very large extent affected by the demands of users, in accordance with the 'squawk factor': those who shout the loudest are most likely to receive more water all the time there is some available.[9] Those of some political or social standing are most likely to have their 'squawks' heard.

A detailed analysis of how the current situation of low levels of management, of water control and of trust between farmers and irrigation staff has been reached, is beyond the scope of this paper. It is however important to point out that a functioning system of water management is a fragile plant from both the physical and institutional points of view. If one element in the system does not work then this tends to have adverse effects on others, generating a series of vicious circles. It is difficult in any particular instance to plot the trajectory of these vicious circles, but the following schematic reconstruction conveys a sense of the kinds of interactions involved:

Water is uncontrolled, too much is permitted to flow through the distributary and field channels at the top of the system—> the banks of channels and control and check structures are washed out—> ample water reaches the field from all directions—> the cleaning and maintenance of channels and other structures is neglected—> farmers at the top

9. The term 'squawk factor' is borrowed from D. Leonard, *Reaching the Peasant Farmer*, University of Chicago Press, 1977, p. 188.

ends cannot manage with less water as the degraded system cannot deliver to all fields the amounts specified in the design—> 'top-enders' use a great deal of water—> there is insufficient water at the bottom ends of the system—> channels are not cleared as water arrives so rarely that the effort does not appear worthwhile—> the tail-end channels become silted, suffer high percolation losses, and receive even less water—> in the effort to push enough water down to the tail-ends, the channels are overloaded beyond design capacity, causing erosion, overflowing and waste high up the system—> even less water is available for tail-enders in the long run—> when water does reach the tail-end, farmers scramble for it—> if attempts are made to rotate water in distributaries by locking gates, farmers destroy the gates to get as much as possible while water is in the channel—> the actual arrival water at the tail-end becomes even less predictable—> tail-end farmers cannot adhere to cultivation schedules—> they agitate for water issues to be made after the agreed final date—> the canal is not dry long enough between seasons for much maintenance work to be done—> .....

The choice of a particular point at which to demarcate this set of vicious circles for purposes of description was made purely arbitrarily. It is clear that to assign causation or blame in such circumstances is very difficult. Farmers of course do blameworthy things, like breaking gates or neglecting to clear field channels. But there are reasons why they do these things beyond greed and laziness. If a system is managed so arbitrarily and wastefully that a farmer cannot be sure of receiving water next week, then he is tempted to break the gate and take water while it is there. It makes little sense to clear a field channel if either (a) so much water is allowed to flow down that it will reach the fields anyway or, conversely, (b) if the chances of receiving water appear so small that clearing the channel would be a waste of effort, nullified in a few weeks by fresh growth of weeds and the treading feet of men and buffaloes. Conversely, engineers have little incentive to make an effort to get a consensus agreement of farmers on a particular water distribution schedule if a dissatisfied group of farmers are able to call upon a politician to interfere and thus secure more water and wreck the schedule.

Although relationships between farmers and irrigation staff are central to the functioning of irrigation schemes, it is clearly implied in the section above that some of the causes of poor water management are not to be found within the irrigation system narrowly defined. There are two factors of external origin which are of particular weight. The first, normally termed "political interference", has been mentioned. The

bureaucracy is to a large extent subordinate to the short-term demands of politicians responding to pressures from farmers. It has very little effective sanction over farmers who damage control structures – e. g. break gates – in order to obtain more water. Attempts to prosecute offenders have been so often thwarted by the interference of politicians that, at the time of writing, such attempts have almost ceased. The judicial process is anyway very slow and the fines levied on irrigation offenders have been too small to serve as a deterrent. The damage to systems is high in many cases. The author was informed that on one scheme about 40% of all gates are destroyed each year. Equally, political pressures frequently disrupt agreed schedules for water issue. The second external factor affecting water management is the inadequacy of maintenance budgets. A backlog of uncompleted maintenance leads to loss of water and a reduced capacity to control it. Improvements in the functioning of the irrigation bureaucracy do not provide the sole key to better management. They are however potentially important, and it is to this subject which we now turn.

Water Management

In the preceding pages a fairly grim picture has been painted. It is not just that levels of water management are poor. In some cases there is no management at all! This conforms with the terminology which the author several times encountered during conversations with irrigation personnel. It would, for example, be said: 'Oh yes, we *are* practising water management.' The content and tone imply that even to be making an attempt to manage water is a matter for approbation.

