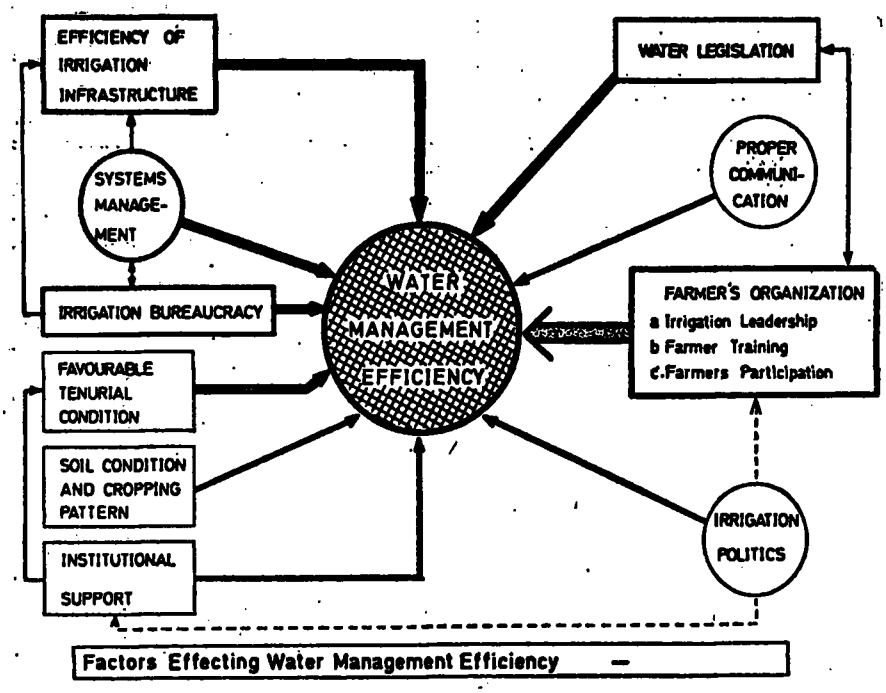

Factors Effecting Water Management Efficiency —

Efficient management of water depends on a host of factors. The intensity and strength of these factors would differ from one another under particular circumstances. For instance, the importance of social factors will be greater than those of the economic, agricultural, engineering and other technical aspects. Yet, it is difficult to isolate the importance of any of one of them as they each have a bearing on the other. It is thus evident that in canvassing for efficient water management the most effective system could arise from an integrated approach, (as illustrated here), where the contribution of all these aspects would be duly considered and co-ordinated.

WATER RESOURCES MANAGEMENT

A representative body at the national level is to be established to decide on a central allocation of water among different user agencies such as irrigation, hydropower, domestic supplies, fisheries, industries etc, in terms of the new Water Resources Act now under preparation. In addition, the Irrigation Ordinance is being amended primarily with a view to promoting the participatory development approach by involvement of farmers, at all levels in the management of the country's major irrigation schemes. These are among the important policy measures due to be brought into effect in the near future. They reflect the high priority now being accorded by the Government to the subject of water management; equally important, they indicate the new approaches to the subject of Water Resources Development in the country.

The proposed legislation is intended to provide an answer to some of the vital issues concerning the peasant farmer and the overall progress of the entire domestic agricultural sector, but the question to be asked is how much has legislation alone achieved so far and how much could it hope to achieve in the future.

The subject of water resources management has no doubt become a crucial issue in the country's economic development programme as well as a controversial issue in Sri Lanka's agriculture today. The importance of proper water management need hardly be over emphasised, but it is accepted that for an expansion in agricultural productivity it is sine qua non.

