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An approach to the Study of Irrigation: Case of Kanyakumari District

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I Introduction

1. The objective of this paper is to develop an integrated approach for analysing the physical, techno-economic, organisational and institutional aspects of irrigation systems. The need for such an approach arises from our inadequate understanding of the forces which bring about changes in the irrigation system and the manner in which agrarian economic units respond to these changes.

2. However, a study of this kind is not very easy because of the complexities involved in disentangling the interrelationship among the various components of an irrigation system. In order to surmount this difficulty, we need to formulate certain analytical devices which make clear distinctions among the components of the system and then proceed to illustrate the same with concrete case studies. This is exactly what we propose to do here. We have taken Kanyakumari District for the case study. This district was chosen mainly because scarcity of water and the consequent crop failures are frequent in the tail-end areas here in recent years.

3. While judging the usefulness of our approach, the folllowing limitations of the study should be kept in mind. Firstly, it is basically a qualitative exercise, ie. no precise quantitative analysis is attempted anywhere in the study. The limited quantitative analysis carried out is meant to provide only some idea of the order of magnitudes of the concerned variable. We have not taken up systematic quantitative

exercises mainly because the sheer work involved is enormous. Secondly, we have not gone in depth into the evolution of the system and the different aspects of the political economy associated with it. Further, some systematic study of the agrarian structure in terms of land ownership and tenancy on the one hand and the caste structure on the other across the command area would have been useful in understanding the influence of these factors on the irrigation system. This is a definite and important limitation of our study. Hence our paper, in its present form should be treated as an initial approach to the study of irrigation.

4. The remaining part of this paper is arranged in the following order. Section II attempts at formulating certain analytical devices. Section III provides a descriptive account of the irrigation system in Kanyakumari district. It is through this section that we move from the abstract developments in section II to the specific case study. In section IV, we have gone into the question of water scarcity in the district in recent years and the causes behind it. Section V takes up the very important question of farmers' response to water scarcity. The last section briefly outlines the issues that are thrown up in the earlier sections which call for further research.

II. A framework for Analysing Irrigation Systems

1. An important task in analysing irrigation systems is to clearly define the inter relation among the component factors of the irrigation system, viewed in its totality. This section makes a preliminary attempt in that direction. We begin with the basics of agriculture and place the role of irrigation in agriculture in its proper perspective. Then we move on to the irrigation system and its component factors.

Agriculture

2. We begin with the basics of agriculture. The starting point of all agriculture is life, and the sustenance of life units depends on its interaction with its environment. It is through this interaction that life draws its sustenance from its environment. As regards any given set of life units this environment may broadly be conceived as having two constituents, the physical and the biological. By physical environment, we mean, the soil, water, temperature................regimes and by biological, we mean, the other units of life as the case may be. Agriculture is basically man's conditioning of the environment inorder to facilitate the growth of life units. This may take various forms: conditioning the soil, conditioning the availability of plant nutrients, etc. These are with regard to the physical environment. Similar conditioning may also be thought of with regard to the biological environment With this let us go on to the question of irrigation.

Irrigation

3. One important conditioning of the environment is with regard to water. This is what goes by the name of irrigation . Narrowly put irrigation is the providing of assured and controlled supply of water to plants.[1/] There are three important aspects to it: (1) Sources and techniques of irrigation: (2) institutions, and (3) organisations. Let us take them up one by one.

1/ Needless to add that this definition also incorporates the question of drainage.

Sources and techniques of irrigati

4. The sources of irrigation may be many such as precipitation, riverflows, springs, underground water etc. As to the techniques these aregoverned by two importent factors. First and foremost is the source of water in relation to the location of fields and the second is the crop water requirement. The interaction of these two factors govern, though on a purely technical level (for the actual selection will ofcourse, be governed by definite institutions) the type of irrigation that can be adopted.

5. Broadly the techniques of irrigation may be brought under two heads: gravity flow types and lifting types. What are common to these are the social activities of construction - a once for all activity, regular repair, maintenance, replacement [2/] and regulation of the flow of water in to the fields. What distinguishes one type from another is tho source of motive power. Gravity flow as the name suggests, has its source of power as the force of gravity whereas any form of lifting calls for the regular supply of other motive power. Here the crucial factor governing the 'nature of the lift' is the depth of the source of water [3/]

6. Here it needs to be noted that in a given environment the crops that can be grown are clearly limited. Further, given the agricultural techniques or the methods of cultivation, the crop water requirements - their timing and quantum - are determined. These

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2/ The boundary between repair and replacement is rather hazy and one often does not know where repair ends and replacement begins.

3/ It may be interesting to note that the evolution of the steam engine, which ushered in the Industrial Revolution had one of its roots in developments in the area of lifting.

together with the source and type of irrigation immediately throw up interesting quantitative relationships among the factors involved. For instance when rainfall is the source, there exists definite quantitative relationship between the area of catchment, loss, crop water requirements, and the area that can be brought under cultivation.

7. Again starting with a definite environment and crop configuration, irrigation means bringing about definite changes in the environment. These changes in turn may make the environment conducive to the growth of plants which otherwise would not have grown in the environment or they may make the environment unsuitable for the plants which were earlier being grown there. These as well as other reasons may call for crop shifts with the introduction of irrigation. Crop-shifts can also take place in a subsequent stage of irrigation due to further changes in it. The change involved here is from an assured supply of controlled moisture to the non-availability of it - water scarcity in other words and the consequent shifts in crops. The striking difference between this crop shift and the earlier one is that this has taken place in response to water scarcity in an irrigated area.

8. What has been attempted so far is to 'place' irrigation on a proper frame. The end points here are the environment, crop configuration and agricultural techniques on the one side and the sources of water on the other. The whole gamut of irrigation is set within these end points.

Institutional aspects

9. Irrigation in as much as it is man's conditioning of the environment of plant life consists of <u>social activities</u>. The first and once for all activity is the construction of the irrigation work.

The tasks around construction are the conception of the irrigation work, ie. decisions regarding its location, capacity, design etc., and its execution ie, the construction itself. Somebody takes these decisions and takes up the construction. To illustrate this the body may be one of the wings of the state or a group of village communities or may be an individual. This body may or may not have any role once the construction is over.

10. The 'regular activities' of the irrigation system pertain to repair, maintenance and replacement of the system, ie. keeping the irrigation work in an 'ongoing' state and the allocation of water to the fields. All these activities, in as much as they are social activities, are governed by definite social rules.4/ Let us elaborate on these institutions of irrigation.

11. We begin with a three way rule of association:

Water ⟷ Men
↖↘ ↙↗
Fields

These rules, merely associate water with men, water with fields and fields with men. The rules that associate fields with men are those regarding <u>private property</u> on land and as such fall outside the concerns of irrigation, though they are one of the bases of it. With this, the rules that associate water with fields are <u>either direct or run through men</u>. Let us take them one by one.

4/ Rules sanctioned by the society (--for the present it is enough to remember that society is a mere collectivity) governing definite social activities and associations are what we call <u>institutions</u>.

12. We begin with rules which associate water with men (which means the institution of private property in water). The rules that associate water directly with men, ie. men have 'right' over water has to be in terms of 'time', ie. so many hours of flow at such a level. If the level is fixed, then it is basically a rule that provides so many hours of flow. This 'time' may have a direct relation with the fields these 'men' own or may not. For the latter the best illustration is the Sonjo of TanganYika (Gray).

13. As regarding the rule which relates water directly to the fields these may take two forms: (a) time based allocation and (b) order based allocation.

(a) Time-based allocation: In this case time units are calculated on the basis of availability of water, area to be irrigated and crops grown etc; say flow of X days is required to irrigate the entire land. Within this X each field is given its due 'time' say between such and such hours on such and such days of the week.

(b) Order-based allocation: In this case fields are ordered starting from any one of them, either the field immediately below the sluice or the 'middle field' or the 'end' field. Water is allocated to the fields as per these 'orders' after fulfilling the needs of the field higher in the order.

14. It may be noted that the ownership of land, ie. the rule that associates men with fields may in itself be such that for every field at the higher order there exists a corresponding field at the lower order so that equity is worked out as related to water (see Leach).

15. It may, further be noted that a set of rules may be valid as of a given state encompassing availability of waterquantum and time structure, cropping pattern, cropping intensity, techniques of cultivation on the one hand and the agrarian structure, hierarchy of social groups, such as castes on the other. Thus it is perfectly conceivable to have one set of rules during normal availability of water and another set of rules during scarce periods. These are the broad institutional aspects pertaining to irrigation.

Organisational aspects

16. As developed the institutional issues immediately lead us to two further sets of problems. In as much as, these are only rules governing the regular activities, the actual carrying out of these activities requires men assigned to perform specific activities or parts there of[5/] Thus there needs to exist a set of persons to carry out the activities and a 'body' to do the assignments. At the same-time the above mentioned rules need to be framed which again calls for a 'body' to do the framing of rules and providing necessary alternatives as and when occasions arise. Thus starting with social activities, we gradually moved on to the set of rules which govern these activities, the 'bodies' which frame these rules and assign specific activities to men, and a set of men carrying out these activities.

17. Continuing along the 'bodies' responsible for framing the rules, these bodies are defined with respect to the irrigation work and part thereof. If it is a small tank or a small diversion weir a

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5/ The set of men with definite tasks assigned may be called the organisation of irrigation.

single community is ~~involved and~~ whatever goes on is within this community. The moment the irrigation work caters to more than a single community a larger organisation becomes necessary.

This can take two forms:

(a) a body built from 'below' - the concerned communities jointly frame the rules and implement them, no outside body enters the scene.

(b) a body from 'above' - in this case a body larger than the collectivity of communities concerned is involved in framing and implementing the rules. The best illustration is the state and its irrigation wing.

18. These forms, in a sense, get linked with the issue raised earlier, viz. the body responsible for conceiving and executing the irrigation work. When the irrigation work itself is conceived and executed by the concerned communities, the occasion for any outside body to make an entry does not arise. When the construction is taken up by a body outside the communities concerned, it may result in that body having a definite say in the maintenance of the system, allocation of water and related issues. This may take such a form that the different communities may simply have to buy water from the larger body. Such a structure can lead to lack of sense of involvement of the communities because of alienation of water - the concrete expression of which is the water rate as well as its allocation by the larger body.

Summary

19. In sum, we began with the basic aspects of agriculture and then moved on to irrigation. The source and type of irrigation together with the cropping pattern and agricultural techniques, it was shown, throws up interesting quantitative relations. After touching upon those basic technical details we moved on to the construction of the irrigation work and the regular activities of maintenance and allocation of water. In the context of the regular activities we touched upon the rules which govern these activities and called them the institutions of irrigation. Then we passed on to the set of men assigned to carry out these activities and called this arrangement the organisation of irrigation. We ended up by touching upon the body responsible for conceiving and executing the irrigation work, and the body responsible for framing the rules as well as assigning specific tasks to men. This, in a nutshell, defines the totality of irrigation in its technical, institutional and organisational aspects.

20. In the following chapters we begin by describing the totality of irrigation as conceived above in the specific case of Kanyakumari. Then we go on to take up definite questions pertaining to this system and its working.

III The Irrigation System in Kanyakumari District

1. The objective of this section is to provide a brief sketch of the irrigation network in Kanyakumari district, its construction, the organisation responsible for its working and the institutions of irrigation. An analysis of this kind will hopefully provide us the background for taking up definite issues relating to the deterioration in the efficiency of the system in the recent past and the responses of the farmers to this changing situation.

The Physical Environment and Paddy Cultivation

2. The District of Kanyakumari: The district of Kanyakumari is situated at the southern tip of the Indian sub-continent lying between 77°.05' and 77°.36' of the eastern longitude and 8°.03' and 8°.35' of the northern latitude. The district is bounded by Tirunelveli district in the north and north-east, by Kerala in the north-west and has sea in the west and south.

3. The district was formed by transferring four Taluks from Travancore-Cochin state on the eve of the reorganisation of the states. They were Agasteswaram, Thovala, Kalkulam and Vilavancode. The district has been named after the sacred Kanyakumari.

4. Kanyakumari, like the neighbouring districts of Kerala, can be divided in to three natural divisions. The north-east portion of the district comprising of the eastern parts of the Vilavancode and Kalkulam taluks and also the north-eastern portion of the Thovala taluk constitute the highlands which form the southern end of the western ghats. In the extreme west and south-west of the district is

the sea-coast which is flat forming the lowlands. In between the high-lands and the lowlands, there exists a strip of undulating valley with a few streams rushing through it towards the sea. But as we move in a south-easterly direction from Kerala, the above distinctions get blurred . Here the country very much resembles the neighbouring Tirunelveli. On the whole, the region slopes gently in southern as well as western directions.

