Sri Lanka Journal of Agrarian Studies 3 (1), 1982, 23-33.

INSTITUTIONAL ADAPTIVENESS AND SUCCESSION: THE CASE OF IRRIGATION IN SRI LANKA

BY

M. P. MOORE

Institute of Development Studies, University of Sussex, U.K.

ABSTRACT

Large organisations exhibit a natural conservatism; a tendency to continue doing the same things in the same way. Yet the external demands placed on an organisation may change. Failure to respond positively may result in an organisation becomimg redundant or even disappearing completely and giving way to new organisations attuned to the contemporary situation. Recent institutional changes in the sphere of irrigation water management in Sri Lanka illustrate this choice between adaptiveness and redundancy. It is not yet clear whether the institutions traditionally concerned with the construction of irrigation potential will be able to adjust to current pressures to make better use of that potential already in place.

I

It is a fundamental axiom of the theory of organisations that, once established, any organisation will tend to develop and pursue its own collective interests independently of the purposes for which it was created. The ultimate objective of any organisation lies in its own continued existence: in maintaining the opportunities for its staff to continue to hold their jobs, draw their salaries, and interact with one another and the outside worlds in familiar ways. This axiom does not however tell one anything about how an organisation will attempt to achieve its goal of immortality. For this there are, conceptually, two broad alternative strategies. On the one hand, an organisation will tend to argue that there is a continuing need for it to perform its original function. This is in many ways the easiest and most likely outcome, for it corresponds to natural conservatism: people, especially the senior people who control organisations, find very attractive the prospect of continuing to do familiar things in familiar ways. Reorganisation and reorientation are threatening and costly processes. On the other hand, expansion into new areas of activity has many attractions. And if the external environment has changed so much that the organisation's original function is no longer defensible, then the organisation may be willing to redefine its purpose and perform a new function as the price of survival. One general principle which does emerge is that an organisation will tend to totally reorient itself—rather than simply expand its area of activities—only under external pressure which appears to pose an ultimate threat to its existence.

This paper is an attempt to understand, in the light of these elementary principles or tendencies derived from organisation theory, the current process of institutional reorganisation in the sphere of irrigation in Sri Lanka. The main focus is on the Irrigation Department. The context for this study is a gradual evolution

---

Footnotes numbered 1 to 21 appear at the end of the text preceding REFERENCES

in the nature of the demands made upon the government agencies responsible for irrigation development. In the latter half of the nineteenth century and the first half of the twentieth century the dominant function of these agencies was to open up new lands under combined irrigation and settlement schemes in the sparsely populated Dry Zone.[2] Settlement—the provision of agricultural livelihoods for households from the densely-populated Wet Zone—was the major aim. Neither water nor land were particularly scarce resources; the capacity to undertake settlement-cum-irrigation projects was. The varieties of paddy—virtually the sole irrigated Dry Zone crop—were relatively low yielding and not very sensitive to differences in moisture regimes. Around the middle of this century it became increasingly evident that crop yields on and economic returns to these schemes were low. Attention shifted to attempting to increase per acre crop yields i.e. to making better use of *land*.[3] New higher-yielding paddy varieties increased the potential benefits of such a strategy. Only in the last few years has the focus been shifted yet again to the efficient use of irrigation *water*. It is now widely accepted that this is the scarce resource.[4] The Irrigation Department finds itself faced with a changing external environment and a different set of pressures. Rather than constructing new irrigation capacity, it is increasingly being asked to do a better job of managing the water on existing schemes, and, in some cases, to physically rehabilitate these schemes to make that goal feasible. The institutional response to these changing demands is the theme of this paper.

II

Established in 1900, the Irrigation Department ranks among the oldest of Sri Lankan government departments. It also has a record of achievement, especially in the construction of large scale irrigation schemes, as proud as that of any other. Leaving aside the small scale schemes with which the Irrigation Department has been only intermittently involved, one could be forgiven for thinking that 'irrigation' and the department are almost synonymous. There is however at least one important historical sense in which this is not true. A very substantial programme of small and medium scale irrigation development was undertaken in the second half of the nineteenth century[5] without the benefit of a specialist irrigation engineering cadre or organisation, but under the aegis of the all purpose Public Works Department.[6] This arrangement was however not found to be totally satisfactory. Justifying the creation of a separate Irrigation Department, the Governor, Sir West Ridgeway claimed that "the irrigation works that they (the Public Works Department) were called upon to perform constituted an irksome additional burden and were undertaken therefore with little enthusiasm and a corresponding loss of efficiency".[7] The circumstances of the birth of the Irrigation Department are very relevant to the argument below: it was created not simply because there were irrigation works to be constructed, but partly at least[8] because an existing organisation was unwilling to give irrigation the attention which it devoted to what it saw as its original and prime area of concern—the construction of roads and buildings.

