PUBLIC INVESTMENT IN IRRIGATION PROJECTS IN KERALA

AN ANALYSIS OF COSTS AND ORGANISATIONAL ISSUES

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I hereby affirm that the research for this dissertation titled *Public Investment in Irrigation Projects in Kerala - An Analysis of Costs and Organisational Issues*, being submitted to Jawaharlal Nehru University, New Delhi, for the award of the Degree of Master of Philosophy in Applied Economics was carried out entirely by me at the Centre for Development Studies, Thiruvananthapuram.

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Certified that this dissertation is the bonafide work of Nalini Netto and has not been considered for the award of any other degree by any other University.

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Contents

List of Tables

List of Charts

CHAPTER I

INTRODUCTION

Ever since the advent of agriculture in early civilisations, water control, especially in the form of irrigation and drainage, has been a decisive factor in their growth and development. A century ago, Marx (1853) suggested that the apparent peculiarities of Oriental Society might have something to do with the technical and organisational compulsions of water control. According to Weber (1927), the question of irrigation was crucial in the cultural evolution of Egypt, West Asia, India and China. The much debated and controverted theory of 'Oriental Despotism', proposed by Wittfögel (1957), was based on the observation that those in control of water supply, particularly in the agrarian societies, enjoyed considerable social and economic power.

A review of the growth of irrigated area in the world shows that much of the progress in irrigation took place in the twentieth century. At the beginning of the 19th century, the area irrigated is seen to be estimated at around eight million hectares which reached 48 million by the turn of the present century. At the end of the Second World War, the area irrigated was around 92 million hectares. Since then there has been a quantum jump in irrigation, the area crossing 200 million hectares by the early seventies (Fukuda 1976:36). About fifteen percent of the world's total cultivated area is now irrigated. Of this, nearly 72 percent is in the developing world, covering about one-fifth of its cultivated area. China and India, the two large agrarian economies account for more than half of the irrigated area in the developing world (Barrow 1987 and IIMI 1987).

The Need

Irrigation, the principal means by which man modifies climate to increase food supplies, has been considered as a critical investment for monsoon Asia. In Asian agriculture, there are three distinct institutional patterns of organisation of production: peasant agriculture, collective agriculture and capitalist agriculture. This discussion will be confined to subsistence crop agriculture carried out in the peasant sector in a wider sense. The two basic conditions specific to this peasant agriculture in Asia are i) the virtual disappearance of arable land frontier and (ii) the lack of basic investment in land.

Basic investment in agriculture in the Asian context refers primarily to the building of a structure in farm land for flood control, irrigation and drainage. Studies reveal contrasting patterns of relations between land productivity and basic investments in the inter-country data of Asia and those of the other regions of the world. In Asia, there is a strong inter-relationship between increase in the basic investment (measured as proportion of the irrigated to total cropped area) and rise in land productivity (measured as the total cereal output per unit of cultivated land). In contrast, such a relationship does not seem to exist in the Near East, Europe and America. Most of these areas have followed a pattern of agricultural development based on natural precipitation, dry land farming and livestock[1].

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[1] In Europe, the basic investments are said to be in the "stables and stone fences", both related to livestock raising.

For the cultivation of paddy which is the main crop in Asia, basic investments in flood control and irrigation are not a precondition. But the yield is substantially greater in areas endowed with such investments. And complementarity among the various inputs which are specific to Asian agriculture is a very important factor to help achieve a substantial increase in land productivity. A kind of input that contributes most to raising output under the constraint of such complementarity (most importantly, by playing the role of a shift variable of the production function) is called the leading input. It is observed that in countries or regions with very low land productivity (a crude measure of it being a per hectare yield of paddy of less than 2.3 metric tonnes), this leading input is basic investment in land such as flood control, irrigation and drainage[2].

According to Ishikawa (1967), the differing roles of irrigation in increasing productivity emerge in actuality in successive productive stages by making possible (i) the stabilisation of the harvest fluctuations due to deficient or untimely rainfall, (ii) the introduction of a second crop, (iii) the increased application of fertiliser, the use of better seeds, and (iv) the introduction of improved farming technology. When the second and third roles come into play, the quality of irrigation must often be improved. In the third role, irrigation acts as an intermediary for making possible a shift in the crop-

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[2] In the case of Japan, the productivity level of 2.3 metric tonnes had been attained as early as the 1860s during the Meiji era, which seems to have been made possible by the basic investments extensively done during the Togukawa period (1603-1867).

cultivation from one input-output combination to another with a higher productivity.

Investment in Irrigation

The capacity of the agricultural producers to respond to technical and economic opportunities available to them depends significantly on the level of infrastructural development, infrastructure implying the inputs and services organized and controlled by the community. A concept of externality in the economic, technical and geophysical aspects and group control is usually implied. Infrastructure is of two kinds, physical and institutional. Irrigation is one component of the former (Hayami and Ruttan 1971).

Investment in irrigation is creation of Social Overhead Capital (SOC) which is usually defined as those basic facilities which are essential for primary, secondary and tertiary economic activity. In addition to many factors the most important factor that characterises an SOC investment such as irrigation is the lumpiness (technical indivisibility) as well as a high capital/output ratio.

The strength and weakness of an SOC investment lies in the fact that it is impervious to the investment criteria that have been devised to introduce some rationality into development plans. The computation of capital/output ratios often presents almost insuperable statistical difficulties and moreover it is considered misleading anyway because of the igniting effect SOC

investment can have on Directly Productive Activities (DPA). As a result, SOC investment is largely a matter of faith in the development potential of a country or a region (Hirschman 1969).

Importance of Public Investment

Basic investments being a matter of SOC, the government must intervene in the determination of the optimum quantity of the leading input to be applied from the national economic point of view (Ishikawa 1967). Investment funds in both the agricultural and non-agricultural sectors are of course, not confined to those disbursed by government. Yet the latter constitutes the funds with the highest opportunity cost, since they are centralized and usable for any purpose conceivable. Under the given institutional setting, the government investment funds are the final means of adjusting the direction of flow of funds, to enable the economy to attain a balanced and maximum growth rate. Consequently it is quite meaningful to consider the magnitude of capital requirement of agriculture in terms solely of the governmental outlay.

The general factors that have to be taken into consideration for irrigation development are (1) natural conditions, such as rainfall and other water resources, sunshine, soil and topography; (2) purpose of the project: whether it is flood control, irrigation, drainage or some other, (3) the phase of land development in the same geographic area, and (4) construction methods of a project in the identical place and identical development phase, which also involve a difference in project sizes, and their capital and labour intensities.

From the stand-point of one country or one region, given the natural conditions and the phase of land development the best purpose of the project is determined technically. So the factors (1) to (3) do not seem to involve choice problems in general. The only choice problem that remains in connection with these factors is in fact, the choice among regions to locate the project or the choice of whether the project is to be constructed for a simple purpose or in combination with some other purposes (such as in a multipurpose project). In regard to factor (4) there seems to be a wider range for the choice problem just as in the manufacturing sector.

A serious choice problem exists at least between major and minor projects, although this may not be the sole one relating to the basic investment projects. The real problem arises in situations where major projects are technically superior and hence the return to investment larger than the minor projects; minor projects may assume a more important consideration in selection when the investment funds are in pressing need because their capital requirement is less. This is especially so, if we take into account the possibility that the centralised investment with a high opportunity cost has an inducement effect of making otherwise unused local resources (especially surplus labour) active, when it is allocated to the minor projects and makes them profitable or rewarding. Such inducement effect is small when the institutional setting of the peasant sector is backward; it becomes larger with the progress of organisational and institutional reforms. Therefore, the choice between major and minor projects involves to a large extent a choice among institutional alternatives (Ishikawa 1967).

In general, divisibility is one of the most desirable characteristics of an irrigation investment project for a balanced development of institutions and management (Zapata 1980:46). While indivisible projects have to be based entirely on probabilities at start, divisible projects have the advantage of generating information as they progress. Divisibility of course, depends on the nature of resources and their location.

Capital Formation in Irrigation

As Tamaki (1977) puts it, an important characteristic of irrigation agriculture in Asia is the duality of capital formation - terre-capital formation on the one hand and agricultural operational capital formation on the other. Investment in flood control and irrigation facilities are two forms of terre-capital formation. The function of terre-capital stock is to integrate labour into land, so that past investment can be used to facilitate 'present labour' in the process of production. This suffers from time over-run and cost over-run. Terre-capital stock also depreciates with time.

Historically, large scale construction works were sponsored by despotic dynasties. Later, during the colonial period, it was taken up by the colonial government and at present, by the central and local governments. This type of capital formation is totally alien to the actual peasants who are the producers and it is way beyond their means.

Flood control projects and irrigation canals flowing over large areas make up part of the agricultural capital formation from the social point of view, but they do not directly induce changes in the capital formation at the level of individual farms. Terre-capital formation thus has practically no relation to the operational capital formation at present. The original meaning of agricultural capital formation, that is, the intensification of the individual farms gets totally neglected. In Asian agriculture, we have thus a situation where the terre-capital formation has advanced by itself leaving behind the operational capital in the realm of on-farm development, in a rather retarded state.

To appreciate the complementarity between terre-capital formation and agricultural operational capital, the following quotation from Tamaki (1977:13) may be useful. "For public terre-capital formation in irrigation agriculture to develop into an efficient accumulated agricultural capital, it must be transformed to actual productive power. Control of rivers, development of water resources, and construction of irrigation facilities are typical cases of capital formation made outside individual production units. Consequently, transforming terre-capital into productive power means the process of internalization of the public investment effectively to help the operation of individual farms".

The Role of Government

We have seen that the construction of water control works covers several phases starting with the controlling and harnessing of a water source through the laying of the distribution/drainage network reaching down to the farm level, to the preparation of land for efficient irrigation. The organisation of water control systems varies widely across countries and regions, conditioned largely by the system characteristics and the manner in which they were evolved. Although the state plays a prominent role in planning, regulating and assisting the development of irrigation, flood control and drainage projects, the extent of its direct involvement varies. For example, compared to India, the higher levels of government in China and Japan play a much more limited role in practically every phase.

All over Asia, community involvement in and contributions to system construction has been most noticeable in small and relatively simple local systems. Large systems covering extensive areas tend to attract a high degree of state involvement. The predominance of large storage systems in South-Asia compared to East-Asia has led to the relatively prominent role of the state in the former region[3].

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[3] This however does not explain how China has been able to mobilise beneficiaries to contribute directly a major part of the project costs while India has not been able to do so. In China, since labour is the main resource needed for the construction of these works and accounts for the bulk of the costs, the mobilisation of resources principally takes the form of labour contributions by members.

Growth of Investment and the Main Issues

That the expansion and improvement of water control facilities and in particular, irrigation, has a crucial role in increasing agricultural production in densely populated developing countries is by now commonplace wisdom (Vaidyanathan 1983:4). The Brandt Report (Independent Commission on International Development Issues, 1980) identified irrigation and water management as the single largest category of investment required in the developing countries (Barrow 1987). During the past two decades, irrigation schemes have become one of the most favoured development projects in Asia, Africa and Latin America. Several countries with irrigation potentials have devoted more than 75 percent of their public spending in agriculture and irrigation projects (IIMI 1987:9). In Asia, the biggest investor in the irrigation projects is the government. The World Bank also is a major funding agency for irrigation projects in developing economies, including India.

Presently many of the better sites of irrigation development are being exploited. It is therefore likely that in future, only less than ideal sites will be available. This means that the cost of establishing irrigation will be more, and the risks of complication and failure significantly greater. Thus although there are opportunities for irrigation development, they may not come as easily and cheaply as in the past.

Much as government resources are pumped into irrigation investment, it has also attracted loud critics who point to the

increasing costs involved, (which are often underestimated in the project reports), yields below forecast and environmental damage to soils or human health. As such a number of negative features of the irrigation projects such as gigantism, high cost, negative externalities leading to environmental problems and above all long delays in completion have become the focus of not only research investigation but also of public attention.

Irrigation in India

As a country in monsoon Asia with nearly 20 percent of the irrigated area of the world (Food and Agricultural Organisation 1988) and with a strikingly prominent role of the Government in irrigation systems, India's experience in the development of irrigation assumes importance.

Public irrigation works have a long history in India. Documented irrigation developments as early a period as 4000 B.C. have been observed. (Dakshinamurthy et al 1973:9). But it is difficult to decide how exactly irrigation practices had begun in India. The more common mode of irrigation in early ages was public tanks. Construction of canals picked up only after the fourteenth century (The Irrigation Commission, Government of India 1972a). By the beginning of the nineteenth century, three predominant sources of irrigation had been established, namely, wells, inundation canals and tanks. Wells, mostly privately owned were spread all over India, tanks were concentrated in southern India while canals were predominant in the northern parts.

Under the British rule, irrigation was given a low priority initially. The British colonisers knew very little about irrigation, compared to Indians. And the irrigation during the British era was basically an exercise in civil engineering, with strong military features, characterised with the traits of mastering nature (Singh 1990). The exaggerated emphasis on civil engineering at the cost of environmental balance, efficient crop practices and local management as found in modern development programmes, thus arises from a historical coincidence (Sengupta 1985). Public investment began as slow sporadic renovation and improvement of the earlier systems. The development of irrigation was financed mainly through public loans, applying a strict principle of minimum financial percentage return as a viability criterion. Thus the primary motivation for irrigation during this period was financial returns accruing immediately on investment.

The recurrence of famines and droughts during the second half of the nineteenth century leading to improvement of agriculture, forced the colonial government to view irrigation more as providing security against natural calamity than as purely a revenue earner. The Irrigation Commission which was appointed in 1901 to review the existing policy recommended that protective works be given prominence[4]. As a result, the overall

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[4] A productive work was one, the net revenue from which, within ten years after the date of its completion, was more than the prescribed percentage on sum-at-charge. The sum-at-charge included direct charges such as cost of works, land and establishment, and also indirect charges and all arrears of simple interest on the capital outlay, if any. Protective works (unproductive works) were those which yielded a net revenue less than the prescribed percentage, fixed from time to time for

outlay on public irrigation increased from about 400 million rupees in 1901 to 790 million rupees in 1920-21. The total area irrigated by public works increased to 10.4 million hectares in 1920. Public irrigation formed the single largest component of total irrigation (The Irrigation Commission, Government of India 1972a).

The partition of the country in 1947 along with Independence brought about a division of the irrigation sources between India and Pakistan, with the latter emerging to be better endowed in irrigation at that time. On partition, Pakistan had 48 percent of its net sown area irrigated while India had only 20 percent. A greater part of the irrigated area in Punjab became Pakistan's territory and this fact; together with the need to rehabilitate the refugees who migrated into India, made it necessary to make heavy investments in irrigation in the eastern part of Punjab immediately after 1947. Most of it was on the Bhakra Nangal Project, the largest multipurpose project in India's first Five Year Plan.

Public investment in irrigation to tap the water resources, imperative for the country aspiring for accelerated development, came under the purview of the Five Year Plans which commenced in

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productive works. Protective works were constructed from the capital provided from the general revenues of India while the productive works were constructed from the capital which has been borrowed. Minor works were small works for which detailed capital and revenue accounts were not maintained. These works could be productive or unproductive. (The Irrigation Commission, Government of India 1972a:129).

1951[5]. A large step up in irrigation investment resulting in a turn around in the long standing stagnation of India's agriculture has been regarded as one of the achievements of the first three Five Year Plans. The productivity differential between irrigated and unirrigated lands being quite substantial, irrigation has acquired a pre-eminent place in the Indian planner's agenda for agricultural growth with a stable path[6]. (Dhawan 1988).

Through the fifties, the period of the first two Five Year Plans, the investment was geared predominantly towards the creation of large scale surface irrigation works, often as a part of multipurpose hydel projects. Many major and medium[7] projects

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[5] According to the National Commission on Agriculture (1976), total water resources of the country after accounting for soil moisture and evaporation are 185 million hectare metre comprising 135 million hectare metre of surface water and 50 million hectare metre of ground water. The complete exploitation of both the water resources in full for irrigation is not possible on account of topographic, climatic and soil limitations in the case of surface water and additional limitations of pumping depths and availability of power in the case of ground water. The ultimate irrigation potential of the country is estimated at 113.5 million hectares (Prihar & Sandhu 1987:2).

[6] Moreover, the importance of irrigation was also brought out in the studies on Mexico, Taiwan, Punjab and Madras with high rates of growth in agriculture in the postwar period. They had considerable irrigation facilities as a result of past investments, followed by an extension of irrigated area during the period in which high growth rates were recorded (Raj 1970).

[7] Irrigation development schemes fall into three main categories - (1) major irrigation schemes which cover a Culturable Command Area (CCA) of more than 10,000 ha, (2) medium schemes which cover a CCA of 2000-10,000 ha (3) minor schemes with a CCA of less than 2000 ha. This classification as recommended by the Irrigation

were sanctioned in large numbers. The criteria followed for the selection of a project in the early years have been criticised by eminent economists[8]. A total of nearly fifteen thousand crores of rupees have now been spent on major and medium irrigation till the end of the sixth plan, creating a cumulative potential of 30.50 million hectares. The investment per hectare of additional potential created has increased from 1200 rupees in the First Plan to 19300 rupees in the Sixth Plan, registering an increase of 16 times, at current prices.

Minor irrigation has suffered a relatively overall neglect in terms of the priorities of public irrigation policy. A purposive shift to minor irrigation did take place during the Third Plan, with a significant rise in outlay on minor irrigation. Enhanced institutional financing was also given to farmers for ground water development. However, it is significant

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commission has been in vogue since 1978. The earlier policy of classifying irrigation works on the basis of financial investment is not rational since change in prices may result in a project classified 'medium' at the time of sanction becoming a 'major' one by the time it is completed.

[8] The selection of projects especially during the First Five Year Plan does not seem to have been based on any economic or social objectives (Gadgil 1972:2). During 1955-61, careful investigations by a Committee of the Planning Commission headed by D.R. Gadgil revealed that the social benefits from irrigation were far larger than the direct financial returns accruing to government from irrigation rates, and recommended that the benefit cost ratio should be used for assessing the feasibility of new projects. The Planning Commission accepted the recommendation in October 1964. Projects with a benefit cost ratio of less than 1·5 are not generally considered for acceptance although theoretically a ratio of unity should meet the criterion. The rule is not strictly applicable to drought affected areas and tribal pockets.

to note[1] that in the Sixth Plan document (1980-85), ground water development hardly finds a place in the thirteen strategies outlined in the preamble to the chapter on irrigation. A cumulative potential of nearly 37.40 million hectares has been created with an investment of a little over four thousand crores of rupees in minor irrigation. The investment per hectare of additional potential created has increased from 578 rupees in the First Plan to 2435 rupees in the Sixth Plan, the latter being four times the former at current prices. Thus although 45 percent of the irrigation potential was created through the major/medium schemes, they absorbed 77 percent of the total outlay.

In the case of major and medium projects, the annual expenditure in real terms and per hectare of irrigation potential created rose steadily throughout the period of planning, except during the Annual Plans (1966-69) when few new projects were started and also in the Fifth Plan when the pressure to finish nearly completed projects was stepped up, thus raising the potential created from existing investments. In minor irrigation, we find a rapid growth in public expenditure and institutional finance from the First Plan onwards, but particularly in the sixties. Real outlays and credit disbursement reached their peak just prior to the beginning of the Fourth Plan. Plan outlays declined significantly in real terms during most of the seventies, although some recovery is evident for 1978-79 and 1979-80. The real level of institutional credit has been broadly maintained in the seventies (Abbie et al 1982).

Even with such increasing cost of major and medium projects, the completion of such projects has been far from satisfactory. Between 1951 and 1985, 246 major and 1059 medium projects were taken up for execution. Among them, only 65 major and 626 medium projects were completed by 1985 (Government of India 1989:389).

Development of Irrigation Potential

Despite irrigation projects getting a significant share of plan resources, the achievements cannot be reckoned as impressive. The gross cropped area irrigated increased from 17.13 percent in 1950-51 to 29.89 percent in 1983-84. The average annual growth rate of the gross irrigated area is around 2.7 percent. In absolute terms the gross irrigated area increased from 22.6 million hectares in 1950-51 to 53.9 million hectares in 1983-84 compared to the increase in gross cropped area 131.9 to 180.4 million hectares.

However the regional distribution of this development has been very uneven. The areas which received attention during the British period continued to be patronised, with the States of Punjab, Haryana, Tamil-Nadu and Uttar-Pradesh having the percentage of gross cropped area irrigated, varying from 48 percent to 91 percent. Karnataka, Assam, Kerala and Maharashtra registered between 18 percent and 13 percent in 1983-84 (Government of India 1986).

There has been a steady decline in the area irrigated by major and medium projects through the mid-seventies, followed by

a marked acceleration thereafter. Minor irrigation picked up only after the Third Five Year Plan. A further breakup of the minor irrigation into 'surface' and groundwater indicated that there is rapid growth of ground water irrigation, mainly private since the mid-sixties, taking off somewhat in the eighties. The minor surface irrigation registered almost nil growth rate from 1951 till about 1969 and thereafter has showed signs of picking up[9] (Bharadwaj 1990:56).

A major weakness of the institutional structuring of irrigation is reflected in the persistent and large gaps between irrigation potential and utilization, for all major, medium and minor works. The plan documents reveal that between 1950 and 1980, the actual utilization of irrigation, out of the reported additional potential of 34 million hectares was only 30 million hectares and that this gap was mainly in the major/medium works.

The potential created has not been fully utilised mainly because of the difficulties faced by the farmers in the levelling of their lands, construction of field channels and supply of other inputs for irrigated agriculture. Mainly with a view to overcoming the above difficulties, Government have started the Command Area Development Programme (CAD) during the Fifth Five Year Plan[10].

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[9] Annual percentage change dipped to 2.7 in 1973/74 from 4.7 in 1955/56 for major and medium irrigation. For Minor irrigation the annual percentage change rose to 4.3 in 1973/74 from 1.7 in 1955/56.

[10] The Command Area Development programme envisages, modernisation and efficient operation of the irrigation system, as well as development of main drainage system,

Cost Escalations

Irrigation is a state subject and finances for the large scale public sector irrigation under the Five Year Plans have been met out of the overall plan resources of the state without any special provision for irrigation. Shortage of finances is experienced for completing the projects, leading to delay and in turn to cost escalations which further aggravate the shortage of finances (Pant 1982). Projects have often taken as long as fifteen to twenty years with costs rising as high as 400 percent of the original estimates. No project in the irrigation, power or flood control sectors has been completed within the time schedule from the date of approval and within the estimates of costs (Committee on Public Accounts, Lok Sabha 1983). Kerala State tops the list for cost escalation in major and medium projects both during 1947-71 and the Sixth Five Year Plan.

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construction of field channels, construction of field drains, land shaping and land levelling with consolidation of holdings, lining of field channels/water courses, exploitation of ground water, installation of tube wells, adoption and enforcement of a suitable cropping pattern, enforcement of an irrigation rostering system, preparation of a plan of inputs like credit, seeds, fertilisers, pesticides and so on, making arrangements for timely and adequate supply of various inputs and strengthening of existing extension training. The central government is giving assistance to the states on a matching basis for some of the items of work taken up under CADA. Institutional finance is also being given for crop planting, water management and marketing of produce. These measures have helped in improving the utilisation but as the pace of development of the potential has been increasing, the gap between the potential and the utilisation has remained large.

Estimates of the Incremental Capital-Output Ratio (ICOR) in the Indian economy show that it has increased from 3.49 in the fifties to 4.45 in the early eighties on gross terms and from 2.59 to 3.38 in net terms (Chakravarty 1987). Delays in the completion of projects have contributed considerably to this increase. Grossly inadequate budget allocations leading to the lengthening of the gestation periods, unsatisfactory monitoring of the progress of construction, an element of politicization of public investment decisions on matters relating to location, facility, design, under utilization of generated potential all go to explain the rise in the ICOR. The delay in completion and the rise in costs of major and medium irrigation projects have thus been a growing concern with the government.

These problems of cost escalation, delays, incomplete construction/planning of the works leading to wastage of resources appear to be almost ubiquitously associated with the major works and as such they cannot be treated entirely as incidental or irregular occurrences arising only in specific cases. Thus allowance has to be made for such possibilities while defending the relative priority to be given to large scale projects against small scale or minor ones and the rehabilitation of traditional systems. It is also necessary to take care of the problems that arise not only in the construction of the asset, but also in its maintenance and delivery.

The Indian Irrigation System

The Indian Irrigation systems are dominated by and dependent on the state's bureaucracy (Vaidyanathan 1983:49). In the case of surface irrigation works, the government agencies do the preparatory surveys, design projects and undertake the actual construction. Prior to the formation of the CADA, the government undertook the responsibility only for constructing the main reservoir, the main and branch canals and usually distributaries upto a certain level (usually outlets covering about 40 hectares or so). The farmers were expected to construct field channels beyond this level and also make the land improvements necessary for irrigation. But now there has been a clear trend towards the government assuming responsibility for these works as well through the Command Area Development Authority, which is now separate from the departments responsible for the construction of the main facilities[11].

