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LINKING IRRIGATION WITH DEVELOPMENT  
THE KERALA EXPERIENCE

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INTRODUCTION

Disproportionately high investment in irrigation projects has been an important aspect of Kerala's planned efforts for agricultural development. The need for and objectives of such investments are best evident from the following extract from an official document.

In view of the variability of rainfall in the state, high priority has been accorded to irrigation projects in the State's Five Year Plans. These projects help the state in stabilising food productions and in increasing production of non-food crops (Government of Kerala 1982)

Certain features of the investment in irrigation in the State are the following:

- (a) Bulk of the investment has been for constructing medium and large-scale irrigation projects;<sup>1/</sup>
- (b) There has been long time overruns in the completion of the projects leading to significant escalation of costs;
- (c) Even for the projects completed the area irrigated is seen to be far less than the targeted command area.<sup>2/</sup>

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While these reflect the basic maladies of project planning and implementation in the state an important issue which calls for careful study is the extent to which the objectives of investment in irrigation are getting fulfilled by the projects which have been commissioned. In this process, it is also important to highlight the factors which hinder the proper use of water in stabilising and increasing agricultural production. This paper proposes to take up some of these issues.

The paper consists of two sections. Section I analyses the impact of irrigation in stabilizing and increasing the yields of paddy crop. The analysis is confined to paddy simply because, the irrigation projects are designed to benefit the paddy lands. Section II attempts at going into the factors hindering the proper use of water for paddy cultivation.

## I

### Impact of Irrigation on Paddy Yields

This section attempts at analysing the influence of irrigation on paddy yields. First we provide an overall picture and then go on to take up the differences across the agro-climatic zones within the state.

#### Data and Method

The data on yields used for the analysis is taken from the crop cutting surveys conducted by the Directorate of Economics and Statistics. As our concern was with the ten major irrigation projects commissioned in the late fifties, data for the years 1963-79 was taken (for the summer

season the data used is for the years 1966-79). Since the definition of irrigation adopted by the Directorate of Economics and Statistics is too general, we haven't carried out any independent analysis of the data for irrigated and unirrigated plots.<sup>3/</sup> In order to analyse the data we used the following methodology.

At the very outset taluks were classified into irrigated and unirrigated categories; irrigated taluks are those which predominantly fall within the command area of the projects and the rest are unirrigated. To get an overall picture of the stabilisation of crop yields coefficient of variation of crop yields were calculated and the taluks were classified on the basis of the range of variation. Three intervals were taken: less than 12 per cent, between 12 and 18 per cent and greater than 18 per cent. (The cut off points as such are arbitrary). Then the number of taluks falling within each range were taken.

In order to carry out the analysis at the 'micro' level taluks/ as approximated by the Committee on Agro-climatic zones were grouped into agro-climatic zones. The agro-climatic zones/were taken as the basis (Government of Jhara 1974). It called for some modifications as grouping the taluks into the twelve zones would have left many zones with no irrigated taluks and many others with only irrigated taluks. The modification is worked out taking into account rainfall patterns and topographical models. The zones with the taluks are presented in appendix A.

Except for zones III and IV, other zones are ignored for this analysis as most of the irrigated taluks are concentrated in these zones. The seasonwise yield is divided by the average yield for the season for the

1963-79 period. These were plotted on graphs. It was thought best to use the ratios because they could be used to provide some idea about the trend in yields, if any. If there exists any increasing trend in yields the observations should get concentrated on the left hand lower and the right hand upper quadrants.

### Results and Discussion

The estimated values of the coefficient of variation of paddy yields across taluks are given in table I. It is seen that the proportion of irrigated taluks with relatively lower coefficient of variation of yields (less than 18 per cent) are higher ( $7/11$  and  $11/11$  respectively for autumn and winter) than the proportion of unirrigated taluks ( $13/39$  and  $27/42$  respectively for autumn and winter). But when it comes to summer, bulk of the irrigated taluks also show very high coefficient of variation of yields. As regarding the summer crop, while the overall (for all the taluks of the state) average coefficient of variation of yields is about 27 per cent, that for the irrigated taluks is about 20 per cent. Here again one observes wide regional variations. The irrigated taluks of Trivandrum district show an average coefficient of variation equal to the state average.