5. <u>Rainfall in Kanyakumari</u>: Most of the high ranges in Kanyakumari receive an annual rainfall of between 65 inches and 100 inches on an average and are mainly forest and plantation areas. The rainfall in the mid and low lands varies between 65 inches and 35 inches on the average. As we move towards the tip of the sub-continent rainfall becomes scanty. Coming to the distribution of rainfall over the months of the year it needs to be noted that Kanyakumari district receives rainfall during both the monsoons, viz. south-west and north-east. Thus the district receives rainfall for about ten months of the year. When the rainfall is plotted on a graph sheet it shows two peaks, one in June and another in October-November. The year can, then, be devided into two halves of five months each, with the April-September half receiving about 45 percent of the total annual rainfall and the September-January half receiving another 50 percent of the total rainfall. The three months of January, February and March together receive about 5 percent of the total rainfall. It is important to note that the number of rainy days in August-September is quite low.

6. In sum, what one observes is a graduated ascent till June and then a sharp fall with only a few rainy days in August-September, another sharp ascent is seen in October-November and a sharp fall

afterwards. Consequently the two halves of five months each are demarcated rather sharply.

7. <u>Cropping pattern</u>: The temperature regimes, soil, and rainfall pattern are generally favourable to the cultivation of paddy, coconut, plantations, tobacco and pulses in the low and mid land regions of the district, Rubber is an important plantation crop grown in the highland areas of the district. For the district as a whole, the cropping pattern is dominated by paddy which occupies roughly about 45 percent of the gross cropped area.

<u>Cropping pattern in Kanyakumari district</u>

Crops grown	Area (000 ha)	As % of gross cropped area
Paddy	53.03	45.82
Tapioca	11.34	9.80
Coconut	15.50	13.39
Rubber	11.40	9.85
Other crops	24.45	21.14
Gross cropped area	115.72	100.00

Source: Government of Tamil Nadu, <u>Season and Crop Report (1975-76)</u>, Department of Statistics, Madras 1976.

8. As is well-known the water requirements of different crops vary a great deal. The water supply required for a paddy crop over the season of about five months ranges between three acre-feet and six acre-feet (Grist) and the minimal requirements in most of the regions is considered to be about four acre foot. In Kanyakumari district most of the mid and low lands receive an annual rainfall of less than 65 inches. This, it needs to be noted, is received in about ten months and the rainfall in any period of five months is not more than 45

inches which clearly points to the impossibility of paddy cultivation in vast tracts of Kanyakumari district dependent solely on rainfall. Thus irrigation in one form or another is a necessity for raising a single crop of paddy.

Sources and Types of Irrigation

9. The question of irrigation immediately takes us to the sources of water in the district. The primary source, of course, is precipitation of rainfall and secondary sources are the riverflows.[6]

10. Rivers of the district: Before going into the question of irrigation it is necessary to give a brief description of the rivers of Kanyakumari district. The major river of the district is Kodayar or Tambraparni. It has two major tributaries, Chittar I and Chittar II. From the upper reaches of Kodayar to about the point where Paraliyar meets it, it forms the boundary between Kalkulam and Vilavancode Taluk. From there on Tambraparni flows through the heart of Vilavancode. It joins the Arabian sea at Tengapattanam. There are two small rivers in the district; Valliyar and Pazhayar. Valliyar originates at the the Velimalai and joins the sea at Kadiyapattanam. Pazhayar originates at a place near Shoralacode and flows in an easterly direction before turning south and joining the sea.

11. Tank Irrigation - some technical relations: In a stretch of about 50 kms. from the tip of the subcontinent to the border of Kerala one finds only about three rivers. With so few rivers flowing

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[6] Since the area irrigated through lift irrigation accounts for only 5 per cent of the gross irrigated area, ground water sources are excluded from the study.

through the district vast tracts of plain lands remain far removed from the rivers. For such lands the only source of water is rainfall. Thus it becomes necessary in these lands to have tanks which are used for collecting the rainwater and storing it for later use. As touched upon in the earlier section there exist definite quantitative relations between the quantum of rainfall, the tank surface area and the area that can be brought under cultivation. Let us make an attempt at formulating these relations.

Let Y be the surface area of the tank.
Let X be the area of the ayacut.
Assume the annual rainfall to be R_f and the rainfall in the crop season to be R_{fs}

Then, $Y.R_fL = X(C_w - R_{fs})$ ....(1)

Where $(1-L)$ is the loss factor accounting for evaporation and other losses from the tank.

C_w is the crop-water requirement.

(1) Can be written as follows:

$$\frac{Y}{X} = \frac{C_w - R_{fs}}{R_f \cdot L} \qquad \text{....................(2)}$$

This is the general relation where the only source of water for the tank is rainfall. This can be refined by bringing in other regeneration flows, or L as a function of X ....etc. But for the present we confine ourselves to the most general relation.

12. Now let us take a concrete case, say paddy. Let us take C_w = 48 acre inches. R_f = 50 inches.

R_{fs} = 25 inches $L = 0.6$

Substituting these values in (2) above

$$\frac{X}{Y} = \frac{48 - 25}{50 \times 0.6} = 0.77$$

This relation thus points to the fact that in a region where the rainfall is about 50 inches, to grow paddy in100 acres it is necessary to have a tank with a chatchment of about 80 acres. If the lands are plain and if tanks are interspersed with fields catchment can be taken as the surface area of the tank.

13. It is important to grasp the significance of the relation (2) above, In this context we may point out the rule of thumb followed by the Irrigation Department of Ceylon. We quote E.R. Leach.

> The whole of Pul Eliya cultivation area taken together, the old Fields plus the freehold acre land plus the badu land, amounted in 1954 to about 135 acres. This is approximately the same area as that covered by the main tank when full. This coincidence is not an accident. The Irrigation Department which issues regulations on these matters, seems to have a rule of thumb that a village tank is capable of irrigating an area of land equivalent to itself. (P 52, Pul Eliya).

It may be noted that the Dry Zone of Ceylon, is comparable to parts of this district.

14. The above relation has very important implications to the calculus of increasing production. Increase in production, given the technique of production, can only be brought about by bringing more area under cultivation. This may be achieved either by growing a second crop in the already existing land or by bringing more area under the single crop. In both the cases more water is required which in turn calls for an increase in the catchment area. Within a given unit consisting of a tank and its ayacut let us see whether bringing some area under a second crop is possible. As per the relation worked out above for every acre put under a second crop about 0.8 acre will be lost as tank surface area. Consequently the desired increase in production may not come about. Thus, this calls for other ways of enlarging the catchment. So much regarding tanks for the present.

15. Diversion-Weirs: The above discussion pertains to the plain areas far removed from the rivers. Near the rivers the river water may be utilised for irrigation. Since in very many places the river-beds are not at a much lower level than the fields irrigation is done mainly with the help of diversion weirs or anicuts. As the name suggests the diversion weirs divert the assured flow in the river into the fields. The use of diversion weirs rests on the rainfall differentials across regions and the regeneration and drainage flows over time. In other words, diversion weirs work on the basis of spatial differentials in rainfall and temporal differentials in regeneration flows.

16. Another aspect of the diversion weirs is that they do not store water, they merely divert the assured flows. Then the extent of the ayacut is governed by the relation between two sets of flows: rainfall and regeneration flows in the river across the season and crop-water requirements less rainfall during the corresponding season. The rainfall and regeneration flows would be falling off towards the end of the crop season owing to the specific rainfall pattern in the district whereas the water requirements of the paddy crop show two peaks, one around transplantation and another around young panicle formation followed by booting. The minima of the ratio between the two sets of flows would determine the extent of the ayacut. Consequently much of the surplus flow in the river over the crop season goes to waste. One way of utilising the surplus flow in the canals, and not over the anicut is by linking these canals with tanks, which, then, can be used as basic storage reservoirs. Even with this linkage the peak discharges over the anicut goes to waste. Such peak discharges can only be utilised by storage dams at the head reaches of rivers. With this the gravity-flow net work consisting of tanks, diversion weirs and storage dams is complete.

Irrigation

17. Description of the System: Now let us go on to attempt a description of the system as it exists at present and then attempt its evolution. There are four storage dams in the district: Pechiparai across the river Kodayar, Perinchani across the river Paraliyar and Chittar I and II across the major tributories of Kodayar. The water of the pechiparai is taken along the Left Bank Canal to the Puthen dam across the Paraliyar. Puthen dam is the main head works of the entire system where the waters of Pechiparai and Perinchani meet. At the head-works these waters are flown into the Pandiam Kal and Padmanabhapuram Puthenar. The Pandian Kal after running for about one and a half miles forks into two at Chellanthurithy, one on the left side called the Thovala channel and another on the right side called the Regulatorkal. The Padmanabhapuram Puthenar irrigates vast tracts of land in Kalkulam taluq. Thovalai channel extends up to Tirunelveli by the name of Radhapuram channel on the way irrigating vast area in Agasteeswaram. The Regulator Kal after running for about a mile bifurcates into two at Sheralacode, one on the right is called the Anandanar Channel and another on the left is the Pazhayar. It is important to note that Pazhayar carries the the entire drainage of the valley. (See III.4 above) This is made possible by the specific physical features of the district. The main irrigation channel under the Pazhayar is the Nanjil nadu Puthenar taking off at Chattuputhoor Anicut. Besides this there are ten other anicuts across the course of the Pazhayar before it drains into the sea.

18. The waters of Chittar I and II are flown into the Left Bank Canal of the Kodayar at the third mile and drawn off at the sixth

...e by the Pattanam Kal channel. This channel irrigates vast areas ...ing between the Tambraparni and Padmanabhapuram channel in Kalkulam. 7/

19. Besides the above reservoirs, there is an anicut across the ...raliyar called the Aruvikarai Anicut irrigating about 600 acres of ...ddy lands. There is a similar anicut across the Kodayar at Thirupara... ...u irrigating about 900 acres. Further, the Kanyakumari branch channel ...f the Neyyar Irrigation Project (situated in Kerala) irrigates vast ...reas in Vilavancode taluq. We do not go into the details of these as ...hey are not linked to the system discussed above.

20. In sum, the system consists of tanks, diversion weirs, storage dams and numerous interlinking channels. Viewed from the end of ayacut we find three types of sources, viz. rainfed tanks, channel-fed tanks and channel distributaries. The rainfed tanks depend solely on rainfall whereas in the channel-fed tanks rainfall is supplemented by channel supply and lastly channel distributories are fully fed from the dams and anicut. Owing to these peculiarities the problems of the three types of ayacut are different. But before going into these questions let us briefly go over the evolution of the system.

21. Evolution of the system: We have no definite information regarding the construction of the numerous tanks existing in the district. As regards the anicut and dams one does get some details.

22. The Pandian dam and the Pandian Kal was supposed to have been built by the Pandian rulers about thousand years back. It is

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7/ For details concerning the dams and channels see the appendix.

mentioned that in the twelfth century A.D., in the battle, between the King of the Kupaks and Rajasimha, the Pandian King, at the anicut across the river Parali, the anicut was demolished by the forces of the King of Kupaks. *After that one finds* mention being made of the construction of anicuts, channels and tanks from about the beginning of the 16th century.

23. We give below extracts from the *Travancore Land Revenue Manual Vol. IV.* merely to provide an idea about the developments in the sphere of irrigation.

(1) In 910 ME[8/] the Puthen dam and the Padmanabhapuram Puthenar channel were constructed with the object of extending to the taluks of Kalkulam and Eraniel the benefits of irrigation which had been provided for Nanijinad[9/] by the Pandian Dam and channel constructed about 8 centuries previously. These works were restored in 1060 M.E................(p.88)

(2) The constitution of the village and taluk organisation, as it obtained at this period, as well as the functions developing on the Proverticars are clearly explained in a Variola dated 29th Thy 921 M.E. The Proverticar was required to attend to the irrigation works in his village, i.e., excavation of tanks, conversion of dry lands into wet, and maintenance of channels and anicuts............(p. 99)

(3) By circular No. 1015 and notification dated 24th meenom 1037 M.E. the Tahsildars of Thovala, Agasteeswaram, Eraniel and Kalkulam were directed to devote special attention to the preservation of irrigation channels and tanks and the prohibition of the practice of the ryots cutting up the bunds for taking water to the fields. The ryots were warned that they would be severely dealt with for such unlawful acts........(p. 3666).

(4) By the proceedings of Government dated 25th September 1882 (11th Kanni 1057 M.E) a separate department of Tanks and Irrigation was created for South Travancore and placed under a special officer styled 'Assistant Engineer'........(p. 450)

8/ Appr. 1735 A.D.
9/ The area consisting of Thovala and Agasteeswaram Taluk.

