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MINOR IRRIGATION PROJECTS IN KERALA:
A CASE STUDY

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Introduction

Our purpose in this paper is to present certain dimensions of the developmental investment in irrigation in Kerala. We begin with some statistics pertaining to investment in irrigation.

Table 1

	<u>Expenditure on Irrigation</u>		
	(Rs. in lakhs)		
Five Year Plans	Expenditure on Major/Medium Projects	Expenditure on Minor Irrigation Projects	Expenditure on Minor Irrigation as a percent of Total expenditure
I (1951-56)	510.79	-	-
II (1956-61)	892.43	226.69	21
III (1961-66)	1031.65	566.69	36
Annual Plans (1966-67, 1967-68, 1968-69)	1111.14	653.00	37
IV (1969-74)	2891.45	1144.47	29
V (1974-78)	7350.88	1340.08	16

Sources: Plan documents and Economic Reviews.

The expenditure on irrigation falls under two broad heads: major/medium projects and minor projects. Minor projects have accounted for about 30 percent of the total expenditure on irrigation. And in terms of overall benefited acreage they have contributed to about 70 percent of all governmental irrigation in the I Five Year Plan period which has come down to about 35-40 percent by the end of 1978 as the major/medium projects have come to maturity (See table 2).

So much by way of Statistics.

Table 2

Area Irrigated (Net) by Government Projects
(in lakh hectares)

Towards the close of	Total	Major/ Medium	Minor	Minor as per- centage of total
I Plan	1.02	0.31	0.71	70
II Plan	1.87	0.71	1.16	62
III Plan	2.54	0.84	1.70	68
1966-67	2.70	0.91	1.79	66
1967-68	2.79	0.93	1.86	67
1968-69	2.87	0.95	1.92	67
1975-76	1.51	0.89	0.66	44
1976-77	1.49	0.93	0.56	38
1977-78	1.46	0.96	0.50	35

Sources: L.U.S. estimates for the earlier period and T.R.S. estimates for the later period which are not quite comparable.

Now, while evaluating the minor irrigation projects the State Planning Board had the following comment to make:

In the absence of reliable data regarding the area under minor irrigation previous to the implementation of the selected projects, it is difficult to estimate the increase in the area benefited by irrigation. Eventhough the projects selected are reported as new works, it will not be quite correct to assume that the entire command area of these projects remained unirrigated as some rudimentary forms of irrigation were practised in most of the areas.

(p 26 GOK 1975) (empha. ours)



What is called for here is an adequate understanding of the situation prior to the introduction of the project so as to assess the impact of the projects. A broader formulation of the same was made by Raj in the context of his study of mechanisation of agriculture in India and Sri Lanka:

..... the characteristics of the technique in the initial situation have to be stated in full to be able to assess the possible or actual biases of substitution introduced by another technique (p 321 K.N.Raj 1972).

Our attempt here is to take a minor irrigation project in a remote village of North Kerala. In the village concerned a stone and cement-concrete diversion weir built by the Minor Irrigation Department replaced the seasonal mud and reed weir usually built by the farmers. We present the irrigation practices which prevailed prior to that event and then take up the changes that came up with it or were forced by it, all along drawing various implications.

As to the limitations of the study, it needs to be mentioned at the very outset that it is intended to be a purely qualitative exercise. Any exercise in quantitative terms calls for a detailed survey of at least two ayacuts which has not yet been undertaken.

The Location and Environment

The location selected is about four kms. east of the Western coast and the nearest railway station is Kotikulam on the Cannanore-Mangalore section.

The region receives ample rains during the S.W. monsoon period. The annual rainfall in the region is about 344 cms. of which almost 90 p.c. is received in the May to September period. (See table 3).

Barring an exceptional year (like 1966) the deficiency in the May to September period does not exceed 90 p.c. of the normal. But what is important to note is the deficiency in the May - June period given almost normal rainfall in the May to September season: years 1962, 1967, 1974 are best illustrations of this. Further, note that out of the 14 years only three years received normal or above normal rainfall in the May - June period.

As to the rainfall in the October to December period the variability is very high. The normal for the season concerned is about 34 cms. and in the 14 year period for which data is provided 4 times the deficiency is about 60 p.c. of the normal.