The cost of all these programmes is financed initially from the budget and to some extent through financial institutions. The common practice of construction is to entrust the construction including the task of recruiting the necessary labour and supervising it to contractors selected by a tendering procedure. The farmers do not contribute any money and labour at the time of construction. The cost of the work is supposed to be recovered from the beneficiaries in easy instalments over a

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[11] While in the maintenance and operation of the water control systems, the involvement of the higher political authority has been and remains quite limited in Japan, it is considerable in China and most striking in India.

period of several years in the form of betterment levies. Water cess is also supposed to be collected from farmers who get the benefit of irrigation water. But little is actually collected so that in effect the beneficiaries hardly contribute anything to the cost of developing the water control facilities.

In the case of ground water, the state's role is less, being practically limited to organising surveys of groundwater potential, providing technical advice and some drilling equipment, and laying electricity transmission lines.

Summing Up

Irrigation development has been the kingpin in the planners' strategy for Indian agriculture. Irrigation has made giant strides since independence and India has emerged as one of the biggest dam builders of the world. But the Sixth Plan Document of the Planning Commission has admitted that the huge investment made in irrigation has yielded disappointingly low results. And of late, the assumptions behind irrigation planning are being increasingly questioned. In the name of priority for ongoing projects, the major irrigation works have crowded out other agricultural schemes and have become the sore point in many quarters.

Studies on Irrigation

There have been a spate of studies in the recent past. But the major contribution of these studies has been the perfection

of the cost-benefit analysis. The survey of research on irrigation suggests an almost exclusive concentration on the problems relating to project analysis or the study of social costs and benefits (ICSSR: A survey of research in economics 1975).

The Objective of the Present Study

The present study mainly aims to find out the lacunae in planning and organisational set up in irrigation which has been absorbing a high share of the plan outlay in total and of the agriculture sector in particular. The state chosen for study is Kerala, which stands out among other states, in various aspects.

There are many reasons for choosing this state for the present study. It has the highest literacy rate in India and a Physical Quality of Life Index comparable with any developing nation, thus pointing to the high priority and importance given to the welfare schemes. At the same time, the state has a highly commercialized agriculture sector and food production far short of its requirements.

Though blessed with abundant rainfall, droughts have been quite frequent in the last decade. The state has invested heavily in irrigation. Disproportionately high investment in irrigation projects has been an important aspect of Kerala's planned efforts for agricultural development (Narayana and Nair 1983). About 800 crores of rupees have been invested so far in 28 major and medium projects of which only 10 are complete.

Even in the irrigation sector, Kerala stands out among other states quite conspicuously. It has been topping the list of states with projects suffering from the highest cost escalations. Moreover, the Irrigation Commission (1972) has also observed that the cost of irrigating per hectare of benefitted area is the highest for this state. A number of reasons could be identified for this state of affairs; some internal to the process of investments planning and implementation in the irrigation sector and some external to it. Examples of the latter are the relatively high costs of land and labour in Kerala.

The objectives of the present study are: (1) to examine the extent of cost escalation and establish its gravity and repercussions by analysing the expenditure pattern in the 17 year time frame from 1972-73 to 1988-89, and (2) to link up the planning and organisational set up in the state with the project cycle concept to highlight the hiatus between theory and practice.

Limitations

Given the limitations of data and time, the cost analysis has been carried out in terms of nominal (money) costs only, unadjusted for its time flow. Ideally cost analysis should be carried out after adjusting for the time flow of expenditure but this requires a time-series index suitable for deflation for the state and relevant to the irrigation sector. The construction of this index is not merely time-consuming but almost formidable given the paucity of information on such variables as prices and

quantities relevant to irrigation projects. This problem was addressed by Tara Shukla (Shukla 1965) when dealing with calculation of capital formation in the irrigation sector. There is awareness of this problem at the national level as borne out by the Report of the Expert Committee on Rise in Costs of Irrigation Projects (Naegamwala Committee) constituted by the Ministry of Irrigation and Power (1973:95). The Committee itself could come out with such an index only for a very short time-period namely 1961-71 and that too for the country as a whole.

The second important dimension in cost analysis is the economic logic in accounting of costs. Here the problem is one of translating financial costs into economic/social costs based on the logic of opportunity cost. This is intended to assess the social costs involved in terms of resources committed for irrigation projects. Apart from such costs as are identified in the project reports this also gives scope for assessing the net external costs of irrigation projects.

Data base

The data used in the study are from the various plan documents of the state, the various project reports from the Irrigation Design and Research Board and the budget documents for expenditure details.

Chapter Scheme

Chapter II deals with the conceptual framework for investment in irrigation projects on the basis of the project cycle. In Chapter III we examine the irrigation planning in Kerala, with an emphasis on the necessity for irrigation, the historical perspective, the present planning mechanism and an analysis of the plan investments. The issues of cost escalation and time over-run of major and medium irrigation projects are elaborated in Chapter IV. This chapter also deals with the analysis of expenditures on major and medium projects with a view to understand the implications of cost escalation. In Chapter V, we describe the present organisational structure of the irrigation set up and examine its relation to the project cycle. And finally Chapter VI deals with summary and conclusions.

CHAPTER II

INVESTMENT IN IRRIGATION PROJECTS

A CONCEPTUAL FRAMEWORK

Until quite recently, economic arguments about the advisability of irrigation appeared almost superfluous, as the obvious richness of irrigated land alone seemed to justify any projects needed (Bergmann and Boussard 1976:11). As projects have become costlier, reasons for justifying investments in irrigation can no longer be taken for granted. Therefore a more indepth look into the various aspects of irrigation investment is imperative.

Plans and Projects

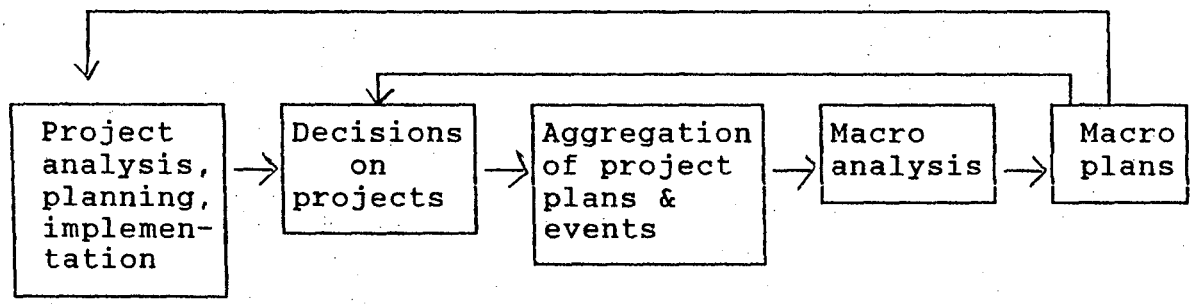
To say that in all developing countries capital resources are particularly scarce is stating the obvious. Yet its effectiveness in utilization leaves much to be desired. While a lot of effort goes into policy formulation and planning of a much broader scope, the specific projects on which the available resources are expended, are often ill-conceived, hastily planned and virtually improvised on the spot! (Gittinger 1982).

Projects are the building blocks of a country's investment plan. Investment plans may consist of a single project, or many projects, often interrelated. A project is thus any scheme or part of a scheme for investing resources which can be reasonably analysed and evaluated as an independent unit. Although the use of the term 'project' can be traced back to several centuries, it is only in the postwar period, beginning in the 1950s, that

development practitioners and academicians have focussed on projects as the units into which investments could be packaged (Baum 1985:6).

The steps in economic development planning thus involve aggregates (macro elements) and projects (micro elements). Both are part of the same reality and are interdependent, the micro being the sum of the macro elements and interactions and the micro elements depending on related aggregates. If a plan is conceived as being authoritative and as an irrevocable basis for action rather than as being subject to correction from project analysis, the benefits of good project analysis will be very limited. The ideal cycle of interaction should be

Chart I
Relationship of Projects to Macroplans



(Solomon 1970: 33, 34).

Development projects are thus the privileged particles of the development process (Hirschman 1967:1)

The Project Format: Advantages and Limitations

The project format itself is an analytical tool. Casting a proposed investment in project form enables a better judgement about the administrative and organisational problems that will be encountered. It also encourages conscious and systematic formulation of the details. It helps contain the data problem too. In short, project analysis facilitates the planning process by providing meaningful indices of economic growth and time phased goals for implementation.

As Gittinger (1982) puts it, projects are planned and implemented in a socio-political environment. And any national investment decision is a political act that embodies the best judgment of those responsible. Project analysis, while providing an effective tool by which this judgment can be sharpened and the likelihood of error reduced, cannot replace it.

Aspects of Project Preparation and Analysis

The various aspects that together determine how remunerative a project investment will be, can be divided, as suggested by Ripman (1964) into six categories - technical, institutional/ organizational/managerial, social, commercial, financial and economic.

The technical analysis, which concerns the project's inputs (supplies) and outputs (production) of real goods and services is a pre-requisite to the other aspects of project analysis and has

therefore necessarily to be thorough and precise. For example, in a proposed agricultural project, technical analysis will examine among other things, the types of soil in the region of the project and their potential for agricultural development, the availability of water, both natural and supplied, crop varieties and livestock species suited to the area, the production, supplies and their availability. The technical analysis may identify gaps in information that must be filled either before project planning or in the early stages of project implementation.

In order that a project is carried out and utilized, it must relate properly to the institutional structure of the country and region. In the case of an irrigation project, the arrangements for land tenure, the size of holding, and relation of the administrative organization to existing agencies become highly relevant. The organizational proposals should be examined to see that the project is manageable. In managerial issues, we have to take into account the needs not only of the project staff, but also of the potential users.

In designing projects we have to take into account the social implications of project investment. Generally care should be taken to see that lower income groups are favoured, employment opportunities are created, and income is equitably distributed. Care should also be taken to see that there are no adverse environmental impacts.

Commercial aspects include the arrangements for marketing the output produced by the project and the arrangements for the supply of inputs needed to build and operate the project. In addition, it also includes arrangements for the procurement of equipment and supplies.

The financial aspects of project preparation and analysis encompass the financial effects of a proposed project on each of its various participants, like farmers for example, in the case of an irrigation project. An analysis of the financial aspects of the project's administration dealing with the investment funds, operating expenses, government policies to finance the project and so on is customarily set up using the methodology of discounted cash flow.

The economic aspects of project preparation and analysis require a determination of the likelihood that a proposed project will contribute significantly to the development of the total economy and that its contribution will be great enough to justify using the scarce resources it will need.

The financial and economic analyses are complementary - the former takes the viewpoint of the individual participants and the economic analysis that of the economy.

The Project Cycle

There is a natural sequence in the way projects are planned and carried out and this sequence is called the project cycle.

This cycle that projects go through from their initial conceptualisation to the implementation stage has been well treated by Baum (1978). The main recognised steps are the definition of the project concept, identification, preparation and analysis, appraisal, implementation and evaluation. While these steps are treated separately in separate phases, all projects do not follow a clearly defined routine in their formulation (Benjamin 1981). In practice, many of the stages overlap. The particular functions involved at each phase are discussed here.

Project: Concept Definition and Identification

Although in practice the concept definition stage may often merge imperceptibly into the identification stage, it is important to separate the two conceptually. The stage essentially aims to express the country's development objectives in the form of projects, based on a thorough understanding of the country's agricultural development objectives, its resource base and an assessment of the options facing the country. This is a pre-requisite to proceed with the identification stage. In the case of irrigation projects, it could be whether the country has considered the alternative of dryland farming. Many project ideas however develop on an adhoc basis and may originate from widely different sources.

The identification stage develops the project idea to the point where a decision can be taken on whether resources should be committed to detailed project preparation stage. This can be

a lengthy and costly process where engineering feasibility study may be entailed. Thus while the thrust of the project concept definition is largely the justification of the project in the sectoral context, the thrust of identification is to delineate the main outlines of the project and to establish the overall viability of the project proposal.

Although there are many sources from which suggestions come for locating projects, the most common are the well-informed technical specialists and local leaders. Ideas for new projects also come from proposals to extend existing programmes. A programme to develop water resources will probably lead to suggestions of additional areas for irrigation. This is a crucial stage at which various alternatives must be explored. A good identification should justify the project, justify pertinent issues and propose solutions, demonstrate that the alternative or alternatives proposed represent the most efficient use of resources, and the viability of the project proposal and justify that further resources should be devoted to preparation, and establish early follow-up steps for full preparation.

Preparation and Analysis

Once the identification is done, progressively more detailed preparation and analysis of project plans begin. This process includes all the work necessary to bring the project to the point at which a careful review or appraisal can be undertaken and if it is determined to be a good project, the implementation can begin.

A feasibility study is first undertaken which will provide enough information for deciding whether to begin more advanced planning. It should define the objectives of the project clearly and explicitly, address the question of whether alternative ways to achieve the same objectives may be preferable, enabling the project planners to exclude poor alternatives.

Even at this early stage, financial and economic analyses are done. In the case of irrigation projects, in view of the uncertainty of data and in particular, the inevitably approximate nature of a cost estimate at this stage, a simplified 'before' and 'after' calculation based on local prices is done. It is essential however to carry out a sensitivity test designed to provide information immediately on the basic issues of the project (Bergmann and Boussard 1976:17).

Once the feasibility studies have indicated which proposed project is likely to be worthwhile, detailed planning and analysis begin. It is only at this stage that sufficiently full and reliable basic data will be available to justify a detailed analysis of the costs and benefits of the project from the standpoint of the community. Detailed pedological, climatological and hydrological surveys are done at this time. In addition to this, a thorough study of the cropping pattern is also done. The analysis of investment costs at this stage will be sufficiently far advanced and detailed to rule out the errors of more than plus or minus 10 percent in real terms.

A final aspect to these calculations is an appraisal of the external effects of the projects and where appropriate, a profitability calculation from the point of view of the investor.

Detailed planning is not only a laborious but also an expensive process. In the case of agricultural projects, it may take even two years or more, costing 7 to 10 percent of the total project investment (Gittinger 1982:23). As a thorough preparation enhances the efficiency of the project and helps ensure smooth implementation in the future, the additional time and money will probably be returned many times over by the increased return from the investment.

Appraisal

The appraisal stage consists of an independent check by the lending institution and/or aid donor. Sometimes the Government itself may also undertake an appraisal of the project intended for its exclusive financing.

Although appraisal in practice does cover much the same ground as that of identification and preparation, the specific area of project financing receives special emphasis here. Appraisal mainly aims at establishing that the major assumptions in project formulation are correct and realistic. The project estimate is checked to ensure economic and financial viability while the proposals for organisation and management are assessed to ensure administrative feasibility. Appraisal checks the technical assumptions relating to yields, cropping pattern, and the question of safety.

Implementation

This is perhaps the most important part of the project cycle. Two aspects of implementation are of particular relevance to project planning and analysis. The first is that the better and the more realistic a project plan is, the more likely it is that the plan can be carried out and the expected benefit realised. The second is that the implementation must be flexible. As the project progresses, technical changes are almost inevitable as more information regarding soils, susceptibility to water logging starts flowing in. Price changes may also necessitate different cropping patterns or adjustment in inputs. Obviously, changes in the political or economic environment influence the way a project should be implemented. The greater the uncertainty of various aspects of the project or the more innovative and novel the project is, the greater the likelihood that changes will have to be made. This necessitates reshaping and replanning the project either partly or fully. Implementation is a process of refinement, of learning from experience. In fact, it is a mini-cycle within the larger project cycle (Gittinger 1982).

The implementation phase can be divided into three different time periods. The first is the investment period, when the major project investments are undertaken. In agricultural projects, this usually extends three to five years from the start of the project. Then as the production builds up, the project is spoken of as being in the development period. Although this takes an additional three to five years, it may be extended if the project

involves investments with long gestation. Once the full development is reached, it continues for the life of the project. The project life is keyed to the normal life of major assets, but for practical reasons a project life rarely exceeds twenty five to thirty years. Both the financial and economic analyses of the project relate to this time horizon.

Evaluation

Evaluation, the final phase in the project cycle, helps the analyst to look systematically at the elements of success and failure in the project experience. Evaluation however need not be restricted to completed projects. It is a most important managerial tool in ongoing projects (Gittinger 1982:25). It may be undertaken, when a project is in trouble, to help replan. It may be appropriate when a major capital investment such as a dam is in place and full operation.

While project management should be continuously evaluating its experience as implementation proceeds, evaluation may also be undertaken by the sponsoring agency or by a separate evaluation unit of the project.

The preparation and implementation of an irrigation project are in fact the result of a slow maturing of decisions, in the course of which the shape of the final product is gradually brought more and more clearly into focus. At each stage of this process, an economic approach, adapted to the degree of technical refinement of the relevant plans is essential; this evaluation of

profitability should start at the stage of the preliminary studies and continue throughout the life of the project (Bergmann and Boussard 1976).

Evaluation Methods

Gittinger cites three tools that are mainly in use for assessing the probable impact of a project on incomes, namely the Benefit-Cost Ratio (BCR), the Net Present Worth (NPW) and the Internal Rate of Return (IRR), the last one being most widely employed in project evaluations. All three measures involve the application of discounting techniques to expected streams of income and expenditure with the aim of expressing the time value of money.

The BCR is derived by dividing the discounted stream of benefits by the discounted stream of costs as

BCR = Present worth of benefits/Present worth of costs

The discount rate usually chosen is one that reflects the opportunity cost of capital in the country. When the ratio exceeds 1.0, then the project passes the minimum acceptable standard in the sense that for every unit of costs the project is expected to contribute more than one unit of benefits.

The NPW is the net annual balance of the cash-flow stream. Differences between the total project's costs and gross benefits during each year of the project's total life are netted out and

discounted using an interest rate that reflects again the opportunity cost of capital. It is the difficulty of choosing an appropriate discount rate that poses problems for use of this and the previous approach. As long as the present worth is positive, the project can qualify to be undertaken. A major disadvantage is that it cannot be used for choosing between alternative projects because what it shows is the absolute surplus after deducting the costs. Therefore the size of the surplus is related to the size of the investment. However, alternatives of a project with the same level of investment may be ranked in terms of NPW for selection.

The IRR, the third measure is the rate of discount that results in a zero net present value for the project. If the discount rate equals or exceeds the opportunity cost of capital, the project is justified. The financial rate of return differs from the economic rate of return principally because it is normally derived from estimates using actual or projected market prices, rather than estimates of the economic worth of inputs and products.

Investment in Projects: The Issues

An agricultural project is an investment activity in the agricultural sector in which financial resources are expended to create capital assets that produce benefits over an extended period of time. Conditions for agricultural projects vary from country to country, some having the population to land ratio low, while others have it high. In any case, ill-conceived and

poorly implemented projects in the agricultural sector with disappointing contributions to economic growth are a cause for concern. This is because rapid economic growth is dependent to a great extent on how agricultural projects are able to contribute.

Agricultural projects are highly sensitive to time phasing which means that if the period of investment is shortened with investment equally phased, the gross rate of return would be much higher. However this is not done and the agricultural projects are made palatable through many other ways. The first is by adopting an optimistic attitude, the second is by treating it as a social project and the third is by using a long enough project life and low enough discount rate to maintain a high Benefit-Cost Ratio.

The characteristic of a project that permits the project planner and operator to mould it or to let it slip in one direction or the other, regardless of outside occurrences is referred to as latitude. Latitudes can be considered mainly under two categories - space and time. With regard to spatial latitude, it can be seen, irrigation projects are far more site-bound than other projects of agricultural improvement. In terms of decision making, irrigation projects which are relatively more site-bound have an intrinsic advantage and a somewhat irrational edge over `foot-loose' projects in winning favours. This may be because it is straight forward and convincing to public opinion, but it has the inherent danger of a mediocre or dubious project getting selected (Hirschman 1967).

With respect to temporal latitude, there is no discipline at all. And projects in developing countries are implemented with enormous waste and misallocation of resources because of huge time overruns. The time of completion of a project is constantly underestimated. Administrators, even those in important planning positions, continually underestimate the time and effort needed to prepare suitable projects (Gittinger 1982:3). The costs of the projects have also been constantly underestimated. This has resulted in developing countries harbouring a number of ongoing projects, resulting in waste of scarce resources. World Bank studies on Sri Lanka, Turkey and Bolivia have led to the finding that too many projects having started at the same time has led to an excessive dispersal of available skills, slow downs in project implementation and lower returns from investment (Baum 1985).

This temporal latitude invites financial uncertainty (Hirschman 1967:58). One of the major hazards faced by development projects is the possibility that they may stay incomplete because the funds required do not become available in time. In many developing countries, there is much visual evidence of stalled construction.

Many financial difficulties of projects derive from unexpectedly arising technical obstacles and low efficiency. They also arise out of the economic, institutional and political environment within which projects function in developing countries. This `external financial uncertainty can `affect even projects that are untroubled in every other respect. This may mainly be due to two factors: (1) the policy makers' fickleness

and second thoughts which may cause funds to be diverted for projects other than those which need priority and (2) inflation which erodes the real value of appropriated funds.

Irrigation projects are victims of this financial uncertainty. Generally, the projects whose construction can be prolonged without causing loss of money already spent and whose advantages are not that evident to the public at large become easy victims of this uncertainty. And irrigation projects which are meant as a drought insurance or flood control should not normally be one of them. But even they have not been able to escape the clutches of this evil.

In view of the serious consequences of neglecting ongoing and completed projects, it is highly desirable to calculate the funding needs of ongoing and completed projects explicitly including operation and maintenance needs, in order to determine the available 'free' resources for new projects.

Apart from financial uncertainty, the other uncertainties that beset a project are technological uncertainty and administrative uncertainty. Projects whose processes require few local material inputs are particularly transferable and copiable and are therefore free from technological uncertainties. But agriculture being an economic activity closely enmeshed with nature, agricultural projects are clearly marked by technological uncertainties. In cases, where irrigation projects act only as a drought insurance, the uncertainties are less but in cases where a great deal of new knowledge has to be acquired about the crops, the element of uncertainty creeps in.

The uncertainty about a project's ability to supply the desired output at more or less the appointed time is dependent not only on the degree to which it is enmeshed with the country's natural resources but also on the "system-quality" of the project. The latter is the extent to which the many inter-dependent components have to be fitted together and adjusted to one other for the project as a whole to become available and to yield the output for which it was designed. Irrigation projects are "systems" whose various components are difficult to fit into place at the same time like the construction of the irrigation works, land distribution and settlement, new cropping pattern and new markets. These contribute to the difficulties more than technological ignorance.

Irrigation projects are also a category where considerable excess capacity is likely to exist for a long period initially. There is thus a 'sequentiality' in the case of irrigation projects which is clear from the more pressure, enthusiasm and competence exhibited for the engineering phase of irrigation projects rather than for utilization of the generated potential. The lag in the utilization of waters made available is more a matter of administrative, technological and marketing problem involving the solving of organizational problems and of technological uncertainty about the crops. Irrigation projects partake of practically each of the supply and demand uncertainties. (Hirschman 1967:71).

Generally irrigation projects are characterised by a long gestation lag at two stages - the first one being in the

completion of the structure per se and the second one being in the utilization of the benefit. The longer the gestation lag, the weaker the relationship between investment and growth rate (Chakravarty 1968). This highlights the importance of proper planning in the irrigation sector which is absorbing a large share of capital, a scarce resource in developing countries.

Projects thus form the connecting link between the final phase in the formulation of developmental programmes and the practical stage of execution. The scope of this study is to understand the planning process at a macro level and no detailed evaluation of individual projects is attempted. However the important stages of a project cycle and the various issues in project implementation as seen from the practical study of the irrigation projects of Kerala are critically reviewed with this chapter as the background.

CHAPTER III

IRRIGATION PLANNING IN KERALA

This chapter attempts to look at Kerala's need and planning for irrigation. It may initially sound puerile to speak of the need of irrigation planning in Kerala, a state well-known for its lush greenery and bountiful rainfall. But the actual picture reveals that this is not so.

Kerala as it is today, came into being on the reorganisation of states in 1956. It accounts for 1.19 percent of the country's area, while holding 3.71 percent of the country's population. Bounded by the Western Ghats in the east, and the Arabian Sea in the west, it has three broad natural physiographic divisions- the high-land, the mid-land and the low-land. The soil and cropping pattern show considerable variation among the three natural divisions which are primarily influenced by differences in topography. A high density of population, and a consequent low land-man ratio, a high level of commercialisation of agriculture in non-food crop sector and food production far short of requirements are characteristics of this state.

I

Land and Water Resources

Land Use Pattern

The state has an area of 38.85 lakh hectares, of which 56.91 per cent is set apart for crop production, 27.83 percent for forests (compared to the all-India figure of 22.7 per cent) and

7.33 percent for non-agricultural uses, according to 1987-88 statistics. The net area sown, 22.11 lakh hectares, is about 57 per cent of the geographical area, while the gross cropped area is 28.62 lakh hectares. The state is unique for the widespread system of cultivation and multiple cropping. The intensity of cropping, defined as the ratio of gross cropped area to net sown area has been 131 percent, which is five percentage points above the national average.

During the period 1960-61 to 1987-88, the share of barren and uncultivable land came down from 4.02 percent to 1.87 percent, while the share of area under permanent pastures and grazing lands decreased from 1.17 percent to 0.08 percent.