III

After 1900 and until recently irrigation in Sri Lanka—leaving aside very small scale village irrigation—was almost synonymous with the Irrigation Department. True that in 1949 the Gal Oya Development Board was created to manage the construction of the Gal Oya Project and that later, under the name of the River Valleys

Development Board, it went on to do the same thing for the Uda Walawe Project. These were however very special schemes, covering a far larger area than any previously developed for irrigation in Sri Lanka, including major hydro-power components, and involving major foreign inputs in design and construction. More importantly, the bulk of the irrigation construction work at Gal Oya was undertaken by the Irrigation Department. The Board was established to manage the settlement programme. Once completed the Gal Oya scheme was handed back to the Irrigation Department; the Uda Walawe scheme remains formally incomplete.

When in the 1960s the Irrigation Department began to plan the Mahaweli Programme it was an organisation to be reckoned with. It had since the 1930s completed many new large scale irrigation schemes in the Dry Zone, and the quality of its staff and work were internationally recognised. Along with its sister organisations, the Survey Department and the Land Development Department, it was the cutting edge of post-1931 agricultural policy—a tool for the opening up of the Dry Zone for cultivation and settlement.

In large part bacause of the continual increases in the scale of new irrigation schemes, professional knowledge and work standards had changed out of all recognition since the later part of the nineteenth century.[9] In that earlier period much of the initiative and direction for irrigation schemes had come from the Revenue Department—from the Government Agents and Assistant Government Agents. Such professional direction as had been given had come, rather reluctantly (see above), from the all purpose civil engineers of the Public Works Department. This may not have been inappropriate for the time. Since land, rainfall run-off and potential dam sites had been relatively abundant in the Dry Zone, and labour and directing organisation scarce, there had been little urgent need for professional supervision of small scale works. Irrigation was largely a matter of organising people to throw an earthen bund across a watercourse, or to repair one already in existence. Thereafter arrangements were required to repair the breaches which inevitably occurred and to ensure that all cultivators in each tank adhered as closely as possible to a common cultivation calendar in order to make the best use of the stored water. On the smaller schemes the physical structures were neither elaborate nor necessarily very permanent. The sheer abundance of traces of disused tanks in the Dry Zone seems to support the view that they were readily deserted, or used as paddy fields, once they became silted to a certain level or otherwise lost their usefulness.[10] The physical investment was small and did not need to be conserved. Irrigation was correspondingly a subject which could mainly be handled by the village or the Government Agent without the help of an engineer.

IV

The gradual increase in the size of new irrigation projects brought the professional irrigation engineer to the fore and led to the exclusion of the non-professional from planning and construction. There was however no sudden break with the past, and some very substantial continuities in design and management practices from the nineteenth century through to recent or present times.

The physical design of the large schemes constructed in the 1930s, 1940s, 1950s and 1960s reflected a conception of the purpose and character of irrigation similar to that embodied in smaller schemes in earlier decades. The main emphasis was

on impounding the maximum feasible quantity of water by placing a bund across a natural watercourse, and spreading this water over a large area in order to maximise the number of settler families served. All this was to be achieved at the minimum cost per settler. Complaints about the expense and lavishness of the earlier schemes (especially) were directed against the housing, physical infrastructure, and land development facilities provided free to the settlers, not against the cost of the irrigation channel network.[11] For this was neither elaborate or especially expensive. The demand that large areas be provided irrigation facilities at low cost led to the construction of a relatively sparse irrigation infrastructure. Irrigation channels were long. Channels nominally of the same category—i.e. field channels or distributary channels—were of grossly unequal length in total and in relation to the acreage they served.[12] Physical structures for controlling water flow—gates, cross-regulators and drop structures—were sparse. Water flow measurement structures—weirs and flumes—were almost unknown.