24. It is clear from the above excerpts that the state was responsible for the construction of these irrigation works. Consequently, over the past centuries a large network of storage dams, diversion weirs, channel and tanks has evolved in this district. The state in as much as it was responsible for the construction of these works also took over the regular activities like maintenance and allocation of water. The ryots had absolutely no role in the maintenance or allocation of water. Thus, there exists an organisation under the state with irrigation as its sole responsibility. Now let us go into the structure of this organisation.

The Irrigation Organisation

25. The Public Works Department is directly in charge of irrigation in this district as elsewhere. The District Collector is the overall head of the administrative wing. The head of the PWD set up is the Executive Engineer. Under him there are different subdivisions and each subdivision has many section offices. The head of the subdivision is the Assistant Executive Engineer and that of the section office is the Junior Engineer. Under the Junior Engineer there are Supervisors, Laskers and Watchmen in that order. It is this set up which is responsible for the overall maintenance of the physical system and allocation of water upto the channel distributories. Beyond the distributories, ie. at the micro level, the maintenance and allocation of water to the fields is done by the Kandottan. He is not part of the PWD set up. He is appointed by the concerned village communities. We may represent this schematically as follows:

PWD set up (bracket: Executive Engineer to Watchman) — Farmers (bracket: District Collector to Kandottan)

District Collector
↓
Executive Engineer
↓
Assistant Executive Engineer
↓
Junior Engineer
↓
Supervisor
↓
Lasker
↓
Watchman
↓
Kandottan

Further, some local organisations also play a role in the maintenance of the system. Tanks with an ayacut of less than 100 acres are maintained by the block offices.

26. The major subdivisions of the PWD in Kanyakumari Dt. are the following:-

AE (Cherupaloor)	- Peechiparai & Perinchani dams, and Puthon Dam Head Works - (No Irrigation)
AE (Kuzhithurai)	- Dams Chittar I & II Chittar - Pattanamkal scheme and Kanyakumari Br. Chl. of Nevvar.
Executive Enginee (Nagarcoil)	
AE (Thuckalay)	- Padmanabhapuram Chl. Thiruvithamcode Chl. (Only irrigation)
AE (Nagercoil)	- Thovala Chl. Anandanar Chl. Pazhayar & N.P. Channel - only irrigation

The Working of the System

27. For the Kodayar system water will normally be released on June 1. and closed on February 28. This is meant for raising two paddy crops which is quite common in this part of the country. The exact working is governed by definite rules the details of which may be found in the appendix.

28. Once water is released in the main canal, water is supposed to be released into the distributories from the tail end onwards. This ensures water at all distributories. After that each person at different levels of the organisation becomes a point for the transmission of messages in two directions. Kandottans are at an extreme end of this chain and EE is at the other end. Kandottan goes around his fields and interacts with the watchman. If more water is flowing through the block than required Kandottan informs the watchman to reduce supplies, if the water that is flowing is less Kandottan asks for more. The watchman informs the laskar and supervisor in that order. If within the section the allocation can be adjusted the process ends there. If more water is required for the section as a whole the section officer approaches the AE and thus upto the EE. At each level the persons concerned take into account the crop water requirements together with the rainfall pattern in the region concerned, verify the messages passed on to them by the subordinates and then take a decision. The crucial factor regulating the release of water at the headworks and consequently at different channel heads and blocks is, of course, the level of water at the storage dams and the inflow into the dams. As may be seen these interactions, and consequent decisions are purely 'within the organiza-

tion' phenomena with the Kandottan as the definite end point. As already mentioned this organization carries out tasks within a definite 'environment' consisting of the farmers on the one side and the District Collector on the other. Now let us go into the interaction of the environment with the PWD.

29. Obviously the purpose of the interaction of the environment is for obtaining definite supplies at definite channels and distributories and the men involved are the farmers of those regions. Now the farmers may interact with any point of the PWD hierarchy. At what level they interact depends on the urgency of water requirement, the quantum and the negative response at a lower-level. This can go up to the District Collector who in turn discusses the situation with the EE and a decision is taken. The forms of interaction may be many. It may be individuals or groups directly approaching the different points or may be through definite association of farmers or through political parties. Thus in a nutshell, the allocation of water is conditioned upon rainfall and the consequent availability of water on the one hand and farmers' demands on the other.

30. Along with the allocation of water the department has to attend to the maintenance of the physical system, viz. channel beds, bunds, sluices, shutters and headworks. If the work required is immediate, then supply is withheld and the work attended to. These pertain to works which call for immediate attention. All other maintenance works are supposed to be done during February 28 to June 1 when the dams remain closed. This, in brief, gives the working of the system.

31. Now, let us attempt at giving some idea regarding the rules followed in allocating water. As already mentioned at the micro level it is carried out by the Kandottan to the details of which we shall come later. In normal times water is allowed to flow on all channels and distributories at required levels whereas in scarcity times 'turn' system is adopted and it is worked out on the basis of ayacut and stage of crop growth. The tanks linked to the system are supposed to be fed by the surplus waters of the channels. In the Pattanakkal scheme turn system is being adopted even in normal times because of the peculiar conditions prevailing over there. Firstly, the ayacut is still very 'young' and the soil is very porous being close to the sea-coast. Secondly, the duty (acreage that can be cultivated per cusec drawn in channel) considered while designing the scheme is much higher than what is attainable under such soil conditions.

The Kandottan

32. Having attempted a sketch of the organization, working, and the 'environment' of the PWD let us go into the micro level, ie. the world surrounding the Kandottan. Kandottan is the person responsible for the maintenance of the distributory and for allocation of water to the fields. It may be distributory taking off from a tank or a channel. In the case of a rainfed tank it is a self contained unit and he does not come into contact with the personnel of the PWD whereas in the case of a channel-fed tank or channel distributory he needs to interact with the watchman of the PWD who is directly above him. The ayacut area coming under the jurisdiction of a Kandottan varies between 50 acres and 150 acres.

33. _Duties of the Kandottan:_ He is supposed to go around the fields twice a day in the morning and evening and report to the watchman regarding the levels. He has to release water to the fields according to the needs of the fields and is supposed to close all leakages and breaches of the different distributories. He has to watch the field during the day/night and prevent any cattle from damaging the crops.

34. During normal times he releases water to the fields as and when the need arises. During 'scarcity' conditions 'field order' allocation is practised. In all the areas which we visited the field just below the sluice was ranked one and the lower fields got the later ranks. Water was allocated from rank one onwards. If 'turn' system is being followed upstream 'turn' system is followed here as well. The first field got its turn only after completing a full cycle of all the fields. Interestingly, in one place of the East Minor of Anandanar, turn system was not followed within eventhough turn system was followed upstreams ie. at every 'turn' of the distributory concerned water was allocated to rank one onwards and not to the field where water had stopped at the earlier 'turn'.

35. _Appointment and Remuneration of the Kandottan:_ There does not seem to be any uniform rule being followed in the appointment of the Kandottan. In most of the places we found some 'powerful' cultivator or the other being responsible for bringing that particular Kandottan. Only in one instance did we find a formal appointment being done by the village community (details of which are attached ,See Appendix C) Further, in many places Kandottan was simply absent. Kandottans were found,

i. mostly in tail-end areas;

ii. in areas where physical participation was low or where predominantly absentee cultivation' was practised.

iii. ownership of land belonged to different castes.

36. Though there was no uniformity as to the appointment of the Kandottan we found remarkable uniformity as to the mode of remuneration. We emphasize the fact that it is only the mode and not the actual quantum; actual quantum does vary in relation to the area of the ayacut under his jurisdiction. The mode of payment was always in grain and it varied between 4 and 6 marakkals of paddy per acre per crop (marakkal is a volume measure. One marakkal is equal to three pakkas and one pakka is approximately 1.50 kilograms). In most of the places it is 4 marakkals of paddy. The payment in grain is important it being a subsistence crop. This is clearly borne out by the fact that the Kandottan disappeared the moment, the crop grown changed from paddy to some other crop like bananas or tapioca. Further, whenever the harvest failed no payment was made to the Kandottan. That completes our account of the totality of irrigation in its technical organisational and institutional details.

IV. Causes of water scarcity in recent Years

1. During the recent past, water scarcity has been quite frequent in the tail-end areas of the Kodayar project. The files in the Executive Engineers office and the District Collectors office pertaining to water scarcity have gained weight after each crop season. Further numerous associations have sprung up in these areas with water as their central concern. At times the problem had become so serious

that conflicts within and between communities took such forms as to cause danger to life and property. This is the context in which the causes of water scarcity are analysed.

2. The dimensions of water scarcity may be gauged by a survey of the command areas. Most of the tail-end areas lost both the crops in 1980-81 and some areas had partial failures during the two preceding crop seasons. We could see this through the response of the farmers. In many areas farmers had shifted over to the cultivation of tapioca and plantains after successive crop failures and were shifting back to paddy after seeing plentiful water in the first season of 1981-82. Thus the problem has come to be in one region or the other since 1975.

3. Causes of Water Scarcity: The causes of water scarcity may be brought under two heads:

(i) A fall in the availability of water per unit area in the total system.

(ii) Miss-allocation of a given total supply, ie., overdrawl by some leading to scarcity elsewhere. Let us take the latter cause first. As is always the case, the locational advantage is with the ryots at the upper reaches of the channels. It is often said that they waste water and also draw water to store in their tanks to be used for the subsequent crops. Further, we believe, the ryots who own land at the upper reaches of the channels all belong to a certain community who are opposed to the ryots belonging to a different community who own land at the lower reaches. This enmity between two communities is not confined to the sharing of water but also permeates all walks of life. This is an issue which we have not investigated so far and it calls for an in-depth study. With this, we pass on to the fall in the availability of water.

Fall in the Availability of Water to Fields

4 The whole question of fall in the availability of water can be put in terms of the key equation of 3.11, viz.

$$Y.R_f.L = X(2C_w - R_f) \qquad \ldots\ldots\ldots\ldots(1)$$

This equation is derived through the following steps. Y is the total precipitation of which a certain quantum of water is lost owing to evaporation, percolation etc. Assuming that this loss is proportional to total precipitation, we get an equation for total availability of water as, $Y.R_f - Y.R_f$ (loss factor) which was put as $Y.R_f.L$ in section 3. Consequently 1 – Loss factor = L or (1 – L) is the loss factor. Note $0 \leq (1-L) \leq 1$. On the other hand, if C_w is the Crop water requirement X the area of the ayacut and R_{fs}, the rainfall in the corresponding season, then $X(C_w - R_{fs})$ is the crop water requirement. Since we are concerned with two crops, C_w may be replaced by $2C_w$ and R_{fs} by R_f. Consequently, the equation becomes,

$$Y.R_f.L = X(2C_w - R_f) \qquad \ldots\ldots\ldots\ldots\ldots\ldots(2)$$

In this equation, the right hand side represents the total crop-water requirement and the left hand side represents the availability of water. Water scarcity occurs when,

$$X(2C_w - R_f) > Y.R_f.L \text{ or equivalently}$$

$$X > Y \cdot \left(\frac{R_f}{2C_w - R_f}\right).L$$

5. The above equation brings out the causes of water scarcity clearly. As C_w and Y may be assumed as given constants, water scarcity can occur owing to the following causes:

(1) an increase in X given R_f and L. ie., a consistent incre se in ayacut area given the quantum of rainfall and the loss factor.

(2) a fall in R_f given X and L, ie., a fall in rainfall which would more than push down $(R_f/2\ C_w - R_f)$, given the ayacut area and loss factor.

(3) a fall in L or rise in (1 - L), given X and R_f, ie. an increase in the loss factor given the quantum of rainfall and the ayacut area.

These causes singly or in combination can lead to serious problems of water scarcity. Let us analyse this for the recent period.

6. <u>The Area Factor</u>: The gross irrigated area was around 55 thousand acres in the mid fifties. It showed a marginal decline in the second half of the fifties and an increasing trend in the sixties. The increasing trend which continued up to 1972 showed a sharp decline thereafter. The three year moving averages of the gross irrigated area already bring out these trends (see table 4.1). Therefore expansion of irrigated area could not be a cause of scarcity of irrigation water in recent years.

Table 4.1

Area under Irrigation in Kanyakumari District

Year	Canals	Net Irrigated Area by Source (acres) Tank	Total	Gross Irrigated area	3 Year Moving Average of G.I.A
1	2	3	4	5	6
1956-57	12680	9876	21387	35864	
1957-58	15935	17316	33831	52912	54800.00
1958-59	15288	19585	25566	55624	50469.33
1959-60	10982	16418	27412	42872	50301.66
1960-61	24387	3403	28047	52409	50182.00
1961-62	23799	5048	28847	55265	55186.66
1962-63	23744	13106	29912	57892	57523.33
1963-64	23700	5304	29004	59413	58560.66
1964-65	18003	11261	29845	58377	58487.66
1965-66	16966	11262	28891	57673	58312.00
1966-67	18891	11210	31310	58886	58851.33
1967-68	19263	11277	31470	59995	59574.33
1968-69	18999	11203	31004	59842	60140.66
1969-70	20376	11505	31449	60585	60624.33
1970-71	-	-	31897	61476	62706.66
1971-72	20567	12315	34055	66059	65045.66
1972-73	20626	12333	34375	57602	64134.00
1973-74	19230	12018	31534	58741	60508.23
1974-75	17190	11178	28615	55182	56449.00
1975-76	16301	11701	28690	55424	55602.00
1976-77	17120	13200	30820	56200	57617.33
1977-78	19220	13100	33320	61228	56584.66
1978-79	16010	11200	28210	52326	56305.66
1979-80	16100	12214	28486	55363	

Source: Various Issues of Season and Crop Reports.