In order to make sense of our analysis of the working of the irrigation bureaucracy it is necessary to give some indication of what is involved in water management, There is no unique answer, since there is a wide range of discretion about the way and the degree in which water can be managed. A minimal programme might involve nothing more than opening and closing the sluices from the storage tanks at agreed times, leaving the distribution of water between distributaries and field channels to the combined effects of such factors as farmer behaviour, the losses through damaged or poorly maintained structures, and the total volume of water available. At the opposite extreme, a maximal programme might involve a schedule for the delivery of stated quantities of water to individual fields on a rotation system, and mechanisms to monitor and enforce the fulfilment of that schedule. To be feasible any satisfactory programme for Sri Lanka would be somewhere between these two extremes. It would probably involve the following elements:–

1. An agreed and publicly-announced timing schedule for cultivation operations in each main tract under a tank.
2. A clearly-stated schedule of the amount of water to be delivered to each tract, adjustable according to levels of rainfall and aggregate water supply.
3. The installation and use of water measuring devices to make it possible to deliver water by volume to defined areas (not individual farms).
4. Control devices on all outlets down to the level of the field channel.
5. A programme of rotation of deliveries at the level of main canals, distributaries, and perhaps field channels.
6. A monitoring mechanism to report on the field situation independently of the 'squawk factor'.
7. Effective sanctions against cultivators who break the rules.

From the point of view of present concerns the important thing is not so much the precise content of such a programme as the nature of the work it involves for the irrigation staff. Apart from involving rather a lot of work,[10] it requires three attributes in particular. The first is applied numeracy. This is necessary for the use of measuring devices, for the calculation of irrigation requirements by crop in the light of varying rainfall, for estimating the optimal pattern of distribution of water between different tracts, and for calculating the rates of water loss in conveyance due to evaporation and seepage. The second quality required is human relations ability: to explain plans to colleagues and farmers, elicit their views and support, and help settle the inevitable disputes and misunderstandings. The third quality is closely related: it is flexibility or responsiveness. All delivery schedules must be provisional and continually adapted in the light of such factors as rainfall, aggregate water availability, and departures from schedules caused by, for example, damage to structures, the need to close canals for urgent maintenance, or faulty original calculations. There is a strong case for formulating and adhering as far as possible to publicly agreed and widely known rules to govern water distribution. However, rules must be flexible to deal with the large degree of uncertainty inherent in managing irrigation systems.

10. There was a locally-famous experiment in very tight water control under the Rajangana Tank (Anuradhapura District) in 1976. In conditions of aggregate water scarcity, most of the paddy crop was saved. Inspection of the files however reveals the truly enormous effort on the part of the irrigation staff which this involved.

The Irrigation Bureaucracy

When discussing the irrigation bureauracy we refer to two main categories of organisations. The first is the Irrigation Department, now responsible for the management of all except small-scale irrigation schemes.[11] This is one of the oldest government departments, founded in 1900. In the second category are the two special boards functioning in very large schemes still under construction: the Mahaweli Development Board for the Mahaweli project and the River Valleys Development Board for the Uda Walawe project. The Irrigation Department is the focus of this paper. The other boards recruit from the same pool of potential staff as the Irrigation Department, often exchange staff and are in many ways similar. The conclusions reached about the Irrigation Department are of sufficient generality to apply in general terms to the special boards.

There are four main cadres of Irrigation Department staff working directly on irrigation projects:- engineers; technical assistants; works supervisors; and labourers, including *kanganies* (foremen). Labourers have no educational qualifications. Most are casual employees. *Kanganies* are recruited directly from among labourers. *Kanganies* may be promoted up to works supervisors - 80% of works supervisors' posts are filled this way - but they are required to have in addition to 3 years service, at least four credits in the tenth grade school examination, including passes in mathematics, physics and chemistry. The remaining 20% of vacancies are filled by open competition among those with the minimum educational qualifications. There is a narrow channel through which works supervisors can ascend to the level of technical assistant: 10% of the technical assistant posts are filled by works supervisors with at least ten years' experience and six passes at the tenth grade school examination. The remaining 90% of technical assistants' posts are filled by holders of the JTO (Junior Technical Officer) certificate in civil engineering, which is obtained after following a full-time two year course. A small proportion of technical assistants can hope for promotion to engineer: 20% of engineers' posts are reserved for technical assistants promoted strictly according to seniority. They are designated non - Professionally Qualified Engineers (NPQE), and cannot rise beyond the lowest engineers' salary grade (Class 2, Grade 2). The great majority of engineers are recruited after obtaining a degree in civil engineering, usually from within Sri Lanka. A few are recruited after obtaining equivalent qualifications in the form of chartered membership of the Sri Lankan or London Institution of Engineers. There are facilities for part-time study in Colombo, but following the course is not compatible with working outside Colombo.