As in the case of most developing Asian, African and Latin American countries Sri Lanka's too is predominantly a rural agricultural society and it is widely accepted that the key to eliminating poverty in these areas is to accelerate the growth of agricultural incomes. The majority of the population of these countries (particularly their poor) live in the rural areas, earning incomes directly linked to the growth of agriculture. A change in the living standards of the less fortunate among these farmers calls for a change in agricultural development programmes as a whole, of which water supply is a fundamental requirement. Where the problem arises is that much of the development needed in agriculture requires investments that are not available, especially since it is necessary to design agricultural development programmes across the board, with very general objectives in view. The result is that the more privileged farmer reaps the most benefit; while generally the small farmer has less access to many of the important requirements (inputs and modern technology for his crops), and this includes water as well.

Sri Lanka's experience in the past, and even recently, has indicated how crucial an assured water supply has been for attainment of production targets. Today, it is being realised how critical water will be to the quest for self-sufficiency in food. The severe droughts that have affected every continent in recent years had brought the attention of almost every country to bear, as never before, on the problems of water conservation. Not only in Sri Lanka but in most parts of the world, the earliest civilizations emerged where soils were richest and water most available, and became extinct when irrigation fell into neglect, when water sheds had been deforested, and when soil erosion and silting destroyed the very basis of agriculture.

International experience has also shown that a basic constraint on the diffusion of new technology is that of irrigation. These problems, it has been observed, could be remedied in two ways:

(a) Expansion of irrigation facilities (the high cost of providing irrigation

INVESTMENT IN IRRIGATION

Irrigation and land development has been the major field of investment ever since the beginning of the 50's; and still continues to absorb a greater part in the agricultural sector. In the period 1958-64 the government's short term implementation programme listed the proposed and actual expenditure as follows:

INVESTMENT IN AGRICULTURE

	Actual Expenditure			Financial Provision	Plan Allocation	
	1958–59	1959–60	1960–61	1961–62	1962–63	1963–64
Irrigation and Land development for non-export agriculture ...	97.63	88.30	106.10	115.60	104.90	104.92
Total Agriculture ...	106.93	11.47	131.47	187.13	174.22	198.48

Source: Short Term Implementation Programme 1961-64

However, despite this considerable investment which was made mainly in the non-export agricultural sector output in the sector had not made any significant impact on the country's food problem for nearly two decades. It was only in recent years that the returns from this investment have begun to show tangible results.

Government expenditure on irrigation alone has continued to increase several fold both in terms of whole values and as a proportion of the total Government's expenditure, as revealed in the table below. From about Rs. 37 million at the beginning of the 1970's voted expenditure on irrigation had exceeded Rs. 500 million by 1980; while from a proportion of .69 percent of total government expenditure in 1973 it had reached 2.54 percent by 1980. (See Table below).

EXPENDITURE ON IRRIGATION

Year	Capital Expenditure (Rs. Million)	Total Expenditure (Rs. Million)	Total Govt. Expenditure (Rs. Million)	Expenditure on Irrigation as % of Total Govt. Expenditure
1973 ...	28.042	37.540	5459	.69
1974 ...	39.229	51.429	6386	.81
1975 ...	46.239	60,862	7783	.78
1976 ...	43.883	59.128	9314	.63
1977 ...	52.001	84.781	9760	.87
1978 ...	144.391	198.382	18853	1.05
1979 ...	313.182*	402.184*	17729*	2.27
1980 ...	431.554*	539.031*	21182*	2.54

(* Estimated)

Source: Estimates of the Revenue and Expenditure of the Government of the Republic of Sri Lanka.

being a basic constraint in this regard).

(b) More efficient management of existing sources of irrigation.

Crucial to both these factors is an efficient and meaningful management of water resources. Out past experience in the management of special projects set up for the selected irrigation and settlement schemes, has left much to be desired, because farmers were also made an input in the programme for increased production. The Minister of Lands and Land Development inaugurating a seminar recently on the "Mobilization of local resources for irrigation", emphasising this point, stated that "the past approaches in organizing management systems in the irrigation and settlement schemes were largely geared to the supply of increasing the yield, and the farmers were either cogs in the machine or else they were reduced to the level of mere passive onlookers". His concern in this instance was with developing a self-reliant participatory approach and he lamented that in land development we have been overawed more by the economic, engineering and agricultural aspects; and whatever management approach we have adopted was merely designed to achieve a higher rate of productivity in the yields without counting the farmer who should have been a key participant in the management organisation.