7. Rainfall Pattern: There are serious difficulties in arriving at any overall rainfall figure for the district as a whole based on observations for fifteen or twenty locations. For our limited purpose of arriving at some conclusion as regarding the quantum of rainfall and its seasonal variation in recent years compared to the immediate past, we have adopted the following method:

8. Comparable monthly rainfall is available for about fifteen locations in the district. We have taken a period of fifteen years ending 1980 and calculated the seasonal rainfall for these locations. Keeping the crop season in mind, the first season is taken to be the period from April to August and the second season from September to December. Median values of the fifteen year seasonal rainfall is arrived at and the deviations are noted. From this we obtain seven positive and seven negative values. Then we counted the negative signs in the last six years for both the seasons.[10/]

10/ We have done this in the following manner. Let the seasonal rainfall for the first season for location A for fifteen years be the following, 10, 15, 12, 25, 4, 8, 10, 12, 11, 13, 7, 9, 10, 12, 13. The median value is 11. Seven values fall below it and seven above. The deviations are the following:- -1, +4, +1, +14, -7, -3, -1, +1, 0, +7, -4, -2, -1, +1, +2. Let us take the last six observations. We find that three of them are positive and three are negative.

Table 4.2

Sl. No.	Location	Number of negative signs		Number of +ve, -ve combination			
		I season	II season	++	+-	--	-+
1	Peechipparai	1	1	4	1	0	1
2	Kulasekaram	4	4	1	1	3	1
3	Puthen Dam	3	2	2	1	1	2
4	Seethapal	5	4	0	1	3	2
5	Thadikarankonam	4	4	0	1	3	1
6	Sharalacode	4	2	1	0	2	3
7	Nagarcoil	4	2	0	1	1	4
8	Mylady	5	2	0	1	1	4
9	Kottaram	5	2	0	1	1	4
10	Adayamadai	4	2	2	0	2	2
11	Mulagumoodu	4	1	2	0	1	3
12	Eraniel	4	5	0	2	3	1
13	Balamore	3	1	2	0	2	3
14	Aramboly	5	3	0	1	2	3
15	Thiruparappu	3	1	1	1	0	4

9. We give the observations for the different locations in table 4.2. It may be seen that the last six years had a preponderance of first season rainfall deficiencies. Further, if we take the catchment areas, in about half of them there is a preponderance of rainfall falling in both the seasons. Interestingly Pechipara seems to be an exception. Thus, from the limited analysis of rainfall data, it seems that the recent period was rainfall deficient. We cannot go any further to give exact quantitative details regarding the deficiency. But the preponderance of rainfall deficiencies in the first season must have contributed to the fall in the availability of water in the system.

Human Component of the Loss Factor

10. Having touched upon ayacut area and quantum of rainfall, what is left out is the loss factor. It is determined by two sets of conditions: (i) natural (ii) Human. The natural set pertains to percolation, seepage, evaporation and the evapo-transpiration losses which depend on soil type, temperature regines and vegetative growth. The human set of conditions pertains to two: (i) lack of maintenance of the irrigation work and (ii) laxity in regulating water at different points of the system. We have no reason to believe that the natural component of loss factor has changed substantially during the short time span under consideration. This leaves the human component of loss factor which can be classified under two heads namely lack of maintenance and laxity in regulating water.

11. Lack of maintenance. The repair and maintenance work of the irrigation project have not been regular and adequate in recent years. A casual visitor can see the effects of it, the farmers complain about it and the PWD personnel accept it.

12. Apart from a general impression, we have been able to document in some depth, the maintenance work undertaken for two important canals in the district namely Thovala and NP channels in the seventies. These channels together have an ayacut area of 21000 acres which is roughly 1/3 of the ayacut area under the Kodayar Project. During the recent past, the condition of these channels were geting deteriorated due to lack of adequate repair and maintenance. Consequently, there was severe scarcity of irrigation water

in the ayacut areas. The reason for this water scarcity was a subject of debate in the Tamil Nadu Legislative Assembly in July 1981. In a report sent in response to the questions raised in the Assembly, the Executive Engineer of the district presented a good description of the state of maintenance of these canals and his explanations for the past failures in executing maintenance work. The Executive Engineers' description of the state of maintenance of these canals is reproduced in table 4.3.

It is evident from table 4.3 that the maintenance work of the Thovala channel was practically nill during the second half of the seventies. Even during the first half, the works undertaken were on a fragmented basis. The story of the NP channel also runs almost along the same lines. It is more interesting to note that the Executive Engineers' report also indicated that the conditions of other channels in the district were not different from that of Thovala and NP channels.

14. An important reason cited by the Executive Engineer for the lack of maintenance of the Irrigation Works in the district was the shortening of the closure period of the project. But changes in the closure period of the Project in recent years were necessitated by the deficiency of the first season rainfall leading to the postponment of the sowing and planting operations of the first crop by a few weeks than what was being done earlier under conditions of normal rainfall. Such changes in the crop calender naturally affect the time period of thé second crop and resulted in the reduction in the

Table 4.3

State of Maintenance of the Thovala and N.P. Channels (1973-80)

Year	Expenditure incured for maintenance (in Rs.) Thovala Channel	N.P. Channel	Remarks
1973-74	5697	7056	Due to short closure periods silt was removed in certain places only.
1974-75	3745	1513	Do.
1975-76	18444	3272	Owing to drought conditions greater maintenance work was done in major reaches under drought relief programme.
1976-77	Nil	24646	Do.
1977-78	Nil	Nil	Silt removal was not done separately due to the execution of flood damage works.
1978-79	1500	2500	Water was allowed in the channels upto March 1979 and hence no silt removal was done in short reaches.
1979-80	Nil	Nil	No work was done due to allowing water in the channels upto 23-3-80.

Source: L.A.Q. File, P.W.D. Office, Nagarcoil.

closure period of the irrigation project. The manner in which it has affected the annual maintenance work in best ill. trated in the following extract from the Executive Engineer's report:

"The irrigation season in the district commences from the middle of May and extends upto 3rd week of March (ie., from the month of Chittirai and Panguni). Water is allowed in the channels from 1st of June to 30th of September for first crop and again by 1st November and it is continued upto March at times, even though the last date of supply is up to 28th February, only during these short gap periods as explained above the positions of silt deposits have to be located and levels have to be taken for the entire channel length to prepare the estimates for the removal of silts. At the same time action has to be taken to prepare estimates for repairs of the damages to the masonary works, leak closing works and repairs to banks and shutters etc., whenever it is found necessary. Further the estimates prepered have to be scrutinised and sanctioned and the works have to be executed after setting agencies for the works and these works have to be got completed before allowing water in the channels for the next season. Further the regular maintenance works have to be completed before 10 days of allowance of water. As per instructions, removal of silt is done where silt is over depth of 9". Hence the depth of silt has to be verified with that of level sheets and has to be removed only at those places where the silt is more than 9". All these processes should have to be done within a short gap and this is found practically not possible as water has to be allowed for some of the standing crops spread over in the ayacut under the channels in the distant reaches under each block. Thus the regular maintenance work, such as removal of silt, weeds and jungle growth which affect the flow of channels could not be done effectively, causing lapse of funds, cancellation of estimates sanctioned, agreements concluded for the works, since they pertain and indent for the works of the particular year."

15. While we agree, to a certain extent, with the reasons cited by the Executive Engineer for the shortfalls in the maintenance work of the Project, our view is that it is possible to complete the work within the available time span which in any case is not less than one and half months. But a necessary condition required for this is that the IWD should activate its machinery for the speedy execution of the maintenance work. This in turn calls for a certain degree of concern among the officials in the organisation (especially those who are in the leadership) about the consequences which

the farmers have to bear in the context of water scarcity. It is a well known fact that such 'committed' officials are rarely found among the irrigation organisations anywhere in India. Corruption is rampant in irrigation Projects[11/] and the speed with which irrigation works are undertaken and completed depends to a great extent on the amount of money the officials realize by way of "feed backs". Generally expenditure on the maintenance work of canals involves only smaller amounts compared to the construction work for irrigation Projects and thus the "feedback" the officials can realise is also lower. Therefore, the incentive for the Irrigation bureaucracy to execute timely and regular maintenance work will be lower. Further if they have to work in an environment in which the public is keeping an eye on their activities, they will be totally reluctant to undertake any maintenance work. Whether a situation of this kind is responsible for the reluctance shown by the irrigation organisation in Kanyakumari district is something very difficult to establish. But some of the available evidence points to the possibility of the consequences of past corruption as a major cause for the lack of maintenance of the irrigation project in recent years.

16. An important reason frequently cited by knowledgeable people on this subject was the activities of the vigilance department. It seems they were very active in going into the activities of PWD (Irrigation) in the early seventies and they booked many Engineers who were responsible for the execution of the Thovala channel and

11/ For a detailed discussion of the extent and spread of corruption in irrigation projects see R.Wade (1982).

the Chittar Pattanamkal scheme on charges of malpractices and irregularities.[12/] The Technical staff who have been booked were known for their efficient and hard work. Consequent upon these charges and proceedings most of the technical staff are not willing to take up any major construction work. Further many technical personnel are unwilling to work in the district and have been obtaining transfers to places outside. This has hit the maintenance work of the system seriously.

17. Regulation of water: Having touched upon the maintenance of the channels, let us take up the question of regulation of water. As mentioned at the very outset, the three important criteria for regulation are the crop water requirements, rainfall and availability of water at the head works. For an efficient regulation of water based on these criteria, it is necessary to ensure: (a) proper interaction among the irrigation personnel at different locations of the system and (b) timely repair of the regulation devices like shutters and locks.

18. Inorder to ensure proper interaction among the personnel at different points of the system it is essential to have an efficient communication net-work among these points. Such communication links were established in the Kodayar system from its very beginning. Roads were built along the canal bunds for the movement of vehicles so as to facilitate efficient supervision of the activities of regulating water along different points. Also, PWD was owningand operat-

12/ The case is still pending before the Madras High Court. Therefore we are unable to provide a detailed account of the story behind it.

ing a Telephone network, connecting the crucial points in the system for the easy and timely passing of messages.

19. Unfortunately encroachment of channel and tank bunds has emerged as a very serious problem over the years.13/ On most of the channel bunds the roads have become so narrow that the vehicles can hardly move along them. Elsewhere, one finds huts being built and cultivation being carried out on bunds. The PWD does not have the necessary powers to evict them. Even when some steps are initiated political pressure come in the way. This causes serious problems for the easy and timely inspection of the activities for water regulation.

29. The Telephone network operated by the PWD were functioning efficiently until it was taken over by the Post and Telegraph Department in the mid seventies. The P and T Department were not attending to the repair work of the system in time. Besides, the equipment

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13/ The seriousness of the problem can be understood from the following letter sent by the Assistant Executive Engineer Nagarcoil to the Executive Engineer, Kanyakumari.

"Action is being taken by issuing notices to the encroachers on tank beds and channel banks etc. But for the removal of encroachers, police help is necessary to avert any possible clash and troubles. For instance nearly 150 huts have been erected in the Thadicarankonam Inspection Bunglow Campus. The encroachers have damaged the rainguage and the usufructus trees, thus causing loss to government and the losee has also prayed for the damages. Any help from the police requisitioned by addressing to the superintendent of Police and the district Collector have not been compiled with till date and also at the Government hospital in Cape. As our staff are distributed to thevarious reaches of the channels, the section office cannot individually take any action in the evictions and encroachments furnished by the Tahsildar, Agasteeswaram, they could not be physically verified and further actions taken for deletion and eviction as the list of encroachers each and every place is at high and at large. Unless a separate squad is formed for this purpose no tangible action can be taken in this district." For the details see, Agriculturists grievance file, Executive Engineer's Office, Nagarcoil.

which were established three decades back is now practically difficult to operate. No attempt is made to replace them so far. The outcome of this neglect of the communication lines has become so serious that it is difficult even for the Executive Engineer's Office to interact with their section offices. Consequent upon this breakdown of communication links a lot of water goes waste. Take an example. A certain watchman is on duty on the i^{th} block and he observes that it is raining in his area of work, consequently he does not need any water in his block. This information needs to be passed on to the section office and from there to other points. He fails to contact the section office owing to failure of the Telephones. He can pass the message only by going to the section office which he cannot do (When it rains) as he has to keep a close watch on the canal network and take necessary actions, depending on the intensity of rainfall. With such problems in many points one could very well imagine the water that goes waste.