The physical design of the large schemes was in certain respects very like that of the village tanks writ large. It is barely an exaggeration to say that they were not designed to *manage* water, but simply to distribute it under continuous flow conditions once it left the tank sluice. It was perhaps almost inevitable that water should end up being distributed between farmers very unequally and inequitably.[13] It was similarly inevitable that the main sufferers should be allottees on the 'tail-ends' of schemes—i.e. furthest from the tank sluice—and that the magnitude of their plight should grow as the size of the schemes expanded. 'Tail-end' land lots were often abandoned or never even claimed by the legal allottees, and left uncultivated or encroached by those desperate for land of any kind.[14]

The water management procedures on these new large schemes also exhibited continuity with practices developed on small scale tanks. The convention of seasonal water meetings to 'decide' the cultivation calendar was perpetuated. This was so even on large schemes like Gal Oya and Uda Walawe where a dozen or more separate meetings had to be held over the whole scheme, thus making nonsense of the idea that the assembled farmers could independently 'decide' on the cultivation calendar. Water management is—or should be—mainly a matter of a cumulative mass of small individual daily decisions taken in the light of crop conditions, the weather, and a host of other variable and unpredictable factors. The once-per-season water meeting could have little to say on these issues. The fact that it continued to hold the stage was in itself an indicator that water was actually being controlled and managed only in the most rudimentary way.[15]

Continued formal adherence to the notion of democratic decision taking in the water meeting was in part the outcome of the persisting role in tank management of the Revenue Department—the Government Agent and the Assistant Government Agent. The GA or the AGA, both busy people with wide ranging responsibilities, continue to chair the water meetings on larger schemes and to have formal responsibility for the enforcement of the Irrigation Ordinance—i.e. the prosecution of offenders. The 'human relations' side of tank management thus remains in their hands, formally at least. At no stage was tank management formally or fully handed over to the Irrigation Department. The Department saw itself as responsible for maintaining the physical structures and impounding water in the tank. It was reluctant to assume responsibility for the flow of water beyond the tank sluice and certainly not beyond the turnout to the field channel.

In practice the Irrigation Department became drawn more and more into opening and closing gates on the main and distributary channels, but it was not a duty enthusiastically embraced. Its field level labouring staff nominally responsible for the physical opening and closing of gates were rarely noted for zeal or initiative. The Department had generally attempted to focus its activities on construction and to keep clear of responsibilities which would get it deeply involved with cultivators and with problems of agriculture. For example, although in 1942 it created a separate Land Development Branch to undertake land clearing and levelling in the new large scale schemes, this activity was in 1947 handed over to the Land Commissioner, and a separate Land Development Department established. The work of land clearing and preparation "had reached such proportions that it was found to be interfering with the *legitimate* (present author's emphasis) work of the (Irrigation) Department".[16]

V

As has now been documented and repeated many times over, the standards of irrigation efficiency on large scale schemes turned out to be very low. Water was delivered in unpredictable quantities and at unpredictable times, and was shared very inequitably between different farmers.

Pressure for remedial action has gradually increased. Precisely why this has happened one cannot say, but the following factors apear to have played a major role:–

(i) Awareness by irrigation staff themselves of the unsatisfactory nature of the situation.

(ii) Increased economic and political pressure to make more efficient use of irrigation water once the best dam sites had been exploited and new schemes became increasingly expensive.

(iii) The very evident and extreme 'tail-end' problems on the two very large schemes, Gal Oya and Uda Walawe, undertaken in the pre-Mahaweli period.

(iv) The increasing involvement of foreign aid donors in the financing and planning of new irrigation schemes, especially after the decision in 1977 to accelerate the Mahaweli Programme. Compared to other Asian countries, but above all to Taiwan and Japan, water management practices in Sri Lanka appear surprisingly crude and wasteful. It may be argued that expatriate consultants and researchers are unnecessarily impatient and pushful, forgetting that the 'model' Asian countries have only attained present high standards of water management after decades of experience and experiment.[17] There can however be little doubt about the role of expatriate stimulus in placing water management issues high on the current policy agenda.

VI

The main immediate target of this growing concern about water management has been the Irrigation Department iself, although the story has been much the same with the River Valleys Development Board, until recently in charge of the incom-

plete Uda Walawe scheme. Demands and suggestions as to exactly what the Irrigation Department might do about the problem vary, and it is not part of our purpose here to examine or appraise these demands. They can however in large part be reduced to a common core comprising three elements. The first is that much more detailed *control* be exercised over the flow of water in irrigation channels. The second is that much more attention be paid to *agricultural* matters—the condition of crops in the fields, availability of agricultural inputs, etc—in planning and implementing water deliveries. The third, following on from the previous two, is that irrigation staff become much more involved in the *human relations* side of irrigation—in organising farmer groups, responding to their requests, enforcing rotational schedules, etc.