Before going any further it is necessary to touch upon the topographical aspect of the region. The significance of topography for cropping pattern is ably brought out in the following passage:

"Under the same topographical condition a given rainfall pattern permits only to grow crops having comparable agronomic requirements. Thus a rainfall pattern with 30 cms. of rainfall for a continuous period of three months would permit only growing water loving plants like rice. On the other hand under conditions of undulating topography with hills and valleys a variety of moisture regimes would be available. Since land has a gradient the precipitation is lost as run-off from the hill tops and get collected in the valleys resulting in well drained conditions on the hilltops and slopes and ill drained conditions in the valleys"

(p 11 GOK 1974).

Table 3
Pattern of Rainfall in Cannanore District
 Quantum of Rainfall (in cms.)

Year	May & June	May to September	October to December	Total
1961	164.96	499.60	44.53	550.53
1962	93.14	318.40	46.22	373.73
1963	74.02	269.91	38.96	322.37
1964	59.66	241.47	23.84	272.39
1965	105.21	239.29	28.26	273.15
1966	81.13	210.28	54.65	271.42
1967	89.35	295.87	14.52	314.75
1968	102.36	387.71	14.82	419.44
1969	88.46	242.76	35.29	286.69
1970	91.63	276.08	18.73	300.79
1971	137.47	294.42	23.01	321.45
1972	113.25	290.71	41.82	337.22
1973	92.01	245.70	22.82	271.77
1974	54.40	297.70	15.19	317.75
Normal	112.36	301.12	34.68	343.79

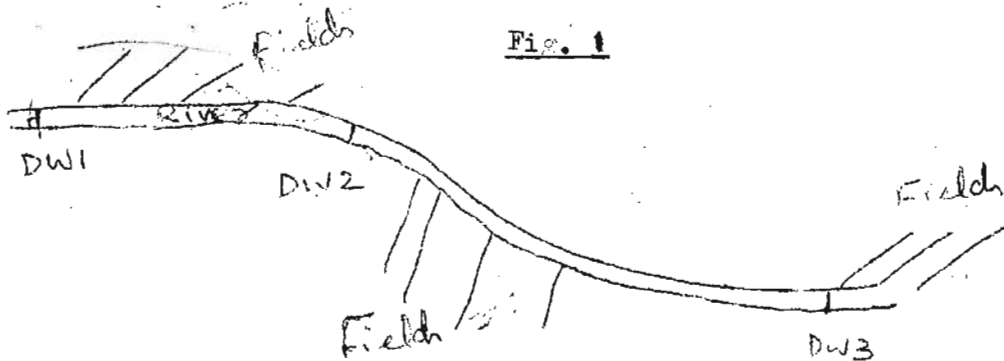
Source: Season & Crop Reports.

The region is characterised by an undulating terrain. The hills have steep slopes near the foothills of the Westernghats and the slopes become gentle as one approaches the coast. The terrain along with heavy rainfall gives rise to drainage channels along the valleys which are the rivers and streams of this region. These

drainage channels normally overflow during the rainy season and mainly depend on the regeneration flows during the rest of the seasons. The regeneration flows are at their peak immediately after the monsoons and decline sharply thereafter and by summer they become mere trickles.

Lay-Out of the Land Under Cultivation

The characteristic lay-out of the cultivated land in this region is owing to the topography. The highest points are the hill-tops and lower to those are the garden lands which have most of the houses located in them. Suitable land in between the hill-tops and the garden lands are also used for agricultural purposes. Lower down the garden lands are situated two types of paddy fields: one crop fields and two crop fields.



The distinction between the land under cultivation in the hill-tops and slopes and the fields is drawn on the basis of techniques of levelling. The fields are levelled with proper bunds and as such they can be flooded to raise paddy crops whereas the hill-tops and slopes are only cleared off vegetation. As to the fields the distinction between one crop and two crop fields is drawn on the basis of the availability of the stream water for irrigation owing to the diversion weirs.

Cropping Pattern

Now let us go into the types of crops grown in the different types of land. All the lands put under the plough other than the garden lands grow crops of paddy during the June to September season. The hill-tops and slopes are sown broadcast whereas in the fields paddy is transplanted. The hill-tops and slopes may also go in for a crop of sweet potatoes instead of paddy once a while.