Table 1: Coefficient of Variation of Paddy Yields  
Across Taluks - Seasonwise (1963-1979)

Season	No. of Taluks falling in different ranges of coefficient of Variation			
	Less than 12 p.c.	Between 12 & 18 p.c.	Greater than 18 p.c.	To
Autumn	2+(2)	5+(11)	4+(26)	11+
Winter	7+(8)	4+(19)	0+(15)	11+
Summer	1+(0)	2+(1)	5+(24)	8+

Figures in brackets correspond to unirrigated taluks.



The above figures point to the conclusion that irrigation hasn't had much of an impact in stabilising the summer crop. As regarding the winter crop it is difficult to draw any valid conclusions because though one finds a low coefficient of variation of yields for the irrigated taluks it is true of a large proportion of unirrigated taluks as well. Coming to the autumn crop it does seem that irrigation projects did have some kind of a stabilising effect on yields. Since these conclusions do not take into account the specificities of agro-climatic zones, in particular rainfall and topography, which have definite bearing on the availability of moisture and crop yields, it is necessary to carry out the analysis at the level of these zones.

When the ratios of the observations on yields to their mean for different taluks in a zone were plotted on a graph sheet the following picture seems to emerge. If there had been any increase in yields over this period owing to irrigation or otherwise the percentage of observations on the left hand lower and right hand upper quadrants should have been high. Such a pattern does emerge for the autumn season for both the zones whereas for the winter season no such pattern emerges (See tables 2 and 3).

Table 2: Percentage of Observations on Different Quadrants - Autumn

Zone III		Zone IV	
16 (33)	34 (12)	4 (21)	38 (25)
34 (15)	16 (40)	46 (29)	12 (25)

Table 3: Percentage of observations on Different  
Quadrants - Winter

Zone III		Zone IV	
25 (29)	24 (23)	25 (16)	27 (25)
25 (21)	26 (27)	25 (34)	23 (25)

We may conclude that irrigation has some influence on improving yields in the autumn crop, but no such influence on the winter crop.

In sum, it seems that irrigation has some impact on stabilising and improving yields during the autumn crop. As regarding the impact of irrigation on stabilising or improving yields of winter and summer crops are concerned no valid conclusions can be drawn with the existing data. In a way this is perfectly understandable as autumn was fully rainfed and winter an irrigated crop in traditional agriculture (For details see D.Narayana 1983 forthcoming).

## II

### Constraints on Irrigation Development

The absence of any visible impact of investment in irrigation in stabilising and increasing yields is owing to the interactions among various factors in the economy of Kerala. The first set of issues pertain to the forces operating in the rice economy within the agricultural sector. The second set of issues pertain to the working of the organisations responsible for conservation and allocation of water resources in the state. A third

set of issues relate to the practices followed so as to attract financial resources for irrigation projects, viz. that of overstating the benefits or understating the costs or both, at the project formulation stage. The above issues are thrown up granting a particular model -- large scale irrigation projects for paddy cultivation -- which has been followed so far. This very model needs to be questioned in the light of the agro-climatic specificities of Kerala.

We begin with the rice economy of Kerala. During the last two decades the performance of this sector has been deteriorating. The area under rice as a percentage of the gross cropped area has been declining. It stood at 35.33 per cent in 1952-53 and declined to about 29 per cent by the mid seventies (P.P.Pillai 1982). Obviously the area under other crops has been expanding at a much faster pace than that of rice. Further, the area under rice has shown a marginal increase during the 1960-75 period. During the latter half of the seventies, it has shown a sharp decline.

The decline in area since 1974-75 has been steady. There have been year to year fluctuations in area during the earlier periods though of a mild order but a steady decline over four consecutive years is unprecedented. The extent of decline over the four crop years works out to 82 thousand hectares, i.e., by about 10 per cent. The decline in area is registered in both the main paddy seasons, Virrippu (Autumn) and Mundakan (Winter) though the area under Punja (Summer) increased slightly by less than 5000 hectares or 5 per cent (P.G.K.Panikar 1981).