The net area sown has registered an increase of 14 percent, during the same time-frame. But this growth has taken place only upto 1970-71, and thereafter the change has been marginal indicating that the extensive phase of agricultural growth in Kerala is practically over by 1970-71. The intensity of cropping also has registered a slight decline from 135 percent in 1970-71 to 131 percent in 1987-88 which should be a matter of concern (Pillai 1981).

Need for Irrigation

Agriculture is the mainstay of the economy, accounting for nearly 30 percent of the state's income and providing employment to over 50 percent of the working population. The agricultural production pattern in the state is characterised by a large

number of small holdings, a large proportion of area under non-food crop cultivation and slow productivity growth (George 1979:13).

In agriculture, structure and characteristics of operational holdings are an essential pre-requisite for drawing out any comprehensive plan for development since an operational holding is the fundamental unit of decision-making. Statistics for 1985-86 reveal that nearly 92 percent of the 45 lakh operational holdings covering 46 percent of the total area are below one hectare.

Cropping pattern varies in the three regions - the high-land, mid-land and the low-land[1]. While plantation crops like tea, coffee and cardamom are grown in the high-land, paddy and coconut are grown in the low-lands, paddy in the low lying areas and coconut in the raised lands called garden lands. The mid-land is rich in agricultural production with a variety of crops including rice, tapioca, banana, pepper, ginger, lemongrass, coconut, arecanut and rubber. The cropping pattern is thus distinctly biased in favour of non-food crops, the share of area under cultivation being 45.5 percent compared to the national figure of 24 percent in 1984-85 (Government of Kerala 1989:117). Of the total area under food crops, 46 percent is under foodgrains, of which 95 percent is paddy.

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[1] Low-land - Less than 7.5 metres above Mean Sea Level (MSL).
Mid-land - 7.5 metres to 75 metres above MSL
High-land -Above 75 metres. MSL (Government of Kerala 1989:17)

Paddy fields are found in the long narrow continuous valleys in the midlands and in the low areas of the coastal region. In the low areas, ground water is also available in addition to rain water. It is worth remembering that the fields were formed at a time when there were practically no irrigation facilities except some small tanks distributed sporadically. Depending on the availability of water, one, two or three crops can be raised[2], since paddy requires a steady supply of water.

The state is rich in rainfall endowment, with an annual precipitation of 3000 mm. The South West monsoon (June-September) contributes 66 percent, the North-East (October-December) 16 percent, the Winter rains (January-February) three percent and Summer rains (March-May), (15 percent), to the total rainfall. The State also does not suffer from too wide an inter-annual variation in the total seasonal rainfall amount, though large variations do occur in the monthly rainfall figures (Menon and Rajan 1989). This makes irrigation a necessity for stabilisation of the water requirement of the various crops.

Rice is the staple food of the Keralites. But the area under paddy is only between 24 to 28 percent of the gross cropped area during the eighties. The state has also the lowest per capita food grain production in India, the average between 1984

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[2] The three crops of paddy are Virippu, (Autumn Crop) from May to August, Mundakan (Winter Crop) from September to December and Punja (Summer Crop) from January to April. Only one crop can be successfully raised if rainfall alone is depended upon. The second crop usually suffers from inadequate supply of water. And the third crop can be raised only where irrigation is assured.

and 1986 being 47 Kg as against the all-India figure of 200 Kg during the same period. This is due to the specialisation in high-value food crops.

A direct consequence of this is that the state's requirement of rice can only be met by imports. The import of rice on state account was 12.70 lakh tonnes for the year 1988-89, which is about 42 percent of the total domestic requirement (Government of Kerala 1989). This is in addition to the four lakh tonnes being imported by private traders. The uncovered gap between availability and requirement has been estimated to be of the order of 18 lakh tonnes by the turn of the century (Government of Kerala 1984:28), necessitating supplies from outside with all its attendant risks.

The productivity of rice was 1735 Kg per hectare during the year 1988-89; for High Yielding Varieties (HYV) it was 1982 Kg per hectare. But the annual overall coverage of area under HYV has not exceeded even one-fourth of the gross area under rice in 1988-89[3].

Studies have also revealed that there is a net loss in area under paddy during 1975-76 to 1985-86 in all the three seasons,

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[3] An evaluation study conducted by the State Planning Board has shown that the cost of cultivation of HYV of paddy is almost 30 percent higher than the cost of cultivation of the local varieties. The benefit-cost ratio for HYV at 1.67 (as measured by the ratio of gross value of output to cost of production) as against 1.49 for local varieties shows only a marginal advantage for HYV. Moreover HYV seed will not lead to higher production in the absence of other complementary factors like fertilizer, water and proper management (Government of Kerala 1984:38).

summer, autumn and winter, with the summer season showing the maximum rate of decline (Kannan and Pushpangadan 1990). Large scale conversion of rice fields for other purposes, especially for the cultivation of coconut, continues inspite of the Kerala Land Utilisation Order. This conversion brought about by the relative price advantage in favour of non-food grain crops has also affected the agricultural labourers adversely since it is less labour-absorbing.

The aim should therefore be to make paddy cultivation more economical and technically viable to compete with non-food crops. The two main elements to the non-price factors for this are the removal of institutional constraints and the provision of critical inputs for enhancing the technology. While Kerala has succeeded in abolition of the system of absentee landordism, which is a necessary though not sufficient condition for increasing productivity (Raj and Tharakan 1983), the provision of critical inputs such as timely availability of water and land development is missing. This is where irrigation and water management become crucial (Kannan and Pushpangadan 1988).

Water Resources of Kerala

There are 41 west flowing rivers and three east flowing rivers. All the rivers are very small, their length and size being controlled by the peculiar topography of the state[4]. Most of the rivers are perennial but after the monsoon months, the discharge decreases considerably.

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[4] Basic data regarding the rivers of Kerala are given in Appendix I.

The rivers have not been gauged systematically for sufficiently long periods to assess the total surface water resources of the state correctly. But from the gaugings so far done, it can be estimated that about 50 percent of the annual rainfall will be received as run-off while the balance is lost by evaporation and by percolation into earth. Studies for making a correct assessment of the total as well as utilisable water resource, indicate the utilisable yield to be 46,600 m.cum. and total annual yield to be 74,200 m.cum.

The utilisable water resources of the state is much less than the total run-off owing to many reasons. In the coastal belt and in the midland area, there are no sites for locating any storage reservoir. As these areas are thickly populated, even small storage and diversion works are difficult to locate. Extensive areas are drained direct to the backwaters and sea through small streams. As the monsoon rains are not spread over the seasons, but are such that all the precipitation occurs in a couple of brief spells in the year, the water which is not stored is bound to be lost unutilised even by standing vegetation. Thus, topography of the land makes it very difficult to tap the potential of water resources of Kerala and the storages are possible only in the hilly tracts.

Irrigation in Kerala: A Historical Perspective

Our preliminary enquiry suggests that the irrigation in Kerala does not have a long and complex evolutionary process like the one associated with the rest of India. Information on the

growth of irrigation facilities in Kerala during the pre-independence period either in terms of the projects or area irrigated and the total number of beneficiaries is scanty (Joseph Irrigation Commission (Government of India 1960:171) has even gone to the extent of saying that prior to 1947, Kerala had no irrigation to speak of.

Prior to its formation in 1956, Kerala comprised separate administrative units — the two princely states of Travancore and Cochin and the Malabar district of Madras Presidency till 1949 and the Travancore - Cochin State and the Malabar district of Madras state between 1949 and 1956. Needless to say, these administrative units with different political backgrounds, financial resources, outlooks and motives pursued different policies in the matter of irrigation.

In Travancore, a large number of tanks were constructed for irrigating paddy fields by the landlords. This was during the heyday of the aristocracy, till the early 18th century. Subsequently, with the decline of the aristocracy, the system slowly lost its importance. It may be mentioned that, King Marthanda Varma in the 18th century (1729-1758 A.D) and the rulers who followed, gave special attention to the construction of major irrigation works and also canals, tanks and reservoirs in the southern taluks of Travancore. (Gazetteer of India 1962:314).

In the Cochin region, attempts at developing irrigation during the modern period of history had a beginning only during

the 1860s when the construction of embankments and drainage canals were taken up by government.

The history of irrigation in Malabar since the beginning of the 19th century is a story of gross neglect by the Madras Government (Joseph 1983:18). Only a meagre amount was spent, and that too on repairs rather than on original works. Dams were however maintained by the government and also by the ryots on a smaller scale, to keep out the salt water and to enable crops to be raised in the beds of the shallow lakes thus formed. (Innes 1908:209). Innes (1908) also points out that the wells in the district were all dug with private money and no advantage was taken of the Land Improvement Loans Act (XIX of 1885) or of the Agricultural Loans Act (XII of 1884).

Let us now briefly look at the reasons for this dismal picture.

Irrigation during the pre-independence period was confined entirely to paddy cultivation. Travancore, Cochin and Malabar regions were importers of rice in the second half of 19th century. The imports, which began to increase from 1852 and continued unhampered till 1941, helped stabilise the price level in the years of scarcity and were of superior quality and low price (Velupillai 1940). This reduced the need for cultivation of rice in these regions. Availability of land for rice cultivation also stood in the way of expansion of irrigation.

In as much as serious Governmental effort was lacking, no determined effort came from the cultivators either. The defective land tenure system, which existed in the 19th century and during the early part of the 20th century, which kept the tenants under the threat of eviction by the oppressive landlords explains the lack of incentive of the tenants. The rate of land assessment from the tenants was also considered excessive (Varghese 1970). Absentee landlordism was widely prevalent in the three regions during the 18th, 19th and the early years of the twentieth century. These being the conditions, it is little wonder that no sustained interest was shown by either the tenant or the landlord in improving cultivation through irrigation. It is interesting to observe in passing that even if the tenant had the interest, they would not have been able to do anything, as in all the three regions, they were immersed in debt! (Logan 1883 and Shea 1959).

Apart from the social and economic set up which was least conducive to investment in irrigation, there were also other constraints. The absence of a competent and responsible agency with well-defined functions to carry out irrigation works in the three regions was a great impediment. This was compounded by the absence of essential data for the planning of a project, such as those on rainfall, run-off, catchment area, classification of soils and so on (Government of Travancore M.E[5] 1058:108), which resulted in abandoning of projects half-way through and revising their estimates. In the year 1068 M.E, only 15 percent of the outlay on irrigation could be expended! (Government of Travancore M.E:1068).

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[5] Malayalam Era, (M.E.) began in 825 A.D.

Thus administrative bottlenecks[6] joined hands with the socio-economic set up and the net result has been a rather inglorious irrigation history for the state.

On attaining independence, four irrigation projects were started in the Travancore-Cochin state even prior to the formation of the state - Peechi, Chalakudy, Vazhani and Neyyar which Kerala inherited on its formation. The state also inherited the three projects of Malampuzha, Walayar and Mangalam started in Malabar by the Madras Government. But since the development of irrigation in the princely state of Travancore was biased towards the southern regions which were lost to Madras state, the states' reorganisation left the newly formed State of Kerala stripped off the irrigation projects especially the Kodayar Extension project started earlier in Travancore.

The state launched the Five Year Plans with thrust on irrigation development to exploit the 16 lakh hectares (net) of irrigation potential. Nearly 900 crores of rupees have been invested so far, resulting in a net irrigated area of 3.25 lakh hectares, about 20 percent of the ultimate potential.

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[6] Kodayar irrigation project in South Travancore, initiated by Lt. Horesly's letter to the Resident in 1837, dragged on for 57 long years to get started; it was postponed thrice and the estimate revised four times (Joseph 1983:45).

Agricultural Performance and Investment in Irrigation

The findings of an ongoing study on Kerala's agricultural performance show that the period 1961-62 to 1974-75 (Period I) is marked by a relatively better performance in terms of increase in area as well as production and productivity, compared to the period 1975-76 to 1985-86 (Period II) which has registered a decline in the aggregate performance, leading to the characteristic stagnation since the mid-seventies (Kannan and Pushpangadan 1988). The growth rate of output during 1975-86 (-0.8 percent) is in sharp contrast to the performance during the previous period of 1962-74 (3.6 percent).

Table 3.1
Agricultural Performance (1961-62 - 1985-86)

Period	Area			Output			Yield		
	All Crops	Food Crops	Non-Food Crops	All Crops	Food Crops	Non-Food Crops	All Crops	Food Crops	Non-Food Crops
I (1961-62 to 1974-75)	1.8	0.8	2.4	3.6	1.8	4.4	1.7	1.0	2.0
II (1975-76 to 1985-86)	-1.0	-2.1	NS	-0.8	-0.8	NS	NS	-2.1	NS

Source: Kannan and Pushpangadan, (1988).
1. All are growth rates. NS - Not significant.

During Period I, productivity contributed more for foodgrains, while area contributed more for non-food grains towards production. At the same time, during Period II, there was a negative growth rate for all crops and also for food crops. No such pattern exists for non-food crops although there is a deceleration in the growth of output and its various components

for the entire period, owing perhaps to an aggregation of crops which include both perennial and annual crops.

Land productivity, which is a contributory factor towards production can be explained by area under irrigation, rainfall index and the index of fertiliser use per hectare in the absence of any major technological break-through in agriculture. Empirical evidence suggests that both irrigation (proxied by water availability index[7]) and fertiliser use have not made any significant impact on increasing the output of the agricultural sector in Kerala (Kannan and Pushpangadan 1988).

In the case of paddy, statistical analysis shows no evidence to support any relationship between yield and irrigation in the major production centres of Kerala. That one should not expect any positive relationship between irrigation and productivity in high rainfall areas (Dhawan 1988) can be a reasonable assumption only in the initial stages of irrigation development when irrigation effect is manifested in terms of stabilisation of output followed by an increase in cropping intensity (Ishikawa 1967). However there exists empirical evidence on the effect of fertilizer on yield, which has been explained in terms of the productivity of the two inputs, irrigation and fertilizer within the modified Ishikawian Stage theory (Kannan and Pushpangadan 1989). This theory assumes that the productivity of the leading

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[7] Water Availability index WAI = W_1 IRI + W_2 RFI Where
W_1 -Proportion of irrigated area to the total area
W_2 = 1-W_1
IRI - Irrigated Area Index
RFI - Rainfall index

input, irrigation, is discontinuous rather than smooth. According to this explanation, the yield breakthrough, the Stage IV of Ishikawa will not take place unless irrigation reaches a critical level, both in quantity and quality.

The findings are disturbing in view of the huge public investment in irrigation since Independence. It has also very important implications for investment in irrigation and the efficient use of available water from the existing sources. The issues of resource allocation in the irrigation sector and also the choice of irrigation become important in this context.

It is quite reasonable to say that the investment has been lop-sided, the larger issues of water resource management and development being relatively neglected. In short the whole problem has been reduced to one of capital construction essentially as engineering feats with little involvement of agronomy and agrarian ecology, with emphases on flood control, drainage, conjunctive use of water, maintenance of field channels, land bunding and so on. All these point to a lack of proper perspective and prioritisation for investment planning in the agricultural sector.

This prompts us to go into the details of planning for irrigation and the analysis of plan investments.

II

Irrigation Planning

The planning for the formulation of irrigation plan involves two processes: the first is formulation of the state's five year plan and fixing the size of the irrigation sector. The second is the approval or acceptance of individual major and medium projects after their scrutiny and consideration.

The State Planning Board[8], constituted in 1967, initiates the planning exercise by constituting a Steering Committee and Task Force for the irrigation sector along with other sectors[9] of the economy in order to review the past performance, estimate the potential and requirements and suggest the programme for the plan, in conformity with the guidelines of the Planning Commission. The Planning Board works out the dimensions of the State Plan after ascertaining the framework of the national plan and the resource position of the State. The Department of Irrigation proposes projects for the plan taking into account the recommendation of the Steering Committee. The administrative department in the secretariat will now take up the plan proposals

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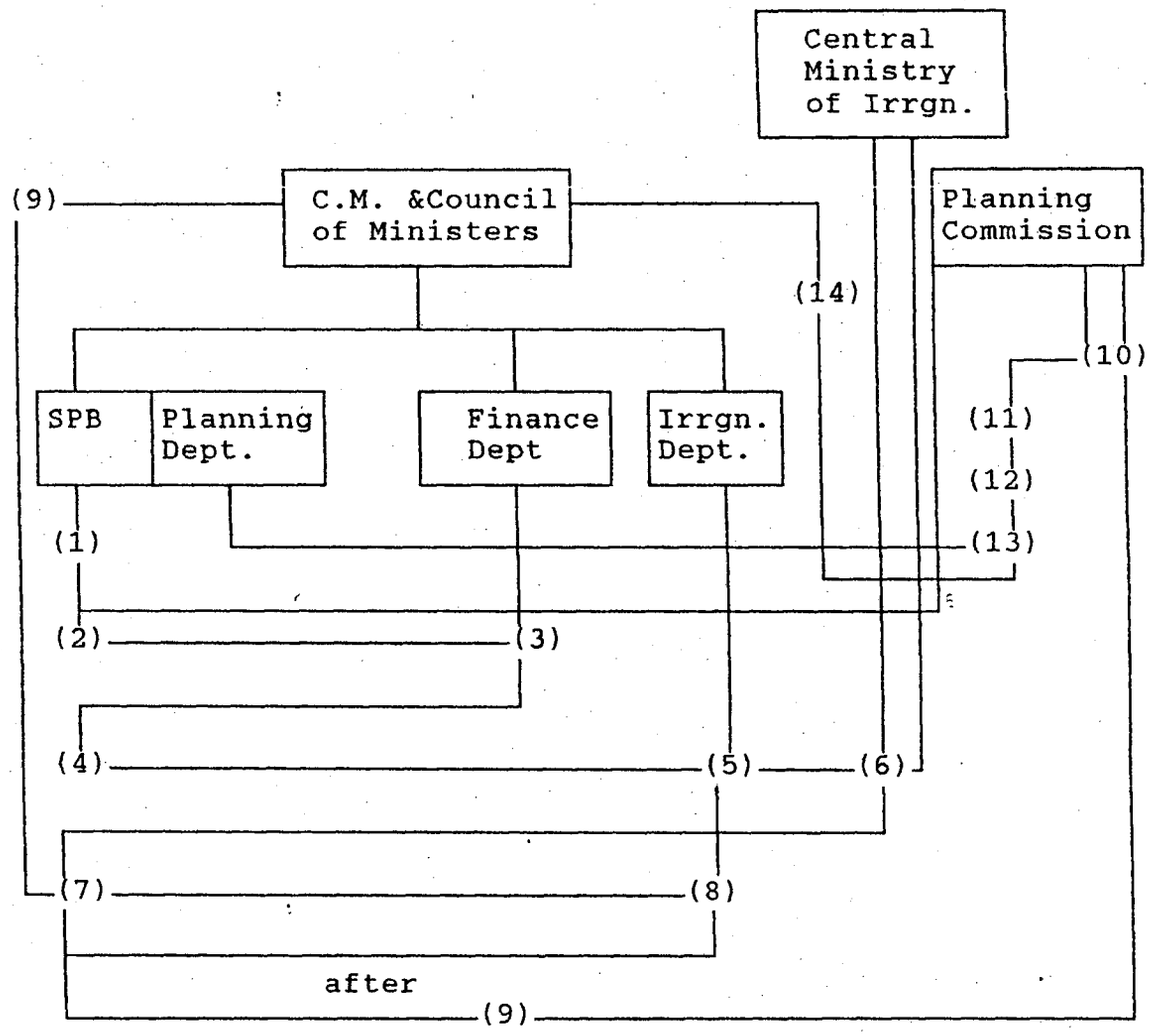
[8] Prior to the formation of the State Planning Board (SPB) in its earliest stages, the State Plan consisted of a set of proposals for outlays drawn up by each Department, detailing the programme and the strategy of expenditure in that sector. These departmental proposals which represent the absolute maximum which the Department can execute were submitted to the State Cabinet. At the Secretariat level, an attempt was made to match the departmental proposals against the available resources. This revised departmental outlay used to be presented before the Planning Commission.

[9] Although we are dealing here mainly with the irrigation sector, the process for the other sectors is exactly the same.

with the Ministry of Irrigation at the Centre for clearance. These proposals after clearance are included in the State Plan and later sent to the Planning Commission for further clearance. The plan proposals after having been cleared by the Planning Commission are approved by the State Council of Ministers, and are then submitted to the Planning Commission at Delhi for discussion, first at the official level and then at a meeting of the Deputy Chairman and the Chief Minister. On the basis of the approved outlay, the draft plan is prepared by the State Planning Board and placed for approval by the Cabinet. The entire process is depicted in Chart 2.

Chart 2
Planning Process in Brief



(1) Constitution of the Steering Committee and Task-forces sectorwise,

(2) Launching of the framework of the National Plan and Issue of guidelines to States,

(3) Formulation of objectives and strategy on the basis of (1) and (2),

(4) Assessment of resources for the Plan by the Finance Department,

(5) Working out of the sectoral outlays and inviting proposals from the Department,

(6) Submission of proposals to Central Ministry by the Department and clearance of projects by the Central Ministries,

(7) Submission of the proposals, cleared by Central Ministries, to the State Planning Board for inclusion in the Plan by the State Departments,

(8) Discussion between the Planning Board and the Departments for drawing up the draft plan,

(9) Approval of Plan proposals, submitted by Planning Department[10] by the Council of Ministers,

(10) Submission of proposals to the Planning Commission,

(11) Discussion in the Planning Commission Working Group,

(12) Firming up the sectoral outlays and the size of the plan in the meeting between the Deputy Chairman and the Chief Minister,

(13) Preparation of the draft plan on the basis of the approved outlay, and

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[10] The State Planning Board interacts with the Government through the Planning Department.

(14) Approval of the Plan by the Cabinet.

Selection of Projects

The projects included by the State Government should be normally those that have the approval of the Planning Commission for investment. This approval by itself is an elaborate procedure and is an exercise of the state Irrigation Department starting from project identification and preparation[11]. The project report containing all the salient features is first examined by the various technical directorates of the Central Water Commission* and then placed before the Technical Advisory Committee on Irrigation, Flood Control and Multipurpose Projects. Based on the recommendations of the Committee and keeping in mind the plan provisions for new schemes, the Planning Commission approves the scheme and communicates the acceptance for inclusion in the plan and execution as per approved outlays to the State Government.

Inclusion of new projects follows no discernable criteria. There is no attempt to rank projects according to their Benefit Cost Ratios. Since there is no shelf of projects as such, projects are usually included on a first come first served basis as soon as they are technically certified by the Central Water Commission. But even those major projects without investment-clearance from the Planning Commission are included with an attempt to ensure that some regional balance is maintained and

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[11] The details of the organisational set up with respect to the project cycle are discussed separately in Chapter V.

* CWC

local demands are satisfied. In general although there is not much room for including a new project since expenditure on continuing schemes absorbs a good part of the department allocation, new ones nevertheless are included.

Just before the formulation of each Five Year Plan, a Working Group on Irrigation is set up by the Planning Commission to formulate proposals for inclusion in the Five Year Plan. The working group takes into account the projects already on hand in the various states, the capacity and capability of the concerned organisations, the requirement of essential construction materials and the need for completing the ongoing lingering projects as early as possible. The extent of central intervention varies. Sometimes the Planning Commission scrutinises the projects individually or insists on the inclusion or exclusion of a particular project to contain the national priorities.

The report of the Working Group is discussed by the Deputy Chairman, Planning Commission with the state Chief Minister before the size of the plan is finalised. Certain adjustments are made on the outlays suggested. In the case of irrigation which is an earmarked sector, project-wise outlays are fixed in these discussions. It is the plan thus finalized that is communicated to the State Government.

Irrigation is a state subject. Till the Gadgil formula[12] came into being, the central assistance was tied to specific sectors; it was not tied to any particular project (Committee on Public Accounts, Lok Sabha 1983:43). Now project-wise outlays approved by the Planning Commission are treated as earmarked outlays by the Commission, with a stipulation that any shortfall in expenditure in respect to earmarked outlays will entail reduction in Central assistance to the Plan. In the case of projects which have not been cleared either technically or financially no earmarked outlay is provided.[13]

The outlays are trimmed by the Department in accordance with the central allocation. One method of achieving this is by stretching out the implementation period of the project. In general, for those projects which are near completion, or where other developments bring on the project's completion (joint development of irrigation and power), slippage should be avoided as much as possible. However if there are strong pressures for new schemes, especially if regional justification is strong, slippage may be the manner in which the trade off takes place.

Postponement of projects on which works are yet to begin, for completion in a later plan period, is undesirable on similar considerations. How postponement affects projects and whether

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[12] It is only since the Fourth Five Year Plan that Central Plan Assistance is allocated among the States on the basis of the Gadgil formula.

[13] In the case of Kerala, the Planning Commission has provided outlays for one unapproved project (Idamalayar) because a substantial amount of expenditure has been incurred already.

the returns will be greatly reduced by postponement are questions not answered in any scientific manner. No rate of return calculations, are seen to have been done prior to the mid-seventies, and the decisions made are therefore very much on the subjective side. This state of affairs is more or less inevitable since planning capacity at the departmental level is very inadequate, and economists play a very limited role in departmental planning work, as we shall see in Chapter Five.