This draw back, which may now appear obvious, where the farmers' relationship with irrigation water was not viewed in its correct perspective, is indeed a crucial issue. But in considering the problem of water resources management there are several wider issues that need to be focussed on. Realising the vital need and limited availability of water in the dry zone, successive governments have expended substantial amounts of finances in attempting to develop and restore the water resources of this region. Irrigation and land development have been the major field of public sector investment in the post-independence era; and they still continue to absorb a greater part of investment in the agricultural sector. (See Box). Yet, despite this considerable investment the benefits have been marginal and have not made the desired impact on the country's food and land settlement problems. A critical examination of the returns to the investment made reveals that what has been most lacking was a realistic approach to development, with the human resources involved receiving low priority. A closer view of the problem further reveals that one of the major bottlenecks is poor water management at the farm level. Basic to the success of any irrigation project is the proper use of water upto and including the field level.

In the historical context, Sri Lanka had a strong tradition of tank irrigation. There was a channel network built on the principle of surface gravity flow to take water to the fields. Infact the whole life-style of the people of ancient Sri Lanka revolved around irrigation and agriculture. It has been mentioned by R. L. Brohier (1934) that "So careful were the inhabitants in husbanding the liquid resources on which their very existence depended, that even the surplus water from one tank which would spill when water was plentiful were not allowed to escape. The tanks were built in an orderly method at slightly varying elevations so that there often was a series of reservoirs to take the overflow from the one above it. The exits of water was regulated by means of sluices to the rice field."

Water Management in Ancient Times

The development of Sri Lanka's ancient civilization was bound up closely with its agriculture which was largely dependent on the prevalent irrigation systems. In more respects than one the cultivation of the staple food, paddy or rice, furnished a way of life to the people and the various prcatices and

rituals connected with it were intricately knit with their religion and social structure. Fundamental to the entire activity was irrigation which came to be extensively practised at that time. Finally it was the great irrigation tanks, served by an efficient channel and regulation system that took water where ever and when ever it was wanted, that stands out among the greatest memorials of the ancient Sinhala kings. There were several water management practices and group activities in the construction and operation of irrigation works in the so called "Hydraulic Civilization".

The evidence available, however, indicates in the mode of construction of these works a system or irrigation management directed by something akin to the 'unseen hand'. Apparently there was a finely regulated movement of water from tank to tank through canals and then from field to field. These conveyances were developed and owned by private individauds to whom belonged the right to income from such work. At each point in the movement of water, the person who owned that particular conveyance (canal or field) was entitled to dues from the owner immediately below him before he passed on the surplus water. There was a feeling that channels and other work were everybody's responsibility which fostered collaborative action.

At the beginning of the season the "Gamarala" and the cultivators gathered to decide on the extent of the land to be cultivated (permitted by the quantity of water available), the kind of paddy to be sown and the time schedule of the operations. The channels of each share (pangu) were the responsibility of the owner, but the common channels were maintained by communal effort or by a system of allocation. If a man refused to participate, then he was not allowed to lead water into his share until he had paid those who laboured for him (Pieris, 1956). The issue of water was regulated by the Gamarala. Each man whose turn it was to plough could have the entire water for one day and if the man at the end of the track (yaya) failed to plough on the day assigned to him he lost his priority right to water. Under this 'Siritha' discipline there was a fine division of powers and duties. Inspections were regular and those who neglected their duty were punished at once. When the water in the tank was inadequate for irrigation, the classical division (Bethma) system was resorted to. The land nearest to the tank was selected, the rest abbandoned. This area was then divided into equal shares in proportion to the original share (Pangu) rights.