21. Lack of regular repairs and replacement of broken locks has also affected the regulation of water in recent years. In many areas the sluices do not seem to have proper shutters and even where it exists the locks seem to be missing. Most of the shutters in the district are of the pad-Lock type[14] and they are tampered with by the ryots and during scarcity times shutters are left uncared for by the PWD.

[14] There are two types of shutters which are commonly used here: the screw - girdle type (S.G.) and the pad-lock (P.L) type. The S.Gs are about four times as expensive as the P.Ls and are difficult to operate. The P.Ls are easy to operate and need a lock to prevent unauthorised regulation. Consequently P.Ls can be tempered with in scarcity times by ryots whereas S.Gs cannot. On the other hand during floods P.Ls can be broken to save the canal even if the watchmen are not around whereas B.G's cannot be. The present Executive Engineer informed us that during clearence of 82, many of the sluices are being provided with screw girdle shutter arrangement.

In sluices where there are no shutters, regulation of water is simply not possible. We have come across, during the course of our investigation, areas where water flows unregulated throughout. In such circumstances flow of water can be stopped only by using mud and straw for closing the sluice which is not done very often.

23. In the foregoing analysis we have touched upon all the basic causes of the scarcity of water. Though, rainfall has been deficient in the recent past, we find that the human component of the loss factor has became quite significant over the years. This is a very important aspect of all irrigation works and has long-term effects on the working of the system.

V. Water Scarcity: Responses of the Farmers

1. In section 4 we had briefly gone over the cause of water Scarcity in the tail-end areas. In this section we propose to deal with the responses of the farmers to water scarcity and some case studies of particular ayacuts.

Water Scarcity: Responses

2. Introduction: Responses, here, are definite changes in various directions to meet the situation arising out of water scarcity. Naturally the question will arise as to the direction of changes. These changes are broadly in two directions: relating to the sources of water and the irrigation works on the one hand and the

crop end on the other.[15/] These may broadly be listed as follows:

Relating to the source of water and irrigation works.

(i) definite changes may be brought about in the rules of allocation of water given the reduced availability.

(ii) changes may also be brought about in the irrigation work like repair, extension........ etc. so as to increase the availability of water.

(iii) other irrigation works may be taken up so as to exploit other sources of water.

Crop end changes may be attempted in the cropping intensity, cropping pattern and timing. These may be taken up singly or in various combinations. We study these responses through definite categories which may broadly be brought under two heads:

(i) Individual Vs. Collective

(ii) Short-run Vs. Long-run.

3. These categories are called for by two sets of factors. The first set of factors has at its 'base' the social aspect of agriculture, viz. the institution of Private Property in land and the rules of inclusion/exclusion associated with it. The second set of factors has at its base the specificities of agricultural production such as agricultural seasons and duration of crops; the definite rainfall pattern and the consequent sources and quantum of water.

4. <u>Individual Vs. Collective Responses</u>: With private property in land (the rules of association of men with lands of section 2) men are conferred definite rights as regarding their unit of land.

15/ Conceptually along with the above mentioned two sets, changes may be thought of in the form of restrictions in the area to be cultivated. Such a course of action crucially depends on the rainfall pattern and is not simply relevent in the case of Kanyakumari.

Consequently the individual could carry out certain activities within his unit of land. When this individual becomes part of a collectivity on the basis of certain rights over irrigation water, he is called upon to fulfill certain obligations regarding the timing of the agricultural operations, cropping pattern, cropping intensity ....etc. as specified by the collectivity. One of the immediate implications of scarcity, i.e. non-availability of adequate water is that the binding force which makes for the collectivity is weakened. Consequently, the individual, if he chooses, can act individually in exploiting other sources of water within his unit of land or to go in for a different cropping pattern which might not have been permitted otherwise. This is the sense in which the distinction between individual and collective response is drawn.

5. Short-run Vs. Long-run Responses: The distinction between short run and long-run is called for on a different basis than the above. As touched upon in section 2, the rules of allocation are worked out on the basis of the irrigation work, availability of water at different time points on the one hand and the cropping pattern on the other. The notion of a shorttun is called for when scope for change in one direction or the other as elaborated in 2 above are just not available. Take for example the case of a standing crop. Change in the direction of cropping pattern or timing is ruled out and the availability of water, in the irrigation work is given. In this situation change can only be brought about in its allocation. Thus for us short-run simply means within a crop season. Consequently long-run points to something longer than a single crop season. Having attempted the distinctions we go on to take up the responses.

6. Individual Responses: We begin with the individual responses for the simple season that this does not depend on the specificity of the irrigation work from which the collectivity draws water. In the short-run he could at best repair already existing walls in his field and go in for lifting water from this wall or come to some understanding with his neighbour if he has a well. In the long-run he could go for a shift in the crop thereby growing a less water requiring crop or digging wells and invest on irrigation of one type or the other. The shift could be of a temporary nature, i.e.shifting over to a less water requiring crop for one or two seasons and then reverting to the original crop as the situation improves or it could be of a permanent nature. This exhausts the individual responses.

7. In the tail-end areas, which we visited in the course of our survey, we found both temporary and permanent crop shifts. Temporary shifts were mainly from paddy to tapioca and plantains. In Nov.- Dec. 1981 after seeing abundant water in the May - Sept. season they were slowly shifting back to paddy. All the permanent shifts were to coconut. This may not entirely be because of the scarcity of water. There are two other forces operating here, viz. 'absentee' cultivation and relative economies. Coconut is probably more remunerative as compared to paddy in certain regions and it calls for much less of intensive application of labour or close attention.

8. During the field visits we found a large number of wells and pump houses in many of the tail-end areas. It needs to be noted that such responses can be had only from relatively well to do farmers

as they call for large lumps of investment. Thus one may expect a certain pattern in the individual responses. The well-to-do going in for changes in the direction of exploiting other sources of water keeping the crops fixed and the not so well-to-do and the poor going in for crop shift. We did not attempt any systematic verification of this during our survey.

9. <u>Collective Responses</u>: Having covered the individual responses, we go into the collective responses. The collective responses, as mentioned at the very outset, may be viewed in two directions, viz. as changes along the irrigation work and the rules of allocation on the one hand and along the crop end on the other. But the changes along the crop end as also the changes in the direction of alternative sources of supply fall within the individual sphere of activity consequent upon private property in land. Thus that leaves changes in the irrigation work and rules of allocation as the only collective responses for the present discussion. However the distinction between short-run and long-run may fruitfully be used in bringing out these responses.

10. <u>Short-run Responses</u>: As mentioned at the very outset short-run refers to the situation where the crop is standing and the total availability of water is fixed. In such a situation each community demands more water for itself from the agency, when there exists an agency for allocating water. This 'demand' may take many forms. In some cases the communities may make representations and in some other cases they may simply bribe one/many of the key personnel. If some marginal improvements can be had by repairing the channel distributaries they may take up that as well. But all these responses are

in the sphere of thecommunity's relation with the outside, i.e. with the agency concerned with the channel distributory bringing water. Within, they may respond to water scarcity by changing the rules of allocation. Mostly these take the form of 'turn' systems. When such rules of allocation are violated conflicts ensue. Thus conflicts and proper rules of allocation of water are two sides of the same coin. Lack of proper rules of allocation lead to conflicts which in turn lead to the framing of rules of allocation. Or, violation of existing rules may lead to conflicts. There may exist bodies within the community who resolve these conflicts or these may be taken to the supra-community bodies like the police and the courts. This broadly is the modality of short-run responses.

11. It needs to be stressed here that these representations may be of a purely temporary nature and once the season is over, i.e. when the standing crop is harvested, whatever arrangements had been made to collect money and select representatives may vanish. In other words, these may not have a permanent existence.

12. As is clear from the case studies which follow conflicts have arisen mainly because of violation of existing rules of allocation. We see that in none of these cases does there exist a proper body which resolves these conflicts. Even when village level committees exist they are found to be incapable of resolving conflicts.

13. <u>Long-run Responses</u>: When the scarcity conditions become frequent, i.e. when consecutive crop seasons experience scarcity conditions farmers realise that the causes of scarcity are deep rooted.

It is then that farmers find it necessary to make representations to tho agencies responsible for irrigation and demand setting right of the irrigation work in its totality. When representations at these levels are called for the nature of the body which makes these representations also change. It is then that farmers' organisations with water as thoir concern take shape.

14. As is clear from the case study taken up below the men heading these organisations hold larger areas compared to their brethern. Further the emergence of these organisations has changed the mode of their dealing with the P.W.D. The dealings at the level of the J.E. or supervisor and watchmen are increasingly reduced and the dealings are made at the level of A.E. and E.E.

15 (c) The interaction of the irrigation community with its outside for water during scarcity period is not as simple as depicted above. These may be at various levels and the modes of interaction may also be very different. We cannot go into them in any detail here. But we would like to make a few tentative points.

16. The district collector is thehead of the revenue administration in the district and he can take certain decisions over the head of the E.E. or in consultation with the E.E. Farmers may go to that level and may be able to convince him of their need. A third level is basically one of political nature. The farmers may have specific political affiliations and they may approach their elected representatives (to the legislative assembly and parliament) or, certain representatives and political leaders may take it upon themsel-

ves to press these demands at proper quarters with an eye on the support of the farmers in elections.

17. Though the above provides the broad sketch the actual working depends on the balance of various forces. Some aspects of it may be found in Wade (1982). Though the treatment in Wade is interesting it lacks proper 'rootings'. It is important to keep in mind the rootings for the simple reason that irrigation administration has to work in definite environments and these are not similar. Any effort by the A.E. or E.E to provide more water to the tail-end areas for pecuniary gains is beset with various dangers. Firstly, any actual implementation depends on the co-operation of the lower level staff in the department who may have definite long-term interests in definite localities Consequently they may sabotage any efforts by the AE's or EE's. This is all the more complicated if the subordinate staff are fully aware of the penalties and are prepared for it. Even the operators who transmit messages and note down the readings can play crucial roles. They may note down the correct reading but transmit something very different. These can only be found out by checking for discrepancies in the various books and is not always very easy because the communication among AEs and with the EE are not always very smooth.

18. Secondly the farmers in the uplands may not like more water being released to the tail-end areas - this may be a mere liking or it may have other 'bases' such as group enmity..........etc. - and they may resort to breaching the bunds. Note that irrigation administration does not have any magisterial powers and the police may not

be very responsive to their requests. (See Pa'.13 in sec IV) Retaliatory measures by the concerned personnel of the irrigation administration may be risky for the farmers may go to the extent of threatening the person concerned and if it comes to the worst they may even physically immobilise him. The above is only by way of presenting the complexity of the issue and the dimensions involved. With this we move over to case studies of specific irrigation communities.

A Rainfeed Tank & Its Ayacut

19. Rough Layout of the Fields: The tank is situated in the Vadassery Pakuthy near Nagercoil Town. The surface area of the tank is about thirty acres whereas the actual catchment is much larger owing to the few hills to the north of the tank all the drainage of which flows into this tank. It has an ayacut of about thirty acres stretched between the tank on the northern side and the Anandnar channel on the southern and eastern sides. On the eastern side the channel is separated from the fields by a stretch of rocky uncultivable land. On the southern side the fields have a common boundary with the channel. Consequently some of the fields could lift water from the channel if situation demands. Especially note the location of the field ABCD. Further, this field draws water from two distributories of the tank at the points D and C (see F1 at the end of the paper).

20. The cultivators: About 30 percent of the fields are under tenancy and the cultivators hail from far and near. It has a judicial mixture of Pillai's, the traditional peasant community and Nadar's,

traditionally outside agriculture. In particular the person cultivating field ABCD is a tenant hailing from Nagarcoil town. (For distribution of operational holdings see T1)

21 (a) The appointment of the Kandottan: The Kandottan is appointed by the community of cultivators. There are meetings of these cultivators to discuss important matters and the last meeting was held on Nov. 19, 1978. In October that year the then existing Kandottan was dismissed and a new one was appointed. The reasons for dismissing the Kandottan were two:

(i) he had diverted water from the tank to the fields lying outside its ayacut for pecuniary gains.

(ii) the money sanctioned by the Block Office [16] for the repair work done by the village committee was drawn by the Kandottan and not deposited with the village committee.

22. Though the village committee has appointed a new Kandottan, the old Kandottan continues to perform his duties in part of the area. This peculiar situation has arisen because of the fact that the old Kandottan was looking after a few fields the owners of which were residing far away from the fields. Thus as regards these fields he is the representative of the owners,[17] and he continues to perform these activities and the village committee has no powers to do anything about it.