In short, the criteria for project selection and the considerations on which the department resubmits its revised proposed outlays to the State Planning Board include a care for political exigencies, regional concerns and interdependence between projects.

Co-ordination between the State's operating departments takes place as necessary on a project by project basis. There is no formal interdepartmental coordination of the perspective plan programme. In the case of the irrigation department, this co-ordination is usually limited to the State Electricity Board and the Agriculture Department.

This planning procedure has several weak links. One is the project selection process at the state level, including the co-ordination between departments and the other is the involvement of the centre. The costs to the State on account of its weak planning capacity resulting in sub-optimal project choices, responsiveness to political exigencies and delays in implementation can be quite high. In the irrigation sector,

there is a chronic tendency for the Department to begin expenditures on new schemes rather than to take stock and ensure that investments necessary for the completion of the ongoing schemes and for full utilization of the potential created have been made.

III

Analysis of Plan Investments

The various sectoral investments are categorised into two groups. While Group I includes all investments in water resource development for catering mainly to the agricultural sector along with investment in agriculture and allied activities, Group 2 includes investment in the remaining sectors. The details of this grouping are as follows:

Table 3.2
Investment Sectors in Group 1 and 2

Group 1	Group 2
1. Major and Medium irrigation	7. Co-operation
2. Minor Irrigation	8. Power
3. Command Area Development	9. Industries and minerals
4. Flood Control and Anti-sea erosion	10. Transport and Communications
5. Agriculture	11. Social and Community Services
6. Other allied activities*	12. Economic Services
	13. General Services

* Other allied activities in Group 1 include Land Reforms, Soil and Water conservation, special area programme for rural development, food, animal husbandry, dairy development, fisheries, forests, investment in agricultural financial institutions, community development, colonisation and others, warehousing and marketing.

The breakup of outlay between the two groups indicates that nearly 35 percent of the outlay relates to Group 1 (Table 3.3).

Table 3.3
Percentage Share of Outlay

Sectors	II Plan	III Plan	IV Plan	V Plan	VI Plan	VII Plan	Average
Group 1	28.8	33.0	34.0	35.1	40.0	34.2	34.2
Group 2	71.2	67.0	66.0	64.9	60.0	65.8	65.8
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: Compiled from various plan documents, Government of Kerala.

The implementation ratio, defined as the ratio of expenditure to outlay, denotes the capacity to incur expenditure. It is seen that for the overall plan investments and Group 2, the ratios are above 100[14], while that of Group 1 it is around 93 percent (See Table 3.4).

Table 3.4
Implementation Ratios of Group 1 and 2

Sectors	II Plan	III Plan	IV Plan	V Plan	VI Plan	VII Plan	Average
Group 1	93.9	89.6	97.5	79.9	94.5	101.8	92.9
Group 2	88.6	115.9	145.2	88.3	107.1	105.1	108.4
Total	90.1	107.2	129.0	85.4	102.1	104	102.9

Source: As in Table 3.3

Given the state's compulsions on investment in social services and the backwardness in industrialisation, Group 1, which comprises mainly of the two major investment sectors, irrigation and agricultural development, capturing a share of more than one-third of the total plan investment, should be considered quite significant. In fact, investment in Group 1

[14] An implementation ratio of more than 100 percent occurs because, towards the end of each financial year, reappropriation amongst sectors takes place with the concurrence of the Finance Department.

more or less equals the share of the primary sector in the state's income. A detailed analysis of Group 1 investment will tell us how the scarce resources are allocated among the various sectors.

Analysis of Group 1 Investment

The investment over the plan periods has been analysed and the results are given in Table 3.5.

Table 3.5
Percentage shares in outlay - Group 1 Investments

Sector	II Plan	III Plan	IV Plan	V Plan	VI Plan	VII Plan	Average
1.Major and medium irrigation	34.47	20.35	30.44	41.87	41.30	34.98	33.90
2.Minor irrigation	9.44	10.18	10.59	8.35	6.45	5.98	8.50
3.Command Area Development	0.00	0.00	0.00	0.11	1.18	2.75	
4.Flood Control and anti-seg. erosion	7.39	7.50	7.44	4.33	4.03	2.43	
5.(1) to (4) as a percent of 8	51.3	38.03	48.47	54.66	52.96	46.13	48.59
6.Agriculture	9.96	25.56	10.35	8.40	16.88	16.17	
7.Other allied activities	38.73	36.40	41.18	36.94	30.17	37.70	
8.Total of 1 to 7	100.00	100.00	100.00	100.00	100.00	100.00	
9.1 + 2 as a percent of 1 to 4	85.59	80.27	84.65	91.88	90.16	88.77	86.88
10.1 as a percent of 1 + 2	78.50	66.66	74.19	83.37	86.49	85.40	79.17

Source: As in Table 3.3

The share of irrigation and related activities in the total investment in Group 1 comes to nearly 50 percent on an average. Furthermore, it is important to note here that water resource development has largely meant investment in irrigation proper. This is around 87 percent of the total investment in water resources for agricultural development. Again, investment in irrigation has meant by and large investment in major and medium projects, its share being around 79 percent on an average for the entire plan period. A closer examination of the investment in major and medium projects, which we shall do in Chapters IV and V will reveal that it is only an exercise in construction in the civil engineering sense, in addition to maintaining an expanding establishment for its administration.

A comparison of the implementation ratios shows that while, major and medium projects have registered over 95 percent, Command Area Development has an average of only 40 percent (See Table 3.6).

Table 3.6
Implementation Ratios

Sector	II Plan	III Plan	IV Plan	V Plan	VI Plan	VII Plan	Average
1. Major and Medium Irrigation	103.36	90.37	108.07	91.99	101.36	108.81	101.00
2. Minor Irrigation	95.36	98.78	121.83	73.43	77.68	98.66	96.64
3. Command Area Development	-	-	-	16.67	30.48	71.12	39.42
4. Flood control and anti-sea erosion	102.16	123.28	106.89	79.35	67.92	101.4	98.71
5. Agriculture	108.4	75.03	125.71	89.03	65.19	101.87	98.62
6. Other allied agricultural services	79.81	89.87	74.74	65.92	111.54	99.19	95.13

Source: As in Table 3.3

This reinforces the point already made when the sector shares were analysed earlier. Command Area Development, which is a centrally sponsored programme with 50 percent central assistance, deals with the construction of field channels and field drains, land levelling, land shaping, introduction of warabandhi and so on. Although this was initiated in the Fifth Plan, it picked up momentum only in the Seventh Plan. This is a clear case where investment in creating the necessary tertiary level infrastructure is lagging behind.

Irrigation - Investment and Achievement

The above analysis indicates that major and medium irrigation covers nearly 80 percent of the total investment in the major, medium and minor schemes, put together. It will be interesting to consider the plan-wise investment and the achievement in terms of area irrigated by the various categories of irrigation systems.

Major and Medium Projects

The investment and achievement in the case of major and medium irrigation projects through the plan periods is given in Table 3.7.

Table 3.7

Investment and Achievement in Major and Medium Projects

Plan Period	Expenditure (Rs.crores)	Area brought under Irrigation (ha)		Cost per hectare of net-area (Rs)	Number of Projects		
		Net	Gross		Started	Spillover	Completed
I Plan	5.11	-	-	-	4	3	-
II Plan	8.93	19070	23918	4683	4	7	1
III Plan	10.32	6068	10732	17007	6	10	6
Annual Plans (1966-69)	11.11	37551	76110	2959	-	10	-
IV Plan	28.91	42246	90360	6843	2	10	3
V Plan	76.85	24189	57544	31771	3	-	-
(Annual Plan (1978-80)	72.35	11744	27848	61606	6	12	-
VI Plan	259.52	30844	70206	84140	-	18	-
VII Plan	287.80	16489	27337	174541	-	18	-
Total	760.9	188201	384055				

Source: 1. As in Table 3.3.
2. Data for VII Plan from Chief Engineer Projects.

The investment has been growing at the rate of 15 percent at current prices although between the Sixth and the Seventh Plans, there has been no perceptible increase. It is seen that the per hectare cost of irrigation has been increasing steadily from the Fifth Plan onwards. During the Seventh Plan it rocketed upto 1.75 lakhs of rupees. In the initial phase of construction, expenditure is quite high while the area coming under irrigation is negligible; whereas near the completion phase, the same scheme involves relatively less expenditure and creates more potential of irrigated area. Thus when projects of the former category are large in number, the per hectare cost will be high. (Gulati 1989). This explains the trend observed, since no project has been completed from the Fifth Plan onwards. The tendency to initiate more schemes than can be completed in a given planning horizon is evident in the large number of schemes that have spilled over into the subsequent plan periods. The Seventh Plan

had a spillover of 18 projects. A cumulative investment of 761 crores of rupees has been made and 1.9 lakh hectares of net area brought under irrigation. Major and Medium irrigation is also basically designed for paddy crop, which forms 28 percent of the Gross Cropped Area.

Minor Irrigation

Let us now have a look at the investment and achievement in minor irrigation. (Table 3.8). The investment has been growing steadily at the rate of 14 percent at current prices. The cost per hectare during the Seventh Plan is 10840 rupees only. A cumulative investment of 114 crores of rupees has been made, which has resulted in 1.4 lakh hectares of net irrigated area[15].

Table 3.8
Investment and Achievement - Minor Irrigation

Plan Period	Expenditure (Rs. crores)	Area brought under irrigation(ha) Net	Gross	Cost per hectare of net area(Rs)
I Plan	1.04			
II Plan	2.60			
III Plan	4.60			
Annual Plan (1966-69)	3.90			
IV Plan	8.81	63567		
V Plan	9.51	10837	13271	8775
Annual Plan(1978-80)	14.27	3673	4593	38851
VI Plan	26.70	19453	23683	13725
VII Plan	42.91	39587	49895	10840
Total	114.34	137117		

Source: 1) Minor Irrigation works in Kerala, A Review (1990).
2) Data for VII Plan from Chief Engineer (Irrigation).

[15] Reliable data for irrigated area under minor irrigation are available only from the Fifth Plan onwards. (See Appendix 2). Moreover, the area given in the Table 3.8 pertains to the achievements of the Public Works Department only. Data on Minor irrigation works executed by other agencies like Agriculture department, private agencies are not available and hence not included here.

A Case for Minor Irrigation

While major and medium schemes absorb 80 percent of the outlay on all irrigation schemes, their contribution to net area irrigated is only 58 percent. This is characteristic of the capital intensive and lumpy investment in this sector. Again, during the Seventh Plan period, the cost per hectare of net irrigated area is nearly 1.75 lakhs of rupees in the case of the major and medium projects whereas it is 11,000 rupees only for minor schemes, the former being nearly 16 times the latter at current prices.

Thus, it is seen that the advantage of minor irrigation over the major and medium projects is mainly the low cost of the former. It is less capital intensive and can provide employment to a large number of skilled and semiskilled personnel. Moreover, only minor irrigation can provide water to the isolated pockets of arable land.

A study conducted by the Planning Commission has revealed that out of the 1.5 million hectares of irrigation potential of Kerala, 0.9 hectare (nearly 60 percent) would be from minor sources (Government of Kerala 1975). In such a situation the necessity to accelerate the tempo of the progress in minor irrigation can hardly be over-emphasised. In this connection, it is pertinent to note that in the pre-independence times, only irrigation through minor schemes was mainly practised. Although the importance has been realised in the plan allocation, the investment has always been biased in favour of huge hydraulic structures.

Rationale for Resource Allocation

Irrigation water, an input for agricultural production, is transformed, from a free good to an economic good through capital stock in the form of dams, wells, canals, reservoirs, tube wells and so on, although there is no change either in quality or its morphological characteristics. Irrigation water thus carries with it, the depreciation of the system, interest on capital and cost of maintenance and operation and has a price. (Gooneratne and Hirashima 1990:2). But when investment in irrigation is made by the state, it fails to recover the cost of either its initial investment or the cost of maintenance and operation. This may be because, (1) the beneficiaries perceive irrigation water as a free good and (2) also the state sets the water rates and land revenue from irrigation deliberately low to serve as incentives for production. In such circumstances, the state should obviously look for and choose the most cost-effective method of making irrigation water available.

There is thus the need to deploy the limited resources in as efficient a manner as possible to provide a critical mass of irrigation for agricultural growth.

Dhawan (1989) has pointed out that it is inappropriate to derive investment norms for irrigation, plan-wise and category-wise, from plan statistics on outlays and irrigation potential. But the difference between cost per hectare of minor and major irrigation is so large that it is doubtful whether major irrigation would be cost-effective even after making all

allowances as suggested by Dhawan (1988) regarding the question of operational costs for minor irrigation and also the validity of data on area irrigated.

Summing Up

Our analysis of the investments in major and medium and minor schemes reveals that no proper rationale has been followed in deciding the share of investment. Moreover, the constraints posed by the topography in the construction of major and medium projects have been totally ignored. Historically also, the state does not have a base for the launching of so many irrigation projects. All these factors contribute to the poor implementation of projects leading to huge cost and time over-runs which we examine in the next chapter.

CHAPTER IV

COST ESCALATIONS AND TIME OVER-RUNS

A strikingly disturbing feature of the irrigation scenario in Kerala is the emphasis on major and medium projects which suffer from cost escalation and time over-run. This problem assumes alarming proportions when one considers the increasing resource constraint and the state's commitment on social services and the compulsion for investing in industry. That these factors may jeopardise the major and medium projects in future, can be predicted by sheer economic logic if not by any other reason.

The twin evils of cost escalation and time over-run are a matter of concern as even the feasibility of a project becomes questionable when spread over a longer time-frame. No detailed study on the cost escalation of the irrigation projects of Kerala has been done so far although the problem has been plaguing the sector since inception. We first review the studies on cost escalation in the Indian context.

I

Review of Studies on Cost Escalation

Even during the decade 1951-60, an important feature of the river valley project construction has been the tendency for the revised and the final estimates to exceed the original by a wide margin. Studies by Healey (1965) regarding the extent of cost revisions on thirteen river valley projects of India[1] indicate that there has been a systematic under-estimation of costs of

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[1] This study does not cover any project of Kerala.

construction. He is of the opinion that although there has been haste and carelessness in cost calculations[2], these by themselves could not have given rise to an underestimation bias. According to him a general failure to make allowance in the original cost estimates for changing prices of materials and labour in an inflationary period, together with a deliberate under-estimation of costs of projects proposed by the States in order to gain the approval of the Planning Commission (which provides a substantial proportion of the funds required) would at least partly explain the escalation.

Healey's findings also reveal that the various different recorded causes of cost revisions of the projects (in the order of decreasing frequency) studied were: (1) increase in the cost of materials and labour, (2) changes in the design of dams etc., (3) unforseen increase in the scope of projects or capacity required, (4) original cost estimates based on inadequate or incomplete data, and (5) inefficient management. Other frequently cited factors include: (1) inadequate geological and technical investigations of the projects in their initial stages, (2)vague and ambiguous specifications and conditions of contract, (3) delays due to slowness in decision making at various stages of construction, (4) lack of availability of materials or transport bottlenecks, and (5) high mobility of

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[2] A detailed study of Hirakud project revealed that the original project report did not contain any designs or plans and the estimated costs were no more than lump-sums based on rough guesswork (Lok Sabha Secretariat Committee on Estimates 1953-54, Sixth Report:4). In the case of Damodar Valley project at least half of the discrepancy between original and revised estimates could be attributed to inadequate planning and management (Healey 1965).

planning and supervisory staff between projects during their construction. However, Healey found no correlation between largest cost revisions and any particular category of project namely, irrigation, hydro-electric, etc.

In general, there are reasons for believing that it will be more difficult to predict accurately the cost of overhead projects in an underdeveloped economy where there is usually less accumulated knowledge about particular areas or processes, than a developed economy. (Healey 1965:114.)

In 1972, the Government of India appointed a Committee with Naegamwala as Chairman, to go into the causes leading to a large number of revisions in project estimates. The Committee examined the issue of cost escalation and the delay in the completion of major and medium projects in a very detailed and systematic way. The methodology adopted by the Committee consisted of sample surveys and case studies and a questionnaire on the formulation, planning and execution of projects was sent to selected project authorities and six projects[3] were subjected to a detailed analysis.

The study has revealed that apart from establishment, the rise in costs under works can be broadly brought under various categories. They are briefly (1) rise in costs of labour and materials, (2) inadequate provision in the estimate, (3) inadequate investigation, (4) change in design, (5) increase in

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[3] One of the projects studied was Kallada, the largest irrigation project in Kerala, both in terms of cost and area irrigated.

the cost of land and (6) other factors like non-availability of funds at the right time, labour agitations, dearth of government contractors and credit squeeze in the market.

Rise in costs of labour and materials

Cost estimate for a project is made at a point of time on the basis of prices prevailing at the time of its preparation and the project is executed over a period of time. No allowance is made in the estimate to cover the increase due to rise in the prices of material and equipment and wages of labour.

There is a tendency to use more and more costly materials of construction, on considerations such as safety, quality control, appearance etc. For example, steel, aluminium, glass etc are used where timber was used earlier and cement concrete is extensively used where masonry or wood-work was used earlier. The rise in prices of petroleum and petroleum products and its impact on labour costs is also an important factor.

Construction equipment and machinery, as far as they are available within the country, cannot be imported. Although this is to conserve our foreign exchange and to encourage Indian industry, this is also an element which gives rise to cost, since indigenous equipments are costlier than imported ones. To cap this all, the delivery schedules of two or more concerns now producing these items in the country are long and irregular. Thus planning of projects without assuring the availability of strategic materials on which their execution depends, has also contributed to the delay.

Inadequate provision in the estimate

Of late, there is a tendency to carry out as much developments in a project area as possible, charged onto an irrigation project. Changes in the scope of the project like increase in area irrigated, more flood protection, etc are often introduced during the stage of execution in order to incorporate more benefits. Creation of settlement colonies for resettled persons, construction of roads, bridges, and other structures etc are some other examples. Sometimes some of the additional works are due to public demand which neither contribute to increase in the scope nor are justified by any considerations of detailed design.

Inadequate investigation

Inefficient and improper investigation results in the preparation of a project-estimate which leads to considerable upward revision during the actual execution, when the quantities exceed and new items come up.

Very major changes in design leading to enhanced costs have been caused by insufficient geological exploration of the foundations of structures. The data collection and analysis are inadequate to determine the hydrology of a project, as a result of which the picture of water availability is completely changed. Soil surveys are not conducted properly and crop patterns cannot be known in the absence of a suitable soil survey. Hence water planning is not possible. Thus changes in soil classification

when detected at a later stage, lead to cost escalation. Sometimes, 'borrow area' (area from which some construction materials could be procured) investigations are not complete, creating an uncertainty in the determination of cost. Owing to inadequate survey, the number of cross drainage works and other structures cannot be known. According to the report of the Expert Committee, optimum development at minimum cost may not be possible if appropriate data are not marshalled for preparing the report (Government of India 1973:145).

Change in design

Changes in designs are often introduced after detailed investigations. More often, they are introduced for reasons of safety and economy.

Increase in cost of land

The phenomenal increase in the price of land has been throwing the estimates totally out of gear. Court awards for land compensation have often upset all calculations made in this regard in the project report.

Other factors

In addition to all these, non-availability of funds at the right time, labour agitations, dearth of good contractors and credit squeeze in the market all contribute to the cost escalation. There is also a general and deliberate tendency to

under-estimate the costs. The effect of all these is to make the exercise on Benefit Cost Ratio literally a mockery!. Since a project once cleared has necessarily to be funded to completion, the real problem is of irreversibility of decision making. (Singh 1990).

Cost Escalation in projects

Pant (1982) has gone into the details of cost escalation and delay in completion of the major and medium projects of India for two periods: for 23 years during 1946 and 1969 and for 10 years during 1971-1981 (See Table 4.1).

Table 4.1
Cost Escalation in Major and Medium Projects

Sl.No	State	Period	No.of projects (Major)	Percent Rise	Period	No.of projects (Major)	Percent Rise	Period	No.of projects (Medium)	Percent Rise
1.	Andhra Pradesh	1951-67	6	124.00	1971-81	6	372.86	1971-81	21	48.00
2.	Assam	-	-	-	1975-80	2	26.16	"	19	27.17
3.	Bihar	1956-68	7	194.00	1975-80	9	24.56	"	44	58.40
4.	Gujarat	1948-66	5	119.00	1971-80	8	146.73	"	48	71.08
5.	Haryana	1951-66	2	136.00	1971-76	2	181.62	"	-	-
6.	Himachal Pradesh	-	-	-	-	-	-	"	2	39.13
7.	Jammu & Kashmir	-	-	-	1973	1	106.46	"	17	45.92
8.	Karnataka/Mysore	1947-63	6	197.00	1976-78	2	33.08	"	15	11.11
9.	Kerala	1957-66	7	238.00	1975-81	7	56.29	"	1	57.89
10.	Madhya Pradesh	1951-67	6	128.00	1971-80	15	47.38	"	73	23.50
11.	Maharashtra	1957-68	13	67.00	1975-81	10	84.64	"	69	40.71
12.	Manipur	-	-	-	1980	1	14.28	"	6	53.98
13.	Orissa	1947.59	3	124.00	1973-79	8	4.91	"	29	106.82
14.	Punjab	1963-69	2	43.00	1975-80	7	28.66	"	2	69.93
15.	Rajasthan	1957	1	80.00	1971-72	2	145.01	"	16	76.44
16.	Tamil Nadu	1962-64	2	78.00	1976	1	394.84	"	8	39.47
17.	Tripura	-	-	-	-	-	-	"	3	28.02
18.	Uttar Pradesh	1959-68	2	84.00	1971-81	21	92.86	"	32	28.60
19.	West Bengal	1946-61	2	61.00	1975-80	3	76.46	"	17	64.90
	INDIA	1946-69	64	108.00	1971-81	105	66.94	"	422	48.94

Source: Pant.N (1982).

In terms of cost escalation, the average for India was 108 percent during the first period, while for the second period it was 66.94 percent. During the first period, Kerala recorded highest cost escalation with the distinction of being the only state having a rise above 200 percent. Kerala also ranked second along with Bihar in the number of projects undertaken, with 7 projects, Maharashtra being the first with 13 projects. If we compare the cost escalations as between the major and medium projects during the 10 year time frame 1971-1981, the medium projects show a lower cost escalation (48.94 percent), compared to that of major projects (66.94 percent).

The Public Accounts Committee (1983:1) of the Lok Sabha has remarked that no project has been completed within the approved cost estimates or stipulated target dates since Independence. Cost escalations of approved ongoing and major irrigation schemes of the Sixth Plan indicate again that Kerala is topping the list with 948 percent. These include only those projects which have been cleared by the Planning Commission (Table 4.2).

Table 4.2
Cost-Escalation in the on-going and new major schemes of the Sixth Plan

State	No.of ongoing & new projects	Original estimate (Rs.crores)	Latest estimate (Rs.crores)	Percent escalation
1. Andhra Pradesh	7	415.96	1336.65	221.34
2. Assam	2	31.15	39.31	26.19
3. Bihar	11	172.26	1021.57	493.03
4. Gujarat	12	281.23	742.29	163.94
5. Haryana	10	251.11	385.17	53.39
6. Jammu and Kashmir	2	35.01	59.82	68.58
7. Karnataka	6	201.93	851.80	321.83
8. Kerala	7	36.41	385.21	947.97
9. Madhya Pradesh	17	420.24	998.21	137.53
10.Maharashtra	24	648.26	2063.93	218.38
11.Manipur	3	55.62	78.68	41.46
12.Orissa	7	430.94	752.93	74.72
13.Punjab	8	481.79	665.54	38.14
14.Rajasthan	10	279.50	773.63	176.79
15.Tamil Nadu	4	48.72	130.25	167.34
16.Uttar Pradesh	25	732.61	1845.99	151.97
17.West Bengal	4	123.07	348.16	182.90

Source: Committee on Public Accounts, Lok Sabha, 1983.

Time over-runs in Projects

The gestation period of large dams indicates that it is often over a decade on an all-India level. The average expected gestation period is 5.9 years, whereas the actual is 13.8 years, leading to about 134 percent delay (See Table 4.3). Here also, among the projects studied, two are of Kerala, which indicate inordinate delay.

Table 4.3
Project Delays

Name	Year of initiation	Expected year of completion	Year of actual completion	Gestation Period (Years) Expected	Actual	Percent Delay
Peechi	1947	1952	1959	5	12	140.00
Malam-puzha	1949	1952	1966	3	17	466.67
All India average of the projects under study				5.9	13.8	133.9

Source: Singh (1990:564).

This is a clear indication that temporal latitude is high. But in cases where irrigation is the immediate need to offset drought, then this necessitates the search for alternatives with shorter gestation periods. Environmental calculations also go wrong by the time the construction is over.

II

Cost and Time Over-runs in Kerala: A Detailed Analysis

The state has 10 projects which are completed and 18 which are ongoing as of date. The year of starting,[4] the year of approval by the Planning Commission and the year of completion in the case of completed projects are given in Table 4.4. Of the ten completed projects, four are major projects and of the 18 ongoing projects, 13 are major.