In the ancient model the different activities and practices of irrigation were closely knit with the duties and obligations of the kings and people at that time. In that social set-up the possession of land was the point on which the entire administration revolved and so the concept of service-tenure (rajakariya); wherein land was held on the basis of certain services rendered, was deeply ingrained in the life and thought of the community as a whole. As long as this system of rajakariya prevailed this model worked well. Rajakariya was no one-sided contract, there was a reciprocal scheme of rights and duties which bound one and all in the community. But when major political and social upheavals occurred in the ancient kingdoms much of the irrigated agriculture also failed.

Numerous explanations have been put out for the break down of the ancient irrigation systems and practices, but among the most evident is the collapse of the social and administrative organisation and more particularly the collapse of the ancient rajakariya system. (See Box on 'Water Management in Ancient Sri Lanka').

When under the colonial administration there were attempts to re-establish irrigation discipline (through various ordinances) we observe that the attempts to introduce by legislation the ancient system into an entirely different economic and social set-up was apparently beset with difficulties. The state official who held land in consideration of rajakariya under the ancient system was replaced by the vel vidane, who was created by the British. But he did not derive his authority from the same source as that of his predecessor nor did he command the same respect. The vel vidane system was replaced by the cultivation committee system under the Paddy Land Acts of 1957 which was later changed to cultivation officer.

The present law governing water management in Sri Lanka is the Irrigation Ordinance No. 32 of 1946 as amended by Irrigation Amendment Act No. 48 of 1968.

In the Amending Act of 1968, the Commissioner of Agrarian Services was made responsible for the general supervision and control of Government Agents in the exercise and discharge of the power and duties conferred and imposed upon them by the Irrigation Ordinance.

The Amending Act also vested Cultivation Committees established under the Paddy Lands Act with the power to attend to all matters connected with the Irrigation and cultivation of land and the preservation of rights and the maintenance of irrigation works.

Although the Irrigation Act made provision for the farming of irrigation rules by Cultivation Committees, no legal effect was given to this provision, although the Cultivation Committees frame draft rules. Consequently, the only irrigation rules which are now prevalent are those rules framed under the earlier Irrigation Ordinance and kept in force under the present Irrigation Ordinance. For, instance, rules had been published in respect of Colombo District and Matale District and these rules are still in force.

Under section 96 of the Irrigation Ordinance as amended by Act No. 48 of 1968, every person who commits a breach of any rule or regulation made under this Ordinance is guilty of an offence.

The Cultivation Committees established under the earlier Paddy Lands Act are now to be replaced by Cultivation Officers who will function on a tract or yaya basis, and they will come under the supervision and control of the Agrarian Services Committees of the area. The draft Agrarian Services Law contains these provisions regarding the maintenance of minor irrigation works, following the recent decision by the Government that maintenance of minor irrigation works should be the responsibility of the Agrarian Services Department. In the absence of the cultivation committees, now it is presumed that newly-elected tract leaders (Vidanes) will perform this function under the supervision of the Agricultural Service Committees.

Provision is also contained in the draft Agrarian Services Bill for the Commissioner of Agrarian Services or anyone authorised by him on that behalf to hold cultivation meetings for the purpose of making rules relating to paddy cultivation or any other form of cultivation enforcement of any established customs, the proper timing of agricultural operations, the efficient management of Irrigation Water and any other collective res-

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ponsibilities enforced on owner cultivators and occupiers of the agricultural lands. These rules will be binding the owner cultivators and occupiers of agricultural land and any owner cultivator and occupier who contravenes any of the decisions made at these meetings will be guilty of an offence. Legal enforcement of cultivation practices and water usage, including penal provisions, are very much in evidence however in the new legislation.