This has come about owing to the unfavourable movement of price of rice along with increasing costs and the lack of any significant gains in the productivity of the crop.<sup>5/</sup> The typical policy instrument adopted for



solving the farmers problems was that of subsidy without any concerted effort at bringing about changes in the techniques of production. It is well known that the instrument of subsidy can have some impact with in the narrow bounds of the movement of price of rice relative to other crops given the movement of wages. Given the specificities of Kerala where the price of rice had to be kept low in view of the social welfare measures while the prices of other major commodities are subject to forces of international trade the assumption of a narrow bound does not hold. Consequently the impact of subsidy on maintaining the health of the rice economy has been minimal. The only solution in this context seems to be in working towards some far reaching technical changes in the rice economy.

(The potential for increasing the productivity of paddy is very high in Kerala.<sup>6/</sup> The prevailing levels of productivity are much below the levels reported from other regions of India and abroad. However, the introduction of the new technologies of rice production in the state call for considerable improvements in the structure and efficiency of water management in the State.)

Any efforts at water management call for certain changes at the crop-land end. In order to make the best use of water fields must be properly levelled and shaped and must also be provided with proper drainage facilities so as to avoid water-logging. The provision of these services requires a great deal of technical competence as well as large financial outlays and the willing co-operation of the farmers concerned. The ideal way would be to consolidate holdings and re-draw field boundaries in accordance with the lay out of the land in a way which would facilitate the construction

of channels and drains for the best use of water. (As far as land management at the end of crop land is concerned the constraints needed to be overcome are numerous (which are partly institutional and partly organisational). Most of these difficulties are highlighted in a report on the consolidation of holdings prepared by the state Revenue Board in the early sixties (T.N.Jayachandran 1965). According to this report, consolidation of garden lands in the state is an impracticable proposition. But it is not clear why consolidation of wet lands is not practicable. Actual implementation, however, may require strong political will and an efficient organisational set up. It is unfortunate that the institutional reforms which are essential for realising the best out of the irrigation projects are neglected in the State.)

Coming to the question of water management it calls for proper conservation and distribution works at the infrastructural level and proper storage and allocation through out the year so as to meet definite needs of the crops. As to the infrastructures, medium and large scale storage works have been built over the years. But how far has the building of proper field channels progressed?

In none of the command areas of Irrigation Projects, on farm development works necessary to adopt scientific water management practices have been carried out. In many blocks of rice fields, in the absence of field boothies, water is let into the natural drainage channels with all its attendant evils.. Field to field irrigation is finalised in the absence of field irrigation channels. (CWRDM 1981).

One of the important reasons for the slow progress, it seems, is the low budgets of these works as compared to the budgets of the major works.

Equally important are the works for maintaining the catchment areas. This is all the more important because of the peculiar structure of the catchments and the rainfall pattern prevailing in Kerala. The reservoirs are getting silted up at an alarming rate due to the large scale deforestation taking place in the catchments. And the latter has come about owing to the large scale encroachment of forest land. The state policy during the last two decades has been one of encouraging such encroachments. No one in this state seems to be bothered about these aspects of the projects.

Moving on to the questions of regulating proper storage and allocation for irrigation throughout the year some imaginative thinking is called for. Owing to the peculiarities of rainfall and cropping pattern in the state allocation of water calls for very careful planning. We have no evidence that such careful planning has been adopted for regulating the waters of the completed irrigation projects. The lethargy of the irrigation bureaucracy and the lack of any strong farmer's organisations seem to be responsible for this sorry state of affairs.

Regarding the practice of manipulating the figures at the project formulation stage we have the authority of the State Planning Board making following statement:

It seems that the blowing up of the ayacut area has become a common practice on account of the strict adherence to the criterion of economic limit adopted by the Department for sanctioning minor irrigation schemes.....(Government of Kerala 1975).

Though the above statement is made in the context of minor irrigation projects, we feel, similar practices are followed in the context of major projects as well.

The discussion so far has proceeded granting a certain model of irrigation and agricultural development. The two pillars of the model are (i) large-scale irrigation works; and (ii) irrigation mainly for paddy. Now, we would like to question this very model of irrigation and agricultural development. One of the important reasons for raising this question is the specific features of Kerala and the attendant high costs involved in erecting large-scale projects:

.....The cost of irrigation water comes to 4.5 paise to 10 paise per cubic meter while the cost of making one hectare of land irrigable works to Rs.5000 to Rs.10,000. The high cost of irrigation projects and the low responses to irrigation is attributed to the topographical features peculiar to Kerala and to non-adoption of scientific water management practices (emphasis ours) (CWRDM 1981).