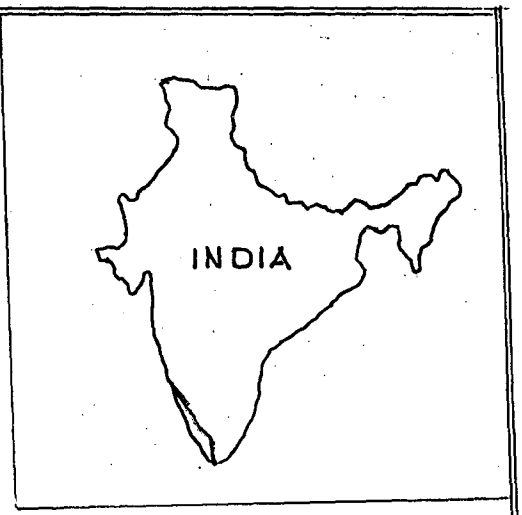
[4] The year of starting here actually means the year in which expenditure first figures in the budget, and not the year of starting of the actual execution of project work.

Table 4.4
Irrigation Projects of Kerala

Sl.No	Name of Project	Year of starting	Year of approval	Year of completion
Madras Plan				
1.	Peechi*	1947		1959
2.	Chalakudy* (Stage I)	1949		1958
3.	Malampuzha*	1949		1966
First Plan (1951-56)				
4.	Neyyar*	1951		1973
5.	Vazhani	1951		1962
2(a)	Chalakudy (Stage II)	1952		1966
6.	Mangalam	1953		1966
7.	Walayar	1953		1964
Second Plan (1956-61)				
8.	Gayathri (Meenkara)	1956		1964
9.	Periyar Valley*	1956	1955	
10.	Cheerakuzhy*	1957		1973
11.	Pothundy	1958		1971
Third Plan				
8(a)	Gayathri (Chulliar)	1961		1970
12.	Kallada*	1961	1966	
13.	Kanhirapuzha*	1961	1961	
14.	Pamba*	1961	1964	
15.	Pazhassi*	1961	1964	
16.	Kuttiadi*	1962	1964	
17.	Chitturpuzha*	1963	1968	
Fourth Plan				
18.	Attappady	1972	—	
19.	Karapuzha	1972	1978	
Fifth Plan				
20.	Chimoni*	1975	1990	
21.	Muvattupuzha*	1975	1983	
22.	Idamalayar*	1976	-	
Annual Plan				
23.	Banasurasagar	1978	—	
24.	Chaliyar*	1978	—	
25.	Kakkadavu*	1978	—	
26.	Kuriarkutty Karappara*	1978	—	
27.	Meenachil	1978	—	
28.	Vamanapuram	1979	1982	

Source: Various Project Reports, Irrigation Design and Research Board (IDRB) and Budget documents.
* Refers to major projects.

IRRIGATION PROJECTS OF KERALA



MAJOR PROJECTS COMPLETED

1. Peechi
2. Chalakudy
3. Malampuzha
4. Neyyar

NEARING COMPLETION

1. Periyar valley
2. Pamba
3. Kuttiadi
4. Chitturpuzha

UNDER CONSTRUCTION

1. Kallada
2. Kanhirapuzha
3. Pazhassi
4. Chimoni
5. Muvattupuzha
6. Idamalayar
7. Beyporepuzha (chaliyar)
8. Kakkadavu
9. Kuriarkutty
   Karappara

MEDIUM PROJECTS COMPLETED

1. Vazhani
2. Mangalam
3. Walayar
4. Gayathri
5. Cheerakuzhy
6. Pothundy

UNDER CONSTRUCTION

1. Attappady
2. Karapuzha
3. Banasurasagar
4. Meenachil
5. Vamanapuram

As we have seen already in Chapter III, the number of projects, spilling over into the successive plans has been increasing, from the Third Plan onwards, with the Seventh Plan having 18 of them. There is thus a cluttering of new projects in the ten years from 1970 to 1980. In this connection, it is pertinent to note that the Irrigation Commission (1972:190) had noticed the heavy spillover and had suggested that the ongoing projects should be completed before the new ones are started. This has however not been adhered to. It is disturbing to note that only two projects which were started after the formation of the state have so far been completed.

For the purpose of analysis, we have divided the projects into two categories, completed and ongoing. Table 4.4 shows that all the 18 ongoing projects, have been started without getting the prior clearance of the Planning Commission for investment. Only 11 of them have obtained the clearance so far[5]. These are again classified as Category A. Those that have not yet been cleared are classified as Category B. In fact, the Category B projects have not even been technically cleared by the Central Water Commission. The names of projects under each category, the location and the districts(s) benefitted/proposed to be benefitted are given in Tables 4.5A and 4.5B. It may be seen that completed projects are concentrated in one region while the ongoing projects are spread out covering a wider area.

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[5] The actual execution of project work has not been started in the case of Vamanapuram although it has been cleared for investment by the Planning Commission.

Table 4.5A
Location of Completed Projects

Sl. No	Name of Project	District# where located	District(s) benefitted	River Basin
1.	Peechi*	Trichur	Trichur	Karuvannur
2.	Chalakudy*	Trichur	Ernakulam & Trichur	Chalakudy
3.	Malampuzha*	Palghat	Palghat & Trichur	Bharathapuzha
4.	Neyyar*	Trivandrum	Trivandrum & Kanyakumari	Neyyar
5.	Vazhani	Trichur	Trichur	Keecheri
6.	Mangalam	Palghat	Palghat	Bharathapuzha
7.	Walayar	Palghat	Palghat	Bharathapuzha
8.	Gayathri	Palghat	Palghat	Bharathapuzha
9.	Cheerakuzhy	Trichur	Trichur	Bharathapuzha
10.	Pothundy	Palghat	Palghat	Bharathapuzha

Source: Various Project Reports, IDRB.

These anglicised names of some of the districts of Kerala have been changed recently to be more in keeping with the vernacular. See Appendix 3.

* Refers to major projects

Table 4.5B
Location of Ongoing Projects

Name of Project	Where Located	Districts Benefitted/ Likely to be benefitted	River Basin
	CATEGORY A		
Periyar Valley*	Ernakulam	Ernakulam	Periyar
Kallada*	Quilon	Quilon & Pathanamthitta	Kallada
Kanjirapuzha*	Palghat	Palghat	Bharathapuzha
Pamba*	Pathanamthitta	Patthanamthitta & Alleppey.	Pamba
Pazhassi*	Cannanore	Cannanore	Valapattanam
Kuttiadi*	Calicut	Calicut	Cauvery
Chitturpuzha*	Palghat	Palghat	Bharathapuzha
Karapuzha	Wayanad	Wayanad	Kabini
Chimoni*	Trichur	Trichur	Karuvannur
Muvattupuzha*	Idukki	Idukki,Ernakulam, Alleppey.	Muvattupuzha
Vamanapuram	Trivandrum	Trivandrum	Vamanapuram
	CATEGORY B		
Attappady	Palghat	Palghat	Cauvery
Idamalayar*	Ernakulam	Ernakulam	Periyar
Banasurasagar	Wyanad	Wyanad	Cauvery
Chaliyar* (Beyporepuzha)	Malappuram district	Malappuram district	Chaliyar
Kakkadavu*	Kasaragod	Kasaragod	Kariankode
Kuriarkutty-* Karappara	Palghat	Palghat	Chalakudy
Meenachil	Kottayam	Kottayam	Meenachil

Source: Various Project Reports, IDRB. * Refers to major projects.

Cost Escalation and Time Over-Runs

The analysis of cost and time over-runs has been carried out here in terms of the two groups of projects in Category A and B respectively. Detailed analysis of a particular project or a few projects individually has not been attempted mainly due to the difficulties in obtaining the relevant data and the limited time at our disposal.

Completed Projects

The projects in this category have been completed in the time-frame 1959-73. On analysis (Table 4.6) it is seen that practically no escalation[6] is noticed in the case of three projects namely, Chalakudy, Vazhani and Cheerakuzhy. Less than 100 percent escalation is noticed in Malampuzha, Neyyar, and Walayar. Mangalam and Pothundy recorded between 100 and 200 percent, Gayathri 368 percent, while Peechi the first project ever to be started in the State, 683 percent.

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[6] Cost escalation is computed as the percentage of the difference between the last and the first estimate over the first estimate.

Table 4.6
Cost Escalation in Completed Projects

Name of Project	Original estimate (Rs.Lakhs)	Final estimate (Rs. Lakhs)	Percent escalation	Remarks
Peechi	30	235	683.33	The first estimate at pre-war rates sanctioned by Cochin Govt. provided for a reservoir of 2000 Million cubic feet (Mcft) only. The capacity of the reservoir was raised to 3900 Mcft which resulted in the escalation to 150 lakhs. Later additional works in communications and canal systems necessitated the revision to 235 lakhs.
Chalakudy	188	188.25	0.13	
Malampuzha	380	580	52.63	The first sanctioned estimate was Rs.380 lakhs. Thereafter some changes took place in the estimated cost of the project Subsequently extensions of canals, branch canals and revision of Schedule of rates have necessitated the revisions.
Neyyar	248	461	85.89	The project has not been completed as designed.
Vazhani	108	107.57	-0.40	
Mangalam	49.28	106	115.10	The original project as sanctioned provided for (1) a reservoir of 250 million cubic feet capacity (2) a distribution system to serve 3,280 acres in Palghat taluk and was expected to cost Rs.49.28 lakhs. Later, in view of the better site direct off take at a higher level for the channel from the main dam itself, scope of the project is more than doubled. The scheme provides for (1) a reservoir of 639 million cubic feet and (2) a distribution system to serve 6000 acres. This led to a revision to 88.65 lakhs which was subsequently revised to Rs. 106 lakhs.
Walayar	116.60	131.66	12.86	The first estimate is stated to be Rs. 116.66 lakhs as per the project report available.
Gayathri	47.00	220	368.09	Meenkara Project, later called Gayathri as envisaged earlier contemplated the construction of one dam across Meenkara. (Stage I) and another across Chulliar (Stage II) both rivers being independent tributaries of Gayathri. The total cost of Stage I for works alone is Rs.79.37 lakhs. The stage II proposals of Gayathri project, when scrutinised to see whether there is any possibility of increasing the irrigated area led to a revision of proposals so as to compound the maximum available water. This led to a increase in reservoir capacity. The two reservoirs at Meenkara and Chulliar are interlinked by Canal system and the water from one supplied to the other in times of necessity.
Cheerakuzhy	91	90.76	-0.26	
Pothundy	88	234.25	166.19	The revision was necessitated on account of the following factors: (1) The provision made for the control structures and spillway were on the lowside (2) The cost of cement and steel had gone up (3) The scope of the schemes was revised to irrigate more land.

Source: As in Table 4.5A.

Ongoing Projects: Category A

In the case of ongoing projects, detailed project reports at each stage are available.

The number of times an estimate[7] has been revised and the percentage escalation are given in Table.4.7

Table 4.7
Revision of Estimates - Category A Projects (Rs. Lakhs)

	Original Estimate	I Revised Estimate	II Revised Estimate	IIIrd Revised Estimate	Remarks	Percent Escalation
1. Periyar Valley (1956)	348.00 (1955)	1795.00 (1974)	3971.40 (1978)	6305.00 (1986)	IIIrd revised estimate was forwarded to CWC on 16.10.1986. No pending comments from CWC. Yet to be sanctioned.	1712
2. Chitturpuzha (1961)	105.63 (1964)	624.14 (1975)	2063.29 (1985)		Second revised estimate not yet finalised (not sent to CWC)	1853
3. Kallada (1961)	1328.00 (1961)	16357 (1966)	45780.00 (1990)		Third estimate not yet approved by the Planning Commission.	3347
4. Pamba (1964)	384.00 (1964)	2015.97 (1976)	4296.99 (1977)	6427.84 ( )	Third revised estimate not yet finalised.	1574
5. Pazhassi (1964)	442.40 (1960)	1481.85 (1970)	4200.00 (1980)	7735.94 (1989)	Third revised estimate not yet sanctioned	1649
6. Kuttiadi (1962)	496.04 (1964)	1520.00 (1975)	4484.78 (1982)			804
7. Kanjirapuzha (1961)	365.00 (1954)	1052.20 (1975)	4307.73 (1984)		Second revised estimate not yet finalised	1080
8. Karapuzha (1975)	760.00 (1975)	4042.00 (1988)			Revision was necessitated owing to change in the type of dam.	432
9. Chimoni	632.71 (1975)	2951.21 (1986)	3615.29 (1989)		Only the last estimate has been approved by the Planning Commission. Rs.2951.21 lakhs is actually a recast estimate. There is an estimate of Rs.4808.15 lakhs, which was not sent to the Planning Commission.	471
10.Muvattupuzha (1976)	4808.15 (1983)	8925.02 (1990)			A revised estimate of Rs.7364 lakhs forwarded to CWC has been subsequently returned for reformulation. The recast estimate is 8925.02, which was forwarded to the CWC during August 90.	86
11.Vamanapuram (1981)	3640 (1982)					Nil

Source: As in Table 4.5B.

[7] A project estimate, when changed after getting approval from the Planning Commission at least once is called a revised estimate. Any change before approval is called a recast. In all cases except those specified in the remarks column estimates given are those approved by the Planning Commission. The years within brackets refer to the year of preparation of the estimate.

It is seen that, the project estimates have increased upto nearly 34 times the original in cases of projects which are more than 25 years old.

When we analyse the escalations into establishment and non-establishment (Table 4.8), we find that the percentage escalation in establishment[8] is invariably higher than that in non-establishment. The actual project work begins much after the project gets its establishment and it seems that expenditure increase has no proportionate relationship with the increase in total expenditure. This is borne out by the increase in the share of establishment cost as a proportion of total cost in the revised expenditure (See Table 4.9).

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[8] Establishment cost here means cost of establishment connected directly with the execution of the project structure. It does not include the cost relating to land acquisition, staff and audit personnel. All other costs are classed as non-establishment of which the major portion is 'works'.

Table 4.8

Escalation in Establishment and Non-Establishment Costs

- Category A Projects (Rs. in lakhs)

	Establishment			Non Establishment		
	Ef*	El*	Percent Escalation	Ef	El	Percent Escalation
1. Periyar Valley	23.20 (1955)	440.52 (1986)	1799	324.8	5864.18	1705
2. Chittur-puzha	9.49 (1964)	250.54 (1989)	2540	96.14	1812.75	1786
3. Kallada	104.8 (1961)	6042.96	5666	1223.2	39737.04	3149
4. Pamba	19.78 (1964)	844.95 ( )	4172	364.22	5582.89	1433
5. Pazhassi	27.43 (1960)	509.82 (1988)	1759	414.97	7226.12	1641
6. Kuttiadi	53.34 (1964)	648.79 (1982)	1116	442.7	3835.99	766
7. Kanjira-puzha	33.85 (1954)	411.03 (1984)	1114	331.25	3896.7	1076
8. Karapuzha	24.91 (1970)	293.43 (1988)	1078	364.09	3748.58	930
9. Chimoni	46.13 (1975)	323.75 (1989)	602	586.58	3291.54	461
10. Muvattu-puzha	292.89 (1981)	577.38 (1990)	97	4514.24	8347.64	85
11. Vamana-puram	304.61 (1982)	-	-	3335.39 (1982)	-	-

Source: As in Table 4.5B.

* Ef - First estimate
El - Latest estimate.

Table 4.9
Percentage share of establishment cost to the total-
Category A Projects

Project	Percentage share	
	First Estimate	Latest Estimate
Periyar Valley	7	7
Chitturpuzha	9	12
Kallada	8	13
Pamba	5	13
Pazhassi	6	7
Kanhirapuzha	9	10
Karapuzha	3	17
Chimoni	7	9
Muvattupuzha	6	7
Vamanapuram	8	-

Source: As in Table 4.5B.

Escalation in Category B Projects

These are seven in number and have not been cleared by Planning Commission. Table 4.10 shows the frequency of recasts of the estimate and the present stage of the projects that are pending clearance[9] either owing to environmental impacts or because interstate waters are involved. The project reports have been recast on various grounds. For Attappady, the ayacut is mostly hill slopes, which are very steep in some locations. The old project reports were revised changing the cropping pattern from paddy to cultivate sugarcane also according to the terrace of the ayacut. Although the Banasurasagar project, originally envisaged the utilisation of the entire water in the Cauvery river basin, for irrigation it was decided later to divert a portion of the yield to the Kuttiadi hydroelectric project for power generation and subsequent irrigation in the neighbouring

[9] A project report returned to the state for comments stands deleted if no reply is received from the state for more than a year.

basin. This necessitated the reduction of the estimate from 1137 lakhs of rupees to 500 lakhs, in 1977. This however later escalated to 1964.73 lakhs. Chaliyar, Kakkadavu, Kuriarkutty are still in the investigation stage. The original project of Kakkadavu could not be implemented owing to opposition from the public, since it necessitated the submergence of occupied and fertile land. The project reports of Meenachil, Chaliyar and Kakkadavu are being modified on feasibility grounds. The details of the present stage of each project are given in the remarks column.

Table 4.10

Recasts in Category B projects (All amounts Rs. in lakhs)

Name of project	Estimate first prepared	I Recast	II Recast	III Recast	Remarks	Percent Escalation
1. Attappady	476 (1970)	842 (1977)	2600 (1983)	5839 (1990)	Pending clearance from CWC owing to non-settlement of interstate water disputes.	1127
2. Idamalayar	1528.64 (1982)	7742.47 (1989)	6740.27 (1990)		Project pending clearance from CWC	380
3. Chaliyar	1061 (1979)	37800 (1985)			Project deleted w.e.f. 30.12.89 for non-receipt of state replies for one year. The project report was submitted to CWC during 6/79 for clearance and the project was deleted by CWC w.e.f. 30.12.81 owing to non-receipt of state replies for more than one year. Considering the submergence of extensive fertile land, it was decided to modify the proposal and to have a major scheme. Investigation of the scheme is still in progress.	3463
4. Banasurasagar	1137 (1971)	500 (1977)	1964.73 (1982)		Project deleted with effect from 31.3.86 since interstate water disputes have not yet been sorted out. Modified and updated project report is under preparation by Chief Engineer, Projects I, Kozhikode.	73
5. Kakkadavu	416.97 (1963)	1335.3 (1974)	5090.34 (1983)	10025.21 (1987)	Project deleted by CWC on 24.9.85 owing to non-receipt of modified report in the light of the findings of the expert committee of CWC. Modified project report can be finalised only on receipt of the report.	2304
6. Kuriarkutty Karappara	2685.06 (1986)	4885 (1983)	6016.18 (1990)		Project deleted with effect from 24.9.85 because of adverse environmental impacts. The modified project report amounting to Rs.6016.18 lakhs was forwarded to CWC on 4.6.90.	124
7. Meenachil	4955.95 (1982)				The project was deleted by CWC with effect from 23.2.88 due to non-compliance of replies to comments. Modified project report of the project can be prepared only after the feasibility study of the proposed alternative diversion system from Malankara Reservoir is completed.	Nil

Source: As in table 4.5B.

A separate analysis to find the escalations in establishment and non-establishment does not indicate any specific pattern as many of these projects are only in the investigation stage (See Table 4.11).

Table 4.11
Escalation in Establishment and Non-establishment - Category B Projects (All amounts in Rs.lakhs)

Name of project	Establishment First estimate	Establishment Latest recast	Establishment Percent Escalation	Non-Establishment First estimate	Non-Establishment Latest recast	Non-Establishment Percent Escalation
Attappady	21.8	533.38	2347	454.2	5305.62	1068
Idamalayar	108.85	600.44	452	1419.79	6139.83	332
Chaliyar	81.16	2931.16	3519	980	34868.84	3458
Banasura-sagar	71.65	147.6	106	1065.35	1817.13	71
Kakkadavu	45.43	437.45	863	371.54	9587.76	2481
Kuriarkutty Karappara	90.96	369.92	307	2594.1	5736.26	121
Meenachil	399.40	-	-	4556.55	-	-

Source: As in table 4.5B.

Cost Escalation - The issues

The above analysis indicates that cost escalation is much higher for ongoing projects than for the completed ones.

In the case of ongoing projects, the major factors in order of importance are (i) the rise in price of labour and materials, (ii) inadequate provision, (iii) cost of land, (iv) change in design, and (v) inadequate investigation, which should include wrong classification of soil.

The contribution of the various reasons for cost escalation leading to the third revised estimate from the second estimate

for a few projects under Category A can be seen from Table.4.12[10]. It shows that more than 40 percent of the cause in escalation is due to rise in cost of labour and materials. Inadequate budget provision is also seen to be a contributory factor among others.

Table 4.12
Contribution of Various Items For Escalation from Second to Third Estimate

Item	Periyar Valley	Chittur puzha	Kuttiadi	Pazhassi	Kanhirapuzha
1	2	3	4	5	6
1. Rise in cost of labour and materials	48.1	38.73	47.0	43	52.1
2. Inadequate financial provision	44.1	20.7	20.6	8.1	22.4
3. Inadequate investigation	1.7	4.0	5.1	11.9	4.2
4. Change in design	4.7	1.6	13.7	21.21	3.7
5. Cost of land	-	20.2	13.50	15.8	7.5
6. Others	1.3	14.8	-	-	10.0
Total	100.00	100.00	100.00	100.00	100.00

Source: 1) Cols (2) to (5) Various project reports, IDRB.
2) Col. (6) Committee of Public Accounts March 1988.

Apart from capital equipment, the physical components of a project can be broadly divided into (i) materials and (ii) labour. For irrigation projects materials such as rubble, brick, and sand are locally available but certain scarce materials such as a steel, cement, petroleum products, blasting powder, fuse,

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[10] This table is not indicative of the relative weightages of the various causes of escalation since it does not cover the original estimate.

etc have to be brought from outside. The main reason for the rise in the cost of local materials is the rise in labour charges[11]. The wages of labourers are related to the cost of living index. This is probably one of the main reasons for the high cost escalation in Kerala compared to other states.

In the Public Works Department, the prevailing rates of labour and materials are given in the schedule of rates which are revised where the rates are found unworkable. This schedule of rates is the basis for estimating the cost of works. From 1980-90, the schedule of rates was revised nearly every second year. Despite the frequent revisions, the estimate rates were always low and unworkable and when competitive tenders were invited the rates quoted were much above the estimate rates. The different schedule of rates from 1960, 1970, 1980 and 1990 will show that the total average labour rates have increased more than ten-fold. In the case of materials, the rise in cost ranges from seven-fold to thirty-fold. Tables 4.13A and 4.13B below indicate the increase in cost of the labour and some of the important materials.

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[11] Major portion of the cost of sand involves labour of collecting sand from river, conveying to river banks, unloading from boat and loading in lorry, again unloading from lorry at site, headload conveyance and so on. Similar is the case with metal, rubble or wood.

Table 4.13A
Cost of Labour

Description	Unit	Rate in Rupees as per Schedule of Rates for 1959-60	1970	1980	1990	Percent increase between 1960 and 1990
1. Man Mazdoor	1	2.50	4.50	13.00	27.00	980
2. Woman mazdoor	1	1.50	3.75	10.00	22.00	1367
3. Mason	1	4.00	7.50	19.00	40.00	900
4. Carpenter	1	4.00	6.50	19.00	40.00	900
5. Blacksmith	1	3.75	6.50	18.00	40.00	967

Source: Government of Kerala, Public Works Department

Table 4.13B
Cost of Materials

Description	Unit	Rate in Rupees as per Schedule of Rates for 1959-60	1970	1980	1990	Percent increase between 1960 and 1990
M.S. Roads	Quental	74.74	130.00	300.00	975.00	1205
Cements	Tonne	127.94	220.00	600.00	1300.00	916
Rubble	Cu Mtre	7.42	6.50	17.00	50.00	574
Bricks	1000 Nos	40.00	55.00	170.20	1200.00	2900
Sand	Cu Mtre	1.77	3.75	13.50	40.00	2160
3/4 (20mm) metal	Cu Mtre	19.43	21.00	60.00	130.00	569

Source: As in table 4.13A.

Moreover, in Kerala, the works in projects are usually entrusted to contractors on the basis of competitive tenders and sanctioned estimates, with no provision for escalation in cost of material or labour in the contract. The provision for going in arbitration in case of disputes has been withdrawn leading to an increased tendency for contractors to quote high rates with consequent delay in settling tenders. If there is provision for escalation of cost of materials and labour in the estimates the tendency for quoting high rates can be curbed to a great extent, (Iyer 1981).

Again, land is a very scarce commodity and is prohibitively costly. Court awards enhancing the cost of land acquired are very common. Availability of land has thus become a major constraint in the financing of major irrigation projects.

Time Over-run

Needless to say, cost escalation and time over-run form part of the same vicious cycle and one leads to and helps augment the other.

For completed projects, time for completion is given in Table 4.14. It must be remembered that all these projects were to be completed within a period of 5 years (Government of Kerala 1976). The following table reveals that the gestation period has been more than a decade in all cases without exception, Neyyar leading with 22 years. The average time required is seen to be 14.6 years bringing the delay to 192 percent.