11. Large-scale schemes are defined as those with a command area of more than 200 acres.

Space does not permit a fuller elaboration of organisational, recruitment, training and reward systems. However, drawing on the information in the above paragraph and related data, one can identify the following set of facts which are relevant to the discussion below:-

1. Possession of educational qualifications is not only necessary for appointment to each cadre; they are regarded as sufficient in themselves at the higher levels. Because of the shortage of trained staff anyone with a degree or a JTO certificate in civil engineering is more or less guaranteed a post as an engineer or technical assistant respectively.

2. Only to a very limited extent do post-recruitment tests effectively discriminate between good and not so good workers. The main example of effective discrimination appears to be the practical examination by which technical assistants can be promoted to the rank of senior technical assistants. For an engineer to advance in his cadre it is essential to obtain chartered membership of either the Sri Lankan or the London Institution of Engineers. This involves both written exams, practical (design) work and an evaluation of job performance. That this is not very discriminatory is evidenced by the fact that almost all engineers receive membership, although some may have to make several attempts. Even more nominal is the examination which newly-recruited technical assistants are required to take after their first year as 'learners'. This must be passed if they are to be appointed. In the last examination for which data are available eight out of thirty-five examinees failed. This, it was said, was because they had not taken the examination seriously and had not worked for it at all; it was expected that all, or almost all, would pass at the second attempt. Thus in general the qualifications which really matter are those obtained in the formal education system. In-service examinations do not comprise a major barrier to advancement after recruitment since they are set at such a level that most people will pass, even if some have to try several times.

3. Of the three 'in-service' examinations mentioned above, two are taken soon after recruitment: the qualifying examinations for 'learner' technical assistants after one year, and the examination for chartered membership of the Institution of Engineers after a minimum of four years. Insofar as the need to pass these examinations constitutes an incentive for good work performance, this does not operate for more than a small fraction of a person's career.

4. Almost all salary increases and advancement both within and between ranks are governed by length of service ('seniority'). This is especially true at lower levels. Some very limited rewards accrue to those who pass 'in-service' examinations (see above), and very little for good work performance per se.

5. The promotion channels between cadres are narrow. Most recruits can expect to finish their career in the cadre into which they entered service. If promotion to the next cadre is obtained, this occurs late in a person's working life, making it almost impossible for him or her to undertake further formal education in order to acquire the same formal technical knowledge as colleagues in the same cadre.

6. Each of the main cadres tend to form very separate social groups, since they differ markedly in educational background, income, and, because of paucity of inter-cadre promotions, in work experience. The salary scales of works supervisors do overlap a little with those of technical assistants, while theirs in turn overlap with those of engineers. But the averages are very different. The gap is especially marked between engineers and others. Thus, while the mid-point in the works supervisors' pay scale[12] is 59% of that of the technical assistants, the mid-point in the technical assistants' pay scale is only 44% of that of engineers. Comparison of minimum and maximum points on the scale leads to the same conclusion. The same pattern is apparent in respect of the predominant social class of origin of the members of the different cadres.

Engineering (and medicine) comprise the most prestigious professions in Sri Lanka, those recruited for training are from the best performers in school science examinations, and belong to the highest social strata. Admission to the university engineering faculties is from those with the best school examination results in physics and maths.[13] Good examination results in these subjects are concentrated in a few schools with good facilities and which serve mainly the children of the more wealthy.[14]

7. Irrigation Engineers comprise part of a civil engineering profession which, by virtue of a relatively homogeneous social background and common educational experience, comprises a relatively distinct social group with a strong sense of identity. The behaviour and attitudes of engineers

12. All information on salaries relates to the scales in force in October 1978.

13. R. P. Dore, (1976) *The Diploma Disease*, London, George Allen and Unwin, pp. 59–60.

14. The gap in both salary and social origin is greater between Works Supervisors and Technical Assistants than it is between the latter and Engineers.

are strongly influenced by professional colleagues, and a reputation for professional expertise is a source of group esteem. In sum, there are important non-material factors affecting engineers' work performance.