16/ The government agency responsible for the maintenance of the tank. The village committee had taken up the repair work anticipating delay on the part of the Block Office.

17/ We have found in all the areas which we visited that the Kandottan not only performs regular activities as regarding water but also takes up the additional responsibility of looking after a few fields the owners of which are absent. Normally in such fields weeding and such other operations are performed by the Kandottan and his labourers.

23.(b) Origins of the Kandottan: Here we could get some hints as to the origins of the Kandottan. The old man of the village say that till about fifty years back there was no Kandottan. All the land was owned by Pillai's and they formed a single community, so there was no need for a Kandottan. Kandottan became necessary when more men belonging to other communities or people residing far away from the fields started acquiring land. In the last forty five or fifty years they have seen only four Kandottans.

24. Rules of Allocation of water:

(a) Normal Times: In normal times water is allocated for ploughing from the field near the sluice downwards. Once the ploughing is over, if it is 'dry' sowing no water is released for about thirty days, when water is released the 'field-order' allocation is followed till water reaches all fields. Then onwards water is allocated to fields where the level is below a certain norm.

25. (b) Scarcity Times: In scarcity conditions water is allocated as per rules (Chattaprakāram in Tamil) and it stipulates that water be taken from highest to lowest point. But as per the Kandottan during scarcity times most of the farmers come to the fields to regulate water and they do not always adhere to the rules.

26. Water Scarcity and Its history: It needs to be mentioned that for the farmers here crop failure owing to water scarcity is a recent phenomena. Recalling from memory they say that they had no crop-failures in the seventy years preceding the 1976-80 period. From 1976 onwards water scarcity and crop failures have become frequent. They attribute it to the leaking bunds of the tank which has a history of its own.

27. About five years back the government agency responsible for the maintenance of tanks decided to build a new bound to the tank. It was built with cement concrete. About two months after the completion of the work the bund started leaking. Obviously much money has changed hands in the name of the work. Since then scarcity has become part of the system. Last year they built a parallel bound to the south of the original bund but the leak could not be controlled. Thus, it seems, the leak is the contribution of the agency for the 'maintenance' of the tank.

28. Conflicts: In this case no major conflict owing to scarcity of water was reported. Instead we came across an interesting case.

The tenant who is cultivating the field ABCD, let us call him X, hails from Nagarcoil town. He sowed the first crop, i.e. the May - Sept. crop (Kanni poov) much earlier than the others. Normally this crop is sown 'dry', i.e. after sowing no water is given for about twenty five days. Consequent upon his early sowing it became necessary for him to draw water early. He opened the shutter of the sluice on the twenty first day after sowing. This affected the others, who had sown by then, by wetting the fields on both sides of the channel (note the location of the field). They told the Kandottan to close the shutter and Kandottan did accordingly. Immediately X came and quarrelled with the Kandottan. Later on when the shutter was opened, he demanded water earlier than his turn. The Kandottan refused to oblige. X drew water forcefully and the Kandottan opposed it. There ensued; a scuffle and X's son hit the Kandottan with a spade. So much regarding the event (we may note that the former Kandottan and X were partners in sharing the spoils which lead to the dismissal of the former).

29. The Kandottan complained to the village committee. But they were powerless to do anything. By then X, anticipating trouble, had approached the police and lodged a complaint saying that his son had been badly beaten by the Kandottan and some others. At the time of our visit the case was still in the court.

30. As is clear this conflict had no relation with scarcity conditions. But the set of events which gave rise to this conflict point to something very significant. But to understand the significance of this conflict we need to go back to the basics of agriculture.

31. Rules of Allocation and Agrl. Change: Our starting point for agriculture was the life-environment separation. In the given environment (including irrigation as part of that) there exists a spectrum of crops that can be grown. Some particular combination with respective techniques of production has come to be when the rules of allocation were being framed. The rules were framed taking this pattern into account. If a different pattern or different technique can be accommodated without violating the rules or if the community as a whole adopts a new pattern then there is no scope for conflicts. Otherwise agricultural changes may lead to the violation of rules and the consequent conflicts.

32. In the case touched upon above X had gone in for a paddy-vegetables - paddy pattern whereas the general pattern was paddy-paddy. This change by X called for the drawal of water much earlier than the stipulated time which affected the paddy crop of the others and that is why the problem arose.

33. Conflict Resolution: Though there exists a village committee, we found that it was powerless to resolve conflicts such as the above and these were taken to the supra-community bodies like the police and the courts.

A Channel - Fed Ayacut

34. The layout of the fields and the distribution of operational holdings may be found in F2 and T2 respectively which are attached at the end.

35. Rules of Allocation of water

(a) Normal Times: In normal times during ploughing water is allocated from field number one onwards. Once ploughing is over water is allocated to those fields in which the level of water falls below a certain norm.

(b) Scarcity Times: In scarcity times turn system is followed starting from field number one. Say water reaches upto field number n in one turn; in the next turn water is allocated from n onwards.

36. Conflicts

(a) The 1976 case: In an especially water scarce season the turn system was being followed. Field number one drew water during the first 'turn' as it was his right. But before allocation upto field number ten was completed field number one wanted to draw again. Field number nine objected to it. Then field number one who is from a nearby village brought his men and was preparing to draw water forcefully. Field number nine is from a traditionally large landholding family with enough men to support him. Since the two parties were equally poised the actual event was delayed to avoid unwanted consequences. The Kandottan had intervened to moderate to the extent possible. Things did not go out of hand mainly because of the bounty of nature—it rained just when field number one was preparing to draw water forcefully.

37 (b). The 1980 Case: Turn system was being followed as it was a scarce season. The Kandottan was allocating water to the fields in the order 1 to 10; just then the farmer of field number 9 whose family was mainly responsible for appointing this Kandottan asked for preferential treatment. The Kandottan said that he would be following the rules and could not go against them. Then the farmer asked him to stop his work. The Kandottan agreed to stop the work instead of contesting it. Thus the Kandottan was replaced.

38. Conflict Resolution: There are no set procedures for resolving conflicts within the community. The individuals go to the court or approach the police when conflicts do arise. But in olden days, say till about fifty years back the village elders (Mududam in Tamil) were respected as arbitrators. In those days whenever conflicts arose they used to meet infrontof the church and send word to the

accused and others through the village barber. They used to discuss the matter and pronounce a judgement which used to be honoured by all.

Channel-Fed Tank And its Ayacut

39. Rough layout of the Fields & Channel: On one side of the tank is situated the tank and on the other the fields (see F3). The ayacut is approximately 45 acres. The channel which feeds the tank joins it on one of its sides after crossing a road. The channel-fed ayacut is on the other side of the road. Our focus, here, is on the interaction between the tank ayacut and channel ayacut. Before taking it up let us clarify the picture within the tank ayacut.

40. Appointment of the Kandottan: The village elders, there are three of them, appoint the Kandottan. They also take up all matters pertaining to his working and any conflict is resolved by them. One of them, an old man of about eighty, is highly respected and his selfless dedication is appreciated by everyone in the village.

The present Kandottan's father was a Kandottan. He had served the village for about twelve years and the present one has already completed about seven years.

41. Rules of Allocation

(a) Normal Times: In normal times water is allocated to those fields which are in need of water.

(b) Scarcity Times: In scarcity times turn system is followed starting from the field nearest to the sluice

42. Conflicts and Conflict Resolution: No major conflicts have been reported firstly because most of the farmers are from the

village adjacent to the tank and secondly, because of the old man of eighty. Further, unlike other areas where those who are responsible for the appointment of the Kandottan demand preferential treatment here the old man does not ask for such preference. So 'within', the allocation of water goes on rather smoothly.

43. Interaction with the Community upstream: For every two days and a night allocated to the direct fed ayacut the tank gets a night's supply. There is no dispute as to this rule. But there are a few cultivators along the channel who draw water on the nights allocated for the tank. In order to prevent this what is normally done is to watch the channel during the night. This is done by the farmers of the tank-fed fields by taking turns.

44. A further problem is that of the channel itself. According to the rules the channel leading upto the tank should have a width of twelve feet. The farmers on both sides have encroached upon the beds of the channel and now it is not even two feet wide at places. During normal times no one bothers about encroachment or water theft; all these arise during scarcity times.

45. There does not seem to be any agency responsible for taking care of these problems. The PWD, at best, specifies the rules but it is powerless to implement them.

Water-User's Association

46. Introduction: In the course of our visits to the tail-end areas in Kanyakumari we heard about numerous water-user's associations.

Accordingly we made an attempt at visiting many of the organisers. Among the five which we visited all but one were one man organisations. Two of them were found to be almost non-existent but for their presidents. Two other seemed to exist mainly owing to the 'power' of their presidents and the water-user's who approach them seemed to have a patron-client relationship with the presidents. Finally, we were left with one which had a proper organisational structure, membership...etc. We shall take up this particular organisation for discussion.

47. Membership: The farmers drawing water from a certain branch of a channel are eligible to become members of this association. Any land owner or tenant belonging to this area becomes a member of the association on payment of one rupee as admission fee. The seasonal subscription is as follows: rupee one for every acre or below per crop and an additional rupee for every additional acre. The total membership as of Dec. 1981 was 319.

48. Executive Committee: A committee consisting of thirty members looks after the working of the association. This committee has a president a secretary and a treasurer. The General Body meets once a year. The tenure of the committee is for three years. Any common member can become the member of the committee.

49. Functions of the Association: The functions are mainly matters relating to water. Those are in the nature of making representations to the government agencies, dealing with the regulation of water and maintenance of the tanks, channels and follow up the same. In cases of emergency instead of waiting for the government agency to take up repair, maintenance----etc. they take up the task.

50. It is one of their functions to attend the meetings of cultivators being held at the Collector's Office every fourth Saturday of the month. Further, they attend the half-yearly irrigation seminars. We give below a sample of thequestion-answer from one such seminar held on Nov. 24, 1980.

Qn. In the last crop part of the area did not get water and in part of the area crops failed.

Ans. Water was supplied to the extent possible and to the extent of area possible.

Qn. When you adopt the turn system due to breakage of shutters at the higher reaches water did not reach us.

Ans. Hereby promised that we will repair the damaged ones and supply water to the extent possible.

Qn. When water is released on the first of June only. When it reaches James Town (lowest point of the channel) the shutters should be opened.

Ans. It will be met.

Qn. To repair all the shutters and send water for the next crop.

Ans. It will be done.

Qn. Repairs should be attended to immediately.

Ans. It will be done.

51. Interaction with the PWD: Then and Now: Earlier when more water was needed in a region some people from that region used to join together and make representations to the PWD. For this purpose the

Kandottan would be asked to collect money from each cultivator and hand it over to the headman. They used to go to Nagarcoil and meet the concerned persons.

The above procedure in itself was not very effective. They used to bribe the junior staff ofthe PWD as well. For this purpose the Kandottan was collecting a regular share along with his own. But even with this only the highest bidders used to receive adequate water.

With the emergence of the association people from different areas are brought together and it is the association which makes the representation which carries more 'weight'. At what level is the representation made would depend on the 'need' and some assessment of the ability of the concerned authority to meet the demand. To have a fair idea about the inner working of the PWD the junior staff are still kept in good humour. But system of bribery has changed over to donations towards festival funds of the Junior staff of PWD.

52. Land ownership Pattern of the Members: It was found that about thirty percent of the members had more than two acres of land either owned or cultivated. Invariably the presidents and secretaries of all the associations owned more land than bulk of the members. At least in three cases out of five the presidents owned more than five acres (which is far above the average size of holdings). For the particular association the details are given in the tables below.

Distribution of Operational Holdings

Under Various Crops

Paddy		Other Crops / Paddy	Paddy and others				
Size Classes	Frequency		0-0.99	1-1.99	2-2.99	3 and above	Total
0	4	0	4	0	0	0	4
0-0-99	128	0-0.99	21	2	0	0	23
1-1.99	100	1-1.99	31	4	0	0	35
2-2.99	52	2-2.99	20	5	3	1	29
3 and above	35	3 and above	8	10	10	3	31
	319						

53 <u>Emergence of the Association</u>: The idea of the association was conceived in 1975 which was a scarcity year. It so happendd that one of the farmer's brother who was in the military returned that particular year and he felt that something needs to be done to mitigate the hardships of the farmers. So the initial efforts were made. From then on successive years witnessed at least one failure owing to the scarcity of water. Thus by about 1979 the association had taken roots and it was reorganised. Here the initiative came from a foreign returned man and some retired school teachers. The former is a relatively big landowner.