Table 4.14
Time Over-run - Completed projects

Name of project	Time frame	Time taken to complete (Years)
Peechi	1947-1959	12
Chalakudy	1949-1966	17
Malampuzha	1949-1966	17
Neyyar	1951-1973	22
Vazhani	1951-1962	11
Mangalam	1953-1966	13
Walayar	1953-1964	11
Gayathri	1956-1970	14
Cheerakuzhy	1957-1973	16
Pothundy	1958-1971	13
Average		14.6

Source: As in Table 4.5A.

For ongoing projects also, there is a clear underestimation of the time required for completion as is evident from following Table.4.15. The fact that none of the projects have been completed so far, is a sad commentary on the planning and implementation machinery for irrigation projects in Kerala.

Table 4.15
Time Over-run - Ongoing Projects
Category A

Name of Project	Year of starting	Estimated gestation period years	Expected year of completion	Expected gestation period years
1	2	3	4	5
Periyar Valley	1956	7	1986/87	31
Kallada	1961	12	1987	16
Kanhirapuzha	1961	5	1989	18
Pamba	1961	6	1986/87	26
Pazhassi	1961	7	1987/88	27
Kuttiadi	1962	6	1987/88	26
Chitturpuzha	1963	4	1986/87	24
Karapuzha	1972	5	1995	23
Chimoni	1975	4	1988	13
Muvattupuzha	1975	10	1992	17
Vamanapuram	1979	8	1995	16

Source: 1) Various budget documents for Col.2
2) Various project reports for Col.3
3) Economic Review, Government of Kerala 1986 for Col.4.

III

Analysis of Expenditure

The cost escalations and time over-run of the various irrigation projects of Kerala can obviously be expected to manifest in the expenditure patterns also. We can expect a dragging of the expenditure, with resources spread so thinly that many of the projects may just be incurring expenditure to support the staff they carry with them. An analysis of expenditures is done with a view to get a picture of the impact of the cost

escalation and time over-run, for the time-frame from 1972-73 till 1988-89[12].

The relative shares of the category A and B irrigation projects, in both plan and non-plan expenditures can be seen in Table 4.16.

Table 4.16
Relative Shares of Expenditure

Projects	Total (Rs.in crores)	Percentage share in Non-Plan	Plan
Category A	646.18 (94.85)*	7.3	92.7
Category B	35.12 (5.15)	Nil	100.0
Total	681.30 (100)	6.9	93.1

*Figures within brackets indicate the percentage share of category with respect to the total.
Source: Compiled from various budget documents, Government of Kerala.

It is seen that nearly 95 percent of the total expenditure is on account of category A projects. And the share of non-plan to the total for category A projects is around seven percent whereas for Category B projects, there is no non-plan component at all. It is worth mentioning that the Category A has seven projects which are more than 25 years old!

The projects having non-plan component are Periyar Valley, Chitturpuzha, Kanjirapuzha, Kuttiadi, Pamba and Pazhassi. Of these, Periyar Valley which accounts for 96 percent of the total

[12] The details of plan and budget data have been collected from 1972-73. This is because prior to that, the mode of classification of the budget heads was different leading to compilation problems.

non-plan expenditure has more than 46 percent of its own total expenditure as non-plan. The bulk of the non-plan expenditure is for pension and maintenance.

We confine our analysis here to the plan component only. Percentage shares of expenditure of the projects over the time-frame is ample proof to show that in a particular year, the expenditures are incurred only by a few projects, while others have only a very nominal share (See tables 4.17A and 4.17B).

Table 4.17A
Share of Plan Expenditure for Category A Projects

Year	Periyar	Kallada	Kanjirapuzha	Pamba	Pazhassi	Kuttiadi	Chitturpuzha	Karapuzha	Chimoni	Nuvattupuzha	Vamanapuram	Total
1972-73	7.37	12.89	10.39	11.96	16.05	32.74	7.31	1.03	0.00	0.00	0.00	99.74
1973-74	6.70	21.05	8.25	18.13	12.75	24.17	8.28	0.23	0.00	0.00	0.00	99.55
1974-75	8.76	19.49	10.23	19.77	9.83	22.53	7.48	0.66	0.00	0.00	0.00	98.73
1975-76	14.36	15.63	7.05	25.61	7.15	23.86	4.19	0.29	0.24	1.02	0.00	99.40
1976-77	14.04	15.00	7.03	20.15	15.02	18.46	5.19	0.27	0.90	2.72	0.00	98.80
1977-78	15.18	21.57	9.48	13.64	14.52	16.06	4.03	1.09	1.13	1.98	0.00	98.67
1978-79	12.15	23.34	10.93	11.86	14.13	12.43	4.16	1.79	2.97	3.59	0.00	97.36
1979-80	11.15	23.52	10.12	11.18	12.56	10.30	3.73	3.06	3.14	6.26	0.32	95.35
1980-81	10.06	26.22	10.35	8.30	14.12	8.83	1.58	3.63	2.27	9.05	0.06	94.46
1981-82	7.96	37.90	7.83	9.27	10.99	7.25	1.84	1.50	3.53	6.61	0.29	94.96
1982-83	6.18	37.59	8.47	7.48	10.57	5.86	1.97	1.24	3.68	6.80	0.31	90.14
1983-84	7.16	44.06	6.75	6.93	7.67	5.06	1.73	1.40	2.64	5.91	0.23	89.55
1984-85	9.51	45.55	7.35	8.51	7.47	1.92	1.75	1.19	3.64	5.50	0.27	92.66
1985-86	5.39	54.15	3.45	4.32	8.04	4.63	2.30	2.25	2.10	3.06	0.40	90.09
1986-87	4.29	66.93	4.77	3.03	4.46	0.98	0.98	2.11	3.79	5.22	0.93	97.48
1987-88	4.93	68.38	3.90	1.12	3.12	0.62	2.90	2.91	3.87	4.75	0.77	97.28
1988-89	7.29	59.26	3.70	1.74	4.45	1.50	1.12	2.86	5.94	6.82	1.10	95.78

Source: As in Table 4.16

Table 4.17B
Share of Plan Expenditure in Category B Projects

Year	Attappady	Idamalayar	Banasurasagar	Chaliyar	Kakkadavu	Kuriarkutty	Neenachil	Total
1972-73	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.26
1973-74	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.45
1974-75	1.27	0.00	0.00	0.00	0.00	0.00	0.00	1.27
1975-76	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.60
1976-77	1.14	0.06	0.00	0.00	0.00	0.00	0.00	1.20
1977-78	1.13	0.21	0.00	0.00	0.00	0.00	0.00	1.33
1978-79	1.74	0.27	0.36	0.02	0.26	0.00	0.00	2.64
1979-80	3.04	0.07	0.83	0.04	0.56	0.10	0.02	4.65
1980-81	2.50	0.31	1.49	0.09	1.04	0.09	0.03	5.54
1981-82	0.98	2.03	0.01	0.17	0.83	0.94	0.08	5.04
1982-83	0.75	8.16	0.02	0.13	0.45	0.23	0.11	9.86
1983-84	0.77	8.71	0.07	0.10	0.33	0.31	0.16	10.45
1984-85	0.50	6.10	0.12	0.12	0.16	0.23	0.12	7.34
1985-86	0.64	8.36	0.14	0.18	0.14	0.18	0.26	9.91
1986-87	0.68	1.19	0.06	0.18	0.06	0.04	0.31	2.52
1987-88	1.06	0.96	0.04	0.19	0.22	0.00	0.25	2.72
1988-89	0.85	1.95	0.26	0.21	0.19	0.52	0.24	4.22

Source: As in table 4.16.

It may be seen that till 1975-76 Category A projects captured nearly 99 percent of the total plan expenditure, Category B had only one project and the percentage share was around one percent. Within Category A, in 1975-76, Pamba and Kuttiadi had shares around 25 percent each, Periyar and Kallada around 15 percent each, Kanhirapuzha and Pazhassi around seven percent each. Chitturpuzha had about five percent, Muvattupuzha about one percent, Chimoni and Karapuzha less than one percent each. Vamanapuram had not been started then.

Five years hence in 1980-81, share of the Category A projects came down to 95 percent and Category B had seven projects amongst which the megre share of five percent had to be apportioned. In 1980-81, among Category A projects, the share of Kallada increased to 26 percent, while that of Pazhassi to 14 percent.

The share of Periyar dropped to 10 percent, while that of Pamba and Kuttiadi eight percent each, Kanjirapuzha and Pazhassi had shares of 10 and 14 percent each. The share of Chitturpuzha fell to nearly 1.6 percent, while that of Karapuzha, Chimoni, Muvattupuzha registered a marginal increase to nearly 3.6, 2.3 and nine percent respectively. Vamanapuram had a very small share of less than .1 percent.

In 1985-86, at the end of the Sixth Plan the share of Category A touched 90 percent. The remaining 10 percent was distributed among Category B projects, with Idamalayar having the largest share of more than eight percent[13]. In Category A, a very interesting change had taken place. Kallada cornered nearly 55 percent of the total expenditure, Pazhassi with eight percent being the next highest. All the other projects except Vamanapuram (with less than .5 percent) had five percent or less. Thus the priority given to the project* with World Bank Assistance brought down the shares of the other projects drastically. During the Sixth Plan, the share of Category A again went upto 95 percent and above. This is in accordance with the policy of the Government to prioritise the expenditure on the projects already cleared.

The above analysis thus clearly shows that starting of projects without the necessary finances results in very thin spreading of the resources which ultimately leads to time over-run and cost escalation. This will be a burden on the exchequer

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[13] Incidentally this is the only project which gets an earmarked outlay though not cleared by the Planning Commission.

* Kallada

though the cause for starting the project might have been genuine.

Components of Plan Expenditure

The plan expenditure is grouped into two categories: establishment and non-establishment. Establishment expenditure comprises of salaries, wages, travelling expenses, office expenses, rent, rates and taxes, publication and others. Non-establishment comprises mainly of works (99.8 percent), and others like tools and plants, making up for the remaining 0.2 percent. Thus for all practical purposes, non-establishment may be considered to represent the actual works of the projects.

In general, the share of establishment expenditure for a project including leave and pensionary charges, in the case of works let out on contract, is of the order of 10 percent on an average - eight to ten percent for concentrated works and 10 to 12 percent for scattered works like canals. For works to be executed departmentally, the provisions could be higher and could go upto 15 percent (Central Water Commission, Government of India 1983:34). At a time when the actual project activity is in full swing, the share will be only around four to eight percent. This means that a high value of establishment share is indicative of a state of affairs where the actual execution of work is minimal. In a particular year, the more the number of projects with little project work in execution, the higher will be the establishment share.

The relative shares of establishment expenditures[14] over the time-frame for the two categories can be seen in Table 4.18.

Table 4.18
Percentage shares of establishment expenditure to total expenditure for Category A and B Projects

	Category A	Category B
1972-73	18.08	20.15
1973-74	21.15	36.14
1974-75	22.54	23.92
1975-76	22.06	23.64
1076-77	11.46	26.15
1977-78	8.26	21.86
1978-79	8.72	14.21
1979-80	9.73	13.03
1980-81	9.33	17.44
1981-82	10.13	20.10
1982-83	10.94	11.08
1983-84	10.79	10.01
1984-85	11.81	13.30
1985-86	14.28	9.74
1986-87	18.66	47.08
1987-88	20.44	47.21
1988-89	21.93	32.95
Total	13.80	16.58

Source: As in Table 4.16.

Overall, the share for the Category B (17 percent) is more than that of Category A (14 percent) indicating thereby that the actual execution is less in Category B projects than in Category A. It is also seen that the range of variation of the establishment share for Category B is much more (10.01 to 47.21) when compared to Category A (8.26 to 22.54). Category B projects were all started only in the 1970s. The higher percentage share of establishment for Category B is only to be expected since the actual execution has not started in any of them except Idamalayar. The sudden steep rise in the share of establishment for Category B projects after 1985 is a reflection of the policy

[14] The share of establishment and non-establishment together make 100.

of the Government to prioritise the expenditure on Category A projects, many of which are nearing completion. As the total amount available for Category B becomes less, it has necessarily to cater to establishment to keep the projects going.

Share of establishment in the estimate and expenditure

A comparison of the share of establishment expenditure as per the latest estimate and the share in the cumulative expenditure reveals that invariably in all projects, the actual share is more than the estimated one, indicating that the works component has been given less importance. This trend over a period of time will lead to a prolonging of the gestation period, the project work being made to drag the establishment with it till completion[15].

Table 4.19A
Share of Establishment as per latest revision and cumulative expenditure - Category A.

Projects	As per the latest revision	As per the cumulative expenditure for the time-frame.
Periyar	6.99	12.05
Kallada	13.20	13.84
Kanjirapuzha	9.54	16.57
Pamba	13.14	15.84
Pazhassi	6.59	10.36
Kuttiadi	14.47	14.85
Chitturpuzha	12.14	17.51
Karapuzha	7.26	12.44
Chimoni	8.96	13.50
Muvattupuzha	6.47	12.84
Vamanapuram	10.02	64.1

Source: Various project reports, IDRB and budget documents.

[15] The Report of the Comptroller and Auditor General of India Government of Kerala (1989:17) has specifically commented on this aspect with regard to Chimoni project.

Table 4.19B
Share of Establishment as per the latest recast and cumulative expenditure - Category B.

Project	Latest recast	Cumulative expenditure for the time-frame
Attappady	9.14	25.31
Idamalayar	10.02	7.31
Banasurasagar	7.51	21.02
Chaliyar	7.71	86.2
Kakkadavu	4.36	23.63
Kuriarkutty Karappara	6.15	13.94
Meenachil	8.06	79.53

Source: As in Table 4.19A.

As seen clearly from the Tables 4.19A and 4.19B, the share of establishment is abnormally high for Vamanapuram in Category A. No work on the project as such has begun in this case, although it has been cleared by the Planning Commission.[16] In all the Category B projects, the share is again very high for Chaliyar and Meenachil, which are in their preliminary stages. Only Idamalayar, where the project work is going on, has recorded a reasonable share of 7.31 percent for establishment.

Growth Rate of Expenditure and its Components

We have already seen that the expenditure incurred is directed towards project works only in the case of a few projects. This should be evident from an analysis of the growth rate of expenditure and its components. Tables below (4.20A and

[16] The Planning Commission approved the Vamanapuram project in 1982. At that time, it was presumed that no separate environmental clearance would be required and works were started. But later, when the request for forest land was moved, the forest authorities insisted on environmental clearance. Since this has not yet been obtained, the work cannot be commenced.

4.20B) indicate the growth rates of the total expenditure, establishment and non-establishment across projects.

Table 4.20A
Growth Rate of Components of Expenditure for Category A Projects

Project	Age of Project Years	Growth rate Est.	Non-Est.	Total
Periyar	33	16.02*	10.02*	10.76*
Kallada	28	23.56*	25.61*	25.22*
Kanjirapuzha	28	12.20*	8.09*	9.21*
Pamba	28	4.76**	-2.23	0.20
Pazhassi	28	7.93*	6.8	7.63**
Kuttiadi	27	-2.04	-10.22	7.57
Chitturpuzha	26	4.95*	2.76	3.48
Karapuzha	17	23.67*	27.48*	26.79*
Chimoni	14	25.02*	23.31*	23.50*
Muvattupuzha	14	15.91*	17.16*	16.76*
Vamanapuram	10	31.37*	23.78	25.50*
Total	14.33*	14.55*	14.48*	-0.124

Source: As in table 4.16.
Note: * Significant at five percent level.
** Significant at 10 percent level.

Table 4.20B
Growth Rate of Components of Expenditure for Category B Projects

Project	Age of the project Years	Growth Rate Percent Est.	Non-Est.	Total
Attappady	17	20.40*	14.16*	16.10*
Idamalayar	13	33.76*	42.19*	37.82*
Banasurasagar	11	-1.33	-25.03	-9.24
Kakkadavu	11	14.42	-25.29**	-12.08**
Kuriarkutty Karappara	11	-1.40	21.79	28.24
Meenachil	11	55.84*	12.29	43.60*
Chaliyar	11	25.42*	7.96*	23.91*
Total		31.95*	31.11*	31.85*

Source: As in table 4.16.
Note : As in table 4.20A.

In the case of Category A projects, the growth rates of establishment are significant in all cases except Kuttiadi (which is nearing completion) whereas for non-establishment, it is

significant only for Periyar, Kallada, Kanhirapuzha, Karapuzha, Chimoni and Muvattupuzha, implying thereby that these are the only projects where some works in the project take place. The overall growth rate is significant for all projects except Pamba, Kuttiadi and Chitturpuzha which are nearing completion. For Category B projects, there is overall growth in Attappady, Idamalayar, Meenachil and Chaliyar. Of these only Attappady and Idamalayar have recorded growth in non-establishment expenditure. Banasurasagar and Kuriarkutty Karappara are stagnant, while Kakkadavu is clearly showing a negative growth rate.

These results reinforce the problem of cost escalation and time over-run in future also.

Consequences

The cost escalation and time over-run have resulted in our irrigation becoming very costly. A comparison of the cost per hectare of irrigation through the plan periods as we have already seen in Chapter III speaks for itself.

The costs per hectare of completed projects have been computed using the total expenditure incurred (ignoring the time element) and the net Command Area. (See Table 4.21).

Table 4.21
Cost Per Hectare for Completed Projects

Project	Plan expre in Rs. till 3/89 lakhs	Command Area (Net hectare)	Cost/ha (Rs)
1	2	3	4
Peechi	235.00	17555	1339
Chalakudy	188.25	19690	956
Malampuzha	580.00	21045	2756
Neyyar	461.00	11740	3927
Vazhani	107.57	3565	3017
Mangalam	106.00	3340	3714
Walayar	131.66	3238	4066
Gayathri	220.00	5465	4026
Cheerakuzhy	90.76	1620	5602
Pothundy	234.25	5465	4286
Total	2354.49	92723	2539

Source: 1. Economic Reviews for Col. 2.
2. Irrigation projects of Kerala for Col.3.

The cost per hectare of ongoing irrigation projects computed using the latest estimate and net area expected to be irrigated[17] is given in Tables 4.22A and 4.22B. The exorbitant cost is evident.

Table 4.22A
Cost Per Hectare of Category A Projects

Name of Project	Latest revised estimate (Rs.Lakhs)	Expected Area to be irrigated (Net hectare)	Cost per hectare (Rs)
1	2	3	4
Periyar Valley	6305.00	30444	20,710
Kallada	45780.00	61630	74,282
Kanjirapuzha	4307.73	9720	44,318
Pamba	6427.84	21135	30,413
Pazhassi	7735.94	11525	67,123
Kuttiadi	4484.78	14570	30,781
Chitturpuzha	2063.29	14500	14,230
Karapuzha	4042.00	4650	86,925
Chimoni	3615.29	13000	27,810
Muvattupuzha	8925.02	17400	51,293
Vamanapuram	3640.00	8803	41,350

Source: 1) Various Project Reports for Col.2
2) Government of Kerala 1988. for Col. 3

[17] These are areas computed by superimposing the map of the canal on the revenue and survey map.

Table 4.22B
Cost Per Hectare of Category B Projects

Name of Project	Latest Estimate (in Rs.Lakhs)	Expected Area to be irrigated (Net hectare)	Cost per hectare (Rs)
1	2	3	4
Attappady	5839.00	4190	1,39,356
Idamalayar	6740.27	13659	49,347
Chaliyar	37800.00	73435	51,474
Banasurasagar	1964.73	2400	81,864
Kakkadavu	10025.21	12817	78,218
Kuriarkutty	6016.18	11736	51,263
Karappara			
Meenachil	4955.95	10000	49,560

Source: Same as in Table 4.22.A.

It is pertinent to note here that none of the Category B projects have started contributing to irrigated area. And among Category A projects only three projects started giving results in 1973-74, a total of four from 1975-76, six from 1980-81 and seven from 1980-81.

Table 4.23
Gross Irrigated Area by Projects (Areas in Ha)

Project	Expected	1974-75	1985-86	1988-89	Percent achieved
Periyar Valley	85600	40900	74925	77584	90.64
Chitturpuzha	29202	11000	24579	25856	88.54
Kallada	92800	-	1375	15921	17.16
Pamba	49456	-	46033	48480	98.03
Pazhassi	23050	-	13468	15642	67.86
Kuttiadi	35850	3500	34051	34710	96.82
Kanjirapuzha	21853	-	15487	15487	70.87

Source: Economic Reviews, Various Issues.

A comparison of the achievement in terms of area irrigated in the case of the seven Category A projects which have started "yielding", indicates that Kuttiadi and Pamba have achieved more

than 95 percent and Periyar more than 90 percent. Pazhassi and Kanhirapuzha have 67.86 percent and 70.87 percent respectively. Kallada has the lowest of 17.16 percent.

Table 4.22 which indicates the physical progress achieved in terms of percentage of work, till the end of 1988-89, shows that the percentage of work executed in the case of Kallada is very low under communications (25 percent), field bothies (21 percent), and distributaries (67 percent).

Table 4.24
Physical progress: Percentage of Work Completed Till The End of 1988-89

Work Breakdown Structure	Periyar	Chitturpuzha	Kallada	Kanhirapuzha	Kuttiadi	Pamba	Pazhassi
Investigation	98	98	97	100	100	100	89
Land acquisition	96	95	92	95	99	99	94
Buildings	95	96	99	98	95	97	92
Communications	100	-	25	100	95	98	65
Headworks	99	100	99	98	96	100	88
Main Canals	100	97	97	92	96	95	90
Branch canals	97	96	86	68	99	87	74
Distributories	91	99	67	88.5	98	89	88
Field Bothies	76	99	21	88.5	95	66	90

Source: Performance budget 1990-91.

It has been stated that the main difficulty in the speedy utilisation of water potential in Kerala is the delay in the construction of water courses and field channels. This delay is aggravated because here the alignment of the distributaries used to be taken up after the completion of the main works. The excessively small size of holdings and the high density of population make the farmer reluctant to part with any land for water course and field channels. According to the Irrigation Commission (1972:181), the state is ideally suited for laying

underground pipes to convey water to the fields and save land for agricultural use. This alternative however would be economically attractive only if alternative systems such as irrigation through a network of decentralized systems are fully exploited.

Summing Up

It is now clear that the state has to bear the burden of a large number of ongoing projects, and endure the problems of cost escalation and time over-run for sometime to come. Out of the 18 ongoing projects, only four are nearly completed; they are Periyar, Pamba, Chitturpuzha and Kuttiadi. The remaining are in various stages of completion. The Category B projects are just in the preliminary stages only. To close down some of the works and to complete the others expeditiously would be a feasible solution in cases of projects where expenditure is only nominal or minimal. In others there is the danger of these costs becoming `sunk costs'. The alternative, which is to find additional funds, can only be at the expense of other sectors like industry and social services on which the state places a high premium. Lop-sided planning with little or no regard for the state's resources, totally ignoring the basic principles in planning and project selection, seems to have created a "rat-trap".

CHAPTER V

THE ORGANISATIONAL SET UP AND THE PROJECT CYCLE

Our analysis clearly indicates that the heavy investment in irrigation projects is concentrated in a handful of them. Others get only a very small share in terms of project works but are burdened with the dead-weight of establishment. Evidently, there has been a misallocation of not only financial, but also human resources. In this chapter, we first attempt to get an overview of the organisational set up and then try to link it up with the project cycle concept to see the divide between requirement and reality.

I

Organisational Set up

Evolution

The organisational base of irrigation has been expanding since Independence. But on close examination it appears that its growth has no bearing at all on the pattern necessitated by the various stages of the project cycle.

The absence of a well-defined administrative machinery for the implementation of irrigation projects has been pointed out as an impediment to irrigation investment in pre-independence era. The State of Travancore-Cochin was created by the integration of the erstwhile Travancore and Cochin states on the 1st of July 1949. The entire Public Works Division was under only one Chief Engineer. The important works that were in progress at that time

included the Kodayar Extension Project, Neyyar Irrigation Project, Peechi Scheme, Chalakudy and Vazhani (Government of Travancore-Cochin 1951-52:92). Two executive divisions were formed in December 1954 with headquarters at Alwaye and Trivandrum under the direct administrative control of the Deputy Chief Engineer (Planning).

In the meantime, Malampuzha, Walayar and Gayathri irrigation projects in the erstwhile Malabar district were also taken up for execution by the Madras Government.

When Kerala state was formed in 1956, the Public Works Department (PWD) was also reorganised in order to enable it to execute the plan schemes efficiently. To relieve the Chief Engineer of his heavy work, the post of a special Chief Engineer was created (Government of Kerala 1957:434)[1]

For administrative convenience, the Kerala PWD was reorganised from 1.11.1956 into three circles - South, Central and North[2].

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[1] The Special Chief Engineer had control of works in respect of major and medium irrigation, inland navigation, port, store purchase, and Government engineering workshop.