8. Despite the fact that political and personal factors sometimes affect promotion decisions at all levels, professional expertise, as well as seniority, do play a role in the appointment of engineers to senior posts. This is almost unavoidable, since the consequences of appointing incompetent persons could be very serious. Engineers have more incentive than technical assistants or more junior staff to work well, since they are more likely to be rewarded by promotions. This receives implicit recognition in salary scales, which provide engineers with the greatest chance of advancing beyond their initial salary scale. At the bottom of the hierarchy, the rewards of labourers are almost fixed according to the number of days they work, with some increases with seniority. For works supervisors the highest salary is 182% of the initial salary; for technical assistants it is 237%; and for engineers it is 297%.[15]

9. It is clear to engineers that they are more subject to professional norms than, say, the technical assistants directly beneath them. This may strengthen the view that technical assistants (and other subordinates) are, apart from being less skilled than engineers, also morally inferior, being more prone, for example, to the temptations of corruption.

10. The relatively homogeneous professional group to which irrigation engineers belong is a *civil engineering* profession. That is to say, almost all its work, training and professional esteem lies in investigations for and the design and construction of physical infrastructure: roads, drainage system, buildings, bridges, dams, etc. However, irrigation engineers also have responsibilities for the operation and maintenance of irrigation systems. They receive very little training in these latter topics, and almost none at all in water management.[16] The same is true of those who become technical assistants by taking the JTO course. The examinations of the Institution of Engineers cover mainly design and construc-

15. The number of points on the salary scale is similar for each cadre: thirty-two for Works Supervisors, thirty-four for Technical Assistants, and thiry-eight for Engineers.

16. The Irrigation Department did run a water management training course for its staff for a brief period in 1976-7, but for a number of reasons this has ceased to function.

tion; operations and maintenance of irrigation systems do not feature.[17] Thus irrigation staff receive little or no formal training in the operation and maintenance of canal systems, and good performance in this area is not rewarded by esteem among their professional reference groups.

11. The average engineer can expect to spend only a small fraction of his or her working life engaged in water management, and thus has little incentive or opportunity to develop expertise in the field. Engineers' posts fall into three main categories: headquarters work (design, experiments, administration, etc.); on-site investigation, design and construction work; and territorial field posts (known as range posts). The country is divided into fifteen Ranges, each in the charge of a Chief Irrigation Engineer. Below them are fifty-nine Divisions, almost all in the charge of an Irrigation Engineer. It is only in range posts (i.e. in Ranges and Divisions) that engineers are at all likely to have water management responsibilities. Yet not all range posts cover large irrigation schemes and, more importantly, the primary duties of range engineers are for all small – scale new construction work in their areas. As of the end of 1978, just under 30% of all engineers in service with the Irrigation Department were in range posts. Since only a small proportion of their time is spent in water management one can see that the typical engineer will spend only a small fraction of his working life engaged in water management.

12. Technical Assistants and other junior staff tend to spend more of their working time in water management duties than do engineers.

13. Irrigation Department staff, especially engineers, tend to live either in Colombo or in the surrounding rural areas. Postings away from home are unpopular, and may sometimes be used as punishments. However, all large-scale irrigation schemes are in the Dry Zone and distant from Colombo. Those range posts which have major water management duties are typically unpopular. The holders tend to return home to the Colombo area as often as possible, perhaps every weekend. Because of the travelling time involved they may not be available for work for a large proportion of the week, although neither farmers nor irrigation water are known to rest at weekends. Further, they do not develop good social contacts with the population of the area they serve.

17. The reason for this is quite straightforward: since the examination caters for the whole civil engineering profession it cannot take cognisance of a special kind of activity – water management – which is relevant to only a fraction of the work schedule of a minority of civil engineers.