Such demands ultimately require that the Irrigation Department change its entire character. It would cease to be a construction--oriented agency concerned with the capture of water, and would instead give equal emphasis to the use of that water. Among other things, this would entail:-

(i) A partial shift in the professional disciplinary base away from civil engineering towards agronomy.

(ii) A change in the style and content of work, with much more interaction with farmers, and all the problems to which this gives rise.

(iii) A change in the focus of the work of the field level professionals—the Irrigation Engineers and the Technical Assistants. Rather than controlling construction and maintenance work, they would be more engaged in supervising the enlarged cadre of junior staff who would be required to exercise closer control over water flows.[18]

VII

It cannot be said that the Irrigation Department has been unresponsive to the demands that it does something about improving the efficiency of water use. As early as 1969 a special research unit was located at Maha Illuppallama, the main agricultural research station, to investigate links between agricultural practices, irrigation designs and water use. More recently a special Water Management Unit has been established in the Colombo head office, and provision made on some scheme to take on extra labourers to control water issues. In 1976 a special task force achieved considerable success in planning and enforcing a very 'tight' programme of water issues on the Rajangane scheme.[19] More recently, a promising experiment in farmer participation in water management has been initiated by the engineer in charge of the Minipe scheme.[20] Consciousness of the need to improve water management has been spreading among the staff. A joint experimental programme has been undertaken between the Irrigation Department and the Agrarian Research and Training Institute in the use of Institutional Organisers to stimulate farmers to take an active role in water management on the Gal Oya scheme. However, partly, for reasons suggested above, the Irrigation Department has limited capacity to respond positively and quickly to demands that it reform itself and its working procedures.

In the first place, the physical design of schemes in some cases makes difficult the exercise of effective control over water flows. Control structures are few. Fair and feasible rotational schedules may be difficult to design, while in some cases channels intended for continuous water flow cannot easily cope with the larger volumes of water issued under rotations and required in order that water may reach 'tail-enders'. The physical deterioration of many facilities—silted canals, broken banks, and damaged gates and concrete structures—exacerbates the problem.

In the second place, and perhaps of equal or greater importance, the staff of the Irrigation Department exhibit a natural conservatism and unwillingness to change the scope, style and content of their work in the way set out above.

VIII

There has then in recent years been an increasing dichotomy or tension between the social and economic need and political demands for better water management and the Irrigation Department's response to these demands. That it has been unable to respond more quickly and satisfactorily was in no sense inevitable. There are plenty of examples of institutions which have changed in form and function to meet new demands. Indeed there is a whole tradition in management science of studying 'institutional imperialism'—the tendency of orgnisations to expand into new activities in order to obtain new powers and resources (see above). That the Irrigation Department has not thus expanded into water management may perhaps be explained by the conditions it has faced over the past decade or so. Experience suggests that institutional adaptiveness is more likely when resources to make the change are available and morale is high. Two features of recent Sri Lankan history have conspired to make conditions unfavourable rather than favourable to change.

The first factor is the 'brain drain' of engineers to overseas posts. This has very recently accelerated, leaving the Irrigation Department very short of engineers, especially the kind of experienced middle level engineers who would be required to re-orient the work of the field engineer. The fact that overseas job opportunities are mainly in construction and maintenance may also have discouraged young engineers from taking an interest in water management.

The second factor is the decision taken in 1977 to accelerate the Mahaweli Programme, with the consequent diversion of engineers, resources, senior administrators, foreign assistance and sense of challenge and endeavour to the Mahaweli area and institutions. The relative ranking of the Irrigation Department and the Mahaweli agencies (the Mahaweli Development Board, the Mahaweli Authority) has been reversed in the last decade. The Mahaweli Development Board was established in 1970 as an offshoot of the Irrigation Department. Its first Chairman was also a Deputy Director of the Department.[21] A decade later the Irrigation Department was loosing Directors who went on to occupy more senior posts in the Ministry of Mahaweli Development. Having conceded major new construction projects to the Mahaweli agencies or to private sector contractors, the Irrigation Department is left with mainly supervisory duties in the field which it considers its own. Yet it has been unable to move firmly into the newly important areas of water management and physical rehabilitation of existing systems.

IX

To conclude at this point would apparently be to offer a rather pessimistic assessment of the prospects for improving water management. That would however be unjustified. For recent events appear to confirm the existence of a more encouraging trend—and one which, with hindsight, one can trace back several years.