[2] The PWD division Nagercoil, with the subdivisions, Nagercoil, Thuckalai, Kodayar Extension Project under it as well as the Shenkottah sub-division , under the Quilon division were transferred to the Madras state on 1.11.56. At the same time the Malabar area PWD comprising three irrigation divisions formed part of the Kerala State PWD. The set-up of the PWD in Malabar was reorganised on 1.12.1956 to bring it on a par with the set up in Travancore - Cochin area.

During 1957-58, the Irrigation Branch started functioning as a separate and independent unit of the PWD. The Irrigation Branch had three circles, each under the charge of a Superintending Engineer. The temporary Special Irrigation Circle which was established in the Malabar area continued throughout the year. The temporary circles for water resources and planning were abolished consequent on the reorganisation of the department. During the year 1958-59, there were 16 Irrigation divisions and two Special divisions under the Irrigation Branch (Government of Kerala 1959:266).

During 1966-67 also, PWD continued to function as two branches, namely Buildings and Roads Branch and General and Irrigation Branch with two Chief Engineers, one for each branch. The Irrigation Wing had five regional offices and two additional divisions were sanctioned in 1966-67.

At the beginning of the Fourth Plan, 1969-70, the state PWD functioned as two branches as before. The Irrigation Wing had three territorial Offices namely, (i) Irrigation South Circle, (ii) Central Circle and (iii) North Circle and two separate circles one for Minor Irrigation and the other for Investigation, Research and Planning.[3] This Investigation Circle with headquarters at Peechi and four divisions at Muvattupuzha, Trichur, Palghat and Cannanore continued to function for the

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[3] A new division with Head Quarters at Alwaye was sanctioned for investigation works with a view to providing employment opportunities to unemployed engineers. This functioned under the charge of an Executive Engineer with 10 sub-divisions each under an Assistant Engineer.

investigation of irrigation projects in some important and major river basins of the state and for preparing preliminary as well as detailed project reports for the optimum use of water resources of the state.

During the course of the year 1970-71, two more wings were created for the PWD: (1) Projects and (2) National Highways[4]. A separate Chief Engineer was put in charge of Projects. At the end of the year 1970-71, there were 35 divisional offices, 136 sub-divisional offices and 434 section offices. Year after year, more divisions were created as evidenced by the Administration Reports. In the year 1974-75 for example, one additional division comprising of three sub-divisions and nine sections were created, thus bringing one Executive Engineer, three Assistant Engineers, three Junior Engineers and 127 others into the establishment.

The set-up was expanded between 1975 and 1982 to accommodate three more Chief Engineers instead of one in the Irrigation Wing. They are: (1) Chief Engineer (Projects I) dealing with all projects in the districts of Cannanore, Kozhikode, Palghat, Wayanad and Malappuram, (2) Chief Engineer (Projects II), dealing with all projects in the remaining districts except Kallada Irrigation Project, (3) Chief Engineer, (Projects III) dealing with all works relating to Kallada Irrigation project. Organisational set-up for the three Projects at the end of the financial year 1983-84 is given table.5.1.

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[4] National Highways come under the Roads Branch.

Table 5.1
Organisational Set-Up as on 29.2.1984

Project	Circle	Divisions	Sub Divisions	Sections
I	1.Cannanore	5	18	56
	2.Kozhikode	5	18	55
	3.Siruvani,Palghat	6	25	81
Total Project I		16	61	192
II	1.Muvattupuzha	6	21	63
	2.Chengannur	3	11	36
Total Project II		9	32	99
III	1.Kallada Right Bank Circle	5	17	54
	2.Kallada Left Bank Circle	6	19	57
	3.Kallada Circle Quilon	5	15	45
Total Project III		16	51	156
Total of I, IIand III.		41	144	447

Source: Administration Report of the Public Works Department (Project Wing) for the year 1983-84.

A typical division has around 35 personnel of which 11 are technical and the remaining ministerial. A Sub-division has similarly around 10 persons of which three are technical and a section has about eight persons of which five are technical. Thus at the end of 1984, the total number of personnel (including engineers) for Irrigation Projects was around 3100 technical personnel and around 3300 non-technical personnel.

At the beginning of the Sixth Plan 85-86, the set-up was as follows. There was a Chief Engineer (General and Administration) in charge of administration, minor irrigation and anti-sea erosion works with six Circles, Chief Engineer Projects I with three circles, Projects II with two Circles and Projects III with

four circles. Each of the circles is manned by a Superintending Engineer. Besides these, there were also three other circles, namely, Investigation Research and Planning circle, Peechi, Water Resources Circle, Trichur and Coastal Erosion Studies Circle, Trichur, all under the administrative control of the Chief Engineer (General). In the year 86-87, two more wings were set up, one for World Bank Assistance and the other for Irrigation Design and Research under two Chief Engineers.

The Present Set up

Irrigation became a separate department from the existing Public Works Department from 1.4.90. There are seven Chief Engineers under the Irrigation Department. They are

(1) Chief Engineer (Irrigation and Administration).

(2) Chief Engineer, Project I, Kozhikode

(3) Chief Engineer, Project II, Trivandrum

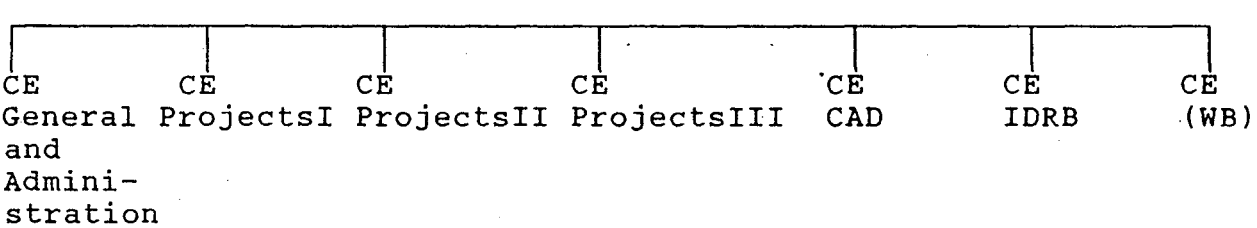
(4) Chief Engineer, Project III, Kottarakkara

(5) Chief Engineer, Irrigation, Design and Research Board, Trivandrum.

(6) Chief Engineer, World Bank Assistance, Trivandrum

(7) Chief Engineer, Command Area Development, Trichur

Chart 3
Engineers of the Irrigation Department



Irrigation (General and Administration)

The entire Irrigation Wing of the PWD functions under the administrative and technical control of this Chief Engineer. This wing is in charge of works relating to anti-sea erosion, flood control, minor irrigation and inland navigation schemes.

For administrative efficiency, the Department is divided into six circles. The Irrigation South, Central and North Circles deal with flood control, anti-sea erosion and inland navigation works. The completed Neyyar Irrigation Project is under the South Circle and the Chimoni dam project is under the Central Circle. The Minor Irrigation works in the Northern region are controlled by the Superintending Engineer Minor Irrigation circle Calicut, while those in the Southern region are controlled by the Superintending Engineer, Minor Irrigation Circle, Trivandrum. The Mechanical Wing of the Public Works Department is a separate unit with two division headquarters being at Alleppey and Malampuzha (See Chart 4)[5].

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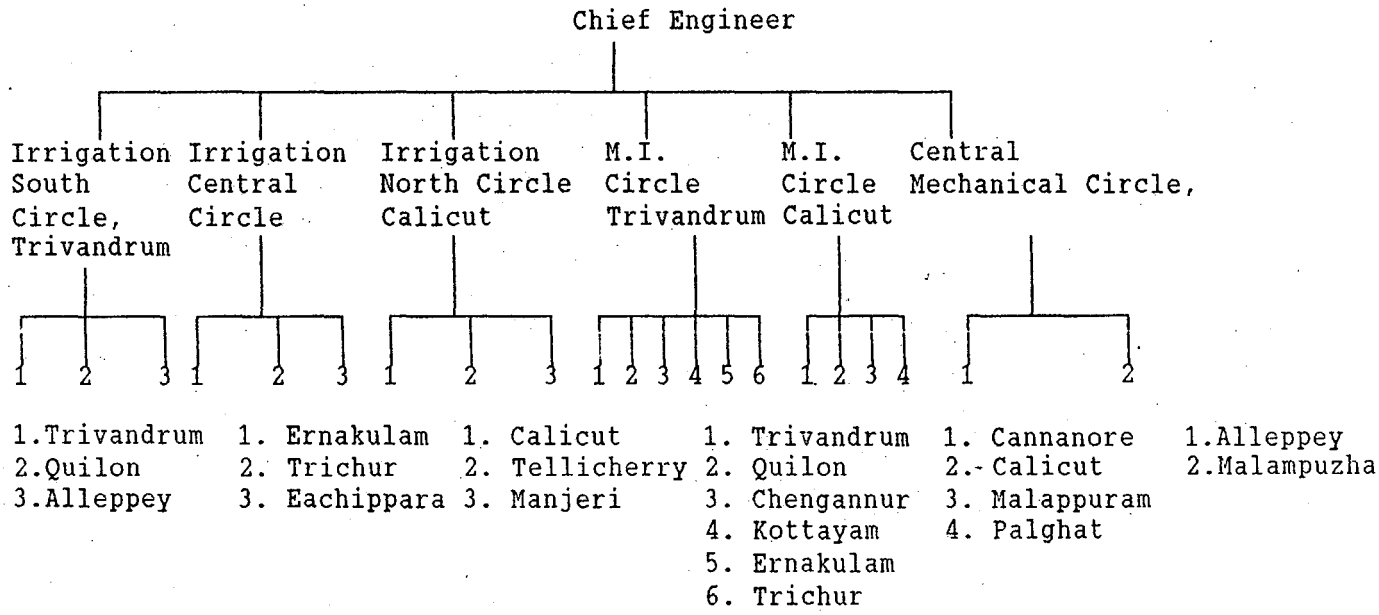
[5] In addition to this, there are also a Deputy Chief Engineer and an Administrative Assistant directly under the Chief Engineer.

Chart 4
Irrigation: General and Administration



Projects I

Chief Engineer (Projects I) has three circles and a total of 13 Divisions under him (See Chart 5). The irrigation projects under him are Pazhassi, Kuttiadi, Kakkadavu, Karapuzha, Banasurasagar, Chaliyar, Attappady, Kanjirapuzha, Chitturpuzha, Kuriarkutty-Karappara, Chamravattom bridge cum regulator[6] and all completed projects in the Malabar area. Of these, only Pazhassi, Kuttiadi, Kanjirapuzha, Karapuzha, and Chitturpuzha are projects which have been cleared by the Planning Commission for expenditure. Chaliyar and Chamravattom (bridge cum regulator) are still in the investigation stage. The remaining have not yet been cleared by the Planning Commission for expenditure.

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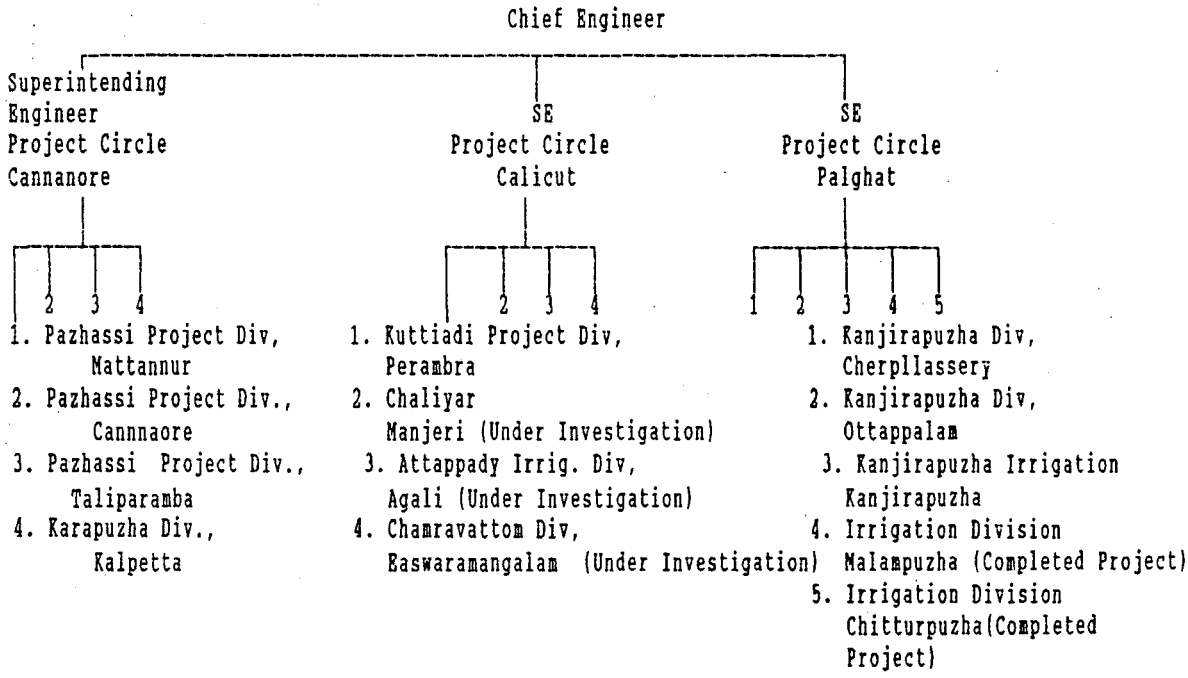
[6] This project is still in the investigation stage only and is not included in the list of 18 ongoing projects in this study.

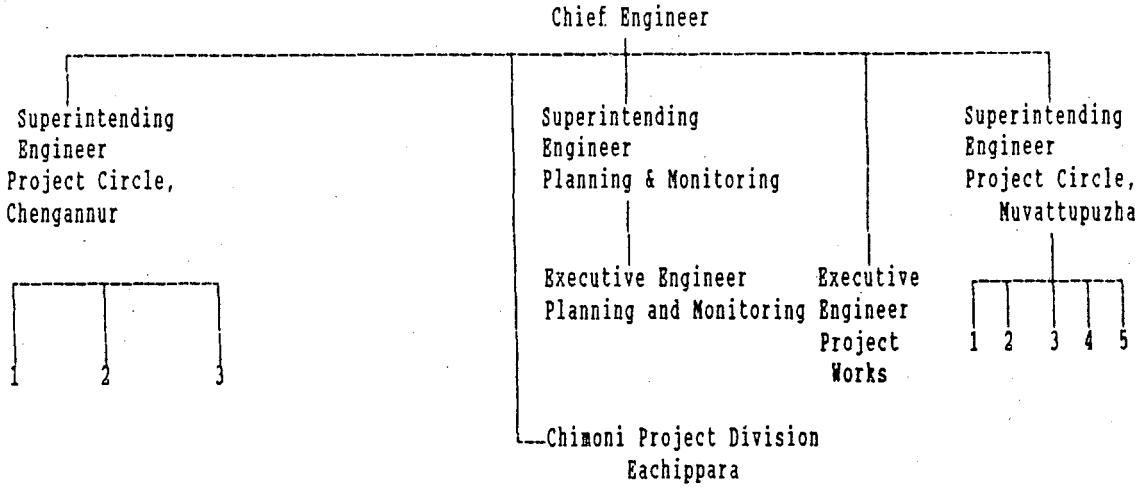
Chart 5
Organisation of Projects I Office



Projects II

The office of this Chief Engineer functions with Trivandrum as Headquarters. It has a planning and monitoring wing under a Superintending Engineer and an Executive Engineer's Office for support. The projects that come under this circle are Pamba, Periyar (both nearing completion), Muvattupuzha, Idamalayar, Meenachil and Vamanapuram. The Chimoni project, which comes under the Superintending Engineer Irrigation Central Circle is also under the administrative control of this Chief Engineer (See Chart 6).

Chart 6
Organisation of Projects II Office



Project Circle Chengannur

1. Pamba Valley Irrg. Div, Chengannur
2. Meenachil River Valley Project Div, Palai
3. Vamanapuram Valley Irrg.Div, Nedumangad.

Project Circle, Muvattupuzha

1. PVIP Div, 1, Perumbavur
2. PVIP Div, 2, Alwaye
3. MVIP Div. 1, Thodupuzha
4. MVIP Div, 2, Koothattukulam
5. Idamalayar Project Div, Angamaly.

Project III

Project III is meant only for Kallada project which is the only World Bank Aided project in the state. The dam work is now complete and the work of the Right Bank main canal and the Branch Canals are in progress. The project has been taking up nearly 50 percent of the total plan expenditure on irrigation during the past 10 years. There are four circles (See Chart 7)and 21 divisions for this project[7] .

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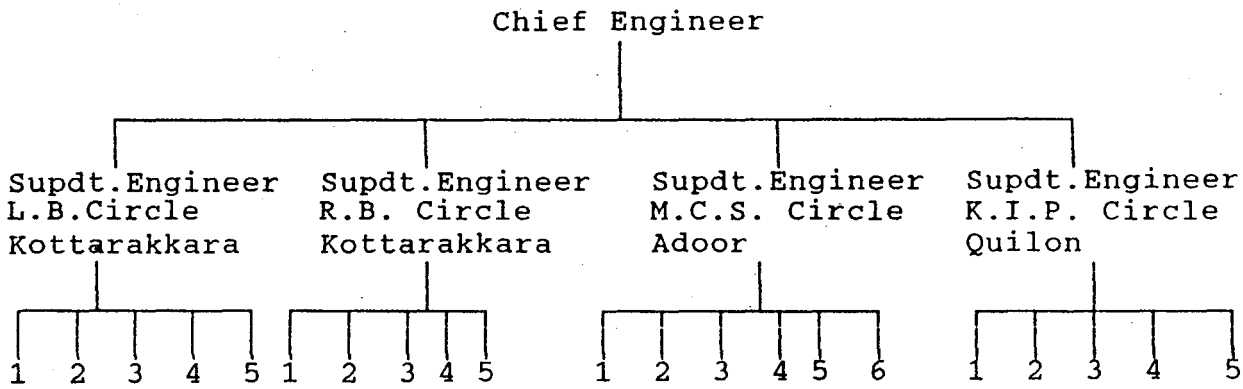
[7] In addition to this in the office of the Chief Engineer Projects III, there is also a Superintending Engineer (Technical) who has three Executive Engineers under him - one for works, one for design and one for monitoring.

Chart 7
Organisation of the Projects III Office



Command Area Development (CAD)

The Command Area Development activities started in the state during 1980 and the Command Area Development Act, 1986 came into force with effect from 11.1.85. The actual functioning of the Command Area Authority with a separate revolving fund started from 1.9.85 only. The main activities carried out by the Authority are construction of field channels from outlets of irrigation canals upto small blocks of fields in order to prevent wastage and provide equitable distribution of water.

This unit with Trichur as headquarters deals with the Command Area Development of the 10 completed Projects[8]. Of these, Malampuzha, Mangalam, Pothundy, Gayathri and Walayar come under the Siruvani Circle (Project I), Cheerakuzhy, Vazhani, Peechi, Chalakudy come under Irrigation Central Circle and Neyyar project comes under Irrigation South Circle. There are thus four divisions under the Chief Engineer CAD. They are (See Chart 8):

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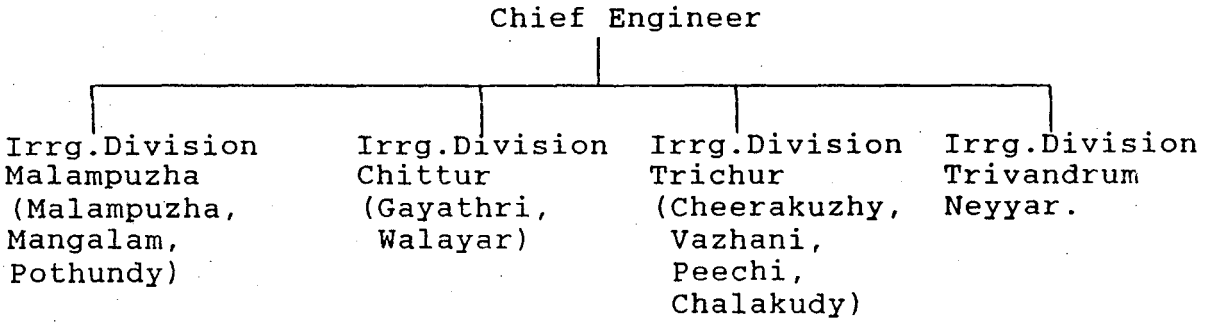
[8] Now, four more projects which are nearing completion, Periyar, Pamba, Chitturpuzha and Kuttiadi are also included.

Chart 8
Organisation of the Command Area Development Authority



Irrigation Design and Research Board

The Design and Research Board[9] is a body for studying and investigating the various aspects of a project before it starts. It also gets the designs ready. The Chief Engineer (Design and Research) is in charge of (1) Water Resources, (2) Investigation of Projects, (3) Coastal Engineering Studies, (4) Research Institute, (5) Designs of major and medium projects, minor irrigation works costing more than five lakh rupees, flood control and anti-sea erosion works, land navigation and other designs specifically referred to by the Board, (6) Inter State Waters (7) Joint Water Regulation Board, (8) High level committee on water allocation, (9) Preparation of design manual and reference material, (10) Dam safety devices, and (11) Scrutiny of project report and revised project reports.

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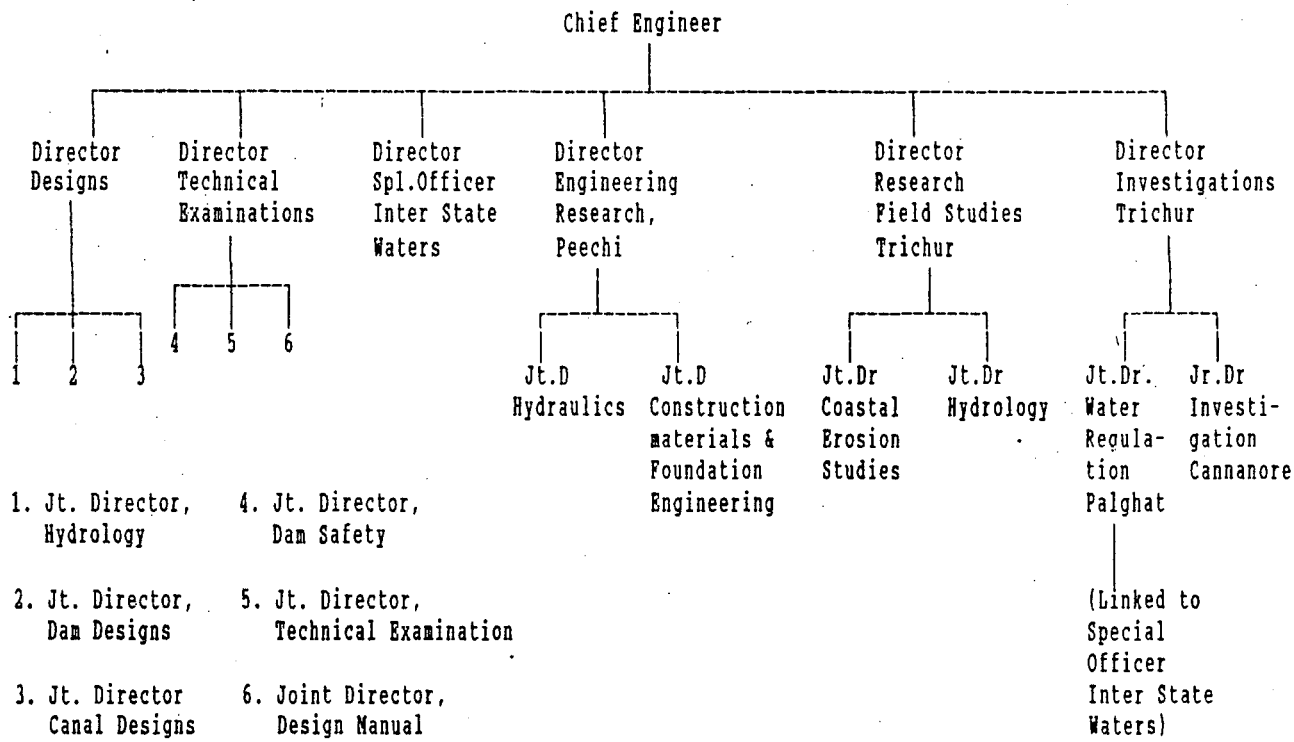
[9] The Chief Engineer (Design & Research) is the Chairman of the Board, the other members of which include all Chief Engineers of the Irrigation Department, Chief Engineer Design Research and Quality Control Board, Executive Director, Centre for Water Resource Development and Management, Kozhikode, Director, Centre for Earth Science Studies, Trivandrum, Additional Secretary to Govt. (Finance), Additional Secretary to Govt. (Irrigation), and two prominent engineers who are not in service nominated by Govt. All Directors of the Board are permanent invitees to the Board meetings.

The Irrigation Design and Research Board (IDRB) was constituted with effect from 1.4.87 by reorganising the Design and Research Wing and bringing the Central Design Organisation, Kerala Engineering Research Institute, Water Resources Circle and Coastal Engineering studies circle together.

The organisational set-up of the Board is given in the Chart 9.

Chart 9
Organisation of the IDRB.



The Director (Designs) has three joint directors under him who deal with Hydrology, Dams and Barrages and Canal Designs. The Hydrology division is responsible for the yield calculation of completed and ongoing projects and also those under investigation, preparation of Master Plan for the river basins of the state based on Integrated river basin approach, in addition to other related activities.