The Effect of the System on Work Performance

We now come to the central part of the analysis: how certain aspects of the personnel structure of the irrigation bureaucracy impede efficient water management. It is argued that this works in five main ways. Firstly, patterns of recruitment and service impede effective social interaction between public servants and cultivators and encourage the bureaucracy to hold to a collective view of water management problems which is both false and an impediment to more effective organisation. Secondly, the patterns of recruitment, rewards and promotion within the irrigation bureaucracy impede the kind of internal communication and working relationships which are especially important for water management.

Thirdly, performance in formal written examinations, which is the main criterion for recruitment of irrigation staff, is not always a good indicator of work ability, especially ability in water management. Fourthly, there are in general few incentives for good work performance; this has an especially adverse effect on water management. Fifthly, the organisation of the bureaucracy consistently if unwittingly results in the devaluation of performance in respect of water management and maintenance activities while correspondingly placing high value on design and construction work.

There are two themes intertwined in the analysis. One is the factors conducive to poor work performance in general. The other is the factors which specifically discourage good performance in the operation and maintenance of canal systems, leaving most incentives in the area of investigation, design and construction.

Although the irrigation bureaucracy is internally divided into clearly separate social-cum-occupational strata the bureaucracy as a whole is very distinct in background education and life experience from the mass of the cultivating population affected by water management decisions. This is especially true of the engineers and technical assistants, who have had the experience of a lengthy higher education course. In the first place the possession of the school qualifications adequate to enter on higher education indicates in the great majority of cases a social background considerably more elevated than that of the mass of dry zone farmers.[18] Secondly, the actual experience of higher education has a major socialising effect, tending to promote a strong sense of identification with other

18. The author is to publish separately information showing the very high correspondence even at village level between socio-economic status and achieved level of educational qualifications.

educated people, especially those from the same or similar institutions. Thirdly, the educated tend to be both born in or near the urban areas, and strongly attached to these areas, – especially Colombo and Jaffna – which are remote from the main canal irrigation schemes. Those in government service do not normally develop strong social roots in the dry zone areas to which they are reluctantly posted. Their main social contacts while in field postings are with other government servants. For all these reasons the members of the irrigation bureaucracy, especially the more senior, tend neither to have nor to develop a sense of empathy with the problems of the farming population they serve. This lack of contact and empathy permits them to cling to diagnoses of water management problems which falsely lay all the weight of blame on the farmer.

It was noted above how complex is the interaction of physical and institutional factors on canal irrigation schemes, how easy it is to fall foul of vicious circles, and how difficult it is to attribute blame. Many engineers and technical assistants understand these kinds of points, but there are many who do not. And the lack of empathy or contact with farmers preserves this ignorance. There is a tendency to blame farmers for all deficiencies, and thus to conceive of improvements in water management as beginning with exhortation or coercion of farmers.[19] Yet it is unlikely that farmers will actively cooperate in water management except within a stable environment of guaranteed water supply. The extent of social distance between farmers and irrigation staff hinders the latter from even appreciating the problems involved in water management.

Our second main argument though analogous to the first, applies to relationships within the bureaucracy. Because of substantial differences in social background, education, work experience and exposure to professional norms, the main cadres of staff tend to form very separate social categories. Communication between groups is inhibited, and such communication as does take place occurs in an environment of social, occupational and professional hierarchy. That is to say, communications from above tend to take the form of instructions, and those from below to be reports or requests. A

19. The professional journal of the Irrigation Department contains an arricle by a very senior Engineer which lays all the blame for poor water management on farmers or other institutions (apart from the Irrigation Department) serving farmers. (A. Maheswaran "Engineers' Role in Water Management", *Jalavrudhi* I (2), 1976). This closing of professional ranks to cast all blame on 'un-educated', 'ignorant' farmers is not limited to either Sri Lanka or irrigation. It does however seem prevalent in the irrigation case. A study in the Philippines revealed that common (and derogatory) stereotypes of farmers' use of irrigation water were simply false (R. P. de Los Reyes "Stereotypes and Facts in Irrigation Management: Preliminary Findings from a Case Study of a Philippine Communal Gravity System", in International Rice Research Institute, op. cit.).

degree of command-compliance is inevitable in a hierarchy. The point is that there tends to be relatively little of other kinds of communication, especially of an informal or non-work nature. This may not matter much where the tasks can be performed efficiently without much 'feedback' from lower levels of staff. This is not the case in water management. An efficient subordinate would not await a request or a formal reporting schedule to advise on such matters as the impending breach in a canal bank, damage to sluice gate, the fact that a heavy overnight shower of rain occurred in a particular location, making a reduction in canal water supplies feasible, or the fact that a particular farmer appeared to be preventing water from reaching the fields of other farmers lower down a channel. The more informal and frequent are social relationships between different levels of staff, the greater the likely amount of such informal reporting.