Large-scale works are not cost effective when intended for supplying water to small valleys spread over a vast area. Here it would have been best to choose a particular model of irrigation after carrying out some comparisons of cost and effectiveness across various irrigation methods.

The questioning of the policy of irrigation mainly for paddy also arises from the peculiar topographical features specific to Kerala. The proportion of garden and uplands in most parts of Kerala are very high compared to the paddy lands in the valleys. Given this feature cost effectiveness could only be achieved by providing water to crops other than paddy as well. But such an approach would call for very careful planning of storage and regulation of flows through the months of the year as the water requirements of the different crops are different in the various months of the year.

In sum, for deriving optimum benefits from the projects completed and projects under construction it may be best to evolve a comprehensive water storage and regulation plan. Further, for the best use of the financial resources it may be best to think in terms of various methods of irrigation, the interests of technicians and contractors not withstanding.

### III

#### Concluding Observations

The objectives of this paper, as we stated in the beginning was to provide a critical assessment of the impact of irrigation on agricultural production in the state and also to identify the major constraints on irrigation development. An attempt of this kind can be carried out only to a limited extent because of the lack of adequate data on the irrigation sector of the state. However by making use of the data on paddy yields in the irrigated and unirrigated taluks we have tried to provide some idea about the impact of irrigation on paddy production. The following are our main findings.

- (1) The impact of irrigation in terms of stabilising productivity of paddy lands and increasing it overtime is seen to be only marginal in the state.
- (2) The lack of any significant influence of irrigation on crop yields is due to the poor management of irrigation water.

A variety of factors are responsible for the inefficient management of irrigation water. On the one hand, no attempt is made so far for improving the management of agricultural land with the result that more than helping to stabilize and increase production, irrigation projects are contributing to waterlogging and in this process there is considerable wastage of irrigation water. On the other hand, the management of irrigation projects are inefficient in terms of (a) supplying water from the main canals to the farmers fields (b) regulating the storage and discharge of water from the headworks taking into account the intensity and spread of rainfall in the command area and the crop-water requirements. ( It also appears to us that even if the management of irrigation projects are made more efficient, unless and until it is accompanied by significant improvement in the management of agricultural land, irrigation projects are not going to add anything substantial in terms of increasing agricultural production and productivity. )



Notes

- 1/ The details of expenditure on irrigation both major and medium along with the total plan outlay are given below:

Expenditure on Irrigation

(Rs. in lakhs)

Five Year Plans	Total Plan outlay	Outlay on Major/medium projects	Expenditure	Outlay on Minor Projects	Expenditure
(1)	(2)	(3)	(4)	(5)	(6)
I (1951-56)	3003.00	598.00	510.79	-	-
II (1956-61)	8700.71	863.48	892.43	236.68	226.20
III (1961-66)	17000.00	1142.00	1031.65	572.00	566.69
Annual Plans (1966-67, 67-68, 68-69)	14254.05	1072.66	1111.14	-	653.00
IV (1969-74)	25840.00	2675.00	2891.45	950.00	1144.47
V (1974-78)	56896.00	8363.00	7350.88	1667.00	1340.08

Sources: Plan documents and Economic Reviews.

- 2/ The details of the physical achievements of the major and medium irrigation projects are given below.

Number of Projects	Command Area (in Hectares)		Cumulative Total as of 1980-81 (in Hectares)	
	Net	Gross	Net	Gross
completed 10	133416	167758	79159	146596
On-going 18	296749	574548	70103	148766

Source: State Planning Board, Kerala Economic Review 1981

- 3/ The definition of irrigation adopted by the Bureau of Economics and Statistics:

"Irrigation is defined as the process of letting in water for the benefit of crops grown which involves some artificial or mechanical or manual effort for atleast one wetting". So a crop which received watering atleast once will be included under irrigated crop even if it is affected by drought before or after it received watering. Moreover irrigated crop includes those with insufficient irrigation also. It may also be noted that there is another limiting factor in comparing the figures as the number of crop cutting experiments based on which the average yield is calculated is comparatively low in the case of irrigated crop.