Again, the Director (Technical Examination), has under him three Joint Directors, dealing with dam safety, technical examination and design mannual. The Joint Director, (Technical Examination) is responsible for identification of new projects and schemes and their feasibility study for detailed investigation, examination of original, revised and modernisation project reports, basic planning, cropping pattern, water management, project estimate, apportionment of cost, financial forecast, Benefit Cost Ratio aspects, formulation of proforma, project reports of Medium projects for clearance from Central Water Commission (CWC), scrutiny of major project reports on the above aspects of CWC for clearance, replies to CWC Comments incorporating the remarks from other directorates, and collection of data for the revision of reference books like 'Irrigation Projects of Kerala' and 'Water Resources of Kerala'.

The Design Directorate and the Technical Examination Directorate are thus primarily responsible for the economical and viable designs for the various minor, medium as well as major structures related to the irrigation projects taken up within the state and also the technical examination of the Project Reports, both revised and original.

The main functions of the Directorate of Research Field Studies are collection, compilation and analysis of data on the water resources of Kerala. The compiled data are published every year in the form of Water Year Books. This wing also attends to the work of preparation of basin reports for water availability and its utilization for river basins of the state.

The Directorate of Coastal Engineering Field Studies conducts research-oriented studies on problems related to Kerala's shore stability.

The Directorate of Investigation and Planning has two wings namely, (1) Joint Water Regulation (2) Investigation and Planning (I&P). The main activities of the former are measuring the discharge of water at various gauging stations in the Pamrambikulam Aliyar (Inter State) river system, the maintenance of the water accounts and reconciliation of the water accounts with Tamil Nadu periodically. The Investigation and Planning Wing is entrusted with the investigation and planning of Major and Medium irrigation projects. Until 1987, the investigation and planning of irrigation projects were being attended to by the local units of construction wings of the Irrigation Department. In 1987 an investigation division of Cannanore was put in charge of the investigation of new projects and attached to the I & P Directorate[10].

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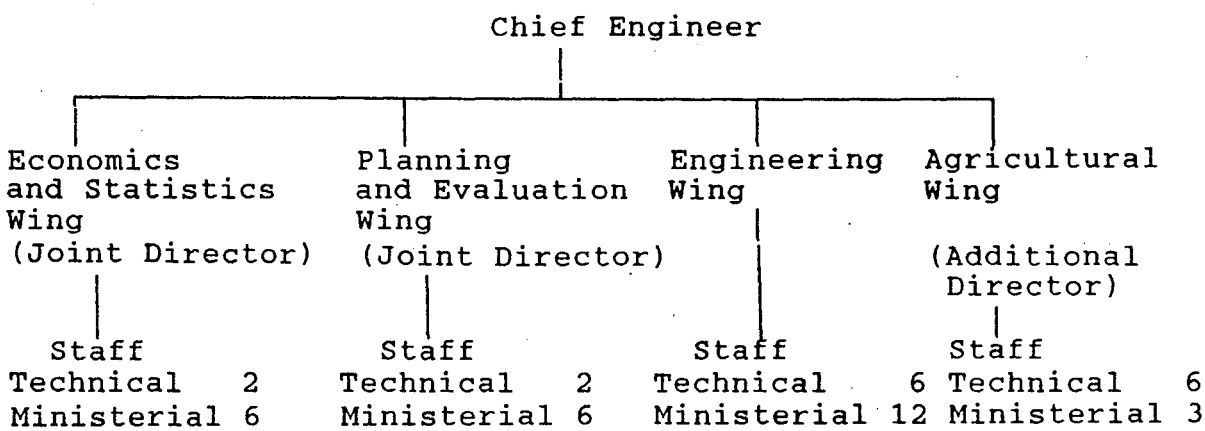
[10] Prior to the 1970s, the Investigation Research and Planning (IRP) Circle Peechi with four divisions at Muvattupuzha, Trichur, Palghat and Cannanore was in existence. Gradually, all these divisions, except Cannanore were either diverted or abolished. The Cannanore Division continued under the IRP Circle and consequent on the formation of the Board, the IRP circle was bifurcated into the investigation circle and Research Circle. The Cannanore Division is doing the investigation of projects in Cannanore District. The new projects are Aralam, Payaswini, Moonamkadavu and Palakuzhipuzha irrigation projects. The investigation of other projects is being done by the Project Divisions under the control of the Chief Engineers Projects I and Projects II. The proposal to bring all investigation under the IDRB is under the consideration of the government.

World Bank Assistance

This office deals with only those projects which are posed for World Bank Assistance and its main activity is to liaise with the State Government and International Development Agency through the Government of India. Monitoring and quality control of the project activities is also to be done by the organisation. Apart from Kallada, Idamalayar and Muvattupuzha have been posed for World Bank Assistance. The Chief Engineer (World Bank Division) has the following staff under him.

Chart 10
Organisational Pattern of World Bank Division



Thus we see that, apart from the Engineering wing, there are three others. They are (1) the Economics and Statistics Wing under a Joint Director to conduct base line socio-economic surveys and monitoring, (2) the Planning and Evaluation Wing under a Joint Director to deal with evaluation and economic analysis of projects, and (3) the Agricultural Wing under an Additional Director to provide agricultural services during and after the implementation of projects. All these wings are adequately supported by technical personnel from the respective departments and also ministerial staff.

Over-all Picture.

The total number of engineering staff alone, in the seven wings which have directly to do with major and medium projects is 1382 comprising of seven Chief Engineers, 25 Superintending Engineers, 94 Executive Engineers, 349 Assistant Executive Engineers and 907 Assistant Engineers. The major share of the establishment is of course for the single project Kallada with 408 engineering staff comprising of one Chief Engineer, five Superintending Engineers, 28 Executive Engineers, 109 Assistant Executive Engineers and 265 Assistant Engineers!

II

The Project Cycle in Practice - The Problems

We have already seen that upon reorganisation, the State inherited six projects which were already in full swing. The investigation of these projects was done by the Madras State or/ and the Travancore-Cochin Government as the case may be. Many of them were not even cleared by the Government of India, Neyyar for example. The remaining four out of the ten now completed projects were handed over to the State after the preliminary investigation stage.

The main difficulty in the investigation is of course lack of basic data. There was no comprehensive master plan for each river basin. In 1958, a study of the river basins titled 'Water Resources of Kerala, An Advance Report' was brought out by the State Government which was followed up and modified in 1974. But

apart from these, we do not have any comprehensive survey to help adopt the most efficient use of our water resources. A comprehensive and exhaustive investigation of the entire resources available is necessary to evolve this. A shelf of well - investigated projects, containing a thorough study of all the aspects involved is a prime requirement for an economically efficient development of water resources for irrigation. Such a crucial and basic investigative work has not been accomplished during the 35 years since the formation of the State of Kerala. All we now have are is the sketchy preliminary proposals contained in the books mentioned[11].

After its formation the state has taken up many projects in the successive plans. The irrigation department had no proper organisational set-up for investigation. Enquiry reveals that in all these cases, preliminary investigation was done by an existing Division which is closest to the site where the project is proposed. Thereafter if an investigation division is proposed for detailed survey, this division is converted into a division for project implementation also. The project reports prepared used to be processed by the Design Section in the Chief Engineer's office before being sent to Government of India for approval. But invariably in all the cases, the project is started before formal sanction is obtained from the Central Government. The Administrative Sanction is given by the State Government and the Technical Sanction by the Chief Engineer.

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[11] An interdisciplinary Committee has been constituted by the Government of Kerala to revise the 'Water Resources of Kerala' prepared in 1958 and subsequently revised in 1974. The work of this Committee is now in progress.

The Irrigation Design and Research Board which came into being in 1987 is now actually the agency to co-ordinate investigation. It has a Director for Investigation also. Even then we find a number of investigation divisions under the respective project Chief Engineers. Only new projects are given for investigation to the Directorate. This lack of co-ordination again points to the scant attention given to the investigation stage[12]. It may be mentioned that the Central Water Commission, and the Expert Committee, have all pointed to the absence of effective investigation as an important contributory factor to high cost escalation.

No appraisal is done at any stage with earnestness. The State Planning Board has a separate Division for 'projects' which does a critical appraisal of all category of projects-industrial, power, hydroelectric. But, prior to the late

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[12] According to the latest guidelines of the Irrigation Design and Research Board when a request comes for a new project an outline report should be prepared based on a first hand office study of the project made on the basis of the available topographical maps and a field reconnaissance to have a general appreciation of the terrain. This is finalised at the level of the Executive Engineer/Joint Director and the Chief Engineer takes a decision to take up the pre-feasibility or the preliminary investigations. This is followed by a preliminary report which speaks of the scope of the project, the nature of the detailed investigations to be carried out, a rough cost estimate and a broad economic viability of the project. This report is finalised at the level of the Superintending Engineer/Director and the decision to undertake detailed feasibility investigations should be taken by the Chief Engineer. A broad assessment of the extent of disturbance of forest area and environment also needs to be made at this stage of investigation so that the project which is not likely to be approved is not taken up for detailed investigations. A detailed investigation is then conducted to collect all the necessary details for the preparation of the project report based on the Government of India guidelines.

eighties, no project was ever sent to the State Planning Board for appraisal. Even now the projects are sent only when they are sent to the Government of India. Had the projects been given earlier, the comments of the Planning Board could also have been taken into account before sending the same to the Central Water Commission. This would certainly shorten the time-lag for getting approval.

Evaluation has not been given any due importance. In the year 1965, the Programme Evaluation Organisation of the Planning Commission brought out an evaluation study of major irrigation projects which included Malampuzha. Again in 1967, the Bureau of Economics and Statistics conducted the evaluation of some irrigation projects of Kerala which covered Malampuzha, Mangalam, Peechi, Chalakudi and Vazhani. Apart from these no evaluation has been done for any irrigation project in the state. We may recall here the importance that has been given to the evaluation aspect of the project cycle in Chapter II. Missing out on this aspect, which is crucial to understanding the defects in planning, has cost the State a great deal in terms of investment planning. The whole exercise of the project cycle has thus shrunk to one of implementation only in the context of Kerala.

Proper monitoring and planning are absent since it is not co-ordinated under a central agency; instead it is being done by Chief Engineer Projects II. Ideally this should be with the Irrigation Design and Research Board[13]. Again there is no communication between the designing and implementing agencies leading to large scale changes in design during implementation.

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[13] This is now under the consideration of the Government.

Summing Up

Thus we see that on the technical side, the personnel are scattered in various divisions and there is no co-ordination of activities, especially designing, implementation, planning and monitoring, which is vital for the success of the projects. The economic side is very weak and rather woefully neglected, with the Planning Board given only a very negligible role to play . Again, there is also the absence of the practice of implementation of works by the department. Thus although there is an expansion of the organisational base, it is not directed towards any activity in the critical areas, which remain neglected. A large number of projects in the execution stage without a proper feedback system points to lack of planning and demonstrates the hiatus between theory and practice. This is probably the crux of the problem plaguing the irrigation sector in Kerala.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Issues in irrigation planning, especially the cost escalations, time over-runs and the negative externalities of major and medium projects are being debated in various forums ranging from popular media to academic circles. The present study on the `Public Investment in Irrigation Projects in Kerala' gains relevance in this context, especially when one considers the importance of irrigation as a crucial input for agricultural development.

The main objectives pursued in the study are: (1) the problem of cost escalation and time over-run, and (2) the gap between theory and practice in the planning and implementation of irrigation projects in terms of the project cycle concept.

The main issues dealt with in the study along with the findings may be summarised as follows:

(1) The various stages of the project cycle and the major issues concerning investment in irrigation projects are discussed to provide a background for the discussion on the performance of irrigation projects in Kerala.

(2) An account of irrigation planning highlights the necessity and the importance of irrigation for a rainfed state like Kerala and the history of irrigation in the state. This is followed by an elaboration of the planning process as it exists today with its weaknesses. We have then analysed the plan investment

pattern in the state with special reference to agriculture and irrigation sectors. Our analysis reveals that agriculture and irrigation sectors put together capture nearly one third of the total plan investment; nearly 87 percent of the investment in water control is in the major, medium and minor projects; nearly 80 percent of the share of investment on major/medium and minor goes to the former, while the contribution of the former to the net area irrigated is only 58 percent. Again, during the Seventh Plan period, the cost per hectare of net area irrigated for major and medium projects is seen to be 1.75 lakhs of rupees, whereas it is only 11,000 rupees for minor schemes, which is just 1/16 of the former. Planning with emphasis on huge hydraulic structures becomes a debatable issue, when studies by the Planning Commission have clearly indicated that 60 percent of the irrigation potential in Kerala is to come from minor irrigation sources. Moreover, since irrigation water is charged only at a nominal rate, the issue of cost effective irrigation becomes important. Our study shows that this aspect has been ignored altogether and the state has gone in for major and medium projects with huge cost escalations and time over-runs.

(3) A review of the studies on cost escalations in irrigation projects in India reveals that Kerala tops the list of states in the matter of cost escalation. Without going into the individual cases, we analyse the situation in Kerala by grouping the 28 projects as completed, ongoing Category A and ongoing Category B. Our analysis shows that the percentage escalations at current prices is higher for the ongoing projects than for the completed ones - the escalation in the former being as high as 3500 percent

in some cases. It is seen that all the 18 ongoing projects have been started by the state without getting prior approval of the Planning Commission. Even now seven of them are waiting for clearance. This poses a limitation on the Plan assistance and will aggravate the issue of time overrun and thereby further cost escalations in the future. Already the 18 projects which have spilled over into the Sixth Plan, went to the Seventh Plan and will be carried over to the Eighth Plan as well.

(4) This is amply borne out by the analysis of expenditure done for the 17 year time-frame from 1972-73 to 1988-89. The analysis indicates that the major share of plan expenditure is for Kallada (45-60 percent from the Sixth Plan onwards), and 35 percent for the remaining projects of Category A and just 5 percent for the entire Category B projects. Taking into account the fact that all the projects of Category B are more than 10 years old, the inadequate budget provision and expenditure will drag the projects for many more years to come along with the dead-weight of establishment. The policy of the Government to prioritise schemes which are World Bank aided and those which are already cleared by the Planning Commission has resulted in the Category B projects getting practically no assistance. This has the danger of the costs in Category B becoming sunk costs.

(5) A discussion of the organisational set-up has examined how far it is in keeping with the requirements of the project cycle. This study shows that although the organisational base has been expanding since Independence, it has no bearing at all on the pattern necessitated by the various stages of the project cycle.

New wings are added on to cater to new activities that come up, but little care is taken to see that the project cycle in its entirety is co-ordinated. Lack of co-ordination in the activities - designing, implementation, planning and monitoring- is evident. Investigation is yet to be taken up by a single agency. Lack of proper investigation has resulted in changes or alterations in the original proposal leading to cost escalation. This has resulted in the organisational set-up becoming disjointed pieces of administrative machinery. The study has also revealed the negligible role played by the Planning Board so far thus pointing to the neglect of the economic aspects of the projects. Again, no evaluation has so far been done on any of the ongoing projects in the state. It must be remembered here that Gittinger (1982) points out implementation as a mini-cycle within the project cycle so that there is a constant correction mechanism. Thus the absence of timely evaluation stands in the way of correcting past mistakes and making up for the lack of a thorough initial planning which is actually difficult for a lumpy, indivisible investment.

The inescapable conclusion from our analysis has been that there is a conspicuous absence of a framework for planning and implementation of major and medium irrigation projects. Even the data base for the preparation of project reports is not merely inadequate but often of doubtful validity.

There is also the problem of choice of suitable sites. The major and medium projects have to be located either in the reserve forests or hilly areas which have been inhabited during

the last two to three decades. One direct consequence of this is that the fields are far away from the reservoir sites leading to the construction of longer canals to reach the ayacut. Again, the Forest Conservancy Act of 1981 necessitates that clearance from Government of India is required for the acquisition of this area, leading to inordinate delay in execution.

The irrigation projects in Kerala are intended basically to stabilise the existing level of output followed by increasing the cropping intensity and/or increasing productivity. Very little has been achieved in terms of objectives. This results in a reduction of incremental benefits in respect of areas falling within the ayacut. Thus the total income from the benefitted area is not that attractive compared to the income from the submerged area (which may already have high value cash crops like rubber).

Land and labour are seen to be the crucial factors which contribute to the cost escalation of irrigation projects in Kerala. However, defective planning, both technical and economic, has also significantly contributed to cost escalations and time over-runs. In order to understand the factors contributing to these problems, detailed analysis of individual projects is called for. This should be an area for future research. Land is really a big constraint so far as the state is concerned. The high density of population, fragmented nature of holdings, the exorbitant cost of land and its scarcity - all make the State of Kerala a very difficult place for major and medium projects. These have resulted not only in cost escalations and

delay in construction, but also in the delay in utilisation of the potential created for want of proper irrigation channels or field bothies. In short the planning speaks of a predominance of engineering structures to the relative exclusion of socio-economic problems. The search for a viable and economically attractive alternative is therefore imperative.

APPENDIX 1
RIVER WATER RESOURCE OF KERALA

Sl. No.	Name of River	Name of River basin	Length of the river (Kms)	Catchment area in sq.km.			Annual yield Million Cubic Ms).			Annual utilisable Million Cubic Ms.)		
				Total	In Kerala	Outside Kerala	Total	In Kerala	Outside Kerala	Total	In Kerala	Outside Kerala
1	2	3	4	5	6	7	8	9	10	11	12	13
WEST FLOWING												
1.	Manjeswar	Manjeswar	16)	340	166	174	698	309	389	379	106	273
2.	Uppala	Uppala	50)									
3.	Shiriya	Shriya	67	587	290	297	1337	620	717	973	358	615
4.	Mogral	Chandragiri	34)									
5.	Chandragiri	Chandragiri	105)	1538	702	836	3964	1718	2246	3129	1218	1911
6.	Chittari	Chittari	25	145	145	-	254	254	-	100	100	-
7.	Nileswar	Nileswar	46)									
8.	Kariangode	Kariangode	64)	751	619	132	1710	1356	354	1138	937	301
9.	Kavvayi	Kavvayi	31)									
10.	Peruvamba	Peruvamba	51)	495	495	-	1143	1143	-	603	603	-
11.	Ramapuram	Ramapuram	19)									
12.	Kuppam	Kuppam	82	538	469	70	1516	1236	280	1024	786	238
13.	Valapattanam	Valapattanam	110	1867	1321	546	4092	2784	1308	2938	1823	1115
14.	Anjarakandy	Anjarakandy	48	412	412	-	986	986	-	503	503	-
15.	Tellicherry	Tellicherry	28	132	132	-	251	251	-	122	122	-
16.	Mahe	Mahe	54	394	394	-	803	803	-	445	445	-
17.	Kuttiady	Kuttiady	74	583	583	-	1626	1626	-	1015	1015	-
18.	Karapuzha)		40)									
19.	Kallai)		22)	4765	4377	388	7775	7135	640	3160	2616	544
20.	Chaliyar)	Chaliyar	169)									
21.	Kadalundi)		130)									
22.	Tirur	Tirur	48	117	117	-	165	165	-	60	60	-
23.	Bharathapuzha	Bharathapuzha	209	6186	4400	1786	7478	6540	938	4146	3349	797

(Contd.....)

RIVER WATER RESOURCE OF KERALA

Sl. No.	Name of River	Name of River basin	Length of the river (Kms)	Catchment area in sq.km.			Annual yield Million Cubic Ms).			Annual utilisable Million Cubic Ms.)		
				Total	In Kerala	Outside Kerala	Total	In Kerala	Outside Kerala	Total	In Kerala	Outside Kerala
1	2	3	4	5	6	7	8	9	10	11	12	13
24.	Keecheri)	Keecheri	51	635	635	-	1024	1024	-	345	345	-
25.	Puzhakkal)											
26.	Karuvannur	Karuvannur	48	1054	1054	-	1887	1887	-	963	963	-
27.	Chalakudy	Chalakudy	130	1704	1404	300	3121	2541	580	2033	1539	494
28.	Periyar	Periyar	244	5398	5284	114	11607	11341	266	8230	8004	226
29.	Muvattupuzha	Muvattupuzha	121	2004	2004	-	3814	3814	-	1812	1812	-
30.	Meenachil	Meenachil	78	1272	1272	-	2349	2349	-	1110	1110	-
31.	Manimala	Manimala	90	847	847	-	1829	1829	-	1108	1108	-
32.	Pamba	Pamba	176	2235	2235	-	4641	4641	-	3164	3164	-
33.	Pallikkal)		42)									
35.	Kallada)	Kallada	121)	1919	1919	-	2770	2770	-	1368	1368	-
34.	Achancoil	Achancoil	129	1484	1484	-	2287	2287	-	1249	1249	-
36.	Ithikkara	Ithikkara	56	642	642	-	761	761	-	429	429	-
37.	Vamanapuram)		88)									
38.	Ayroor	)Vamanapuram	17)	867	867	-	1324	1324	-	889	889	-
39.	Mamom	)	27)									
40.	Karamana	Karamana	68	703	703	-	836	836	-	462	462	-
41.	Neyyar	Neyyar	56	497	497	-	433	433	-	229	229	-
	Total			40112	35469	4643	71981	64263	7718	43226	36712	6514
EAST FLOWING												
1.	Kabbini	Kabbini		1920	1920	-	4333	4333	-	4333	4333	-
2.	Bhavani	Bhavani		562	562	-	1019	1019	-	1019	1019	-
3.	Pambar	Pambar		384	384	-	708	708	-	708	708	-
	Total			2866	2866	-	6060	6060	-	6060	6060	-
	GRAND TOTAL			42978	38335	4643	78041	70323	7718	49286	42772	6514

Source: Water Resources of Kerala, P.W.D. Government of Kerala, June, 1974.

APPENDIX 2

Data on Irrigated Area: The nature of data itself on irrigation seems to raise doubts on its authenticity because we find a sudden and sharp decline in net area irrigated in the mid-seventies.

	Lakh hectare		Lakh hectare
1962-63	3.36	1972-73	4.46
1963-64	3.47	1973-74	4.57
1964-65	3.52	1974-75	4.65
1965-66	3.82	1975-76	2.28
1966-67	3.93	1976-77	2.21
1967-68	4.11	1977-78	2.28
1968-69	4.18	1978-79	2.30
1969-70	4.23	1979-80	2.31
1970-71	4.31	1980-81	2.39
1971-72	4.39	1982-83	2.59

Source: GOK - Statistics for Planning - various issues.

The aggregate data on area irrigated in Kerala suffer from a major defect in that the series show a sudden decline in area from 1975-76 onwards. This is due to the source of data employed. Till 1974-75, the data on area irrigated was supplied to the Bureau of Economics and Statistics by the irrigation wing of the PWD.*

The Statistics relating to Minor Irrigation schemes completed till December 1976, available with the Public Works Department were not accurate or reliable. In order to get a clear picture of the Minor Irrigation Schemes functioning properly and the actual area irrigated by these schemes, a field verification of the Minor Irrigation Scheme was conducted during

the period October to December 1976. Considerable reduction in the actual ayacut served under Minor Irrigation was noticed after field verification. Before field verification the area benefitted as per records under Minor Irrigation Works was 230,900 hectares (net) or 275,000 hectares gross). When the Revenue department started collection of cess, it was found that the actual benefitted area was well below that of the area in the records. And field verification revealed that only 74,596 hectares (net) or 92,155 hectares (gross) of land was benefitted under Minor Irrigation. The reduction in the ayacut was mainly due to the following reasons.

(1) Some of the major irrigation projects since completed, have absorbed a certain portion of the ayacut served by Minor Irrigation.

(2) Some of the minor irrigation schemes damaged due to natural calamities have not since been repaired.

(3) The maintenance of Minor Irrigation works after completion, rests with the Panchayats concerned. The Panchayats failed to attend to the maintenance due to lack of funds, technical staff etc. Owing to this negligence of maintenance for years together, some of the Minor Irrigation works have deteriorated and fallen into partial or full disuse.

(4) A portion of the area developed during the first Five Year Plan had later been transferred to Tamil Nadu on re-organisation of the States.

(5) Change of land use pattern.

(6) Normal depreciation of the ayacut which is of the order of two to five percent per annum and

(7) The life of a minor irrigation class II scheme or Intensive Paddy Development Scheme is about 15 years maximum.

Since 1975-76, the data on area irrigated have been generated, inter-alia, by Timely Reporting Surveys (TRS) under the Establishment of an Agency for Reporting Crop Statistics (EARCS). Data on irrigation are gathered through the surveys conducted under the TRS system and this lends credence to the data on area irrigated since the mid-seventies.

APPENDIX 3

The anglicised names of the districts of Kerala State have been changed to local names. However throughout the dissertation, the old anglicised versions are used. Both the versions are given below for information.

1.	Trivandrum	Thiruvananthapuram.
2.	Quilon	Kollam
3.	Alleppey	Alappuzha
4.	Trichur	Thrissur
5.	Palghat	Palakkad
6.	Calicut	Kozhikode
7.	Cannanore	Kannur

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