Some Conclusions

54. Though we began by sketching the totality of responses to water scarcity we did not pursue all of them. The individual responses, viz. crop shift and investment in lifting, are touched upon but

not gone into. These are areas for future work. Our own concern in this section was with the rules of allocation, conflicts and water-user's associations as borne out by the case studies. Interestingly, the case study of the rainfed tank ayacut has thrown up an important issue which has much to do with agricultural change. What is at issue here is the collective nature of water supply and the individual nature of its use and the consequent conflicts when the 'use' deviates from a certain pattern. This is an issue which has serious implications to agricultural change.

55. Another important conclusion that may be drawn from the case studies is the problems around conflict resolution. These seem to be reaching the police and courts which may not be the best places for resolving these conflicts.

56. Finally, the activities of the various water-user's associations will be intensifying with the ageing of the works. The health of the system, then, would depend on the force with which they press their demands and the concern with which the PWD responds to it.

VI Epilogue

1. The objective of our exercise, as we stated in the introduction was to evolve an approach to the study of irrigation in its totality. For this, we formulated a framework for analysing irrigation systems and then applied this to the specific case of Kanyakumari. In this process, we have come up with many interesting issues which call for further work. This section briefly highlights such issues.

2. In section two, while conceiving the irrigation system in its totality, we made clear distinctions among the technical, organisational and institutional aspects of it. An important issue thrown up with these distinctions was the emergence of the institutions of irrigation as the ground reflecting the interactions of various forces in agriculture and the definite implications of these to agricultural change. Though a proper development of this theme calls for the study of the evolution of the system as well as the changes in the agrarian structure and agricultural techniques, we have been able to provide only glimpses through our own study. This is an important area which needs further investigation.

3. Section three made an attempt at viewing the system as it exists in Kanyakumari through the analytical frame of section two. It is here that we moved from the abstract to the system in the concrete so as to provide a base for taking up definite questions regarding the evolution of the system, water scarcity etc. Though a base was built to take up various issues, our own focus in the latter sections was limited to the question of water scarcity.

4. In section four, the causes of water scarcity were traced, to a minor extent to the deficient rainfall, and more importantly, to the lapses of the PWD on the one hand and the wasteful use of water by the ryots, especially at the upper reaches of the channels on the other. The question of rainfall could have been taken up on a much more rigorous way if only we had attempted a systematic quantitative exercise. This could have settled whatever ambiguity that exists now. Such an

exercise hopefully would have provided additional insights into the efficiency of the system. Leaving that aside, the regulation of water by PWD and the use of water by ryots reveals enough of the cause of water scarcity.

5. Regarding the control, regulation and use of water from the headworks to the fields our findings indicate that a proper allocation of water by the Kandottan should improve the situation to a great extent. But it is important to note that in most of the upland areas where there is no scarcity of water there are no Kandottans and farmers tend to misuse water. Even in locations where Kandottans exist, they are appointed not because of the farmers' concern with the proper use of water, but because of the problems arising out of the agrarian structure. The nature of these problems and the manner in which they affect the institutions of irrigation call for further work.

6. The men who are responsible for the allocation of water in the irrigation system lack formal training in their specialised work. In the case of the Kandottan, he has a traditional understanding of the crop water requirements and is concerned about the equity in allocating the available water among the farmers. This motivates him to carry out the job efficiently . But in the case of the PWD, the story is different. Many of the subordinate staff have absolutely no training in the regulation of water. This is equally true of the Engineers. They are more thorough with physical work than with allocation of water. Unfortunately the maintenance of the physical structure is also poor. This arises mainly because of the way the work is executed by the department and the elements which motivate them to take up work. It is

here that the PWD finds itself in a hostile social environment. The result is that they are unwilling to take up work and the funds for regular maintenance and repair gradually get reduced. In this context an important point which the PWD holds against the ryots is the latters lack of involvement in the operation and maintenance of the system. Whether this phenomenon is because of the historical specificities of the region is somethingwhich calls for further research. However, our own limited review of the historical evidence indicates that in the earlier days, the ryots in the region had no involvement in any aspect of the working of the system and it is hard to expect them to take up these tasks now. But compelling social and economic forces may motivate them to do so. One does see signs of this in a few locations of the command area.

7. In section five, we made important analytical distinctions between individual and collective responses to water scarcity. The basis of this distinction is Private Property in land and the importance of it lies in the community's collective control and regulation of water and the individual nature of its use. That this had important implications for agricultural change is touched upon in one of the case studies. But this aspect again, calls for further research. Most of the other case studies are confined to the question of conflicts and their resolution. In the traditional irrigation communities, there were built in mechanisms for resolving conflicts at the community level itself. But, when these traditional irrigation communities were replaced by the modern irrigation system, there was no built in device for resolving conflicts. The consequences of this is that

those who are rich and more close to the bureaucracy and the political system manipulate the system to their favour. How exactly these forces work and the manner in which it gets reflected in the functioning of the system needs much more careful and detailed work.

8. *In sum*, the study has opened out various directions of work than it has attempted to complete. In that sense the study is only the groundwork for moving along these various directions.

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APPENDIX A

Rules of Regulation of Peechipparai and Perunchani Reservoi

These reservoirs will be under the control of the Executive Engineer who will be the controlling officer.

The Head sluices of the Peechipparai and Perunchani Lakes will be reopened simultaneously for irrigation on the 1st June for Kanni crop. Whenever a postponment of the date of opening is warranted for special reasons, the EE may postpone the opening date in consultation with the Collector.

The requirement of the system shall primarily be drawn from Peechipparai reservoir, subject to a limit of 500 cusecs which is designed full supply discharge of the Kodayar LBC. The storage of Perunchani Dam shall supplement the supply from Pechipparai dam to meet the balance requirement.

If and when the Perunchani Reservoir surpluses, the controlling officer shall regulate the discharges from the Reservoir so as to allow only the total requirement minus the surplus discharge of Perunchani dam. The regulation shall normally done twice a day 8.00 AM or 6 PM.

The supplies through the Pothon Dam Head sluices hall be at the rates noted below.

Period	P.P. Channel System		Pandian Channel System	
	Discharges in Cusecs	Duty	Discharges in Cusecs	Duty
June 1st Half	207	100	550	70
June 2nd half	400	50	480	80
July	330	60	480	80
August	330	60	430	90
September 1st half	330	60	480	80
September to October half	400	50	550	70
October half to December end	330	60	430	90
January	250	88	390	100
February	200	100	–	—

Rules of Regulation in the Branch Channels and Distributaries

1. The sluices should be so operated that the ayacut under each of the sluices is safeguarded and gets its legitimate supply. The Assistant Engineer will have full control over the sluice.

2. All sluices feeding the tanks should be kept closed till the cultivation operations in the direct fed lands have been started and are nearing completion and then only the tank Sluices should be opened and the tanks given the filling.

3. If there is acute demand for water in tanks, no sluice should be kept open in full and fill up the tanks during the first

fortnight of the Kanni crop season; but kept throttled and supply given through diversion chal to feed the tank ayacuts direct instead of filling the tank and through the sluice without detriment to the supply to the converted or directed lands. All preferences should be given to the direct channel fed ayacuts and only after meeting this demand, the tank fed lands be looked into.

4. In case, the reservoirs are about to surplus in the months of June and July, care should be taken to fill up the tanks to avoid wastage by surplusing reservoirs.

5. On no account water should be let into Pazhayar below the Chattuputhur dam, without the specific order of the Executive Engineer as the tanks under the Pazhayar system are not entitled for Kodayar water except at times of declared drought conditions. Whenever such supply is made to these tanks, care must be taken to note down the quantity of supply made so as to assess water rate and consequently, collection of water cess from the benefit of concession given to them.

6. Pechipparai and Perunchani reservoirs should not be reopened for Irrigation if the level of water in the reservoir are below the ruling levelling (viz) 30.00 at the end of May and 25.00 in September.

7. Tank Ayacutdars cannot ask for water to fill in the tanks as a matter of right unless they stand on par with the direct ayacut in respect of payment of water cess and water will be given to their tanks as and when the supply conditions in both the reservoirs are

encouraging. On no account should they raise crops under the tanks if the storage condition in the tank is unsatisfactory or if the monsoonic conditions are gloomy. If they cultivate these lands inspite of these, they do so at their own risk and government will not undertake any responsibility of saving the crops.

8. At times of acute draught, turn systems will be adopted giving preference to channel fed lands only. At times of such exigencies tank ayacutdars should wait and watch the change over in the seasonal conditions and then take up cultivations.

9. Closure period from 1st March to 31st May. During this period the scowl vent to Puthen dam shall be kept open.

Regulation of Branches and Distributaries

1. The supply through branch channels and distributaries should be made according to the extent of new (conversion) and wet ayacut irrigated by them plus the transmission loses.

2. All the sluices feeding the tanks should be closed till the puddling and transplantation operations in the project land were completed and then only the tank sluices should be opened and supply given if necessary.

3. If there is acute demand for water in tanks no sluice should be kept open in full to fill up the tanks during the 1st fortnight of the first crop-season.

Appendix B

Technical Details of the Kodayar System

I The Storage Dams*

Perunchani Dam

Dam Details	Before Improvement	After
Length of masonry dam in ft. (Gravity type with drainage gallery)	1224	1224
Top of the level (above M.S.L)	+ 309	+309
Maximum Water level (dO)	+ 306	+ 306
Full reservoir level (do)	+ 300	+ 306
Sluice sill level	- 229	+ 229
Capacity		
Water spread area at FRL sq. miles	3.34	3.72
Capacity at FRL		
Gross in Mcft.		
Net in Mcft.	2300	2890
Dead in Mcft.		
Average annual yield		
Catchment area in sq-M	61.87	61.87
Average annual rainfall in inches	88.28	88.28
Mx. flood discharge in cusecs	31000	31000
Average annual yield at dam site in Mcft.	7700	7700
Surplus arrangements		
Length of spill way section in ft.	142	
Length of flush escape in ft.	179	
Surplus regulator vents	- 4 Nos.	40' x 15'
Designed discharge in Cusecs	31600	31600
Year of construction	1948 - 1953	1964 - 1969
Cost of dam in Rs. (in lakhs)	43.71	19.00
Head sluice	2 Nos.	6'-0" x 8'-0"

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* The perunchani and Pechipparai dams were improved between 1964 and 1969.

Pechipparai

Dam Details	Before improvement	After
Length of masonry dam in ft. (gravity type-ru ble in surky Mortar solid masonry without drainage gallory)	1396	1396
Top of dam level (above MSL)	+ 303.00	+ 310.00
M.W.L (d0)	+ 302.00	+ 302.00
FRL (do)	+ 296.00	+ 302.00
Sluice sill level	+ 254.00	+ 254.00

Capacity

		Before improvement	After
Water spread area (in sq. mile		5.47	5.85
Capacity at FRL			
Gross in Mcft.		4465	5306
Net		3509	4350
Dead		956	956
Sluice sill level	254.00		
Over sluice level	204.00		
Dead average	50.00		

Average Annual yield

	Before improvement	After
Catchment area in sq.miles	80 .00	80.00
Average annual rain fall (inches)	85.66	85.66
Maximum flood discharge in Cusecs	39000	39000
Average annual yield in Mcft.	14200	14200

Surplus arrangements

	Before improvement	After
Length of surplus weir in ft.	736	
Surplus regulator vents	6 nos.	10'0" x 15'-0"
Designed discharge in cusecs	39000	39000
Year of construction	1896-1907	1964 - 1969
Construction of dam in Rs. (in lakhs)	26.10	15.00

Chittar Dam I & II

Dam Details	Chittar I	II
Length of Dam in ft. (Earthen Dam)	2645	3720
Top of dam level (above MSL)	+ 279.00	+ 279.00
MWL	+ 269	+ 269.00
FRL	+ 269.00	+ 269.00
Sluice sill level	+ 251.00	+ 250.00

Capacity	Chittar I	II
Water spread area at FRL in sq. miles	1.13	1.60
Capacity at FRL		
Gross in Mcft.	610	1007
Net in Mcft.	393	600
Dead in Mcft.	217	409
Average Annual Yield		
Catchment area in sq.miles	8.50	10-10
Average annual rainfall in inches	80	80
Maximum flood discharge in cusecs	8300	9350
Surplus arrangements		
Surplus regulator shutters	2 nos. (40'0" X 15'-0" (+ interconnecting chl)	4 nos. (20'0" X 4'0")
Year of construction	1964	1964
Cost of construction	Estimated cost 189.49 lakhs.	
Interconnecting chl.		
Length	3300'	
Sill	+ 251.00 to 250.00	
Bed width	30'	

II Canal System

The irrigation mainly begins at Puthen dam and then diverts into Pandian kal and Padmanabhapuram Puthenar channel.

Pandian Kal

This Kal with a head work consists of 5 vents of 5' - 0" x 6'- 3", after running 1½ miles forks into two at Chellanthurithy one on the left side called as Thovalai channel and another on the right side called as Regulator Kal.