While officials proclaim that they have at last realised the value of the "human relations" aspect of irrigation they ensure at the same

time that the farmer who is regarded as "the major culprit in the crime of wasting costly irrigation water" will be adequately penalised. The more important factor, namely the need to inculcate among the farmers a better understanding of the value of efficient water management can often be lost sight of in the anxiety to assert bureaucratic authority. Undoubtedly the success of an irrigation scheme will depend on the active participation and cooperation of the farmers. But, as we shall see, no farmer would willingly consent to a fruitful participation and commitment unless he is convinced that

he would become a beneficiary of any programme being adopted in his name.

What is Water Management

It is necessary at this stage to give some indication of what is involved in water management. There is no unique answer. It covers generally a number of separate functions of both bureaucrats and farmers. The term water management in a broad sense includes the integrated process of water shed management, water resource development and conservation, water application and control at the farm level, drainage and irrigation water release. As applied to irrigation projects it includes the management of water at two levels.

(a) Reservoir or water supply systems level;
(b) Farm level.

Thus, water management may be considered as the control and operation of the distribution, allocation, application and drainage of water from the sources of supply to the final drainage state. There is the strictly technical aspect of supply of on-farm water (see box on 'Procedures for planning on-farm water management).

The problems of water management at the farm level, however, are very complex and not merely confined to the technical aspects. They are interdependent and linked with technical, economic and social aspects. Hence, improvements in water management cannot be limited to engineering aspects alone (see Box on 'Current Issues in Water Management). It must be integrated to cover technical, economic and social aspects if optimum benefit is to be achieved. It is now agreed that effective water management at the field level should be the focal point in any irrigation project as the effectiveness of all investments depend ultimately on a proper water use.

There is now a growing appreciation of the enormous potential economic and social benefits in improving water management and an increasing interest in this subject in various sectors and many countries in the region. (See Box on 'Perspectives in Water Management').

Most Asian Developing countries are investing large amounts of funds as well as their physical resources on the development of irrigation schemes. In most cases, largely as a result of water management problems, the expected results have not been realisetd. For instance, further increases in yields can be obtained by making further use of scarce land through multiple cropping, which also generates a very high demand for labour and provides significant benefits for under employed small holders and landless who depend entirely on crop incomes. But one of the most important pre-requisites for such multiple cropping is water. It is for this reason that only about 10 to 15 percent of the agricultural land in India and Pakistan is used for multiple cropping, and about 40 percent in Bangladesh, compared with nearly 90 per cent in China where the irrigation sys-

tem is well developed. It has been established that many of the less productive irrigated areas require improved arrangements for sharing water; and farmers, including those with down stream holdings, need to be confident before they start planting that they will receive their entitlement of irrigation water. It is clear therefore, that there are a variety of problems involved and it is necessary to consider irrigation systems as a whole; which includes people and their social and economic relations as much as the physical structure and water.

The problems of these less developed Asian agricultural economies are not uncommon to Sri Lanka. There is much evidence to show that the relationship between people and irrigation water in this country has not been given due consideration in past land development programmes. Particularly in the planning and implementation stage efficient water resource management has usually not been regarded an important factor. For instance, Robert Chambers in his book on "Technology and change in rice growing areas of Tamil Nadu and Sri Lanka" (1977) emphasises this point when he states "Attention is usually fixed on hydrological, engineering, agricultural and economic aspects. Especially in official documents it is rare to find described, let alone analysed, the human side of the organisation and operation of irrigation systems — the management of those who manage the water, the procedures for irrigation control, the processes of allocation of water to groups or individuals, the distribution of water within groups. There may be almost as many instances of these commissions as there are reports on irrigation".

It has often been pointed out that inefficient water management procedures result in considerable waste of costly irrigation water, staggering of cultivation schedules and flooding of fields as a weed control measure. Ineffectiveness of rural institutions in charge of water issues is said to be a major cause that leads to excessive use of water. The result is that tank water cannot be very often reserved for a second crop. It has been estimated that more effective water control alone could add about four to ten million bushels to our paddy output, according to Robert Chambers. How to enforce stricter discipline and economy in use of water has been a controversial issue. Some have suggested going back to the old vel vidane system (irrigation headman) while some favour pricing irrigation water. This issue now becomes particularly important in the areas irrigated by the waters of the Mahaveli Ganga.