Since this definition in no way helps us to assess the impact of irrigation by medium or major projects we have not used the data on irrigated yields provided by their crop-cutting surveys.

- 4/ Our results differ from the results of George and Nair (George and Nair 1982) for the following reasons. George and Nair have used the data provided by the Bureau on yields of irrigated and unirrigated paddy. Owing to the reasons mentioned in 2 above it is questionable as to what valid conclusions could one draw from the data. Moreover this exercise has no direct bearing on the impact of irrigation by the projects under consideration.

The exercise carried out for six taluks (three benefited and three control) also are subject to various limitations. Firstly the yield figures used are for all the seasons which limit the validity of the conclusions drawn. Secondly, the selection of the control taluks ignores the agro-climatic specificities of the benefited taluks which might vitiate the results.

- 5/ As to the price movements it is best to see Panikar's table. We reproduce parts of it ( P.G.K.Panikar 1981 a).

Table 4: Trends in Prices of Paddy, Wage Rates and Price of Nutrients (State Average)

	Farm Price of paddy Rs.per Kg.	Kg.of paddy re- quired to buy one man-day of Labour	Kg.of paddy required to buy one Kg. of		
			N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
1960-61	0.41	4.51			
1961-62	0.44	5.00			
1962-63	0.41	5.90			
1971-72	1.00	5.43	2.02	2.91	0.90
1972-73	1.19	4.86	1.75	2.44	0.77
1973-74	1.87	3.57	1.32	1.60	0.60
1974-75	2.38	3.38	1.83	2.24	0.86
1977-78	1.30	6.67	2.66	2.38	1.03
1978-79	1.20	7.49	2.73	2.59	1.12

- 6/ 'The proportion of area under HYVs of rice in Kerala, viz. 30.9 per cent, was less than the all-India average of 34.6 per cent, and far below that in Tamil Nadu (92.3), Punjab (85.9), Haryana (57.4), Jammu and Kashmir (75.7), Andhra Pradesh (55.5), etc.'

See for details (P.G.K.Panikar 1981 b). We reproduce parts of table 1.

Table 1: Area under HYVs in Kerala, Season wise Area in Hectares

Year	All seasons combined percent under HYVs
1969-70	15.57
1970-71	18.20
1972-73	23.96
1973-74	28.38
1977-78	34.90
1978-79	34.94



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Appendix A

Zones	Rainfall	Topography	Taluks
I	Pattern I	Model I	Chirayinkil, Quilon, Karunagapally, Karthigapally, Mavelikara, Ambalapuzha, Shertalai, Vaikom, Kanayannur, Cranganore, Parur, Cowghat, Ponnani.
II	Pattern II	Model IIb	Nedumangad,* Kottarakara, Kunnathur, Chennannur, Tiruvalla, Changanacherry, Kottayam, Quilandy, Badagara, Tellicherry, Cannanore, Taliparamba.
III	Pattern I	Model IIa	Moovattupuzha, Kunnattunad,* Alwaye,* Trichur,* Thalappally,* Ottapalam, Perinthalmanna, Mukundapuram*.
IV	Pattern II	Model IIa IIc	Chittur,* Alathur,* Palghat,* Tirur, Ernad, Kozhikode, Hosdurg, Kasaragod.
V	Pattern I	Model III	Pathanapuram, Pathanamthitta, Kanjirapally, Peermade, Devicolam, Udumbanchola, Thodupuzha, S.Wynad, N.Wynad.
VI	Pattern I	Model IIb	Neyyattinkara,* Trivandrum.*

\* Irrigated Taluks.

Rainfall

**Pattern I** : Both the South West and North East monsoons moderately distributed. South West monsoon with June maximum.

**Pattern II** : Ill distributed rainfall. South West monsoon with July maximum and concentrated in 3-4 months.

Topography

**Model I** : Extensive valleys with level but raised garden lands.

**Model IIa** : Valleys less extensive. Hills with moderate gradients and slopes having mild gradients.

**Model IIb** : Valleys less extensive, hills with moderate gradients and with egg shaped bump. Slopes are steep.

**Model IIc** : Valleys less extensive; Hills with table tops. Slopes are steep.

**Model III** : Narrow valleys and hills with steep gradients.

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