The third point can be stated very briefly. The main criterion for the recruitment of irrigation staff, especially at senior levels, is the ability to pass written examinations in certain kinds of subjects. Ability to pass examinations is not necessarily indicative of ability in water management. In particular, facility in human relationships and responsiveness to changing circumstances are important for water management, but are not tested in the procedures for staff selection. The existence of applied numeracy is probably effectively tested in the formal education courses undergone by potential engineers and technical assistants. However, works supervisors and other junior staff also require this skill if they are to play an effective role in water management, and the evidence available to the author suggests that this is not effectively tested in secondary level exams. A separate test is implied.

If one is prepared to take a thorough and critical look at the relevance of formal education certificates to work performance then one might come up with some very disturbing but useful insights. A study of Kenyan agricultural extension staff has found that formal education is actually associated with relatively poor work performance. This is attributed to the fact that the educated have high expectations about their own abilities and just rewards, and react unfavourably to a relatively lowly rural-based job requiring interaction with ordinary rural people. Those with lower educational qualifications had fewer expectations to frustrate, and actually worked better. It would not be totally surprising if something similar were found to apply among junior irrigation staff in Sri Lanka.

The fourth point is equally brief: that there exist few positive incentives to good work performance, especially in water management. Professional norms apply mainly to engineers. Otherwise, as was demonst-

rated above, neither promotion prospects nor 'in-service' examinations constitute major incentives to good work. Some of the main work incentives are negative in nature: adverse personal reports which might jeopardise otherwise near-automatic salary increments; the threat of transfer to another post, with all the inconvenience which that entails; or the very rigid application by superiors of rules about such matters as requests for leave, times of reporting for duty, etc. Faced with such a work environment it is rational for staff to concentrate on avoiding these negative sanctions. And the best way to do this is to avoid making detectable mistakes or inconveniencing one's colleagues or superiors.[20] A good strategy is to concentrate efforts on tasks where performance can be physically checked: e.g. constructing anicuts or repairing the wall of a canal once maintenance funds have been allocated. The other important strategy is to complete those tasks which, simply because they result in tangible constructions, are likely to be the subject of quantitative target accounting. This in particular applies to new construction. It is the non-fulfilment of programmes for new construction which is especially likely to attract the unwelcome attention of superiors and politicians.[21] The range staff of the Irrigation Department are responsible for new construction, maintenance and water management. The system of incentives tends to emphasise mainly new construction; maintenance work occupies an intermediate position, while water management work is very little rewarded.

The fifth point follows on closely. It is that the organisation of the irrigation bureaucracy strongly reflects its preoccupation with investigation, design and construction work, and in the process discriminates against the water management function. Most of the evidence has been given above. The main points may be briefly repeated:

1. Capacity or performance in water management is not sought or encouraged in the processes of selection, training, evaluation or promotion of staff. Ability and performance in investigation, design and construction are rewarded to some extent.

20. One way of inconveniencing superiors is by annoying farmers, perhaps by denying them water, and thus having them take their case to a politician, who is likely to take it up at the highest level of decision-making to which he has access, sometimes ministerial level.

21. It is possible that the Decentralised Budget, whereby allocations for new capital constructions (but not maintenance), are made at the district level, will exacerbate this trend by concentrating even more attention and resources on new construction, and correspondingly less on maintenance.

2. There is a strong correspondence between hierarchical rank, professional competence and lack of involvement in water management. For example, the promoted former technical assistants (professionally non-qualified engineers) who comprise 20% of the engineers cadre are sometimes considered a positive embarrassment and tend to be placed in those range posts involving most water management, not only because they are most suited to the job, but as a way of keeping them out of the mainstream of engineers' work.