Perhaps the most striking single change in water management policies in recent years is the widespread acceptance of the need for the organisation of farmers into groups at the field channel level in order to facilitate channel maintenance and an equitable distribution of water between individual farmers. This concept has been commonly termed 'farmer participation' in water management and is in its early stages of trial in Sri Lanka and several other countries of this region as we shall see.

Water User's Association

Hitherto, as we observed, the main emphasis has been on the supply of irrigation water rather than its effective management. Among the many adverse effects of this approach has been the waste

of irrigated water (expected to mainly supplement rain water supplies) which is made the only source of supply when no other is available. Further, irrigation water is used constantly and the utilizing of these channel irrigated lands exclusively for paddy cultivation has also been found to be wasteful. The obvious result has been an inefficient land and water use (highland plots being underutilized or neglected) which has been one of the major causes for the failure to rapidly improve overall food production in the country. In these circumstances the setting up and strengthening of appropriate Water User's Organisation has become an important prerequisite. This idea has received fresh impetus recently, especially in connection with the Mahaveli Development Scheme.

The success of an irrigation scheme depends on the active participation and co-operation of farmers. An irrigation "bureaucracy" alone cannot satisfactorily operate and maintain an agricultural and land settlement scheme. Experience has shown that rules and requirements laid down from above have never been well received by farmers. It is accepted in all quarters today that it is necessary to organize collective thinking about water use and that if the authority came from within the village community itself the chances of success were greater. The participatory approach to water management is now being experimented with locally (See Box on 'Participatory Management: A Proposal for Gal Oya') and has been tried out in other Asian countries such as the Philippines where some of the initial problems still remain unsolved.

It is expected that farmer participation in the decision-making process for the management of the irrigation schemes, should be made an essential requisite; and the subject of farmer participation can only be effectively developed through farmer organisation. It is only through initiating the farmers into the management organisation that the scheme can profitably gain, but no farmer would consent to a fruitful participation and a commitment, until he is convinced that he is becoming a beneficiary of any re-structured management approach.

At present, cultivation practices are based on individual enterprise. This on-farm delivery of irrigation water is inefficient. Farm-

ers, do not pay adequate attention to water course cleaning and maintenance. The Mahaveli Authorities too are aware of the need for the organisation of farmers at grass-root level. The authorities were deeply concerned about the social aspects of a programme so large and complex as that in the Mahaveli Project and in 1979 the services of a UNICEF Consultant, Shoaib Khan were obtained to report on the social aspects of development programmes in the "H" area of the Mahaveli Project. In April 1980 the report of the first review on programmes in this area was submitted by Khan and one of his significant findings was that "the farmers problems which remain unresolved mainly fall into the category of water management and remedial action in this sphere is immediately needed". Although considerable work has been done and most of the problems have been identified. "resources should be made available to tackle the problems on an emergent basis" he emphasised.

The authorities realized that it is not possible to solve the water management problems without getting farmers involved on a group basis. There is a need that farmers be taught the importance of group action and proper water use. This could also help to develop and strengthen social relationships and to regain some of the social cohesion that was found to have collapsed particularly among the resettled colonists. (See Box on 'Community Development Programmes in the Mahaveli Area').

The Mahaveli Development Board realising this evolved a new design layout in an attemt to eliminate some of the worst features of the old irrigation design, notably long field channels. A common feature in the existing irrigation schemes had been the long distributory and field channels which were designed to command as large an area as possible. One result was that severe problems were created in getting water to the tail-ends.