Thovalai Channel

It is a contour channel having a length of 30 miles 3 furlongs. At the tail end it forks into two branches called Nilapparai channel and Maruthuvalmalai channel. This channel has been improved under C.P. Scheme to increase the capacity from 206 c/s to 356 c/s. The hydrology of the channel and its branches are as follows.

	Before Improvement	After
No. of vents at the head works	2nos. 8'0" x 6'0"	3 nos. 8' x 6'0"
Bed width (at headreach)	11.75	11.75
Full supply depths (d0)	4.80	4.
Discharging capacity (d0)	206 c/s	356 c/s

Ayacut

		M	Fg.	Ft.	Ayacut
1.	Thovala channel (main)	30	3		9704.72
2.	Nilapparai chl.	3	4	505	1763.85
3.	Maruthuvalmalai chl.	0	7	000	-
4.	(i) East major	2	0	110	635.37
	(ii) East minor	1	3	331	335.88
	(iii) West Branch	1	6	365	404.90
					12864.72

Radhapuram canal

Besides the above, to irrigate about 17,000 acres of single crop dry in Tirunelvely Dt. a new canal namely Radhapuram canal with a carrying capacity of 150 c/s has been excavated, branching off from 1/2 - 250 of the existing Nilapparai chl. in addition to its present carrying capacity of 40.73 c/s. The total length of the channel is 20 miles and 4 furlongs, the bed fall being 1st mile. The entire canal system has been lined with cement concrete.

Regulator Kal

The Regulator Kal after running for about a mile bifurcates into two at Shoralacode, one on the right is called as Anandanar chl. which is a contour chl. and another on the left is called Pazhayar, which carries the entire drainage of the valley.

No. of vents at the head: (1) 2 nos. 8' - 0" x 6' - 0"
(2) 2 nos. 8' - 0" x 7' - 0"

Ayacut	M	F	Ft	Ayacut
Anandanar chl.	16	5	29	9901.67 acres
Pazhayar (including N P Chl.)	17	2	340	15821.12 1/2
				25722.79 1/2

Anandanar Chl.

It is a contour chl. running for a length of 16 M ft. 29'. There are several branches and sub-branches. The hydrology of the channel and its branches and sub-branches are as follows:

No. of vents at the heads	4 Nos. 4' - 0" X 4' - 0"
Bed width	15' - 0"
Full supply level	3.5'
Discharging capacity	108 c/s
Ayacut	9901.67 acres.

Anandanar System

		M	F	Ft.	Ayacut acres
	Anandanar Main	16	5	29	4111.81
1.	West branch chl.	1	6	365	786.09
2.	Anandan Kal (A K Kal)	2	3	115	455.85
3.	Krishnacoil branch	1	3	350	408.02
4.	Asaripallan chl.	4	2	458	638.67
5.	East main	3	0	580	358.41
	(i) Athikadai chal.	2	1	240	373.75
	(ii) Kottar chl.	2	3	232	535.81
	(iii) Thengaputtoor chl.	2	1	221	697.40
6.	Karacillai chl.	4	7	022	987.00
	(i) Krishnaputhoor branch	8	3	00	470.30
	(ii) Chembattaodai				78.67
					9901.78

Padmanabhapuram Puthanar Chl. (P.P.chl)

The head sluice of this channel consists of a 5 vents of 5' - 0" x 6' - 3". Thiruvithamcode and Erattakar taking off from 5/0 and 10/7 of this chl. are the two major distributaries. The hydrology of the channel and its ayacut are, as follows:

Bed width: (at head reach)	24' - 0"
F.S.D.	4.75'
Discharging capacity	345 c/s

Ayacut	M	F	Ft.	Ayacut (acres)
1. P.P. Chl.	18	4	330	4592.44
2. Erathakurai chl. system	4	2	130	6907.06
3. Thiruvithancode Chl system	16	0	70	8202.87
				19702.37

Erattakarai chl. (E.k.Kal)

The head sluice of this channel consists of 2 vents of size 7' -0" x 4' - 6". There are several branch channels and subchannels as given here under.......

Bed width	(at head reach)	12' 0"
F.S.D	(Do)	3' 0"
Discharge		137 c/s

Ayacut	M	F	Ft.	Ayacut (area)
1. E.K.Kal main	4	2	130	1124.99
(a) Madathattuvilai	2	1	005	386.27
(b) Kandaraivilai channel	1	6	260	472.76
(c) Mallancode chl.	1	6	287	361.03
(d) Kodappakuzhi chl.	3	0	000	1078.77
Muttam chl.	2	4	055	1420.30
Rajakkamangalam chl. (main)	3	2	000	1301.79
(i) Santhapuram chl.	1	6	650	408.52
(ii) Munchirai chl.	0	4	334	170.86
(iii) Azhakanvilai chl.	0	5	166	181.77
				6907.06

Thirukancode Branch Channel

The head sluice of this channel consists of the vents of 2 nos. of size 4' 0" x 4' 0". There are several branch channel and subchannels. The hydrology of the channel and the ayacut are as follows:

Bed width	(a.h.r)	14' - 0"
F.S.D.	(2)	5' - 0"
Discharge	(")	156 c/s

Ayacut		M	F	Ft.	Ayacut (acres)
1.	Thiruvithancode main	16	0	70	2896.85
2.	Eraniel branch chl.	10	5	532	3141.19
3.	Neyyar branch chl.	0	6	300	395.83
4.	Cheramangalam major	1	7	350	370.67
5.	-do- minor	1	2	020	288.21
6.	Colachel	1	0	120	454.24
7.	Thickanamcode branch	4	6	180	655.88
					8202.87

The details regarding pattanamkal could not be included.

Appendix C

A copy of the Appointment Order given to the Kandottan by the community of cultivators

(Free Translation of the Tamil Original)

A meeting of the landowners and cultivators of Puthukulam tank fed area (Kaniyakulam Panchayat, Vadassery Pakutty) was convened under the chairmanship of Sri. B. Kolappa Pillai in the year 1978, October 31, Monday at 12 O'clock.

It was resolved in the meeting to dismiss the old Kandottan and appoint a new one.

The old Kandottan, viz. Kaliappan, s/o Chadayan, a native of Kaniyakulam parayadi, is herely dismissed and Solomon, s/o Andy of Kaniyakulam Parayadi is appointed in his place.

Duties of and Rewards to the Kandottan

Duties

1. The Kandottan must build a temporary shed near the tank to look after the fields during the rainy and harvesting seasons. During such times he must regulate the inflow and outflow of water to the tank and the fields. Besides he must protect the fields from the thieves.

2. It is his duty to prevent the livestock from grazing on the bunds of the paddy fields. However, he is allowed to cut the grass on the bund for his own use.

3. Kandottan should not indulge in any activity which is detrimental to the interests of the landowners or cultivators. If he does not follow these rules he will be dismissed forthwith and he does not have any right to continue in this job.

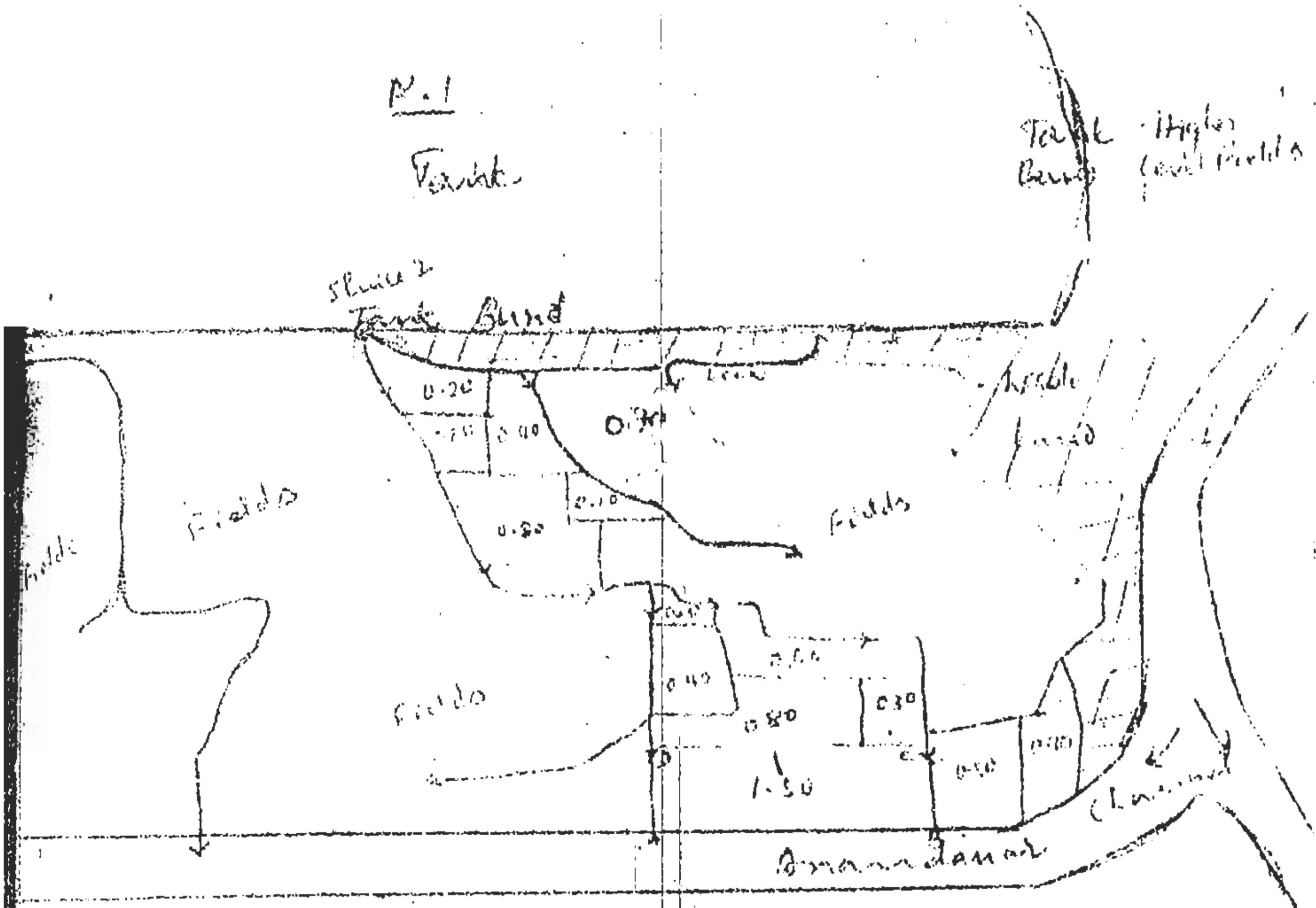
Rewards

The Kandottan shall be paid 5 (five) marakkals of paddy per acre per crop by the landowners of the area. If they fail to pay the above mentioned quantity of grain he should report the matter to the other landowners or cultivators and get the reward with their help.

Names and signatures of the members who participated in the meeting

1. Velappan
2. Mahalingam
3. S. Gopalan
4. E. Sivalinga Nadar
5. A. Nahur Meeran Saip
6. Ganesan
7. P. Ratnam
8. S. Varavelu
9. V. Tharashi muthu
10. Rangam Pillai
11. Chettappa Pillai
12. Bhagavathi Ammai
13. Ramaswamy
14. Umaya Parvati
15. Muthyya
16. Velayyan
17. Maharaja Pillai
18. Subhayyar
19. Arumugham Pillai
20. Velayudhan
21. Panivel Pichai
22. Itha Prakash
23. Boothalingam
24. R. Neelakantan Pillai
25. A. Subbiah
26. P.C. David
27. Kamala
28. Sarojini Devi
29. Rangayya
30. Velappan
31. Kumara Das
32. Puthukunathan
33. Maráswamy
34. Dorairaj
35. Chidambaram
36. Paramadas.

F.1

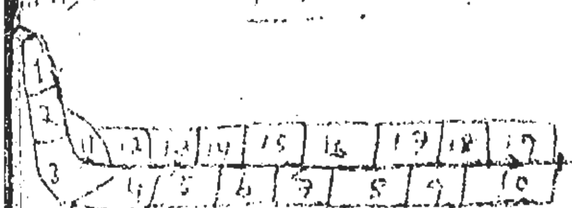


F.1

Distribution of the operational holdings

Size Class (in acres)	Frequency
< 0.25	15
0.25 – 0.49	25
0.50 – 0.74	13
0.75 – 0.99	4
1.00 – 1.24	3
> 1.25	2

F.2



F.2

Distribution of Land

Field No	12	11, 13, 14	15, 18	4, 6, 17	2	7, 16	3, 5	4, 8, 9
Area in Acres	0.25	0.50	1.00	1.50	1.75	2.00	2.25	1.25

F.3