3. There is no institutional provision for the promotion and development of a cadre of specialists in water management. The Water Management Division of the Irrigation Department has a purely advisory and research role, has only a handful of staff, and is under the authority of a Deputy Director whose main task is the supervision of four out of the fifteen ranges.

In the light of all these institutional disincentives to good water management the overall poor results from irrigation schemes appear less mystifying. However, the very paucity of serious attempts to manage water means that, given a serious effort, there are very substantial possibilities for boosting agricultural production and incomes. And our analysis suggests that there are feasible strategies for improving the performance of the irrigation bureaucracy in water management:

1. In staff recruitment, the partial replacement of academic achievement criteria with tests of job-related capabilities, especially perhaps applied numeracy and human relations ability.

2. A more flexible occupational hierarchy with greater scope for promotion. This is required in order to reduce the social gap between cadres and thus improve communications, and to recruit into the higher ranks a larger proportion of staff with substantial field experience and thus understanding of water management. This could entail both recruiting staff at an earlier stage in their education than is now the rule and providing opportunities for professional training while in service.

3. As a corollary of the previous point, but also something valuable in its own right, greater promotion and other rewards for good work performance at all staff levels.

4. The establishment of a distinct and separate career structure for those with expertise and ability in operations and maintenance work. This implies the eventual division of range posts into design and construction posts on the one hand and operation and maintenance posts on the other.[22]

5. Water management training programmes involving substantial periods of sustained fieldwork in which the officer is led, as far as possible, to see the irrigation system from the farmers' point of view.[23]

This is not the occasion to discuss suggested reforms in detail. It may however be noted that it is in no sense an 'all or nothing' situation. Each of the five approaches could be pursued gradully and delinked from reforms in other areas. Any effort in these directions is likely to be better than none.

The issues upon which attention has so far been concentrated are those where improved water management can be expected to result from institutional reforms operating *within* the irrigation bureaucracy. There is a further constraint on effective water management which merits discussion but needs to be treated separately because it is more centrally a matter of ideology than the others discussed above and because it relates mainly to relationships between the bureaucracy and the outside world, especially clients. In brief, the argument is that aspects of the prevalent ideology of public service discourage realistic and useful administrative innovation.

The issue may perhaps be encapsulated in the phrase: belief in the legitimacy of the organisation chart. That is to say, public officials in the irrigation bureaucracy (and elsewhere) are encouraged to believe that the authority relationship described in the organisation chart of their section of the public service is legitimate and optimal. Relationships which correspond to the lines and boxes of the chart meet approval and are to be admitted publicly; those which do not correspond to the chart are not to be exposed publicly. These relationships have two aspects: the vertical or hierarchical

22. The freeing of design and construction specialists from operations and maintenance tasks would be additionally very useful at the present time because of the great shortage of experienced civil engineers in Sri Lanka, a shortage made all the more acute by the acceleration of the Mahaweli Project. The time which Engineers in range posts currently spend in operations and maintenance could be used in design and construction, while promoted Techical Assistants could take over water management.

23. An example of such a programme is given by B. Badagion et al., "The Water Management Training Program of the Upper Pampanga River Project, National Irrigation Administration, Philippines", in International Rice Research Institute, op. cit.

aspect between superior and subordinate, and the horizontal or 'separateness' aspect of relationships between peers. The latter phrase refers to the fact that organisation charts typically permit only very limited contact, if any, between individuals or 'cells' on the same level. The implicit theory is that individuals or 'cells' (e. g. departments) on the same level have separate and defined areas of competence, that one shall not become involved in the work of the other and that communication between peers shall be mainly up through superiors and down again.

Now of course organisations do not in practise work as the organisation chart would seem to imply; neither could they. The organisation chart abstracts from almost all reality. In the first place, it takes no cognisance of the complexity of work. In the second place, it does not admit that the relationships in the organisation are social, and ultimately political relationships. Subordinates do not respond to the nominal sanctions of superiors in the way they are supposed to. The sanctions may either be inadequate or, what may amonut to the same thing, so drastic as to be impractical in many cases. Superiors may resort to a wide variety of 'unofficial' strategems to get work out of subordinates.[24] The relationship becomes one of implicit bargaining. Similarly, separate departments have to resort to 'scratching each other's back' in order to get assistance in completing their work or pursuing other goals. Anyone in the public service knows about this, and social scientists have built up a whole sub-discipline of organisation theory devoted to examining how organisations actually operate as social and political organisms. In its applied or practical role, organisation theory is transmuted into management theory: the art of channelling and building upon social and political relationships within organisations in such a way as to serve the interests of management.