Perhaps one of the earliest indications of this trend is to be found in a design innovation which emerged in the early 1960s from the newly-created Mahaweli Development Board. Mention has been made above of the obstacles to effective water management posed by the sparseness and excessive and variable lengths of distributary and field channels on older irrigation schemes. The new thinking stimulated by the creation of the Mahaweli Development Board led to the evolution of a new channel and field layout. The core idea was short and relatively uniform field channels each designed to deliver one cusec of water and to serve an area of thirty to forty acres. The fact that these new turnout areas each included about a dozen to fifteen farmers proved to be an advantage in later years when it became conventional wisdom that farmers needed to be organised into 'turnout groups' to manage inter-farm water distribution and maintain field channels. At the time the concern was to make it physically possible to deliver water to every field.

This new design has since been adopted by the Irrigation Department for its own new schemes. A precedent has been established: that innovations in or related to water management should come from outside the Irrigation Department. Recalling the way in which the Irrigation Department had been created because of the conservatism of the Public Works Department (see above), one might begin to detect a pattern of institutional succession. In recent years the pattern seems to have become clearer. The main internal pressure for improved water management now comes from officials working on the Mahaweli Programme. It has recently been decided to put the newly-completed H area of the Mahaweli Scheme under the management of a new Mahaweli Economic Agency, which will pay special attention to water management. The Uda Walawe scheme, dogged by severe water management problems, was at the beginning of 1981 taken under the umbrella of the Mahaweli Authority. Further, agencies affiliated to the Ministry of Agriculture have developed an independent interest in water management. The Agrarian Services Department, which in 1978 assumed responsibility for minor irrigation schemes, has appointed its own water management specialist and become involved in promoting better water management in village tanks. The Cropping Systems Research Project at Maha Illuppallama Research Station has developed an integrated set of agronomic and water management practices for small tanks based on the preparation of land using the pre-*Maha* monsoon rains, early sowing, and the saving of the tank water for a *Yala* crop. The Tank Irrigation Modernisation Project has been promoting the same concept in five large tanks in the North Central and Northern Provinces. It has also brought agriculture and irrigation closer together by organising work teams comprising members of all field departments—Agriculture, Irrigation, Agrarian Services and Land Commissioner's Department—to promote and supervise early sowing and a tight water rotation system at the tract level.

X

It is too early to claim either that there is much firm progress in implementing water management or that progress will definitely come from outside the Irrigation Department.There is however a level of interest in doing something about water management which did not exist before, and this interest is coming from institutions which are either completely new or new to irrigation.

Although one could not begin to predict the future, we can suggest two changes which may come about if present trends continue. The first is that those existing irrigation schemes which have either recently begun to receive Mahaweli water (e.g. Minneriya, Kaudulla, Kantalai) or are scheduled to do so in future—will come under the control of one of the Mahaweli agencies. Cropping on, for example, the Kaudulla scheme is currently determined in large part by the volume and timing of water releases from Mahaweli via Minneriya tank. It seems unlikely that the two systems can be managed separately in an efficient way.

The second potential change, perhaps less likely in the shorter term, is that large-scale schemes outside the Mahaweli system will be brought under some kind of integrated management, similar perhaps to that practised on the Mahaweli areas. Such a form of management would give equal emphasis to agriculture and to water management, aiming ultimately at the dissolution of the distinction between these two disciplines. A prototype may be the joint 'planning teams' each comprising an Agricultural Instructor and a Technical Assistant (i.e. junior engineer), which are being established in the Agrarian Services Department to draw up water management procedures for minor tanks.

Whether or not such scenarios are realised, there will certainly be pressures in this general direction arising from the objective situation. The structure and character of Sri Lanka's irrigation organisation still largely reflect a situation in which the main problem and thrust of public activity lay in impounding rainfall to create an irrigation potential. The pressures now are (*a*) to manage water so that this potential may be realised; and (*b*) to undertake the physical rehabilitation of existing systems in order to make it physically easier to manage water. If existing irrigation organisations are unable to meet the challenge, then new ones may arise to take their place.