Parts of the hill-tops and slopes as also the one crop fields take a crop of pulses in the post September season. Parts of the one crop fields may go in for a crop of vegetables and parts for a crop of paddy all dependent on lift irrigation. All the two crop fields take a second crop of paddy.

Parts of the two crop fields are put under a third crop of paddy and parts under a crop of vegetables or pulses. All the third crop is dependent on lift irrigation.

Coming to the garden lands as the name suggests these are used for growing garden crops such as coconuts, arecanuts and plantains. Some jack and mango trees may also be found.

Traditional Irrigation

By traditional we are only referring to the situation as it existed about twenty years ago, i.e., prior to the introduction of the changes we are going to touch upon later on. In this set up different types of land were irrigated by different techniques during different seasons and in a way the layout and the pattern of crops grown crucially depended on the techniques of irrigation.

Let us begin with the garden land. These lands used to cultivate garden crops among which the main were coconut, plantains and arecanut. These were irrigated from about late November by lifting water from the wells with the help of what are called pikotas.

The one crop fields used for the second crop were irrigated by lifting water from wells and usually vegetables and to some extent paddy were grown. The technique used for lifting is the one with the pikota.

Coming to the key segment, viz., the two crop fields. The levels of these fields at the upper reaches are just a few feet above the riverbed. Consequently, the typical technique adopted for irrigating these lands was the diversion-weir. By this the level of water in the stream is raised and part of the flow is diverted to a channel with the help of a weir. These weirs are of two types the distinction coming not by way of its construction but by way of its use. The first type were normally constructed towards the end of May and remain there till next April. Sometime in April after harvesting the third crop the weir is removed with the usable material retained for the construction in May and the rest being burnt as firewood. These weirs ensure water for the crops during the rainy season as well as for the other crops. The construction of these weirs are such that the excess water flows over them and over the channel into the stream so that only the required quantum of water is flown through the channel.

The second type of weirs are built sometime in October at the commencement of ploughing for the second crop and remain as such until April. These weirs supply water for the second and third crops.

Something needs to be said about the level of the top of the weirs at this stage. The levels are chosen in such a way that the fields in the higher ayacut are not submerged, i.e. the weir lower down should in no case obstruct the drainage of the upper fields. To illustrate, the level of diversion weir 2 should be such as to ensure the drainage of the ayacut of diversion weir 1. Thus the level of water on the weir and in turn on the level of the flow of channel. Consequent to these very fine limits it is possible that the flow in the channel gets reduced considerably even in the midst of a rainy season if there are no proper rains for about 15 days. It is in such a situation that a low-lift technique is used.

In this technique the handle of an elongated scoop is hung at shoulder height of an adult. The working edge of the scoop, which holds the water, is normally a few inches deep in the water. The working of the instrument is through a swinging motion through which the handle goes up and down. The downward swinging motion of the handle carries the water and deposits it on the channel. This can be worked by one or two men. More than two is normally not found.

The low-lift technique is used on a regular basis once the flow in the channel stops during the post monsoon period. But it needs to be noted that this technique cannot be used once the level of water falls too low in the stream. Normally it is observed that

till the end of the second crop this technique serves the purpose. Once the level of water has fallen too low lifting with the pikota from the stream between the stretch DW_2 to DW_3 or from wells on the fields is resorted to.

Construction of the Weir

Materials & Technique

The materials used for the construction of these weirs are stems of coconut trees, branches and leaves of trees and mud. A strong beam at the appropriate level is fixed touching the two banks. Parallel beams are kept vertically with one end resting on the beam. Branches of trees are knit on it almost like a fence or basket. Coating of leaves and mud are applied on it. The mud surfaces over which the water flows has normally a good spread of grass. These are, infact, skinned from the field bunds and kept carefully on the weir. It seems that the leaves and the grass resist any dissolution of the mud surface of the weir.

Collection of Materials and Labour

Materials and Labour required for the construction of the weir are collected from among the farmers who benefit from it. The collection is proportional to the field area operated by the individual farmer. It is the contribution of materials and labour which entitles right over water.