It is not the author's intention to argue for any particular aspect of management theory. The point is that it is built on the commonplace observation which is almost wholly if only implicitly denied by those with authority over Sri Lanka's irrigation bureaucracy: that the way in which the public service actually operates is likely to be consistently and substantially at variance with the formal organisation. Once one is prepared to look at the question in this light it becomes possible to investigate how the service operates from a sociological and political point of view. The adoption of this approach in the case of the irrigation bureaucracy could lead to the following kinds of conclusions and institutional innovations:-

24. In the context of rural development in the Third World, an especially good piece of research on this subject is D. Leonard, op. cit.

1. It would become clear that the lower level staff have very little incentive to work well and that checks from above are not very effective. One might begin to experiment with 'payment by results systems', where 'results' could be equated to areas effectively irrigated, etc.

2. It could be seen that the relationship between farmers and irrigation staff is institutionally very difficult. That is to say, there is no mechanism by which implicit or formal performance bargains can be struck. If staff fail to deliver water, farmers have recourse only to the blunt and destructive weapons of (a) destroying control structures or (b) calling on politicians, whose response is unpredictable, and whose intervention saps further the morale of the irrigation staff. Correspondingly, if farmers destroy gates or do not perform maintenance work on canals, irrigation staff only have recourse to denying water or prosecution. These reactions are very ineffective, unpredicatable and may incur the wrath of politicians. If the problem is recognised as a lack of bargaining potential, then it seems much more important to pursue the strategy mentioned above: to promote farmers' groups able to trade off local level channel maintenance and water distribution against guaranteed supplies of water.[25]

3. It would become apparent that one reason for the ineffectiveness of the threat of prosecution of farmers for damage to irrigation infrastructure is that the authorities charged with prosecution – the police and the regular administration (Government Agents and Assistant Government Agents) – do not pursue cases actively because they have nothing to gain except unpopularity. It is one thing to assign these duties to a department; it is quite another to provide an incentive to perform them. If prosecution could be viewed as a bargaining counter in the kind of farmer – bureaucracy relationship mentioned above, then it would become apparent that it should be in the hands of the Irrigation Department, and that the Department should be staffed to exercise it effectively.

A more detailed analysis than that which the present author has been able to conduct may substantially modify these recommendations. The point of raising the issue here is mainly to point out the existence of two very different perspectives for examining an organisation – the formal and the sociological – and to suggest that the latter is much more informative and useful.

25. Among the issues over which the bureaucracy and farmers' organisations could usefully bargain is the question of the optimum timing of water supplies and thus of cultivation. The weight of opinion in the irrigation bureaucracy favours uniform timing schedules for all cultivators in each scheme. There are however many reasons why farmers should prefer 'staggered cultivation', a tract at a time (Chambers, *op. cit* pp. 37–40). Local bargaining could presumably produce a more informed decision than (widely-flouted) administrative fiat.

Conclusion

It is now a commonplace observation that the procedures and structure of the public service in Sri Lanka still strongly reflect the colonial legacy, and that this is oriented much more towards control (internally and in relation to the public) than to innovative and creative work of development.[26] This conflict is epitomised in water management: effective work requires a kind of responsiveness and local/lower level initiative and responsibility alien to the procedures of public administration. The paradox is however far less rooted than it might at first appear. It is not difficult to envisage changes in personnel policies and organisation which, even in the context of a bureaucratic public service, should substantially improve performance. It may be true that the inherent constraints of a public bureaucracy mean that it is unlikely that, for example, water use efficiencies on Sri Lanka's irrigation schemes will reach world records. But this is not what is required: relatively small improvements in water management can yield a very large pay-off. A relatively simple sociological analysis of the work situation of the irrigation bureaucracy makes a great deal seem possible.

26. This issue is discussed in detail in W. A. Wiswa Warnapala, 1974, *Civil Service Administration in Ceylon*, Department of Cultural Affairs, Colombo.