The major departure in the layout and distribution of the irri-

gation delivery system in the Mahaveli is the design of rotational issues in the turnout units of 30 to 50 acres each. This improved design has now become standard for all new schemes, though in the meantime, the old design has to be lived with.

A system commonly known as

Turnout Groups for action on proper water use has therefore been introduced by the Mahaveli Development Board. There are differing views on the effectiveness on the Turnout Groups system and on the extent to which the farmer is at fault in wastage of water. See Extracts from UNICEF Study and comments on "Water Management Myths" by Kapila Wimaladharma. This system has been in operation now for one year at the field channel level. While this system has many positive features a People's Bank Study (Tilakasiri 1979) on this aspect, in the Mahaveli H Region, shows that there are many characteristics as well. They may be identified as :

(a) Poor selection procedures, which have led to selection of farmers with inadequate leadership qualities and a proper social awareness as Turnout leaders.

(b) Lack of co-ordination between the Turn-out leaders and the bureaucrats. The level of trust and good will between these two categories has been found to be low.

(c) The Turnout Group has tended to buttress the control and organization of power in the village in the hands of a few rich or better-off peasants.

A study in the Thoranegama hamlet of the Mahaveli Development Area has shown that 78 percent of the farmers were not in favour of the Turnout Groups due to incapability of work or misuse of their responsibility. They are not satisfied with Turnout leaders and therefore they cannot get together with them to carry out work within the turnout area. As a result it appears difficult to organize farmers towards achieving the nesessary collective action. The question arises therefore how farmers may best organize themselves; and how the pitfalls of the earlier colonization schemes may be avoided in the Mahaveli Scheme. It is apparent that steps should be taken to strengthen farmer groups here. In order to achieve, this, it was found in the course of experiments carried out here, that what was most necessary was:

(a) A strong and well-disciplined leadership for enlisting the cooperation of all farmers in the turnout area. Nc individual should dominate the others or be permitted to assert a superior social status (class or caste wise).

(b) The water management officers must have a sound understanding of the farmers, and they should tactfully but firmly take remedial action when unexpected problems arise.

(c) Farmers should be motivated to organize to improve their water courses and to solve their own water problems.

Organizing farmers in this way could improve water use and maintenance as well as provide immediate and tangible benefits for both the farmers and the nation.

The People's Bank study has found that the inadequacy of water supply has already developed a degree of disunity among the farmers, vis-a-vis a developing income gap. Various conflicts were observed in different parts of the Thoranegama area. Complaints and quarrels were noticed instead of co-operation in the use of irrigation water. This situation appears to exist in both the Inter-turnout areas and Intra-turnout areas.

It is apparent that the inadequacy of water has been at the bottom of many a problem such as a lack of co-operation, variations in the levels of production and landlessness connected with increasing income gaps. Irrigation water is critical for the settlers and the authorities carved out the irrigable areas into units of farm land of 30-35 acres commanded by one measurable source of water called the Turnout Gate. Contrary to expectations, however, the 12-20 farmers in the Turnout farm area have not on their own managed an equitable distribution of water amongst themselves; and also not maintained the irrigation works and field canals within the Turnout area. The lack of skills to co-operate and manage on their own in the 'H' area has resulted "in an inequitable distribution of water area amongst the farmers (in some cases farmers never got water for more than one year), and in damage to irrigation works (a recent survey showed 70 percent damage to irrigation works within the Turnout area) because of non-maintenance".

Economics of Irrigation

The economics of irrigation are determined not only by costs, but also from potential benefits. Even if irrigation construction is carried out at the lowest possible costs, the project could be uneconomical if water is not put to the best use. Hence the success of an irrigation project depends to a very great extent on the motivation of farmers to obtain maximum production and the availability of means at hand to do so. Several incentive schemes such as a guaranteed price for paddy, subsidised seed materials, fertilizer and agro-chemicals have been introduced in Sri Lanka, but for some reason or other most of these incentives do not seem to be working effectively. On the other hand it has been found in a number of surveys that in general most of the irrigation schemes are not well utilized due to the lack of

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proper socio-economic incentives.