Rules of allocation of Water

If there is free flow in the channel no explicit rules of allocation are followed, for the topography together with the flow serves the needs of all the fields. The question of explicit rules

arises only when the free flow in the channel stops; it is then that low-lifting is resorted to. In such a situation it is normally the largest holder who comes first in the order. As to the rest there is no exact hierarchy. Once the order is established sometime towards the beginning of the season, it is followed till the end of the year. Within this order if Y's turn comes after A's then Y should be present there at the time when A completes his. If Y is not present he can claim a turn only at the end of the cycle, i.e. when all the others below him have completed their turns.

Paddy Cultivation

There are certain differences in cultural practices of the different crops. We touch upon only those practices which have some relevance for water use. Though the I & II crops are flood paddies, and transplanting is adopted ploughing practices are markedly different.

For the first crop what is called dry ploughing is practised. As regarding the timing of ploughing one finds two variants. Those fields which are sown for a third crop are ploughed soon after harvesting that crop whereas other fields are ploughed after the first showers in late April or May. For this crop normally six turns of ploughing are carried out - three dry and three wet. The three wet ploughings are carried out just before transplantation. Here after one turn of ploughing mould board is used, then two more turns of ploughing are carried out just before transplanting.

For the second crop nine turns of ploughings are carried out and mould board is used thrice. All these are wet operations which call for considerable volume of water. In fact, the timing of the

construction of the second type of weir coincides with the ploughing operations for the second crop. Here the sequence of operations is as follows: after four turns of the plough mould board is used once; two more turns are made before using the mould board once; then one turn of the plough is made and the field is kept ready for transplanting. Just at the time of transplantation two more turns of the plough are carried out and the mould board is used once.

Now it may be observed that the use of the mould board is rather intense for the second crop. This may be for a proper levelling of the field as this crop depends fully on irrigation. This is not a problem for the first crop as rains are frequent and even if there is a dry spell watering may be called for only once or twice in between.

The discussion so far has attempted at providing an outline of the traditional agricultural systems with emphasis on the different types of irrigation. Now let us go on to take up the changes in irrigation techniques that have taken place in the last twenty years. Before taking up that question we need to clarify a few points regarding ownership and tenancy changes in the period under consideration.

Out of about 15 acres which is the total ayacut under diversion-weir 2 (see fig. 1) about 50 p.c. was under tenancy in the early sixties. In the ensuing period all of this land has come under owner cultivation either by way of the tenant becoming the owner, or by sharing the land on a 50 : 50 basis between the landlord and ^{the} tenant recognising the provisions of land reforms. Thus, as of now the issue is not one of ownership tenancy ^{vs.} but one of cultivation with

hired labour. This has a bearing on the types of changes in irrigation as we would see later on.

Changes in Irrigation Techniques

The first change in the traditional canvas was brought about by a school teacher who incidentally was one of the larger farmers. He had a special problem. He had fields to the extent of about 50 cents in the upper reach and the rest - about 150 cents - in the lower reach. The field in the upper reach was very sandy and it was a big problem to hold the level of water in the field. And this was coming in the way of drawing water from the channel. So he brought a 1.5 h.p kerosene pump in 1960 to water this particular field. This was a special case to solve a special problem.

The introduction of the energised pumps gave rise to some peculiar problems regarding rights on water. Initially these pumps were sought to be used for drawing water from the stream. The first two pumps were installed at points P and Q of the stream (see fig. 1) and started drawing water. As soon as this was known in the locality the farmers of the ayacut of DW_3 asked the owners to remove their sets from those locations. This was not readily complied with. The result was that pipes were seen to be damaged during the nights; it was carried to the extent of drowning and the pump-owners found it necessary to dig wells close to the stream within their fields.

In the early sixties pumps were rarities and had an insignificant impact on the irrigation set up. A far-reaching change came about in the mid-sixties with the intervention the wing of the

government concerned with minor irrigation. The intervention was in the form of a stone and cement-concrete diversion weir at the location where the erstwhile mud and wood weir stood. The farmers had no idea about the structure till it was completed and they did not have any role in its construction except that some of them bought cement from the contractor at slightly lower than the black-market prices. The weir with a channel of about 50 feet length was built and wooden shutters were provided.