FOOTNOTES

1. The author was stimulated to put these ideas on paper by a conversation with Gil Levine. He hopes that in the process Gil's ideas have not been unduly plagiarised. Useful information was provided by C. M. Wijayaratne; supportive comments on an earlier draft by Mr. J. Alwis and Dr. C. Panabokke; and useful comments by Robert Wade and Doug Merry. They are however not responsible for the opinions expressed here. For the purposes of writing this paper it was felt unnecessary to footnote in detail points about irrigation and water management which the author and others have made elsewhere. For general background see Chambers 1975; Moore 1979 and 1980 and the papers presented to the seminar on Land Settlement Experiences in Sri Lanka held in Colombo in April 1981.
2. The classic account of this process remains Farmer 1957.
3. This concern was concretised in the designation of certain Dry Zone schemes as Special Projects in the 1960s.
4. Perhaps the first publicly-available written statement of this point is Chambers 1975.
5. Roberts 1972.
6. Perera 1975: 13–14.
7. Quoted in Perera 1975: 14.
8. One might note that the creation of a separate Irrigation Department immdiately preceded a shift of emphasis to larger scale new irrigation schemes (Farmer 1957: 106). The causal connection between these two events is unknown.
9. Some idea of this is conveyed by Perera 1975. See also the list of important events in the history of the Irrigation Department in pp. 86–96 of the same volume.
10. See Manamperi 1975: 36. The author is grateful to Mr. P. Ganewatte for this reference.
11. See for example the Report of the Gal Oya Project Evaluation Committee.
12. For example, it was found on part of the Mahakanadarawa scheme that the largest field channel was fifty-one times the length of the shortest. For distributary channels the figure was thirteen times. More importantly, the area served per foot of field channel was nearly six times as great in one case as in another. In the case of distributary channels it was almost thirty times as great (see Irrigation Department, Sri Lanka and Tropical Agriculture Research Centre, Japan, 1975: 44).
13. For example, in the study referred to above, relating to the 1973–74 *Maha* season, the farmers on one distributary channel received four times as much water per acre as those on another (ibid: 56).
14. The causes and extent of this inequality between top-enders and tail-enders are discussed in Moore *et al.*, forthcoming.
15. These points about seasonal water meetings are discussed and documented in case studies in Murray-Rust and Moore, forthcoming.
16. The quotation is from p. 88 of the brief history of the Irrigation Department quoted in footnote 9 above.
17. See, for example, on the Taiwan case, Bottrall 1977.
18. This presumes that improved water management would require a denser ratio of staff to irrigated area in line with other Asian countries. It is however possible that farmers' organisations could provide effective substitutes.
19. See Shanmugarajah and Atukorale 1976.
20. See De Silva 1981.
21. Source as in footnote 16, p. 95.

REFERENCES

BOTTRALL, A. (1977). Evaluation of irrigation associations in Taiwan. *Agricultural Administration* 4 (4).

CHAMBERS, Robert (1975). *Water management and paddy production in the dry Zone of Sri Lanka.* Colombo: ARTI, 71p. (Occasional Publication Series No. 8).

DE SILVA, N. G. R. (1981). Farmer participation in water management: the Minipe project in Sri Lanka. *Rural Development Participation Review* 3 (1), p. 16–19.

FARMER, B. H. (1957). *Pioneer peasant colonisation in Ceylon: a study in Asian agrarian problems.* London: Oxford University Press, 387p.

MANAMPERI, H. de S. (1975). "So said Manamperi". (In) *Irrigation: Souvenir to mark the 75th anniversary of the founding of the Irrigation Department,* 1900–1975. Colombo: Irrigation Department, p. 35–39.

MOORE, M.P. (1979). The management of irrigation schemes in Sri Lanka: a study in practical sociology. *Sri Lanka Journal of Social Science* 2(2), p. 89–111.

MOORE, M. P. (1980). *Approaches to improving water management in large scale irrigation schemes in Sri Lanka.* Colombo: ARTI, 47p.

MOORE, M. P. *et al.* (1981). Space and the generation of socio-economic inequality on Sri Lanka's irrigation schemes. (paper submitted for publication in Marga Quarterly Journal).

MURRAY-RUST, H. and MOORE, M. P. (1981). Managing Sri Lanka's irrigation schemes: the role of cultivation meetings. (mimeo).

PERERA, P. H. (1975). 75 years in the nations' service. (In) *Irrigation: Souvenir to mark the 75th anniversary of the founding of the Irrigation Department.* Colombo: Irrigation Department, p. 13–25.

ROBERTS, Michael (1972). Irrigation policy in British Ceylon during the nineteenth century. *South Asia No.* 2, p. 47–63.

SHANMUGARAJAH, K. and ATUKORALE, S. C. (1976). Water management at Rajangane scheme: lessons from cultivation, Yala 1976. *Jalavrudhi* 1 (2)

SRI LANKA, Irrigation Department and JAPAN, Tropical Agriculture Research Centre (1975). *Report on the joint investigation into water management in Sri Lanka at Mahakandarawa Scheme.*