In Sri Lanka irrigation water has always been free of charge, which means that it is fully subsidised. Although this has been justified on the grounds that it increases farmers profits by cutting down cost, it has been taken by the farmers as a social welfare measure and political favour and has therefore not had the desired incentive effect. This has even resulted in an increased consumption of water with little increased benefits. As an illustration we could see the difference in an area like Vavuniya where the well-irrigation sys-

tem, is used. Here they consider irrigation water as an input like any other. Recent experience in some lift irrigation areas where water is pumped from wells for the cultivation of subsidiary food crops has shown that farmers are willing to pay for water as long as it can assure them an extra, more secure or more lucrative crop.

Farmers sometimes have not realized the value of the irrigation water, and they consider water as a "Gift of the Gods", since it is not to be charged for. It is necessary therefore, that farmers consider irrigation water as an economic input similar to fertilizer, labour, weedicides etc. rather than regard it as a 'free' item such as air or sunshine. It has to be appreciated that this water has been provided by the authorities at considerable cost; though the existing water rates could be regarded as nominal. This is all the more reason why the primary object should be to achieve the most effective water use.

Water rates and systems should vary countrywise according to direct water rates (charges are based on cropping patterns and amount of water diverted) and indirect water rates (charges are based on land values). The farmers organizations referred to earlier are very important in this context because the success of a water rate system depends largely on the farmer's attitudes and understanding of the rationale behind the system.

However, before considering a tax on irrigation water use it must be realised that there is a great responsibility involved in supplying adequate water based on a reliable system. If not, it would not merely be difficult to collect water charges, the chances are that the whole system may fail. For instance in our Mahaveli Study Area though they planned to collect Rs. 75/- per year. per plot, only a small percentage of the farmers had paid their tax for last Yala 1980. They refused to pay till they got adequate water into their fields. The necessity to maintain a reliable balance on both sides becomes quite apparent in such a situation.

Even though a farmer's organization is established, it will also be necessary to introduce certain penalties for farmers to prevent mismanagement of irrigation water. inappropriate land preparations. channels maintenance and cleaning, etc. But a tactful use of such penalties and an understanding by farmers on the need for them is absolutely essential. Such penalties were practised in the traditional village system too and they worked under the system at that time. This is evident in the following expression from an ancient inscription.

"The fines to be levied are: for the offence of contravening an order, an aka; for an offence connected with ploughing; a kalanda; for ploughing late, five kalandas" (Stone inscription by an old king of 924-935 A.D.).

Conclusion

Authorities involved in water management at various levels have made persistent efforts to organise some aspects of water use over the last 50 year period. Yet these attempts were basically confined to the engineering precast models, which did not encourage the use of indigenous water management techniques evolved and practised by Sri Lankans, during their long history of existence. However, it is not too late, to study these indigenous and conventional water management practices which are still practised in most of the original settlements and minor irrigation schemes in the Dry Zone. Studies on water management in this country have been mostly biased towards the technical aspects of the problem. Very little investigation has been undertaken on the behavioural aspects pertaining to the problem. It is necessary therefore to make closer studies of the socio-economic aspects, including existing water management practices. (See excerpts from paper on 'Irrigation research possibilities in Sri Lanka').

Most irrigation schemes in Sri Lanka are characterised by low levels of production, low water use, efficiency and low farm income. It can be concluded that one of the basic problems is the lack of effective water management at the field level. Considerable changes are required in this respect as discussed earlier.

It is essential that all disciplines (such as engineering, agriculture, social sciences), coordinate their efforts in solving the numerous problems involved in the planning, development and operation of irrigation projects. Most important, however, is the fact that systematic water management at the farm level should be given top priority in irrigation projects as it is this which decides ultimate water use and crop production efficiency.