It had hardly supplied water for about an year when large leaks were observed all over the body of the weir and in the very second year during the second crop the flow was so low that the farmers had to resort to low-lift with the scoop. In the next two years the use of the scoop had to be increased considerably and the farmers thought of doing something about the leaks. Collections were made and some minor repairs of the weir was attempted in 1969. But this failed to yield any better results. Increased use of the scoop was also becoming difficult with the level of water falling too low owing to the leaks becoming larger and larger. It is during this period that the farmers dependent on hired labour started going in for petrol, kerosene pumps in a big way. These were mostly small sets - 1.5 h.p to 3 h.p was the range. The main reason for going in for small sets is portability. Since not all farmers had their holdings consolidated these sets had to be moved from one location to another. Further, farmers found that these could be used in the garden lands where the frequency of irrigation is about once in five days.

With the coming of the seventies a new source of energy was added, viz, electricity and many well-to-do farmers went in for electrified pumpsets. Interestingly, these farmers had not sold their petrol/kerosene sets off. The reasons are two: (i) uncertainty of power supply and voltage fluctuations; (ii) non-portability of the sets. Thus, on the whole, one observes a spectrum of water lifting techniques in use in the ayacut: the large holders and the rich possessing petrol/kerosene and electric pumpsets totally dispensing with the traditional techniques of lifting; the small holders and the relatively poor who still use family labour to a great extent retaining both low-lifts as well as lifting by pikotas.

Coming back to the cement concrete weir the department concerned carried out two repairs one in 1975 and another in 1981. According to the farmers the 1975 repair ruined the weir sparing the short stretch of lined channel whereas the 1981 repair ruined the channel as well thereby ruling out the very possibility of low-lift even during the rainy season.

Implications of the Changes

Let us go on to take up the implications of these changes. The first and foremost implication is to labour. In traditional lift irrigation manual source of energy had a predominant role, but now that is totally undermined. The dependence now is on inanimate sources of energy, viz. kerosene petrol and electricity. Thus the displacement of hired labour in this activity is total.

Owing to these changes investment in irrigation has been considerable in the period under consideration, but the implications

of these to intensity of cropping or yields have not been commensurate with the investment. Preliminary observation suggest a marginal increase in intensity of cropping i.e. the two-crop land brought under paddy or vegetables for the third crop has increased marginally. This cannot be otherwise for even in the traditional set up third crop used to be raised with the help of pikota-lifting. Now, these pikotas have been replaced by energised pumps. In the traditional set up the third crop was limited not by lack of hands for lifting but by scarcity of water as such.

As to the yields one need not expect much of a change for only the technique of lifting has changed and not the technique of cultivation or water-use as such. It is seen that very few farmers use HYVs or go in for large scale use of chemical fertilisers or pesticides.

Some Questions

It may be seen that there are two processes of irrigational investments: (i) the yearly 'investment' by the farming community; and (ii) governmental investment. The change which was the subject matter of the above discussion was the replacement of (i) with (i

There are various aspects particular to each of the processes. As regarding (i) the materials and labour needed for the construction are supplied by the community, the technique of construction is their own. As to (ii) above, the cost of the work is met by the government and not borne by the community, there is no involvement of the community at the any stage of the work and the traditional knowledge of the specificities of the location are completely ignored.

What are the merits and demerits of the two processes ?

As to (i) though the construction is an yearly affair it used to meet the requirements of the community. As to (ii) the construction is often substandard as in the above case. Then there are cases where the design is faulty, for instance, there is a weir upstream the above mentioned weir the level of which is such that when the shutter is closed the fields above the weir used to be submerged. Owing to these problems, most often farmers cannot use the weir and there is duplication of investment in lift irrigation.

The problems of the governmental investment have their roots in the procedures followed in the formulation and implementation of the projects. Though in the formulation stage the Village Panchayat, the Block and the District Development Committees are involved, because of the very size of these bodies vis-a-vis the size of the farming community, the community is not directly involved. The construction is mostly carried out by contractors under the supervision of the P.W.D. There are two fall-outs of this procedure. Firstly, whatever traditional knowledge regarding the specificities of the location that existed with the community is not utilised; secondly, the community which functioned as a unit around the construction of the seasonal weir is automatically destroyed. The pertinent question to ask, then, is should this approach be followed ? This is all the more pertinent at this juncture because the irrigation cess collected by the government does not even cover the annual maintenance costs, and most of the construction is either sub-standard or very expensive owing to the procedures followed by the

Public Works Department. To add to it all the gains in increased acreage or yields and stabilisation of yields is only marginal in a state like Kerala.

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